

Express roads in Europe

Research in the framework of the European research project SAFESTAR, Workpackages 3.2 & 3.3

D-99-3

Ingrid van Schagen

Leidschendam, 1999

SWOV Institute for Road Safety Research, The Netherlands

Report documentation

Number: D-99-3
Title: Express roads in Europe
Subtitle: Research in the framework of the European research project SAFESTAR, Workpackages 3.2 & 3.3
Author(s): Ingrid van Schagen
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Project manager: Atze Dijkstra
Project number SWOV: 66.886
Project code client: Contract No. RO-96-SC 203
Client: This research was funded by the European Commission under the Transport RTD Programme of the Fourth Framework Programme.

Keywords: Motorway, specification (standard), safety, highway design, Europe.
Contents of the project: Express roads are a rather miscellaneous road category hierarchically situated between motorways and ordinary single carriageway interurban roads. In general, the safety record of express roads is bad, in particular when compared to motorways. The current report contains the results of 1) an inventory in a number of EU Member States on the current status and characteristics of road which could be classified as express roads, 2) an inventory of the decision making process and an interview on a Dutch case, and 3) an expert workshop on express roads identifying the main design elements affecting their safety level.

Number of pages: 20 + 9 pp.
Price: Dfl. 17,50
Published by: SWOV, Leidschendam, 1999

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Deliverables D 3.2 & 3.3
Express roads in Europe

SAFESTAR

Contract No. RO-96-SC.203



Project: *Safety Standards for Road Design and Redesign*
Coordinator: *SWOV Institute for Road Safety Research, Leidschendam NL*

Partners: *TNO Human Factors Research Institute; Soesterberg, NL*
RD Road Directorate; Copenhagen, DK
VTI Swedish Road and Transport Research Institute; Linköping, S
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LNEC Laboratório Nacional de Engenharia Civil; Lisbon, P
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Centre; Grand-Quévilly, F
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**PROJECT FUNDED BY THE
EUROPEAN COMMISSION UNDER
THE TRANSPORT RTD PROGRAMME
OF THE FOURTH FRAMEWORK
PROGRAMME**

Summary

Express roads are a rather miscellaneous road category hierarchically situated between motorways and ordinary single carriageway interurban roads. In general, the safety record of express roads is bad, in particular when compared to motorways. Nevertheless, they exist, and they will continue to exist. For example, express roads will form an integral part of the Trans European Road Network (TERN).

The current report reports on part of the work carried out in the framework of SAFESTAR Working Package 3:

- an inventory in a number of EU Member States on the current status and characteristics of road which could be classified as express roads;
- an inventory of the decision making process and an interview on a Dutch case;
- an expert workshop on express roads identifying the main design elements affecting their safety level.

It is concluded that express-type roads exist in most EU countries. However, they are often named differently and can often be found in more than one road category of the national classification system. Cross sectional design and intersection design differ widely as well, both between countries and within countries. This makes it impossible to define an express road in terms of geometric design characteristics. However, it was possible to define an express road in terms of its functional characteristics:

a medium to high capacity road for long distance traffic with limited access and closed for non-motorised traffic

The main elements affecting the safety level of express roads were identified as cross section design (in particular separating opposing traffic streams), intersection design, and road side design.

The decision on the type of road appears to be mainly based on (expected) traffic volumes and financial resources. Occasionally, environmental considerations play a role as well. Safety arguments hardly play a role at all.

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1. Introduction

Motorways and single carriageway ordinary roads are two main types of roads which exist in all EU Member States and which are known by all motorists. Most countries also know some sort of roads, which do not fulfil the design criteria of a motorway, but which are of a higher order than the ordinary single carriageway roads. These intermediate types of roads are sometimes classified under the name of 'express roads', but in the majority of EU Member States these roads do not occur as such as a separate category in the national road categorisation.

In general, the safety records of this intermediate type of roads are bad. From a detailed analysis of the Portuguese accident database (Cardoso and Costa, 1998), it was found that the accident rate on express roads is around 3 times higher than at motorways. It was found that the most common accident type on express roads is single vehicle run-off accidents (around 30 per cent).

Despite their bad safety record, express roads exist and are still being designed and constructed. It must be accepted that they will continue to exist in the future. For example, it is foreseen that express roads will form an integral part of the Trans European Road Network (TERN) in the less populated areas of the EU.

The current report reports on part of the work carried out in the framework of SAFESTAR Working Package 3:

- an inventory in a number of EU Member States on the current status and characteristics of roads which could be classified as express roads;
- an inventory of the decision making process and an interview on a Dutch case;
- an expert workshop on express roads identifying the main design elements affecting their safety level.

This, together with the results of a detailed accident analysis of express road accidents (Cardoso and Costa, 1998), was the background for the literature review and formulation of recommendations for improving the safety record of express roads (Hummel, 1998).

Whereas express roads also exist in built-up areas (e.g. ring roads), the current inventory emphasised express roads outside built-up areas in order to maximise the usefulness of the results for the further development of TERN.

2. Express roads in TERN

The development of TERN, the Trans-European Road Network, as set out in the 1993 Treaty of the European Union, aims to provide a road network for main international road travel, connecting all parts of the European Community. The largest part of the network consists of existing motorways. A substantial part, however, consists of roads which are non-motorways. In 1992 this was around one third of the total TERN in the, at that time, 12 EU countries. Whereas it is expected that the share of non-motorway links will decrease in the future, they will continue to exist, in particular in the less populated and less economically developed countries of the current and future European Union.

In October 1994, the Motorway Working Group Action START presented its final report on the 'Standardisation of Typology on the Trans-European Road Network'. The report describes both motorway and non-motorway TERN links and gives recommendations for standardisation in the near and medium term future, mainly with respect to the level of services, including a safe driving environment. Non-motorway links consist of ordinary roads and express roads. Ordinary roads generally have a traffic flow capacity of less than 5,000 vehicles per day. It is suggested that for traffic flow between 5,000 and 10,000/15,000 vehicles per day an express road may be the best solution, with the optimal traffic flow capacity depending on the exact characteristics. The Working Group states that 'in the long term all links of TERN which will not be upgraded to motorway standard should be *HIGH QUALITY ROADS*' (emphasis as in original). With respect to the general characteristics, the Working Group recommends that express roads should:

- have no urban section;
- have no private access;
- not permit parking and stopping on the carriageway;
- not permit slow moving vehicles, bicycles, pedestrians, or animals;
- have a minimum lane width of 3.5 m;
- have edge line and central line markings;
- have a head clearance of 4.5 m;
- provide for emergency calling points;
- provide for service areas at a maximum distance of 100 km, directly accessible from the road and with 24 hours refuelling possibilities.

The START Working Group distinguished between three types of express roads with the following general characteristics:

Type 1: Single carriageway express roads with either at-grade or grade-separated junctions but not mixed on the same road. The design of both types of junctions must be in accordance with the European agreement on main international traffic arteries (AGR). Single carriageway express roads must have a minimum width of 11 m (either consisting of two lanes with hard shoulders or of three lanes).

Type 2: Dual carriageway express roads with interchanges by roundabouts, right-in, right-out junctions or grade-separated junctions. Dual carriageway

express roads should not have level junctions which require crossing of the central reserve.

Type 3: Dual carriageway express roads with grade-separated junctions which will be upgraded to motorway standards within a reasonable period (with exceptions only if this is clearly not possible, for example at mountain passes).

In general, it is recommended that non-motorway sections which look like motorways (i.e. dual carriageway and grade-separated intersections) should be avoided, since this may lead to confusion of the users.

3. Express roads in EU Countries: an inventory

3.1. Method

In order to get an overview of the status of and requirements for express roads in the EU, experts at national Transport Ministries, national Road Administrations and national Research Institutes of 12 European countries were approached to provide the required information for their own national situation. Initial contact was made by phone in order to make sure that the identified person was indeed the appropriate one to answer the questions. When the appropriate expert had been contacted and had agreed to participate, he or she received a short questionnaire in English. They were asked to complete the questionnaire and to add as much relevant information and enclose as many relevant background documents as possible.

The questionnaire consisted of four parts (see *Appendix 1* for a copy of the full questionnaire):

- A. the national non-urban road classification system (main classes only) and the position of 'express roads' therein;
- B. design and operational characteristics;
- C. arguments used in the decision to build express roads;
- D. safety information;

Safety information received in response to part D of the questionnaire was forwarded to the Portuguese National Laboratory for Civil Engineering (LNEC), the partner who was responsible for the safety analysis work.

3.2. Results

A total of 11 completed questionnaires came back which covers the countries Belgium, Denmark, Finland, France, Germany, Ireland, the Netherlands, Portugal, Sweden, Switzerland and UK. Greece did not respond. (*Appendix 2* provides a list of names and affiliation of information providers). Not unexpectedly, the level of detail of the provided information differed widely.

A. Road categorisation and the position of express roads

All responding countries apply a road categorisation system distinguishing between 4 to 6 road categories in non-urban areas. Most responses pointed to the roads classified directly below motorways as express roads, i.e. road which have mainly a function in connecting different regions, however in some cases an interurban road was also classified as an express road.

B. Design and operational characteristics

Roads, appointed as express roads, exist in all types and formats with huge differences in both design and operational characteristics. In some cases an express road is designed in such a way that in due time it can be easily upgraded to full motorway standards (e.g. Finland).

Cross section design: Express roads exist as dual carriageway (2x2 lanes with physical separation of opposing traffic streams, most often by an unpaved median) or as single carriageway (1x2 normal lane width, 1x2 with wide lanes, or 2+1 with the middle lane alternately assigned to one direction for overtaking purposes). The majority of express roads have hard shoulders. Single carriageways seem to be more common. Dual carriageway tend to concentrate near built up areas and economical centres.

Intersection design and traffic control: Both grade-separated and at-grade intersections exist on express roads. Grade-separated intersection can be redesigned up to the full motorway standard, but are sometimes designed at reduced standards. In some countries the use of grade-separated intersections at express roads are discouraged to distinguish them from full motorways. At-grade intersections either have right-in right-out traffic control, minor road yield, or stop control, or traffic signal control. Roundabouts are not very common on express roads, but they do exist. In France, roundabouts are used at the beginning and end of an express road.

Type of traffic: In the UK and Ireland non-motorway roads, including express roads, are all-purpose roads and as such open for all traffic. In all other countries the vast majority of express roads are closed for non-motorised traffic, although Sweden and Portugal report on a limited number of express-type roads where non-motorised traffic is allowed.

Design speed and speed limit: Design speed for 2x2 express roads varies between 100 and 120 km/h; design speed for single carriageway express roads between 80 and 100 km/h. Speed limits vary between 80 and 120 km/h.

Access control: Access control at express roads is less limited than on motorways, but more limited than on ordinary single carriageway roads. For example, in France, the distance between two access points on express roads generally exceeds 10 km.

C. Arguments used in the decision to build express roads

With respect to the arguments and their relative weights the answers were very consistent: an express road is built or an existing ordinary road is upgraded when the (expected) traffic volume exceeds a particular number, when higher speeds are considered to be desirable, and when there are financial and/or environmental restraints to build a full motorway. An economical cost-benefit analysis is applied in, for example, France and the UK. Once the argument of better accessibility to main economical centres alongside the road compared to motorways was mentioned. Safety as an argument in the decision process was never mentioned, although some design standards and guidelines refer to the need for uniformity and continuity in relation to the adjacent network for safety reasons.

3.3. Conclusions

Express-type roads do indeed exist in all countries, though they are often named differently and can often be found in more than one road category of the existing national road classification system. The common functional characteristics are: limited access, with a capacity for moderate to fairly high traffic volumes, and aiming at moderate to long distance journeys.

Express roads are generally open for motorised traffic only. Exceptions are the UK and Ireland, where banning non-motorised users from non-motorway roads runs counter to current practice. Furthermore, there are some exceptions in Portugal and Sweden.

Cross sectional design and intersection design differ widely, not only between countries, but also within countries. Both single carriageway express roads and dual carriageway express roads are common, though single carriageway express roads are more frequent. The number of 2+1 single carriageway express roads (middle lane alternately assigned to one direction for overtaking), still often in an experimental way, is limited. Intersections on express roads are in some countries predominantly at-grade and in other predominantly grade-separated.

The decision on type of road is mainly based on (expected) traffic volumes and available financial resources. Also environmental considerations play a role. Safety was not mentioned as an argument in the decision on type of road, but does play a more or less explicit role in the design standards or recommendations.

4. Workshop 'the role and nature of express roads in the road network'

4.1. Organisation and attendance

In late September 1997, a one-day workshop was held in Lisbon, Portugal, parallel to a major international road safety conference. Apart from representatives of the organising institutes SWOV Institute of Road Safety Research (NL) and the LNEC National Laboratory of Civil Engineering (P), nine experts from both European and non-European countries participated in the workshop. Both research and administrative backgrounds were represented in the meeting. *Appendix 3* provides a list of participants. The workshop aimed to clarify and define the status of express roads and to identify means to optimise their safety.

4.2. Results

From the discussions during the Workshop the following functional definition of an express road was agreed upon:

'a medium to high capacity road for long distance traffic with limited access and closed for non-motorised traffic'

It was agreed that express roads exist, and will continue to exist, as both single and dual carriageway roads. The design characteristics both between these two major categories and within each category were too different to formulate a geometric definition.

Furthermore, there was a difference between express roads which had been upgraded from ordinary single carriageway roads in order to cope with increased traffic volumes, single or dual carriageway roads which were planned to be express roads from the very beginning, and express roads meant to be upgraded to full motorway standards in due course.

The main design characteristics affecting the safety level were identified:

- cross section design (in particular separation of opposing traffic streams)
- intersection design
- road side design

Good practice safety design recommendations needed to be different for single and dual carriageway express roads.

4.3. Conclusions

The outcome of the Workshop very much reflected the outcome of the questionnaire. Design characteristics differ widely between countries, but as to the function of this type of roads there is major consensus. With respect to the road user restriction part of the definition, it was unfortunate that neither the UK nor Ireland was represented in the workshop. In these countries almost all roads but motorways are all-purpose roads open to all

road users. For example, in 1996, a trunk road from Exeter to Plymouth (UK) was designated as an express road, and designed as a near motorway standard dual two lane road. The banning of non-motorised traffic was considered as a safety/capacity measure, but was declined for the reason that this runs counter to UK practice. In the majority of countries road user restrictions are more common and non of the workshop attendants had objections to include it in the functional definition.

The identification of the three main design elements affecting the safety level (cross section design, intersection design, road side design) needs further elaboration by quantifying the relationship between design and accidents, accident severity, and relevant driving behaviour (e.g. speed/overtaking).

5. An interview on the decision making process and safety work on express roads in the Netherlands

5.1. Introduction

Aiming to get more in-depth information on the process of decision making when assigning roads to road categories, and on the impact of safety arguments in this process, an interview was organised with the safety inspector of one of the regional departments of the Ministry of Transport (Rijkswaterstaat Directie Zuid-Holland).

The interview took place on 15 June 1998 between Mr Berry van Exel of the Ministry of Transport and Mr Ton Hummel and Mr Atze Dijkstra of the SWOV Institute for Road Safety Research, both involved in the SAFESTAR workpackages on express roads (WP3).

5.2. The Dutch express roads

In the Dutch system of road categories the road type 'autoweg' comes closest to the operational and functional definition of an express road.

An 'autoweg' exists both in a single and dual carriageway design, has a speed limit of 100 km/h, is closed for non-motorised traffic, and has no private access. Intersections can be at-grade or grade-separated. The category just above the 'autoweg' is the motorway, the category just below is an 80 km/h single or dual carriageway road closed for non-motorised traffic.

As for motorways, construction, administration and maintenance of the 'autoweg' (from here on to be called express roads) is the responsibility of the regional departments of the Ministry of Transport.

5.3. The relative importance of decision arguments

The relatively bad safety record of express roads, and the reasons for it are well known by the road administrators. Nevertheless, express roads still exist and are still being constructed.

The main reason for the existence of express roads is considered to be a financial one. Because of the high costs of motorway construction, cheaper express roads may be considered as a financially better solution, unless preconditions compellingly force the construction of a motorway. The preconditions on which it is decided to choose for a motorway or an expressway, are formulated in so called Ministerial Road Plans. In these plans road sections of the national road network are assigned as motorway or as express road. The assignment is mainly based on:

- Function of the section within the entire road network: if a section has a less important traffic function in the network, the choice for a express road design is more likely.

- Traffic volumes: if traffic volumes or estimated traffic volumes exceed a particular level (15.000 - 20.000 vehicles per 24 hrs), an express road is not a valid option and a full motorway design is chosen.

Decisions on the Ministerial Road Plans are not made at the level of the Regional Departments, but at the level of the National Ministry of Transport. In the decision making process all consequences have to be weighed. In this process the weight of traffic safety (or the difference in traffic safety between motorways and express roads) is often less than the weight of costs, congestion, accessibility, and reliability of the road network. One could say that the actual safety difference between motorways and express roads is not large enough to make it an important issue at this level.

The national budget for (re)constructing roads is limited. Replacing existing express road sections by the more expensive motorway sections or planning for motorways rather than express roads, would cause other road projects to be delayed or cancelled. This factor further complicates the discussion on the safety record of express roads and their right of existence.

At the level of the Regional Departments (the actual road authority for motorways and express roads), the importance of traffic safety arguments is said to be better recognised. Here, a strong preference for motorways instead of express road designs is clear. Both safety inspectors and designing departments try to avoid express road designs. However, it is very difficult for the Regional Departments to deviate from the decisions made at the national level, although exceptionally convincing (safety) argumentation could result in a reassignment of an express road to a motorway.

5.4. Efforts to improve the safety records of express roads

Given that express roads exist, and will continue to exist, efforts have been made to make this type of road as safe as possible and to approach the safety record of motorways. Activities take place mainly at the regional level.

Safety of existing express road sections is improved by infrastructural measures. In some cases measures are local, based on black spot accident analysis. In other cases the measures were implemented to an entire express road aiming to give it a more 'motorway-like' design (and safety record). Measures taken are, for example:

- separation of opposing traffic by using barriers;
- adding or widening shoulders;
- adding or widening obstacle free zones.

Similar measures are applied when designing new express roads aimed to improve traffic safety beforehand by adding some motorway-design concepts to the design. For example, a new section of a single carriageway express road (N11) has been designed in such a way that opposing traffic cannot collide, one of the reasons for the good safety records at motorways. On the express road, opposing traffic will be separated by dividing the two lanes by a barrier. This type of road is known as a 2x1 express road. The 2x1 express road is a new development in the framework of the Dutch

sustainable safety programme and is considered to be suitable for roads with a regional flow function.

Between the safety measures proposed and/or implemented at express roads, traffic calming is generally not considered. The traffic function and the resulting high speeds on express roads make this type of measures inappropriate.

In the nationwide meetings of regional safety inspectors, the issue of safety on express roads is discussed regularly. The general opinion of this meeting is that the presence and use of express roads should be limited, and motorways should be used wherever possible. Measures on existing express roads and new design elements for new express roads are discussed, and effects are monitored. It is thought likely that the design of express roads will develop in the direction of (low cost) motorway design standards, and that this will result in a better safety record.

The often heard idea that the design of an express road should be clearly different from a motorway design is not supported. It is stated that mistaking an express road for a motorway should not lead to safety problems if the design is clear, consistent, and safe on critical elements (e.g. crossings).

5.5. Conclusions

From the interview it becomes clear that, whereas it is generally acknowledged that express roads are less safe than motorways, the extra costs for motorway construction compared to the construction of express roads would appear to be more important. Apparently, the difference in safety level between the two road types is considered to be too small to justify the extra costs of the safest solution. Since the budget for road building is limited, the decision to go for a motorway rather than an express road automatically means that other road projects have to be postponed or even cancelled. This argument is frequently used when deciding to choose for a less safe solution. Hence, if traffic function and (expected) traffic volumes allow for it, there is a good chance that an express road will be chosen rather than a motorway.

Both express roads and motorways are the responsibility of the Ministry of Transport. Whereas decisions to assign a road to one or the other category are made on a national level, the actual construction and maintenance are the responsibility of regional departments. It is on the latter level that one is directly confronted with the safety consequences of earlier choices. Not surprisingly, the regional departments, when constructing or reconstructing express roads, 'experiment' with different designs aimed at making the road as safe as possible with the available financial resources. Generally, in doing so, motorway design elements are integrated into the express way design, such as separating opposing traffic streams and widening shoulders and obstacle free zones. Such practice runs counter to the idea heard in some places, that express roads must not look like motorways to avoid motorists getting confused and do not adapt their behaviour sufficiently on the lower order express road. However, the idea is that the negative effects of possible confusion are outweighed by the increase in safety by a safe design.

6. Conclusions and recommendations

Express roads are a rather miscellaneous road category hierarchically situated between motorways and ordinary single carriageway interurban roads. Express roads can be defined as

a medium to high capacity road for long distance traffic with limited access and closed for non-motorised traffic.

In general, the safety record of express roads is bad, in particular when compared to motorways. Nevertheless, they exist and it must be accepted that they will continue to exist. For example, express roads will form an integral part of the Trans European Road Network (TERN).

When applying the functional definition described above, express-type roads exist in most EU countries. However, they are often named differently and can often be found in more than one road category of the national classification system. Known exceptions are the UK and Ireland where all non-motorway roads are open for non-motorised traffic. In Portugal and Sweden there are some roads which have all characteristics of an express road, but which are open to non-motorised traffic as well.

Cross sectional design and intersection design differ widely as well, both between countries and within countries. Express-type roads exist as single carriageways and as dual carriageways. A 2+1 cross section design (middle lane alternately assigned to one direction) is still uncommon. In some countries intersections on express-type roads are predominantly at-grade, in other they are predominantly grade-separated. In short, *the* express road does not exist, neither in terms of functional and operational characteristics, nor in terms of design characteristics.

Taking account of their bad safety record, it could be wondered why express roads exist at all. The decision on the type of road appears to be mainly based on (expected) traffic volumes and financial resources. Occasionally, environmental considerations play a role as well. Safety arguments hardly play a role at all. Whereas it is probably justified to state that the vast majority of decision makers are well aware of the fact that, from a safety point of view, express roads are not a satisfactory option, the financial arguments seem to outweigh the safety arguments. Possibly it is so that the difference in safety level between express road and motorway is considered to be too small to justify the extra costs which are involved in building a full motorway. Furthermore, it has to be borne in mind that the costs resulting from road traffic accidents and casualties do not directly affect the budget of road administrators. It can be expected that the strict application of the one million ECU rule (saving one life justifies an investment of one million ECU) would markedly increase the relative weight of safety arguments in the decision making process.

Even if the one million ECU rule would be applied consistently, there will still be situations where a motorway is not justified given the (expected) low traffic volumes. Hence, as was stated before, it must be accepted that express roads will continue to exist. They are here to stay! In these cases it

is important that their design is as safe as possible, with specific attention to cross section design, intersection design, and road side safety.

Literature

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Appendices

1. Questionnaire
2. List of Information providers
3. Workshop Attendance



Background

One of the activities of the EC IVth Framework funded SAFESTAR (Safety Standards for Road Design and Redesign) project aims to identify recommendations for the safe design of what could be called 'express roads', provisionally defined as a road type between motorways and ordinary single carriageway roads. We assume that this type of road exists in all EU countries, though possibly not as a separate road category. As a starting point we would like to know whether in your country an 'express road' is distinguished as a separate road category or as part of a more general category. Furthermore, what 'express roads' generally look like and, if data is available, how safe they are compared to motorways on the one hand and ordinary single carriageway roads on the other. We are also interested to get some insight in the decision making process; what are the reasons for building express roads and how are the different arguments weighted.

The questions below must be considered as a general guide towards the type of information we are looking for. Please use additional paper if the left-open spaces are insufficient. Any additional information and supporting (selections from) publications (in Dutch, English, French or German) will be gratefully received.

Please return your information to:

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E-mail: schagen@swov.nl

Given our times schedule we would be pleased to receive your response at your earliest convenience.

A. Which main interurban road categories can be distinguished in the national road network and how are they defined?

B. If 'express road' is not a separate category, in which of the road categories would it fit and how would you define it to distinguish them from other interurban roads (ordinary rural roads/ motorways)?

C. Are there (national) design standards for express roads and if so are they mandatory or recommended standards?

D. What are the main design characteristics of interurban express roads?

1. What is the design speed and general speed limit of express roads:

Design speed	km/h
Speed limit	km/h

2. Are the following road user categories allowed on express roads?

	yes / no
motorised vehicles	
agriculture vehicles	
bicycles, mopeds	
pedestrians	

3. What are the intersection/interchange types and traffic control modes of 'express roads'? Please, give a rough estimate of their relative occurrence in percentages.

grade separated intersections	%
at-grade intersections with separate turning lanes	%
at-grade intersections without separate turning lanes	%

4. What are the traffic control modes for at-grade intersections?

minor road yield or stop control	%
merge control	%
round about control	%
traffic signal control	%
other:	%

5. How many lanes has an 'express road'?

two, normal width (..... m)	%
two, wide lanes (..... m)	%
three, middle lane assigned to both directions	%
three, middle lane alternately assigned to one direction	%
2x2, without physical separation	%
2x2 with physical separation	%
other:	%

6. Are there any other important design characteristics that you would like to mention?

E. Could you give an indication of the arguments and their relative weight in the decision to build an 'express road' rather than a motorway or ordinary interurban road, or upgrading existing ordinary road to 'express roads' rather than motorways?

F. Could you give an indication of the safety of 'express roads' compared to motorways on the one hand and to ordinary interurban roads on the other in terms of
 a) relative risk (e.g. per vehicle km)
 b) accident typology (e.g. head-on, run-off, rear-end)



Appendix 2 List of Information providers

SWOV is grateful for the information provided by the following persons and organisations:

FIN:	Mr Harri Peltola,	VTT Communities and Infrastructure
IRL:	Mr Don O'Conneide,	University of Cork
DK:	Michael Aå. Nielsen	Ministry of Transport, Road Directorate
D:	Mr Reinhold Maier,	Institute für Strassenverkehr, GDV
NL:	Mr Jaap van Minnen	SWOV Institute for Road Safety Research
F:	Mr David Laurent	CETE, Centre d'Etudes Technique de l'Equipement, Normandie Centre
B:	Mr Armand Rouffaert Mr Ruddy Dieleman	Ministry of the Flemish Community, Dept. for Roads and Traffic Belgium Institute for Traffic Safety
S	Mr Torsten Berg	Swedish National Road Administration
P	Mr João Cardoso Ms Silvia Costa	LNEC National Laboratory for Civil Engineering
CH	Mr G. Scaramuzza	BFU
UK	Mr Ian Summersgill	TRL Transport Research Laboratory



Appendix 3 Workshop Attendance

Leonid Braimaister, SWOV, NL
João Cardoso, LNEC, P
Silvia Costa, LNEC, P
Atze Dijkstra, SWOV, NL
Rune Elvik, TØI Institute for Transport Economics, N
Shalom Hakkert, Transport Research Institute, Haifa, ISR
Lars Leden, VTT Communities and Infrastructure, FIN
Kenneth Opiela, Transport Research Board, USA
Harri Peltola, VTT Communities and Infrastructure, FIN
Frank Poppe, SWOV, NL
Kelvin Roberts, Insurance Corporation British Columbia, CAN
Anneli Tanitu, Ministry of Transport, FIN
Marian Tracz, Cracow University of Technology, PL
Ingrid van Schagen, SWOV, NL
Fred Verweij, Ministry of Transport, NL
Fred Wegman, SWOV, NL