ANNEX IV
to SWOV report
Safety effects of road design standards
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International organizations and road design standards

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Notice to the reader

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The full publication consists of the following volumes.

Main report: Safety effects of road design standards
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Annex I: Road classification and categorization
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Annex II: Assumptions used in road design
M. Slop; SWOV Institute for Road Safety Research, Leidschendam, The Netherlands

Annex III: Methods for investigating the relationship between accidents, road user behaviour and road design standards
G. Maycock & I. Summersgill; Transport Research Laboratory, Crowthorne, England

Annex IV: International organizations and road design standards
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Annex V: National road design standards
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Summary

In this study, the European organizations are analyzed having regard to the role they play in the field of road design standards and/or road safety. The European Union, the United Nations Economic Council for Europe, the European Conference of Ministers of Transport and the European Committee for Standardization are paid special attention to. The role of other organizations, such as the O.E.C.D., P.I.A.R.C., F.E.R.S.I., and others, is only highlighted.

1. Introduction

Road design standards and traffic regulation are most of the time a matter of national interest. As geographical, historical, psychological and still other conditions differ from country to country, it is rather evident that those questions, that rule road design and traffic, are treated at a national level.

But traffic tends to cross borders and with the increase of international traffic, international regulations and standards are nowadays indispensable. A certain degree of harmonization is necessary to present the user of road infrastructure with a more or less continuous image of a set of road types and traffic rules that one can find.

In the same time, it would be a matter of importance that the level of safety would be somehow the same in all European countries. This would be to the benefit of the road user, especially to those who travel abroad.

The most important organization in this perspective is the European Union. This is not so much due to the work already done in the past, but more to the potential this organization has. In effect, it is the only international organization that can enforce by legal means the decisions taken. It therefore is a very effective organization for harmonization, also to confirm the work already done by other international bodies.

As the Maastricht' treaty on the European Union entered into force on 1 November 1993, new fields of competence were attributed to the Union. A new provision on road safety was inserted in article 75 and a whole new chapter on Trans-european Networks (article 129) was added.

It is clear that the European Union has been attributed competences in the field of road safety and infrastructure. Further action will be undertaken, but for a first period, given the principle of subsidiarity, the exchange of information and the study of main points of interest will be started. On a longer term, the European Union will be the principal actor in this field, because of the delegation of power in the field of transport from the Member States to the Union and because of the legally binding juridical acts the Union can take and which can be enforced by legal means.

In the field of infrastructure, the EU is establishing a network, called the Trans European Road Network (TERN). This network is formally approved by the Council of the EU, but the TERN will have to be approved once more along the newly introduced cooperation procedure. This new procedure, introduced by the Maastricht' treaty, gives more rights to the European Parliament.

Meanwhile, working groups have to provide the necessary background thought for this network. One called START (Standardisation of Road Typology) elaborates road design standards for this network. The information this study will produce, will through the Commission hands come to the use of this working group.

The past actions of the EU in the fields of road safety and infrastructure will be analyzed as well as its future potential. The legal basis for these actions will be discussed and the principle of subsidiarity. Other actions that influence the policy of road safety and infrastructure will be highlighted.

The United Nations' Economic Commission for Europe is the international organization which is of great importance in the field of infrastructure, and to a lesser extent of road safety. This importance is due to the long experience of action in this field of interest. The treaties of the E.C.E. are the only existing international treaties. They can not be enforced, but they remain of value as a first forum of international discussion. It is a document upon which can be built.

The main agreement on this subject is the European Agreement on Main International Traffic Arteries, most of the time called AGR, which is the French acronym (Accord Européen sur les Grandes Routes de Traffic International). It is an agreement of the United Nations Economic Commission for Europe (UN-ECE), which established the E-road network. The AGR has annexes that among others give road design standards.

Recently, very similar standards, but much more detailed ones, have been fixed for the TEM network, which is the Trans-European North-South Motorway, a network in central and eastern European countries. These standards have guidance from the ECE, but do not form part of a UN-agreement, so they have another status than the AGR.

Other international agreements exist for standards on specific subjects. There are several international agreements on road signing and marking from the UN-ECE and from the European Council of Ministers of Transport (ECMT). Most important are the UN Conventions on Road Signs and Signals of 1949 and of 1968. The UN also elaborated a European Agreement in 1971 and a Protocol on Road Markings in 1973 supplementing the '68 agreement.

These Conventions on Road Signs and Signals of 1949 and 1968, should not be confounded with other important UN agreements of 1949 and 1968, i.e. the Conventions on Road Traffic, which are also supplemented by a European Agreement of 1971.

In this chapter, all the international treaties will be analyzed briefly.

The UN-ECE has, like the ECMT did in 1975, consolidated the Conventions of 1968, the Agreements of 1971 and the Protocol of 1973 into a document entitled:"European Road Traffic Rules". A major revision of this document is being prepared since a few years now and has been adopted by the Principle Working Party on Road Transport at its eighty-third session. It is expected to come into force soon. The final document will comprise two parts, part I dealing with road traffic rules and part II dealing with road signs and signals.

The European Council of Ministers of Transport is another forum for international cooperation in this field. It has a similar position as the UN-ECE and is working on the same files in close collaboration with the UN-

ECE and the European Union and the OECD. The Council of Ministers can adopt Resolutions, which are of a similar value as the treaties of the UN-ECE because they are almost always implemented in national legislation.

In 1975, the ECMT consolidated the treaties of the E.C.E. into what is called a 'European Highway Code".

The work of the ECMT will just be commented in this chapter.

Mention should be made then of work done in an other body: CEN, the European Committee for Standardization. CEN is working in technical committees that each have a specific object for which they discuss technical harmonizations. A committee that is of interest to this study, is TC-226, which is concerned by European standards on road equipment. This TC is composed of several Working Groups (WG), which deal with specific topics, like there are road restraint systems, road markings, vertical signs, noise barriers, etc. Though CEN standardises, it does not fix road design standards. CEN is not making policy, but it is setting functional requirements.

The work of CEN will be studied in the light of interest to this study.

The other international bodies discussed, OECD, FEHRL, FERSI, IRF, IRU, PIARC, and PRI are important for all the work they fulfill as organisators of congresses, contractors of studies, by which a lively exchange of information is created. The field of interest and competence of these bodies will be studied.

A schematic representation of all these international agreements and other cooperation forms, could be the following (in chronological order):

Table 1:

Title:	Year:	Body:	Members:
Convention on Road Traffic	1949 and 1968	UN-ECE	UN-ECE members
European Agreement	1971	UN-ECE	UN-ECE members
Convention on Road Signs and Signals	1949 and 1968	UN-ECE	UN-ECE members
European Agreement	1971	UN-ECE	UN-ECE members
Protocol on Road Markings	1973	UN-ECE	UN-ECE members
"European Highway Code"	1975	ECMT	ECMT members
"European Road Traffic Rules"	1990	UN-ECE	UN-ECE members
European Agreement on Main International Traffic Arteries (AGR)	1975 (amended annexes 1988)	UN-ECE	UN-ECE members
TEM - Standards and Recommended Practice	1992	UN-ECE	UN-ECE members
TERN	1993 (and 1995?)	EU	EU members

In this study, the international organisations are presented in a linear order, which is decreasing competence. The international agreements that emanated from these bodies, are analysed meanwhile.

2. The European Union

2.1. Introduction

On 1 November 1993, the Maastricht' Treaty on European Union came into force. The European Union (EU) then has been designated specific competences in the field of road design. A new chapter on "Trans-european Networks" is inserted in the treaty of Rome. This inevitably will lead to a certain involvement of the EU in this field, or at least a positioning of the EU towards road design.

By the same Maastricht' treaty, art.75 of the treaty of Rome is amended and a new provision on road safety is added. This will provide a clear basis for communitarian action in this field, which was somewhat contested until now. The role road safety plays in road design is the object of this study. In the "Communication from the Commission to the Council for an action programme on road safety" the European Commission published lately, a chapter is dedicated to road infrastructure.

To understand the possible involvement of the EU, it is useful to highlight the history of its policies on infrastructure and road safety up to today. After this historical analysis of actions in both fields, possible future actions will be studied.

2.2. Historical analysis of EU actions in the field of infrastructure

Actions in the field of infrastructure have not only been undertaken in recent years by the EU. Already in 1966, a consultation procedure has been instaured. It provided a consultation of Member States, coordinated by the Commission, on their investments in infrastructure. In 1978, this procedure was renewed and the Infrastructure Committee was created.

A second phase began in 1982. In that year, a first regulation in a series of six was adopted for a specific action on financial assistance to infrastructure projects. Similar regulations were adopted in 1984 (2x), 1986, 1987 and 1988. Though these actions were punctual and of limited scope only, a set of criteria for selection has been developed that formed the preliminary for a kind of policy in the field of infrastructure.

A third phase started in 1990, when regulation 3359/90 was adopted. A three-year programme for investment in infrastructure was instaured that permitted a more long-term approach. The article 1 of the regulation gives clear objectives, one of which at least should be met by the infrastructure project. They are:

-elimination of bottlenecks,
-the integration of areas which, geographically, are either landlocked or situated on the periphery of the Community,

-the reduction of costs associated with transit traffic in cooperation with any third countries concerned,
-the improvement of links on land/sea routes,
-the provision of high-quality links between the major urban centres, including high-speed rail links.

These objectives are politically oriented selection criteria. The regulation does not give any specifications about standards the infrastructure projects have to fulfill.

In 1990 as well, the Motorway Working Group has been set up within the Transport Infrastructure Committee. It had to formulate a policy on transport networks in the field of motorways. A report was published in May 1992. To specify the outlines of this report, seven action groups were set up in the beginning of 1993. They are:

-NEMO I: Monitoring of the execution of the outline plan and its extension to the Union's partners
-NEMO II: Analysis of international mobility
-START: Standardisation of road typology
-MAGIC: Management of traffic
-AIRE: Integration of the trans-european network into the environnement
-SPREAD: Contribution of the road network towards spatial and economic development in the Union
-FINER: Financing of the road network

This work is meanwhile well under way. It should be noted that the working party of the AGR-treaty of the UN-ECE will wait for the recommendations of START before deciding any amendments to the second annex of that treaty. The recommendations of the different action groups, after being discussed and decided upon by the Motorway Working Group, are presented to the Commission, that can decide about the proper action it is going to take.

It is necessary and useful to say in this place something more about the work done by the START action group. The terms of reference of this action group ask to "define a European level of services in terms of:

1. Geometric and maintenance harmonisation
2. Harmonised system of road signs and general route information
3. Leisure and service facilities
4. Motorist information:- road traffic conditions
   - emergency services
   - tourist interest"

The START action group decided to take the international treaties as a base for their work, with the text of the AGR as a main starting frame, more specifically the text of Annex II, entitled "Conditions to which the main international traffic arteries should conform". This text is critically analysed and paragraphes are added or deleted where necessary. So there are important new paragraphes on a highway code, on vertical signs and road markings, on equipment (rest areas, emergency telephones, road information), on road works, and others. The final START action group report will probably be split up into two separate reports: one on motorways and one on non-motorways. In fact, the trans-European Road Network will consist of both motorways and non-motorways, given the low

traffic volumes on some major connections in the periphery of the European Union. The aforementioned Annex II of the AGR-treaty hardly defines any standards for this category of roads (see IV 3.3).

A formal decision on the trans-european road network was taken by the Council of Ministers of Transport on 19-11-1993. This means that the network is approved and adopted for a period of two years. Because of the right of co-decision of the European Parliament introduced by the Maastricht treaty for this field of action, a new proposal should be submitted by the Commission midth 1995 for adoption by both Council and Parliament. Whether the work of the action groups is going to be incorporated in or attached to this proposal, is not clear yet.

2.3. Historical analysis of EU actions in the field of road safety

When analysing the history of the road safety actions undertaken by the EU, 1984 can be considered as a turning point. In that year, the European Parliament adopted a Resolution on 13 March 1984 on the base of the Baudis Report. The Council followed by adopting a resolution stating that there was a need for Community action. It called upon the Commission to submit proposals and declared 1986 the European Road Safety Year.

Prior to 1984, a large number of actions were undertaken to secure the functioning of the internal market. For the free movement of goods, it was necessary to harmonise numerous technical aspects of vehicles like braking devices, lighting and light-signaling devices, anchorages for and installation of safety belts, roadworthiness tests, speed limitation devices for certain vehicles, etc. These directives have been amended many times and there number is still growing. The safety aspects of these regulations were though of less importance than the good functioning of the internal market.

From 1984 on, regulations more directly related to road safety have been adopted. Concerning driver behaviour, directives on driving licences and the wearing of seat belts, as well as on restraint systems for children have been adopted. Other regulations that have a direct impact on road safety concern dangerous substances (training requirements for drivers), social legislation (driving time/rest periods, tachograph) and technical measures (weights and dimensions).

On the more political side, there has been an evolution towards the realisation of a road safety policy. After the report Baudis, the European Parliament adopted in 1986 a new resolution based on the "Faith Report on common measures to reduce road accidents, as part of the Community's programme for the Road Safety Year, 1986". This road safety year has been evaluated in the "Seefeld Report on 1986 Road Safety Year: progress and prospects". Recently, the Report Tauran has been adopted by the European Parliament (January 1993).

The European Commission published a communication in 1989, titled "Road Safety: a priority for the Community". In 1989-1990, an indepen-

dent committee of high-level experts draw up a report on the road safety situation in the EU Member States, presenting in the same time a list of more than 60 proposals to improve the rather deplorable situation they found.

In 1991, the Council adopted a resolution requesting the Commission to draw up and implement a Community programme of measures on road safety. For that purpose another high-level group, constituted by representatives of Member States' governments, was invited by the Commission. The result of the work of these high-level groups is reflected in the Communication the Commission adopted in June 1993, titled "for an action programme on road safety".

2.4. Road safety and infrastructure

The EU is well aware of the direct link between road safety and infrastructure. This can be illustrated by the attention paid to this subject in the recent "white book" of the Commission, titled:"The future development of the common transport policy". In this politically important document, three paragraphes (202-204) deal with the role infrastructure plays in road safety. Paragraph 204 says:

> "To the extent that the Community, in the context of the development of trans-European networks, supports the development and modernisation of the road system, it is wholly appropriate that it gives full attention to the measures needed to reduce the accidents on the network which at present constitute such a terrible toll in both human and economic terms."

In the report "Trans-european networks: towards a master plan for the road network and road traffic", published in May 1992 by the Motorway Working Group, chapter 9 deals with road safety. Two points were considered to be of particular importance: infrastructure and harmonization of road signs. The paragraph on infrastructure is formulated in very general terms:"It is axiomatic that the choice of design will have a strong influence" (i.e. on road safety). Some points raised were:

- -separation of local and through traffic
- -provision of rest areas
- -road traffic information
- -lighting at night on major intersections

Furthermore, the work under way in the Working Groups of CEN is mentioned. The Motorway Working Group recommends "the Community should still consider further standardization" of road signs, e.g. "colours in direction signs".

The "action plan on road safety" the Commission published in June 1993 also contains a paragraph entitled "Infrastructure and road safety". This paragraph first of all evokes the question of the appropriate level of action: national or communitarian. Then it refers to the report on Trans-european Networks, pointing out that this report identifies the question of road safety and the need for harmonization and standardization of techni-

cal characteristics.

The report then identifies a limited number of objectives, which are:

-road surface characteristics
-dynamic equipment
-fixed equipment, "and, in particular, vertical signposting and road markings, while pointing out the importance of standardizing them on major roads at least"

For all these objectives, an extensive reference is made to the work done by CEN, and more specifically to the interpretative document of the "New Approach Directives", in this case Directive 89/106 [1].

For the moment, the actions undertaken in this field are notably studies. Mention can be made of this study and of studies concerning direction signs and regulatory signs. Future action will particularly concern the "exchange of information on technical aspects of infrastructure related to road safety and the pooling of know-how in this field."

2.5. Other relevant EU actions

Certain other actions are of direct interest to the subject of infrastructure and road safety. They are the legislation in the field of the internal market and of weights and dimensions and innovative developments in the DRIVE program.

For the functioning of the internal market, a free flow of goods, persons, capital and services must be assured. Technical trade barriers are therefore eliminated. This can for instance concern the installation of safety belts in cars. In the field of infrastructure, a certain number of task has been delegued to the CEN (see par.V.).

A series of directives concerning weights and dimensions saw the light since 1985. Actually, weights and dimensions are harmonized for vehicles of more than 12 t. in international traffic. In a recent proposal by the Commission, a harmonization for national traffic of all dimensions and of the total weights of combinations with 4, 5 or 6 axles. Notably the width of the design vehicle is of influence on the design of roads. The proposed maximum width of a lorry is 2m.55, with an exception of 2m.60 for refrigerator lorries. In most national road design standards, the design vehicle has a width of 2m.60.

In the research program DRIVE, under responsability of the Directorate General of Telecommunication of the Commission of the EU (DG XIII), the possible role of telecommunications on safety is studied. Advanced transport telematica applications can in the future be of influence on the design of roads. The outcome of these studies will have to be followed carefully. Other interesting research is carried out in the BRITE/EURAM

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[1] Council Directive 89/106/EEC of 21-12-1988 on the approximation of laws, regulations and administrative provisions of the Member States on construction products.

program of the Directorate General of Science, Research and Development of the Commission of the EU (DG XII), that deals a.o. with road construction materials. The regional policy of DG XVI and the energy policy of DG XVII of the Commission of the EU sometimes have effects on road safety as well.

2.6. Conclusions

As the Maastricht' treaty on the European Union entered into force on 1 November 1993, new fields of competence were attributed to the Union. A new provision on road safety was inserted in article 75 and a whole new chapter on trans-european networks (article 129) was added.

Article 75, 1 says:"For the purpose of implementing Article 74 (general article on transport delegating competence to the European Union), and taking into account the distinctive features of transport, the Council shall, acting in accordance with the procedure referred to in Article 189c and after consulting the Economic and Social Committee, lay down:
(a) common rules applicable to international transport to or from the territory of a Member State or passing across the territory of one or more Member States;
(b) the conditions under which non-resident carriers may operate transport services within a Member State;
(c) *measures to improve road safety*;
(d) any other appropriate provisions."

The articles 129b, 129c and 129d form the new Title XII of the Treaty of Rome, inserted by the Maastricht' treaty on the European Union, on "Trans-european Networks". Article 129b defines the objectives of the Trans-european Networks, article 129c the actions and article 129d the procedures. One of the actions article 129c distinguishes, is:"(In order to achieve the objectives referred to in Article 129b, the Community) shall implement any measures that may prove necessary to ensure the interoperability of the networks, in particular in the field of technical standardization;".

It is clear that the European Union has been attributed competences in the field of road safety and infrastructure. Further action will be undertaken, but for a first period, given the principle of subsidiarity, the exchange of information and the study of main points of interest will be started. On a longer term, the European Union will be the principal actor in this field, because of the delegation of power in the field of transport from the Member States to the Union and because of the legally binding juridical acts the Union can take and which can be enforced by legal means.

3. European Conference of Ministers of Transport

The European Conference of Ministers of Transport (ECMT), an intergovernmental organization, established by a Protocol signed in Brussels 17 October 1953, is now existing for more than 40 years. It is a forum for discussion for the Ministers of Transport of European countries. The purposes of the Conference are "to take whatever measures may be necessary to achieve, at general or regional level, the most efficient use and rational development of European inland transport of international importance" and "to co-ordinate and promote the activities of international organizations concerned with European inland transport, taking into account the work of supranational authorities in this field".

So, the ECMT has encouraged the UN-ECE to draft the treaties on road signs and signals, as well as on road markings. The ECMT prepared much of this work and is still studying further action in this field. Another means the ECMT has to realise its purposes, are Round Tables and Symposia.

The work of the Council is prepared by a Committee of Deputies. Their work is prepared by standing committees, such as there are the committee for road safety and the committee on road traffic and signalization. Recent notes for discussion in the lastmentioned committee are the harmonization of traffic signs and the coherence between infrastructure, signalization and road traffic rules.

In 1986, the ECMT published an overview of its principal actions in the field of road safety.[2] In the preface, the role ECMT can play, is put in perspective:"It should be pointed out that the Conference is not a supranational organization and so has no decision-making machinery to ensure the immediate and direct application of the provisions adopted. When the Ministers of Transport of the Conference meet in Council and approve a draft Resolution they enter into a political commitment to implement the proposed measures in their respective countries." But this is a commitment only and there is no instrument for enforcement. This is the most significant difference with the European Union, which accounts also for all the other international organizations.

[2]ECMT, "Principal actions of ECMT in the field of road safety", Paris, 1986

4. The United Nations, Economic Commission for Europe

4.1. Introduction

The Economic Commission for Europe of the United Nations (UN-ECE) is one of the regional bodies the United Nations know. It is working as an inter-governmental organization. The countries member of UN-ECE have established several treaties, agreements, conventions or still other documents that deal with specific subjects, which demanded an international approach. Countries can become a Contracting Party to a treaty, that enters into force when a given number of countries have signed and/or ratified that treaty. Later amendments are not always automatically binding, but concerning the treaties studied in this chapter they are, or the Contracting Parties have to withdraw. No means for legal enforcement exist.

4.2. European Road Traffic Rules

The European Road Traffic Rules are not a formal UN-ECE treaty yet. It is an informal document, presented as a draft version in October 1990 and can after adoption become a new treaty. It includes:
-the provisions of the 1968 Conventions on Road Traffic and on Road Signs and Signals as supplemented by the 1971 European Agreements and the 1973 Protocol on Road Markings;
-the draft amendments to the Conventions and European Agreements adopted by the Principal Working Party on Road Transport at its eighty-third (special) session.
The lastmentioned adopted draft amendments form a substantial part of the new text. Therefore, the document contains a lot of valid and new information, worthy to be published in an official document, so that the actual state-of-the-art at the UN-ECE level would become transparent.

4.2.1. *Road Traffic Rules and Annexes*

This part I of the European Road Traffic Rules is the most interesting to this study on safety effects of road design standards, and more precisely the chapter I:"General Provisions". Article 1 gives definitions on all kind of vehicles, but also on infrastructure. It defines a built-up area, a residential area, a road, a carriageway, a lane, an intersection, a level-crossing, and a motorway. This last definition is as follows:

"Motorway" means a road specially designed and built for motor traffic, which does not serve properties bordering on it, and which:
(i) Is provided, except at special points or temporarily, with separate carriageways for the two directions of traffic, separated from each other either by a dividing strip not intended for traffic or, exceptionally, by

other means;
(ii) Does not cross at level with any road, railway or tramway track, or foothpath; and
(iii) Is specially sign-posted as a motorway.
This definition is exactly the same as the one used in the AGR-treaty (see IV.3.)

The other articles of Chapter I deal with the annexes (art.2), with the obligations of the Contracting Parties (art.3) and with signs and signals (art.4)

Chapter II contains the main information of this part I of the Road Traffic Rules: rules of the road. Several articles are directly or indirectly related to this research. So there are:
-art.18: Intersections and Obligation to Give Way
-art.19: Level-crossings
-art.22: Islands on the Carriageway
-art.25: Motorways and Similar Roads
-art.25bis: Special Regulations for Tunnels Indicated by Special Road Signs

All these articles contain information on traffic rules that do play a role when assessing the safety of certain infrastructural facilities. Article 25: "Motorways and Similar Roads", gives the normal restrictions applying to motorways:
-prohibition to pedestrian, animals, cycles, mopeds, ...
-no parking
-no U-turn
-driving to the right
But the same article states: "2. Drivers emerging on to a motorway shall give way to vehicles travelling on it. If there is an acceleration lane, they shall use it." (adopted amendment) Such a rule is important when studying acceleration lanes.

Chapter III gives the "Conditions for the Admission of Motor Vehicles and Trailers to International Traffic". Chapter IV deals with "Drivers of Motor Vehicles" and Chapter V with "Conditions for the Admission of Cycles and Mopeds to International Traffic". Then still follow 6 annexes of which annex 5 "Technical Conditions Concerning Motor Vehicles and Trailers" and annex 6 "Domestic Driving Permits" are important.

4.2.2. *Road Signs and Signals and Annexes*

This part II of the European Road Traffic Rules is set up in a similar way as part I. The first chapter, "General Provisions", is almost identical. The main information can be found in the chapters two to four. Chapter two deals with "Road Signs", chapter three with "Traffic light signals" and chapter four with "Road Markings". Chapter five is entitled "Miscellaneous".

The annexes to this part are most important as they give precise samples of signs, signals and markings.

4.2.3. *Conclusion*

The ongoing work at the forum of the Principal Working Party on Road Transport of the UN-ECE can be considered as being of great importance. It is not the only place at international level where a harmonisation of traffic rules and of signs, signals and markings has been discussed for so many years - the ECMT has worked closely together with the UN-ECE in the preparation of the treaties, and the EU has more recently started studying appropriate action in this field - but the treaties are the only international documents of public law dealing with this question. It is an excellent basis for further, more legally binding harmonisation at the EU-level, as soon as this would appear to be opportune and necessary.

4.3. European Agreement on Main International Traffic Arteries

The European Agreement on Main International Traffic Arteries, known as the AGR agreement was signed on 15 November 1975 and entered into force on 15 March 1983. Of all EU countries, Ireland and Spain are not members of AGR. Great Britain signed but did not ratify. Of the EFTA countries, Norway is not a member and Finland and Austria signed, but did not ratify. Iceland is not concerned by this agreement. (situation as on 1-12-1992)

The agreement is composed of a so called "main text" and of three annexes.

4.3.1. *The main text*

The main text defines and establishes the international E-road network, referring to annex I (art. 1 + 2).

Article 3 states:"The roads of the international E-road network as referred to in article 1 of this Agreement shall be brought into conformity with the provisions of annex II to this Agreement." There is no time limit for doing so.

Article 4 deals with the signing of the network.

The rest of the main text deals with juridical aspects, being: the procedure for the signature (art. 5), the entry into force (art. 6), the procedures for amending the main text and the annexes (art. 7-9), notification of the adress of the national administration (art. 10), cessation of validity of the Agreement (art. 11-12), settlement of disputes (art. 13 and 15), limits to the application (art. 14), notifications to the contracting parties (art. 16) and the deposit of the present Agreement (art. 17).

The text of the agreement being in force today is the original main text and the annexes as amended in 1988.

The UN-ECE envisages a new revision of the AGR. At a first meeting, held in September 1993, it was decided to wait for the outcome of the work done by the START action group, working for the Motorway Working Group, instaured by the Directorate Generale of Transport of the Commission of the EU. (see II.2.)

4.3.2. *Annex I*

Annex I describes the numbering system first and then gives a list of roads. A distinction is made between main roads (A-roads) and branch, link and connecting roads (B-roads). Other distinctions made are the orientation (west-east and north-south) and a distinction between reference roads and intermediate roads.

4.3.3. *Annex II*

Annex II is named: "Conditions to which the main international traffic arteries should conform". Confusion can raise, whether these conditions do also apply to the B-roads, being the branch, link and connecting roads, as the A-roads are called 'main roads". But they do apply to the entire network.

4.3.3.1. General

The annex opens with a chapter called "General". Remarkable is the fact that main international traffic arteries are allowed to cross built-up areas, and moreover, that in these rather unsafe areas the conditions set out in annex II do not apply.
A direct reference to safety is here made, saying that traffic safety criteria were taken into account in the provisions of this annex. They are not specified however.

4.3.3.2. Classification

Chapter two gives a rough classification of international roads. Three categories of roads are distinguished: motorways, express roads and ordinary roads. There seems to be nor a functional philosophy neither capacity definitions underlying this classification. Only the design standards are different.

The characteristics for motorways are quite clear:
-for motor traffic only;
-not serving properties bordering on it;
-separated carriageways with a dividing strip not intended for traffic;
-no at level crossings;
-motorway sign posting.

For the two other types of roads, the characteristics are less evident. Express roads are:
-reserved for motor traffic;
-accessible only from interchanges or controlled junctions;
-stopping and parking are prohibited on the running carriageway(s).
Ordinary roads, as a last category, are open to all categories of users and vehicles, and may have single or separate carriageways. The final specification is that international roads preferably should be motorways or express roads.

4.3.3.3. Geometric characteristics: general considerations

The first paragraph of this chapter says:"The choice of geometric characteristics shall be such as to afford to all users proper safety and traffic flow conditions, bearing in mind the function of the road and the general behaviour of drivers." No reference though is made to what proper safety means to be, nor to the function of the road, neither to the behaviour of drivers.

Mention is made of general consistency of the route (for new ones and upgrading existing ones, or construction in stages) and of 'readability'' by the driver. Internal consistency of construction characteristics is also explicitly mentioned.

Essential in this paragraph is the description given of design speed: "The design speed is that speed which in a scheme for the improvement or construction of a road is chosen to determine geometric characteristics permitting isolated vehicles to travel at this speed in safety." The choice of the design speed is crucial for the overall design of the road.

The range of recommended design speeds in km/h on international roads is as follows:

Table 2:

Motorways	x	80	100	120	140
Express roads	60	80	100	120	x
Ordinary roads	60	80	100	x	x

AGR makes another specification in direct relation to design speed: "Design speeds of over 100 km/h should not be selected unless the carriageways are separated and the layout of intersections so permits.' This means that express roads with a design speed of 120 km/h must have separated carriageways (as well as all motorways).

4.3.3.4. Geometric characteristics: horizontal and vertical alignment

In this paragraph, the following recommended figures are given:

Table 3:

Category (design speed)	60	80	100	120	140
Minimum radii in plane (max. superelevation of 7%)	120	240	425	650	1000
Maximum gradient (perc. not to be exceeded)	8	7	6	5	4
Min. radii at highest point of the vertical alignment one-way	1500	3000	6000	10000	18000
Min. radii at highest point of the vertical alignment two-way	1600	4500	10000		
Min. radii at the lowest point of the vertical alignment	1500	2000	3000	4200	6000
Min. stopping distance	70	100	150	200	300

Some other values are specified. The gradient resulting from longitudinal slope and superelevation shall not exceed 10 per cent.
Visibility distances - the agreement does not specify what this includes - shall at least be equal to stopping distances for obstacles over the whole length of the road.

On this point, the rather loose, non-obligatory character of values AGR specifies, can be demonstrated. Partly this appears through general attenuations like "should" or "when possible". But most reservations are made for ordinary roads and express roads, the agreement only being specific for motorways. For example: "On two-way roads, the minimum visibility distances required for overtaking shall be provided on as great a percentage of the length of the road and be as uniformly distributed as possible."

4.3.3.5. Geometric characteristics: cross-section

The number of lanes must be based on "foreseeable flows of traffic" and must ensure a "necessary standard of service". The width of lanes is 3.50m minimum; supplementary lanes on gradients may be 3m only. Separate one-way carriageways are prescribed on motorways and strongly recommended for other four-lane roads. The use of the central lane of three-lane roads must be 'particularly taken care of".

For motorways, the shoulder should be 3.25m, of which 2.50m should be stabilized and paved. Shoulders of ordinary roads should be 2.50m large, of which a stabilized lateral strip of at least 0.70m width.

An obstacle-free area of at least 3m should be provided beyond the edge of the running carriageway. Obstacles should be isolated by appropriate means.

The recommended minimum width of the central reserve on motorways and roads with separate carriageways is 3m. It shall normally be equipped with safety barriers. Crossfall should be from 2 to 3 per cent and overhead clearance shall not be less than 4.50m.

4.3.3.6. Geometric characteristics: intersections

On motorways, grade-separated intersections shall be obligatory. On other roads, level junctions or grade-separated junctions of all possible types (with or without traffic lights, roundabouts) can be constructed. Principles on the use of right and left-turn deceleration lanes are given, as well as on intersection angles. Objectives of simplicity and uniformity are stressed once more.

The values for slip roads of grade-separated junctions, which permit traffic to pass from one road to another, are defined.

Table 4:

Slip roads	Values
width	6m(one-way carriageway) 9m(two-way carriageway)
internal min. radius on the level	50m
max. ascending gradient	7%
max. descending gradient	8%
min. radius in convex vertical curve	800m
min. radius in concave vertical curve	400m

Further recommendations are given on weaving sections, divergence and convergence of traffic streams, deceleration and acceleration lanes and tapers.

4.3.3.7. Equipment, environment and landscaping, maintenance

The chapter on equipment comprises such different topics as vertical signs, road markings, roadworks and signing, safety barriers, traffic control, road lighting, rest areas, ... Reference is made to the interna-

tional agreements in this field. Only recommendations are formulated, no standards, e.g. "Lighting is desirable in some special areas ... '

The chapters on environment and landscaping and on maintenance are also set out in very general terms, but regular reference to safety is made.

4.3.4. *Annex III*

This very brief annex deals with the identification and signing of E-roads.

4.3.5. *Conclusion on the AGR*

When comparing the AGR, annex II of 1975 and 1988, the latter one is much looser, unprecise. This is a surprising constatation. Values given are less restrictive, strong limits are fewer. It seems that in this way, the annex can respond better to the diversity of national norms.

The text of 1988 is though the one in viguour right now. A very weak point seems to be the classification. The category of motorways is clearly defined. Express roads are not. The ordinary roads, which surprisingly enough still form part of the E-road network, are left almost without any values or standards. A very clear (functional) classification philosophy would encounter these problems. Anyway, if no international agreement on the categories of roads under the motorway category could be reached, this seems to prove that the national situations are divergent and research is necessary on this topic.

4.4. Trans-European North-South Motorway

4.4.1. *Introduction*

The Trans-European North-South Motorway, or shortly TEM, is a network of motorways in the central European countries, being Austria, Bulgaria, the Czech Republik, Greece, Hungary, Italy, Poland, Romania, the Slovak Republics, Turkey and former Yugoslavia. Work on the TEM started officially on 1 September 1977, after several years of preparation. The United Nations Development Programme supported the TEM project and the UN-ECE has been (and still is) the executing agency responsible for technical backstopping and administrative aspects of the coordination activities. There is nothing such as a UN-ECE TEM-treaty.

Due to political difficulties in some of the central European countries and due to the economical recession, the construction process has slowed down and the rather "generous" standards are under discussion. Poland recently changed the standard for lane width from 3m.75 to 3m.50, thus diverging from the TEM standard of 3m.75.

4.4.2. *TEM-Standards*

The TEM document "Standards and Recommended Practice" only deals with motorways, which have well defined general characteristics. Only these roads can be signposted as TEM motorway sections. Phased construction, a realistic approach for the countries concerned, is foreseen and treated consequently as well. These roads, not having the full motorway characteristics yet, are signposted differently, as TEM route connecting sections.

The TEM has only one category of road, motorways, so it does not have a classification system like the AGR. All the standards specified do apply to motorways. The TEM standards stipulate[3]: "The TEM is classified in the category "motorway". In principle the standards refer, therefore, to a highway:
-consisting of two one-way carriageways with a minimum of two lanes each, separated by a central reserve not intended for traffic;
-reserved for use by certain categories of motor vehicle in accordance with international agreements;
-accessible by means of grade-separated interchanges;
-where, except in the case of service and rest areas, no stopping is allowed other than on the hard shoulders (emergency stopping lanes) or in lay-bys, and then only in emergencies;
-provided with traffic signs indicating the beginning and the end of the motorway."

Annex II of AGR is titled "Conditions to which ..." and gives some values which E-roads should conform to, as well as it formulates recommendations. The TEM document on road design standards is titled "Standards and recommended practice". This title already shows us the philosophy of the document, which is given in the introduction of the document:
"Each specific provision has been formulated in accordance with the following subdivisions:
(a) Essential and uniform throughout the whole length of the TEM. Countries will make every effort within reason to comply with these Standards: (S)
(b) Recommended practice: (RP)"
Throughout the whole TEM document one can find very clear indications about the status of the design standard concerned.

TEM deals extensively with all aspects found already in the AGR Annex II. Moreover, it describes extensively the design parameters of bridges and tunnels, of pavements, of drainage systems and of supervision of construction works. It largely deals with traffic regulation and safety facilities like signs, marker posts, lighting and others. Further on, chapters on facilities like rest areas, toll and frontier check-points, on environmental considerations and on maintenance can be found in this document.

Only a general overview of standards can be given within the scope of

[3]TEM, Standards and recommended practice, July 1992

this study. Tables with figures would mean reproducing a great number of pages.

Chapter 1 gives some general considerations. Chapter 2, entitled "Planning", gives values for the level of service, which are taken from the Highway Capacity Manual of 1965. Chapter 3, "Design Parameters", gives parameters for design speed, horizontal and vertical alignment, gradients, crossfall, superelevation, cross section, shoulders, median, interchanges, pavements, construction works, and still some other features. Chapter 4, "Traffic regulation and safety facilities", deals with road signs and road markings, lighting, safety fences, anti-glare devices, traffic control and traffic regulation. Furthermore, there are detailed descriptions of facilities like rest and service areas and check points (chapter 5), of environmental considerations (chapter 6), of bridges (chapter 7) and tunnels (chapter 8), and of maintenance (chapter 9).

The TEM-standards seem mainly to be based on the Highway Capacity Manual of 1965. Compared to the AGR-treaty provisions, they are very detailed and it is legitimate to wonder, given the economical situation, if they still can be met in practice. Do such "large" standards improve safety in the first place? A short comparison of AGR, TEM and national standards is interesting to learn whether these international standards are compatible.

4.4.3. *Comparison of some AGR, TEM and national standards*

Only where a conflict between the international and the national standards was noted, a short description of the conflict is given. In tables, which can be found in the annex attached to this document, these conflicts are visualised.[4]

Table 1: minimum stopping sight distance
France, Italy and The Netherlands do not apply the AGR value for the 60 km design speed. Nor does Norway, but that country is not member of AGR

Table 2: minimum horizontal curve radius
Greece and Portugal do not apply the AGR value for the 80 km design speed. Greece and Switzerland don't for the 100 km design speed, nor do Greece for the 120 and Italy for the 140 km design speed. Ireland and Norway, not members of AGR, do not apply the values for all design speeds.

Table 3: maximum superelevation
Portugal does not apply everywhere the AGR value. Nor does Norway.

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[4]The tables in the annex are taken from: "Comparison of Road Design Standards and Operational Regulations in EC and EFTA Countries", Dr.D.O'Cinnéide a.o., Traffic Research Unit, University College Cork, Cork, February 1993 (DRIVE II, Project V20-02, Workpackage 9, Commission of the European Union, DG XIII)

Table 4: maximum gradient
Austria, Italy and Switzerland do not apply the AGR value for the 60 and 80 km design speed.

Table 5: minimum vertical radius - convex
Italy, The Netherlands and Spain (not a member of AGR) do not apply the AGR value for all design speeds.

Table 6: minimum vertical radius - concave
Italy and The Netherlands do not apply the AGR values. Nor do Norway and the United Kingdom which are not members of AGR.

Table 7: cross-section
All countries apply the AGR values. It is here that applying TEM standards would encounter opposition from some EC and EFTA countries. The TEM values in the other tables differed little from AGR values.

5. Comité Européen pour la Normalisation

5.1. Introduction

Much of the work on standardization is today an international process. At an international, global level are operating the International Standardization Organization, ISO, and the International Electrotechnical Committee, IEC. At a regional, european level, three organizations are active in the field of harmonization. They are:
-European Committee for Standardization, CEN (French acronym)
-European Committee for Electrotechnical Standardization, CENELEC
-European Telecommunication Standards Institute, ETSI
At national level, national standardization institutes are active, which also cooperate in the regional and global organizations.

In the perspective of this study, the work CEN is undertaking is of great importance. Its policy is fixed by the General Assembly (AG) and the coordination of the technical work is done by the Technical Board (BT). The Technical Board advices the General Assembly, decides on standardization, controls the standardization programs and organizes the execution thereof. For the organization Technical Sectorial Boards (BTS) can be installed. Technical Committees (TC), eventually supported by Subcommittees (SC), are installed by the Technical Board to execute a specific part of the harmonization work. A Technical Committee can have Working Groups (WG) which are always temporary and which have a precise task.

Different degrees of harmonization are possible and the documents vary accordingly. These are:
-European Standards, prepared by a Draft European Standard: Member States have to adopt such a standard without any changes in their national legislation;
-Harmonization Document, prepared by a Draft Harmonization Document: Member States have to withdraw conflicting standards, may implement a corresponding standard, but must at least publish the Harmonization Document;
-European pre-Standards: when consensus on standardization can not be reached a pre-Standard can be drafted as a starting point for further discussion. It may indicate future developments. Member States may maintain conflicting legislation;

Another important document existing is the CEN-report. It is a publication of technical data or an inventarisation of standards per country.

5.2. The E.U. and CEN

Proposals for standardization can be raised by international, regional and national organizations. The European Union has become an important

'commissioner" of standardization. In its legislation there can be direct reference to the need of standards: national technical specifications can form trade barriers that have to be eliminated between the Member States of the European Union.

In an earlier stage, the European Union produced directives that concerned one product only. Given the increasing quantity of work involved eliminating technical trade barriers, this procedure became unworkable. In 1985, the "new approach" was therefore adopted. In "new approach directives" only general requirements concerning health, safety, environment and consumer protection are formulated. They are called the fundamental requirements. A directive new approach thus applies to a whole group of products. The technical work is handed over to CEN. The principle of subsidiarity is also favoured by this new approach. Products resorting under a directive new approach have to fulfill the fundamental requirements. Then the product may carry the CE-mark (Conformité Européenne).

5.3. TC 226 and TC 227

Two Technical Committees are working in the field of road infrastructure. It are TC 226 'Road Equipment" and TC 227 'Road construction and maintenance materials". Both Technical Committees have several working groups. These are:

CEN/TC 226:

- WG 1 'Road restraint safety systems'
- WG 2 'Horizontal signs'
- WG 3 'Vertical signs'
- SG 'Variable information'
- WG 4 'Traffic signs'
- WG 5 'Traffic lights'
- WG 6 'Noise protection devices'
- WG 7 'Emergency telephones'
- WG 8 'Temporary signs'
- WG 9 'Parkmeters'
- WG10 'Brake away safety systems'

CEN/TC 227:

- WG 1 'Joint fillers'
- WG 2 'Asphalt'

But also work in other Technical Committees can be of interest, like TC 169 "Applied illumination" or TC 19/SC 1 "Binders for asphalt constructions".

The actual work done by these Technical Committees concerns the technical specifications only. These technical specifications have to be described and fixed in classes, that do have to correspond with the classes existing in the national legislations. Certain "low" classes garanteeing insufficiently the safety requirements may be eliminated, 'high' classes may not. Harmonization may be effected to reduce a to great number of classes. For every technical specification set by CEN a testing method has to be

provided at the same time.

The actual color of a sign, its position or its frequence, the choice for a certain pavement on motorways, the obligation of noise protection devices along built-up areas, all that are political decisions that have to be taken by other national or international organizations; it is not a CEN task.

TC 226 and TC 227 have in this moment not yet finalized any standards. But the work done by these Committees is a preliminary for much future work by organizations who can take more political oriented decisions. To make it possible to impose e.g. a pavement type on motorways, these types first have to be classified by CEN.

The work done by these Committees falls under the Construction Products Directive 89/106/EEC. The essential requirements referred to in Annex I of this Directive concern "Works", being all building and engineering constructions. These requirements are put in performance terms: mechanical resistance and stability, safety in case of fire, hygiene - health - environment, safety in use, protection against noise and energy economy and heat retention. These requirements have to be fulfilled for an economically reasonable working life, subject to normal maintenance. The mandate given to CEN concerns the products used in works. For making the link between the requirements formulated in the Directive and the products to be standardized, an interpretative documents for each requirement has been drawn up. These are meant to guide the CEN standardization work.

The essential requirement "safety in use" states that the construction work will not present an unacceptable risk for accidents such as slipping, falling, collision, burns, electrocution and injury from explosion. The interpretative document therefore puts that the risks to be covered have to be:

- -impacts by falling after slipping, stumbling or tripping or falling due to changes in in level
- -direct impacts
- -burns
- -electrocution and electrical shock
- -explosions
- -accidents resulting from vehicle movement

6. Other International Organizations

A great number of other organizations are existing that represent specific groups of users, supplyers, countries, interest organizations a.o. Some of them have to be mentioned here for the special interest they have in the field of infrastructure.

6.1. Organization for Economic Cooperation and Development

The Organization for Economic Cooperation and Development, OECD, was created by a Convention signed in Paris on 14 December 1960 and has 24 Member States. Its purpose is to promote policies that aim to achieve sustainable economic growth and employment and a rising standard of living. The Road Transport Research Program is one of the activities. It was founded in 1968 and the activities take the form of Scientific Expert Groups, Research Workshops, Seminars, Symposia and Conferences and joint research programmes. A good overview can be found in its recent publication "Road Transport Research Outlook', at the occasion of the 25th anniversary of the Program.[5]

6.2. ERSF AND ETSC, FEHRL, FERSI, IRF, IRU, PIARC, and PRI

The European Road Safety Federation (ERSF) and the European Transport Safety Council (ETSC) have both been founded in 1993. The ERSF is an organization constituted by international bodies that represent consumer and industry interests. Its founding members are the:

-Alliance Internationale du Tourisme (AIT)
-Fédération Internationale de l'Automobile (FIA)
-Association des Constructeurs Européens d'Automobiles (ACEA)
-International Road Federation (IRF)
-Prévention Routière International (PRI)
-International Road Union (IRU)

The European Transport Safety Council is the independent counterpart of the ERSF and is not only aiming road safety but more generally transport safety. Its founding members are:

-Deutsche Verkehrssicherheitsrat (DVR)
-Parliamentary Advisory Council for Transport Safety (PACTS)
-Raad voor de Verkeersveiligheid (RVV)

It is not clear yet what the role of the ERSF and the ETSC will be, nor whether their activities will be conflicting. The membership of the PRI in

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[5]OECD, "Road Transport Research Outlook", 25th anniversary, Paris, 1993 (French title:"Perspectives de la recherche en matière de routes et de transports routières")

the ERSF seems to contradict the opinion that the ERSF is only representing the consumer and industry interests.

The Forum of European National Highway Research Laboratories, FEHRL, has been created in 1989. Its mission is to encourage collaboration between their laboratories and to provide relevant knowledge to EC and EFTA governments, the European Union, the road industry and road users.

The Federation of European Road Safety Institutes, FERSI, has as well been created in 1989. Its purpose is to collaborate to improve road safety. Knowledge will be exchanged and international studies can be carried out in good cooperation. Its founding members are:

-Kuratorium für Verkehrssicherheit (Austria)
-Institut Belge pour la Sécurité Routière (Belgium)
-Radet for Trafiksikkerhedsforskning (Denmark)
-VTT (Finland)
-INRETS (France)
-BASt (Germany)
-SWOV (The Netherlands)
-TØI (Norway)
-LNEC (Portugal)
-VTI (Sweden)
-BPA (Switzerland)
-TRL (United Kingdom)

The International Road Federation, IRF, represents the highway engineering companies, who construct motorways. The IRF pays a lot of attention to research for which it sets up Working Groups. One of these is the IRF Working Group on Road Signing and Safety Equipment. Regularly studies are executed of which the reports are distributed by the IRF-seat at Lausanne

The International Road Transport Union, IRU, represents the road users. Its purpose is to contribute to the promotion and prosperity of the national and international transport of passengers and goods by road and to safeguard the interest of professional road transport and road transport for own account. In 1986, on the occasion of the Road Safety Year, it published a brochure, of interest to this research, entitled: "Road Transport and Road Safety".[6]

The Permanent International Association of Road Congresses, PIARC, organises a world road congress every four years. During the congress held in Brussels 13-19 September 1987, Conference Discussion No.1 dealt with "Road Safety and Infrastructure".[7] PIARC also regularly effects studies and publishes "country-specials" in its journal.

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[6]IRU, "Road Transport and Road Safety", Geneva, 1986

[7]PIARC, 'Road Safety & Infrastructure", Conference Discussion No.1, Brussels 13-19 September 1987, XVIII World Road Congress

The "Prévention Routière Internationale", PRI, is a worldwide organization favouring road safety. It organises international campaigns on particular themes of important interest to road safety, it organises world congresses on road safety, as well as round table conferences. To spread out information, it publishes a quarterly journal.

7. Conclusion

In this paper on international road design standards, the work of international organizations in the field of road safety and infrastructure is analysed.

The most important organization in this perspective is the European Union. This is not due to the work already done in the past, but more to the potential this organization has. In effect, it is the only international organization that can enforce by legal means the decisions taken. It therefore is a very effective forum for harmonization, also to confirm the work already done in other international fora. Recently, a code of conduct, called the principle of subsidiarity, was adopted. This principle says that only those actions that can be undertaken more efficiently by the Member States all together, will be executed by the European Union. For all other actions the more appropriate level for execution will be the national or regional one.

In the field of road safety and infrastructure a more complex situation seems to occur. As the European Union will be a prime investor in infrastructure, it is logic that decisions are taken at that level. The execution of the projects occurs at a national and even a regional level however. The planning of infrastructural investments is a matter of both European and national interest. The outcome could be that the European Union fixes a set of criteria to which new infrastructure has to respond.

In this moment, the Commission of the European Union is studying the policy concerning road safety and infrastructure. The Treaty of Rome, as amended by the Maastricht' Treaty on the European Union, delegues power to the European Union for both road safety and infrastructural networks. It is explicitly asked to define technical specifications for these Trans-european Networks. This will involve safety aspects, as among others studied by this research.

The United Nations' Economic Commission for Europe is the international organization which is of great importance in the field of infrastructure and, to a lesser extent, of road safety. This importance is due to the long experience of action in this field of interest. The treaties discussed in paragraph four are the only existing international treaties. They can not be enforced, but they remain of value as a basis for international discussion.

The conventions and agreements incorporated in the Draft European Road Traffic Rules have been subject to regular updating and amendments. It therefore is a very actual and useful document.

The Annex II of the AGR-treaty, dealing with the conditions international traffic arteries have to fulfill and which is of concern to this study, has been updated in 1988. The updated version seems however a less precise document that therefore is not a very elaborated starting point for further harmonization. It proves that harmonization in the field of infrastructure is very difficult.

The main conclusion that can be drawn, is that AGR, which is the only international agreement in the field of infrastructure and dealing with road design standards, is too loose. It gives very few ''standards' and recommendations are unprecisely formulated. Moreover, AGR utilises a classification that worsens the clarity of the reader of the agreement and of the user of the E-road network, which consist of bendy, narrow two-way single carriageway roads up to large motorways, all having the same E-number signposting.

The European Council of Ministers of Transport is another forum for international cooperation in this field. It has a similar position as the UN-ECE and is working on the same files in close collaboration with the UN-ECE, the European Union and the OECD. The Council of Ministers can adopt Resolutions, which are of a similar value as the treaties of the UN-ECE. Their implementation can not be enforced, but therefore decisions are most of the time taken by unanimity and thus transposed in national legislation.

Given the legal means and the financial power the EU has, the EU will be the main actor in the field of road safety and infrastructure. The principle of subsidiarity will make the EU coordinate its actions with the other international organizations and the Member States of the EU. The EU will only undertake action when appropriate and according to the aforementioned principle. The relation between the EU and other international organizations like the ECE-UN and the ECMT should be of cooperative nature. However, if the EU will be enlarged, the specificity of ECE-UN and ECMT (having far more Member States) will be reduced. A clear partition of tasks would improve clarity.

The European Standardization Organization, CEN, is important for its work done in the field of Standardization, in collaboration with the Commission of the European Union. TC 226 and TC 227, dealing with road equipment and road construction and maintenance respectively, have been created in 1990 and will play an important role in fixing classes for the products concerned. This work can be used in future, e.g. for setting high standards for the category of motorways.

The other international bodies discussed, OECD, FEHRL, FERSI, IRF, IRU, PIARC, and PRI are important for all the work they fulfill as organizers of congresses, contractors of studies, by which a lively exchange of information is created. OECD and PIARC are the main actors in the field of research. Their working field is clearly defined (OECD: transport, PIARC: road transport) and their research is organized in a very effective way. FERSI is the principal actor for road safety research. FEHRL, although no research of their behalf is known today, could be a prime research actor in the field of road engineering. PRI is the independent body for promoting the cause of road safety and for organizing campaigns and the diffusion of information. IRF and IRU are the organizations that defend the interest of the road users and the road constructors. As such, they can provide valuable information on the state-of-the-art of the roads and their usage.

TABLE 1	MINIMUM STOPPING SIGHT DISTANCE (m)												
	RURAL ROADS												
DESIGN SPEED (km/h)	140	130	120	110	100	90	85	80	70	60	50	40	30
AGR													
AUSTRIA	380		275		185			120	90	70	50	35	
BELGIUM			275			150				70			
DENMARK			255		180			120		75			
FINLAND			250		180			120		75	60		
FRANCE					160			105		65		40	
GERMANY			330		230	230		180	150	118			
GREECE			280	280	190	155		125	94	69	48	31	17
ICELAND					170	140		115		70	50		
IRELAND			270		190			130		80		40	
ITALY	313		229		160			103		58		28	
NETHERLANDS			260		160*	135		105*	80	65*	40	35*	30*
NORWAY					175	147		119	87	64			
PORTUGAL			250		180			120	100	80	60	40	
SPAIN	274		221		171			125					
SWEDEN				195	165		120				70		35
SWITZERLAND		340	280		195			125		75			
UNITED KINGDOM			225		165		125		95	70	50		
T.E.M.	325		225		150			100					

MINIMUM STOPPING SIGHT DISTANCE (m)
(Figures apply to a 0% gradient)

NOTE : Above values represent
"Absolute Minimum" for UK
and "Minimum" for all other countries

* Non-Motorway Design Speeds (NL)

TABLE 2	MINIMUM HORIZONTAL CURVE RADIUS (m)												
DESIGN SPEED (km/h)	140	130	120	110	100	90	85	80	70	60	50	40	30
AGR	1000		650		450			240		120			
AUSTRIA	1000		700		450			250	180	125	80	45	
BELGIUM			750			350				130			
DENMARK			872		492			265		130		50	
FINLAND			1100		650			350		170	110		
FRANCE			665		425			240		120			
GERMANY			800		500	380		280	200	135			
GREECE			500		350			200	140		75	50	30
ICELAND					450	350		250		125	80		
IRELAND			600		400			240		130		50	
ITALY	965		667		440			260		120		40	
NETHERLANDS			750		450*	350		260*	185	130*	85		
NORWAY					430	320		230	160	110			
PORTUGAL			700		450			230	170	120	80	40	
SPAIN	1000		650		450			250					
SWEDEN				625	500		350				160		
SWITZERLAND		780	650		420			240		120			
UNITED KINGDOM			720		510		360		255	180	127		
T.E.M.	1000		650		450			240					

MINIMUM HORIZONTAL CURVE RADIUS (m)

NOTE : Above values represent
"Absolute Minimum" for UK
and "Minimum" for all other countries

* Non-Motorway Design Speeds (NL)

TABLE 3	MAXIMUM SUPERELEVATION (%)												
	RURAL ROADS												
DESIGN SPEED (km/h)	140	130	120	110	100	90	85	80	70	60	50	40	30
AGR	7		7		7			7					
AUSTRIA	6		6.2		6.2			6.4	6.5	6.6	6.75	7	
BELGIUM			5			6				7			
DENMARK			6		6			6		6		6	
FINLAND			4		5			6		6	7		
FRANCE			7		7			7		7			
GERMANY			7(8)		7 (8)	7 (8)		7 (8)	7 (8)	7 (8)	7 (8)	7 (8)	
GREECE						MAX 6 TO 10 %							
ICELAND					7	7		7		7	7		
IRELAND			7		7			7		7		7	
ITALY	7		7		7			7		7		7	
NETHERLANDS			5		5*	5		5*	5	5*	5*	5*	5*
NORWAY					8	8		8	8	8			
PORTUGAL			6		6			8	8	8	8	8	
SPAIN	7		7		7			7					
SWEDEN				5.5	5.5		5.5				5.5		
SWITZERLAND		7	7		7			7		7			
UNITED KINGDOM			7		7		7		7	7	7		
T.E.M.	7		7		7			7					

MAXIMUM SUPERELEVATION (%)

* Non-Motorway Design Speeds (NL)

TABLE 4	MAXIMUM GRADIENT (%)												
	RURAL ROADS												
DESIGN SPEED (km/h)	140	130	120	110	100	90	85	80	70	60	50	40	30
AGR	4		5		6			7			8		
AUSTRIA	4		5		6			8	9	10	11	12	
BELGIUM			4			6							
DENMARK			3.5		3.5	3.5		5		5			5
FINLAND			4		5			7		7	7		
FRANCE			4		5			6		7			
GERMANY			4		4.5	5		6	7	8			
GREECE			4	5	5	6		8					
ICELAND					5	5.5		6		8	9		
IRELAND			4		4(4.5)			5		6 - 7		7 - 9	
ITALY	5		5		6			6-7		7-10		10	
NETHERLANDS			3		4*	4		5*	6	6*	7	7*	7 - 8*
NORWAY					6	6		6	7	9			
PORTUGAL			4		5			6	6	7	8	9	
SPAIN	4		5		6			6-7					
SWEDEN				6(8)	6(8)		6(8)				6(8)		
SWITZERLAND			4		6			8		10			
UNITED KINGDOM			3(4)		4		6		6	6	6		
T.E.M.	3		4		5			6					

MAXIMUM GRADIENT (%)

NOTE : Brackets denote "exceptional values"

* Non-Motorway Design Speeds (NL)

TABLE 5	MINIMUM VERTICAL CONVEX CURVE RADIUS (m)												
	RURAL ROADS												
DESIGN SPEED (km/h)	140	130	120	110	100	90	85	80	70	60	50	40	30
AGR (1)	27000		12000		6000/10000			3000/4500		1500/1600			
AUSTRIA	35000		20000		12500			7500	4000	3000	2000	1500	
BELGIUM			12000			7500				1600			
DENMARK			15000		6000			3500		2000			
FINLAND			17000		9000			3900		1500	800		
FRANCE			10000		6000			3000		1500			
GERMANY			20000		10000	7000		5000	3500	2750			
GREECE			16000		9000			5000					
ICELAND					13000	9000		6000		2500	1300		
IRELAND			18263		9005			4203		1574		446	
ITALY	26289		14072		6869			2847		902		210	
NETHERLANDS			12400		5800*	6500		2500*	3700	920*	1400		
NORWAY					6400	4400		2900	1500	820			
PORTUGAL			14000		9000			5000	3000	2000	1500	1500	
SPAIN	13000		12000		6000			3500					
SWEDEN				10000	7000		3500				1100		
SWITZERLAND			20000		12500			6000		3000			
UNITED KINGDOM			18502		10505		5906		3304	1902	1101		
T.E.M.	27000		12000		6000			3000					

MINIMUM VERTICAL CURVE RADIUS - CONVEX (m)

NOTE : The Irish and UK values have been converted to radii
from curve length and K values
* Non-Motorway Design Speeds (NL)
(1) Lower value apples to dual carriageway road
Higher value applies to single carriageway road
The higher value corresponds to the TEM value

TABLE 7	STANDARD CROSS-SECTION DIMENSIONS FOR INTERURBAN DIVIDED MOTORWAY:				
	CLASSIFICATION	VERGE WIDTH (m)	PAVED SHOULDER (m)	LANE WIDTH (m)	MEDIAN (m) Includes Shoulders
			OUTER INNER		
AUSTRIA	A1	1.0	3.0 1.0	3.75	5.50
DENMARK	I-1 (wide)	1.5	3.0 0.5	3.75	13
FINLAND	>9000 AADT	0.25	2.75 1.0	3.75	17.5
FRANCE	L100/L200	0.75 - 1.0	2.5-3.0 1.0	3.5	2.50 - 5.0
GERMANY	Category A I (2x3) a6ms	1.5	3.0 1.0	3.75	6.0
ICELAND	>40,000 AADT	0	3.0 1.0	3.75	13.0
IRELAND	RNM 120 (2X3)	2.0	3.75 2.0	3.75	>10
ITALY	Category I(b) (2x3)	0.5-0.75	3.0 0	2x3.75 + 3.50	4.0
NETHERLANDS	Category A1	2.25	3.5 - 3.0 1.25	3.5	12.0
NORWAY	4-Lane M1	N/A	1.5-3.0 1.0	3.5	9
PORTUGAL	Cross Section No.9	N/A	3.5 1.0	3.75	>6
SPAIN	A-120	0.75	2.5 1.0	3.75	9.0
SWEDEN	MV;4F;K7.5V2.75	N/A	2.75 1.0	3.75	>12
SWITZERLAND	-	1.0 - 1.50	2.5 0	3.5 - 4	1.0 - 3.5
UNITED KINGDOM	(2x3) MOTORWAY	1.5	3.3 0	3.65	4.0

STANDARD CROSS-SECTION DIMENSIONS FOR INTERURBAN DIVIDED MOTORWAYS

N/A denotes unavailable information

TABLE 6	MINIMUM VERTICAL CONCAVE CURVE RADIUS (m)												
	RURAL ROADS												
DESIGN SPEED (km/h)	140	130	120	110	100	90	85	80	70	60	50	40	30
AGR	SPECIFIED IN TERMS OF MAXIMUM ALLOWABLE ACCELERATION												
AUSTRIA	12000		8000		5000			3000	2500	2000	1500	1000	
BELGIUM			2200			1250				550			
DENMARK			15000		6000			3500		2000			
FINLAND			6300		4300			2800		1500	1000		
FRANCE			4200		3000			2200		1500			
GERMANY A			10000		5000	3500		2500	2000	1500			
GREECE			8000		5000			4000					
ICELAND					4000	3200		2600		1300	800		
IRELAND			6628		4614			3002		1574		557	
ITALY	4285		3086		2103			1295		666		265	
NETHERLANDS			1200		1500*	700		1000*	400	550*	200		
NORWAY					2500	2100		1600	1250	920			
PORTUGAL			6000		4500			3000	2000	1500	1500	1500	
SPAIN	7500		5000		3500			2500					
SWEDEN				5500	4500		2800				1400		
SWITZERLAND			8000		6000			3500		1600			
UNITED KINGDOM			3701		2601		2002		2002	1301		901	
T.E.M.													

MINIMUM VERTICAL CURVE RADIUS - CONCAVE (m)

NOTE : The Irish and UK values have been converted to radii from curve length and K values

* Non-Motorway Design Speeds (NL)