

Traffic legislation and safety in Europe concerning the moped and the A1 category (125 cc) motorcycle

Chris Schoon

R-2004-10

**Traffic legislation and safety in Europe
concerning the moped and the A1
category (125 cc) motorcycle**

A literature and questionnaire study commissioned by the Swedish
National Road Administration

Report documentation

Number: R-2004-10
Title: Traffic legislation and safety in Europe concerning the moped and the A1 category (125 cc) motorcycle
Subtitle: A literature and questionnaire study commissioned by the Swedish National Road Administration
Author(s): Chris Schoon
Project number SWOV: 69.958
Contractor: Swedish National Road Administration SNRA

Keywords: Traffic, legislation, safety, fatality, severity (injury), accident rate, moped, motorcycle, interview, Europe.

Contents of the project: Questionnaire study, commissioned by the Swedish National Road Administration, into the safety aspects of mopeds and the light motorcycle A1 category in European countries. A comparison was made of national moped regulations, such as minimum ages for riding a moped, theoretical test, practical tests, speed limits for urban and rural roads, compulsory helmet use and the existence of registration plates and documents.

Number of pages: 58 + 3
Price: € 12,50
Published by: SWOV, Leidschendam, 2004

SWOV Institute for Road Safety Research
P.O. Box 1090
2290 BB Leidschendam
The Netherlands
Telephone +31 70 317 33 33
Telefax +31 70 320 12 61
Internet www.swov.nl

Summary

A study, commissioned by the Swedish National Road Administration, of the safety aspects of mopeds and the light motorcycle A1 category (max. 125 cc) has been carried out.

The study consists of a comparison of European countries. An important part of the information was gathered using questionnaires that were filled in and returned by all EU countries except Greece and Ireland, and two non EU countries, Norway and Switzerland. In addition, several European databases were used, among which CARE. A literature study of crash analyses was also carried out.

Using questionnaires, information about national moped regulations was obtained, such as: minimum ages for riding a moped, theoretical test, practical tests, speed limits for urban and rural roads, compulsory helmet use and the existence of registration plates and documents. Concerning the A1-category, information was gathered about the minimum age for riding, a necessary practical test for transforming from an A1 (light motorcycles, < 125 cc; < 11 kW) to an A-normal licence and the possibility of driving a 125 cc motorcycle with a car driving licence.

European databases (U.N. Statistics, ECMT, and CARE) were used to determine the relative moped safety for the European countries. This is expressed in the crash rate (the number of killed mopedists as a percentage of the total number of killed road users) and the vehicle rate (the number of killed mopedists per 100,000 mopeds). CARE was also used to determine the share of 14-15 year old deaths among the 14-18 year olds for those countries where the minimum age for riding a moped is 14 years.

The Dutch data was used to obtain insight in the mopedist and motorcyclist rates per age group; these were expressed in casualties per million kilometres travelled.

To determine the numbers of crashes for the A1 category, a German study appeared to be very useful, especially concerning the 16-17 year olds.

Various European countries encountered the same problems concerning the following subjects: tuned-up mopeds, separation of mopeds from other traffic, and the minimum age. These problems are discussed, and where there are relevant measures, these are mentioned. For the Netherlands it was calculated how many casualties could be saved by the implementation of such measures. The measure that 'saved' the most is raising the minimum age from 16 to 17 years, or from 16 to 18 years. Because this measure faces considerable opposition, a Dutch study of the public support for this measure is examined extensively.

International data shows that the crash rates for mopedists and motorcyclists are high in comparison with, for example, motorists and cyclists. It seems that the anti-tampering measure that was introduced for mopeds a few years ago, can be sidestepped. Also, the new EU regulation that promotes the use of the 125 cc motorcycle by setting the low minimum age of 16 years and permitting motorists who have had their driving licence for a few years to

drive a 125 cc motorcycle without having to pass an exam, seems to be bad for road safety.

Regarding this, we recommend sharpening the EU anti-tampering of mopeds and light-mopeds regulation, as well as the European Commission proposal of October 2003 to harmonize the driving licence regulations.

Contents

1. Introduction	7
1.1. Target group within the group motorized two-wheelers	7
1.2. Target group European countries	7
1.3. Realization of the study	7
1.4. Arrangement in chapters	8
2. Mopeds in Europe	9
2.1. Legislation on mopeds in European countries	9
2.2. Possession and use of mopeds and light-mopeds	10
2.3. Moped casualties and extent of vehicle fleet in European countries	12
2.3.1. Description of CARE	14
2.4. Killed mopedists in relation with legislation and age	15
2.5. Crash and behavioural studies in some countries	16
2.5.1. Denmark (crash study)	16
2.5.2. Austria (crash study)	17
2.5.3. France (crash study)	18
2.5.4. Switzerland (behaviour study)	19
3. A1 category motorcycles (125 cc) in Europe	21
3.1. EU-legislation of the A1 category in the European countries	21
3.2. Present legislation of the A1 category in European countries	21
3.3. Size of fleet in Germany	23
3.4. Crashes and casualties in some European countries	25
3.4.1. Germany	25
3.4.2. Austria	27
3.4.3. France	28
3.4.4. The Netherlands	29
4. Rates of motorized two-wheelers and other transport	30
5. Problems and measures for mopeds	31
5.1. Tuned-up mopeds	31
5.1.1. Problems with tuned-up mopeds (results questionnaires)	31
5.1.2. Measures concerning tuned-up mopeds	31
5.1.3. The effect of anti-tampering measures (the Netherlands)	32
5.2. Separation of mopeds from other traffic	33
5.2.1. Results questionnaires	33
5.2.2. The measure and effect of mopeds on the road (the Netherlands)	34
5.2.3. SWOV recommends increasing speed limit	35
5.3. Registration plates and documents	36
5.3.1. Result of the questionnaires	36
5.3.2. Problems with the identification of light and normal mopeds (the Netherlands)	36
5.3.3. Implementation of registration plates (the Netherlands)	37
5.3.4. Implementation of registration plates (France)	37
5.4. Practical test for mopedists	37
5.4.1. Result of the questionnaires	37
5.4.2. Inexperience of mopedists in France	38

5.4.3.	The effect of the practical test for mopedists (the Netherlands)	38
5.5.	Obligatory helmet use	38
5.5.1.	Result of the questionnaires	38
5.5.2.	The effect of the helmet use for light-mopedists (the Netherlands)	38
5.6.	Raising the minimum age for riding a moped	39
5.6.1.	The effect of raising the age from 16 to 18 (the Netherlands)	39
5.6.2.	The effect of raising the age from 16 to 17 (the Netherlands)	40
5.7.	Study of the support for the measure 'raising the minimum age for riding moped'	41
5.7.1.	Motivation and realization of the study	41
5.7.2.	Results	42
6.	Analysis and discussion	46
6.1.	Mopeds	46
6.1.1.	Analysis of the relation between minimum age of mopedists and light-mopedists and safety	46
6.1.2.	Discussion	47
6.2.	125 cc motorcycles	49
6.2.1.	Exposure and crash data	49
6.2.2.	Discussion	50
7.	Conclusions	52
7.1.	Light mopeds and mopeds	52
7.2.	Motorcycle category A1	55
	References	57
	Appendix 1 Questionnaire	59
	Appendix 2 Risk values for different transport modes and for different age groups in the Netherlands	61

1. Introduction

The Traffic Safety Department of the Swedish National Road Administration asked SWOV to perform a literature study on 'Mopeds, light motorcycles, and road safety in Europe'.

In general, mopeds (and other small motorcycles) are involved in many serious and fatal crashes. The risks for the riders are very high, taking into account the small number of vehicle-kilometres which is driven. In order to take measures for this group of road users, it is necessary to know their backgrounds, such as their type of motorized two-wheeler, their use, the driving education, their performance, and the crash data.

The comparison of the European countries regarding the extent of crashes in which light motorized two-wheelers are involved, can be seen as the basis for the study. In this report, more details of the European countries are given.

1.1. Target group within the group motorized two-wheelers

The study is focussed on the group of light motorized two-wheelers:

- light-mopeds (< 25 km/h)
- mopeds (< 45 km/h)
- light motorcycles (< 125 cc; < 11 kW); with the licence category A1 it is permitted to ride this type of light motorcycle.

Another group light motorcycles (< 25 kW and > 120 cc and intended as the step-up category to a heavier motorcycle) is not taken into account in this study because it is more a real type of motorcycle meant for the group 18 year and older.

NB. To make a distinction in this report between these two types of light motorcycles, the motorcycle related to the licence category A1 will be referred to as the 125 cc motorcycle or as the *category A1 motorcycle*.

1.2. Target group European countries

In this study a choice had to be made which European countries were to be involved in the study. Since the number of crashes with light motorized two-wheelers is the basis for the study, the availability of figures was the starting point. Therefore, crash databases of European countries needed to be used. This approach resulted in the participation of the following countries: Austria, Belgium, Denmark, Finland, France, Germany, Italy, Luxembourg, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom.

1.3. Realization of the study

The study made use of the following sources:

- crash and exposure databases;
- information gathered by questionnaires;
- literature.

Consulting crash and exposure databases

For data of crashes and the number of killed mopedists, basically two sources were used: ECMT/CEMT and CARE.

For exposure data, the Statistics of Road Traffic Accidents of the United Nations was used. Unfortunately, only the number of vehicles was available and not the number of kilometres travelled.

In some cases, national statistics of some European countries were used for supplementation and checking.

NB. CARE is a rather new European database; therefore a description is given in *Section 2.3.1*.

Information gathered by questionnaires

To gather information from the selected European countries (see *Target group European countries*) SWOV sent questionnaires by e-mail to European research institutes and sometimes to European ministries. In most cases the response was quick and adequate.

In the questionnaire (*Appendix 1*), the following information was asked for the relevant types of motorized two-wheelers:

- legislation: minimum age, education / tests, speed limit, helmet use, registration plates, driving 125 cc motorcycles with a car driving licence;
- problems / measures with: tuned-up mopeds, the separation of mopeds from other traffic;
- the availability of (crash) studies related to light motorized two-wheelers.

Studying the literature

In the SWOV library a literature search was carried out. The questionnaire also asked for recent literature. From five countries we got a response to this question.

The literature study focussed on (crash) problems in relation with legislation and on measures for light motorized two-wheelers (realized measures, plans, and effectiveness in terms of casualty saving).

1.4. Arrangement in chapters

The report discusses the category mopeds in *Chapter 2*, followed by a discussion of the category 125 cc motorcycles in *Chapter 3*. The rates of both categories are described in *Chapter 4*, and *Chapter 5* discusses the specific problems and measures for mopeds only.

The report gives an analysis and discussion in *Chapter 6*, and presents a conclusion in *Chapter 7*.

2. Mopeds in Europe

2.1. Legislation on mopeds in European countries

To gather information from European countries SWOV sent questionnaires to those European countries from which we had gathered crash data by means of a European database. These are the EU-countries minus Greece and Ireland, and plus Norway and Switzerland.

The questionnaires were sent by e-mail. In *Table 2.1* the received information is given. A distinction is made between light-mopeds and mopeds. Light-mopeds have a maximum vehicle speed of around 25 km/h. In some cases we did not get the information; this is marked with a "-".

Legislation countries for: LM: light-mopeds M: mopeds		Min. age	Compulsory test		Speed limit		Compulsory helmet use	Registration plates
			Theoretical	Practical	Within the built-up area	Outside the built-up area		
Austria	M	15	Yes	No	45	45	Yes	Yes
Belgium	LM	16	No	No	25	25	Yes (2003)	No
	M	16	Yes	Yes	45	45	Yes	No
Denmark	LM	16	Yes	Yes	30	30	Yes	-
	M	18	Yes	Yes	45	45	Yes	-
Finland	M	15	No	No	45	45	Yes	-
France	M	14	Yes (school test)	Yes (3 hours)	49	49	Yes	Yes (01-01-2004)
Germany	LM	15	Yes	No	25	25	Yes	No
	M	16	Yes	Yes	45 (2001)	45 (2001)	Yes	No
Italy	M	14	Yes	Yes	-	-	-	-
Luxembourg	M	16	Yes	Yes	30	40	Yes	No
Netherlands	LM	16	Yes	No	25	25	No	No
	M	16	Yes	No	30	40	Yes	No
Norway	M	16	No (intention to do it)	No	50	50	Yes	Yes
Portugal	M	16	Yes	Yes	45	45	-	-
Spain	M	14	Yes	No	45	45	Yes	Yes
Sweden	LM	15	No	No	25	25	Yes	No
	M	15	Yes	No	45	45	Yes	Yes
Switzerland	LM	14	Yes	No	30 (not specific)	30 (not specific)	Yes	Yes
	M	16	Yes	Yes			Yes (2003)	Yes (2003)
Un. Kingdom	M	16	Yes (L-plates)	Yes (L-plates)	50 (30 mph)	50 (30 mph)	Yes (1998)	Yes (2001)

Table 2.1. Legislation data from different European countries. It describes the situation in 2003; regulations implemented in the period 1998-2003 are mentioned in the table (source: SWOV questionnaires in 2003).

As shown in *Table 2.1* we received information about the legislation of mopeds from 15 European countries. In some countries, legislation differs for the light-moped and the moped.

The minimum ages for riding a moped differ strongly and depend on the type of moped:

Countries (6) with a light-moped:

- 14 year: 1 country,
- 15 year: 2 countries,
- 16 year: 3 countries.

Countries (15) with a moped:

- 14 year: 3 countries,
- 15 year: 3 countries,
- 16 year: 8 countries,
- 18 year: 1 country (light-mopeds: 16 year).

Two countries have no theoretical test for mopedists and two countries no test for light-mopedists.

Nine of the 15 countries have a practical test for mopedists. Only Denmark also has a practical test for light-mopedists.

Only a few countries have different urban and rural speed limits:

- Germany 25 and 50 km/h respectively,
- Luxemburg 30 and 40 km/h respectively,
- Netherlands 30 and 40 km/h respectively; this regulation will probably be changed. (*Section 5.2.3*).

Of all these 15 European countries, the Netherlands is the only country without compulsory helmet use for the light-moped.

In seven of the fifteen countries mopeds must be provided with formal registration plates and documents. In France this has been arranged recently (see *Section 5.3.4*) and in the Netherlands it will be introduced in 2005/2006 (*Section 5.3.3*).

2.2. Possession and use of mopeds and light-mopeds

It is shown that collecting data about crashes and the number of vehicles is relatively easy. But figures about the possession subdivided by moped type and age of the user, and the use expressed in the number of kilometres travelled, are difficult to get.

Only one study, from the Netherlands, was found with these figures. We will see that within the selected European countries, the Netherlands scores average in the number of killed mopedists (*Section 2.3*). Presented data about possession and use of mopeds possibly serve as a guide to understand some of the crash data.

Possession (the Netherlands)

Demographic data and a survey among mopedists (Bos & Schoon, 1998) have established what percentage of the population of 16 and 17 year olds possesses a moped or light-moped. The sum of these two moped types will, from now, on be referred to as "(light-)mopeds". A comparison with the 18-24 year olds is added. As this data refers to the years 1994-1996, the population data also does.

Age group	Population (average 1994-1996)	Number of (light) mopeds	(Light) moped possession
16-17 years	365,710	92,845	25.4%
18-24 years	1,522,165	122,905	8.1%

Table 2.2. *Moped and light-moped possession by age group 1994-1996 in the Netherlands (source: CBS, SWOV).*

This table shows that a quarter of the 16-17 year olds has a (light-)moped. Of the 18-24 year olds, only 8% has a (light-)moped.

Use (the Netherlands)

Two aspects were looked at here:

- the number of kilometres travelled per year by age group,
- most-frequently used modes of transport by the young.

Table 2.3 shows the number of kilometres travelled.

Age group	Light-moped	Moped	Total	
			Abs.	%
0-14 years	2	10	12	0%
15-17 years	129	1027	1156	32%
18-19 years	69	574	643	18%
20-29 years	111	535	646	18%
30-39 years	68	269	337	9%
40-49 years	93	253	346	10%
50-64 years	114	154	268	7%
65 years & older	124	54	178	5%
Total	710	2876	3586	100%

Table 2.3. *Annual kilometrage (million kilometres travelled) on moped and light-moped in the Netherlands (source: National Travel Survey /OVG; 1995-1997).*

Table 2.3 shows that the (15), 16, and 17 year olds account for one-third of all kilometres travelled. The following two age groups, 18-19 and 20-29 year olds, each account for 18%. This means that (light-)moped owners younger than 30 account for 68% of all these kilometres travelled.

The light-moped is used factor 4 less compared with the use of the normal moped.

Among the 16-18 year olds, the (light-)moped is not the mode of transport which they use most. Both bicycle and public transport appear to be used more.

Mode of transport	Used most by:
Bicycle	49%
Car	9%
Public Transport	20%
Walking	9%
(Light-)moped	13%
Motorcycle	1%
Total (n = 194)	100%

Table 2.4. *The most-frequently used modes of transport by the young in the age groups of 16 – 18 years old in the Netherlands (source: NIPO, 2002).*

Table 2.4 shows that the (light-)moped is most used by only 13% of the young in the age groups of 16 – 18 years old. Most-used is the bicycle with 49%, followed by public transport with 20%.

The data in Table 2.4 is from a NIPO/Team Alert survey which was held in February and March 2002 among 16-25 year olds (Team Alert, 2002). The sample had a size of 624, of which 194 were 16-18 year olds.

2.3. Moped casualties and extent of vehicle fleet in European countries

Different sources have been used: databases of the United Nations, ECMT/CEMT, and CARE (see the description of CARE in Section 2.3.1). In some cases the national statistics of some European countries were also used for supplementation and verification.

Using figures from different databases has the advantage that there is a way to check the figures. If the match is rather satisfactory, one can assume the figures are correct. In case of a mismatch, the best way to check is to ask the original figures from the countries in question.

Only Denmark (and to a lesser degree Spain) gave a mismatch between the number of killed mopedists and the total number of road users killed. A check with the national Danish data made clear that the CARE data only contained the EU-moped class and not the 'original' Danish 30 km/h-moped. From Germany the CARE data was missing, so that a match with the ECMT-data was not possible. Also in this case the national database was used. For Germany it was remarkable that the number of killed mopedists is 'only' 148 considering the high total number of road users killed (data from ECMT, 2001). A verification with the German data confirmed this low number.

From the databases, only the road users killed are taken into account (Table 2.5). The reason for this is that the registration rate is highest for deaths. For an international comparison of crashes figures, an equally high registration of casualties is preferable.

European countries	Number of mopeds* 1000	Killed mopedists	Total killed road users	Crash rate: killed mopedists as % of all fatalities	Vehicle-rate: Nr of killed mopedists per 100,000 mopeds
Austria	363	32 32	963 798	3.3 4.0	8.8
Belgium	356	78 78	1500 1336	5.2 5.8	21.9
Denmark * Danish statistics	-	39 *) 10 ?	499 111 ?	7.8 -	-
Finland	100	16 16	400 338	4.0 4.7	16.0
France	1,482	422 458	8437 8918	5.0 5.1	28.5
Germany	1,747	148 -	7792 -	1.9 -	8.5
Italy	4,000	627 675	5857 5417	10.7 12.5	15.7
Luxemburg		1 -	57 -	1.8 -	-
Netherlands	529	89 89	1066 956	8.3 9.3	16.7
Norway	114	10 -	352 -	2.8 -	8.6
Portugal		278 -	1865 -	14.9 -	-
Spain	2,337 (1999)	506 373	5957 4321	8.5 8.6	21.7
Sweden		12 12	531 462	2.3 2.6	-
Switzerland	284	20 -	597 -	3.4 -	7.1
Un. Kingdom	90	10 10	3421 3421	0.3 0.3	11.4
Total/average	11,213	2,281 1,869	39,294 29,563	5.4 6.3	17.8

Table 2.5. Number of mopeds, number of killed mopedists and rates in different European countries. Figures from 1998, unless different is stated.

Sources:

Vehicle fleet:

(letter type: normal) Statistics of Road Traffic Accidents, U.N. (2001)

(*italic*) Belgium: nat. statistics; Netherlands: nat. statistics.

Figures of the number of deaths:

(letter type: normal) ECMT Road Accident Statistics (2001)

(*italic*) CARE (2002); see explanation about CARE below.

Table 2.5 shows that the southern European countries Italy and Spain, but also Germany and France, are countries with a lot of mopeds. As a consequence the number of killed mopedists is also high in these countries. The exception is the comparatively low number of mopedists killed in Germany.

The final two columns give rates to compare the European countries concerning the numbers of mopedists killed. In the last-but-one column this is the crash rate (the number of killed mopedists as a percentage of the total number of road users killed), and in the last column the vehicle-rate (the number of killed mopedists per 100,000 mopeds).

The crash rate is calculated using both the ECMT- data (see the upper part in the cells of the table) as well as the CARE data (see lower part). This crash rate gives high percentages for the southern European countries Italy, Portugal and to a lesser degree for Spain. In contrast we see a very low score in Austria, Germany, Luxembourg, Norway, Sweden, Switzerland, and the United Kingdom.

The vehicle-rate (see the last column) is only expressed in the figures of the ECMT-data and not with CARE-figures, due to more available figures from ECMT-data.

On average the countries with low crash rates, also have low vehicle rates. This confirms that the presented figures are reliable.

France and Belgium have a median score in the crash rate, but a bad score in the vehicle rate. The problem with Belgium is that the figures of the number of mopeds are from 1987 instead of from 1998. Probably the number of mopeds is too low, which gives a high rate.

In the UK the number of mopeds and the number of killed mopedists are small. UK is more a country for riding motorcycles than mopeds (Department for Transport, 2002).

2.3.1. *Description of CARE*

CARE is a EU-database of road crashes resulting in death or injury. It contains no statistics on material damage, only on crashes. The major difference between CARE and most other existing international databases is the high level of disaggregation, i.e. CARE comprises detailed data on individual crashes as collected by the Member States. Its structure allows for maximum flexibility and potential with regard to analysing the information contained in the system, and opens new possibilities in the field of crash analysis.

The purpose of CARE is to provide a powerful tool which makes it possible to identify and quantify road safety problems throughout the European roads, evaluate the efficiency of road safety measures, determine the relevance of Community actions, and facilitate the exchange of experience in this field.

Today, the only systems comparable to the CARE database as far as the degree of disaggregation is concerned, ARE FARS (used in the USA) and BIS used by SWOV in Netherlands.

The EU Council decided in 1993 to create CARE (CARE - Community database on Accidents on the Roads in Europe). Instead of entering into a lengthy process of defining and adopting a new standardised structure, it was decided that the national data sets should be integrated into the CARE

database in their original national structure and definitions, with confidential data blanked out. Subsequently, the Commission provided a framework of transformation rules so that CARE provides compatible data.

The process of improving 'homogenisation' of crash data within CARE and the process of developing this, are underway.

2.4. Killed mopedists in relation with legislation and age

It is interesting to consider the legislation, in particularly the legal minimum age for riding a moped, and the number of mopedists killed with this minimum age for the different European countries. *Tables 2.1* and *2.5* are the basis for this comparison. For this purpose countries with different minimum ages and a high number of killed mopedists have been selected. Based on these criteria only five countries are suitable for comparison (see *Table 2.6* for the selected countries).

All selected countries have significantly fewer killed mopedists from the age of 19 years onward, than in the younger years. Therefore the years from 14 to 18 are given in *Table 2.6*, and also the sums of these five years.

European countries	Minimum age moped riding	Number of killed mopedists per year by age						Killed mopedists all ages
		14	15	16	17	18	14-18 *	
Spain	14	10	17	31	32	25	115 (31%)	373
France	14	23	24	49	56	33	185 (40%)	458
Italy	14	14	27	50	41	37	169 (25%)	675
Belgium	16	2	2	8	10	8	30 (39%)	78
Netherlands	16	0	1	17	10	17	45 (51%)	89
Total(average)		49	73	162	150	120	554 (33%)	1705
*) Percentage: the number of 14-18 related to the killed mopedists all ages								

Table 2.6. The number of killed mopedists in 1998 for different ages for some European countries (source: CARE, 2002).

Table 2.6 shows three countries with the minimum age of 14 years (Spain, France and Italy). In absolute sense, these three countries have the highest number of killed mopedists for all ages (respectively 373, 458 and 675 deaths per year).

The number of killed mopedists in the other two countries is considerably lower (< 100 death). This has some consequences for the annual fluctuations in the share of the ages in this table.

Table 2.7 summarizes the percentages mentioned in the second last column of *Table 2.6*.

Min. age for riding	% deaths 14-18 year-olds as % of all killed mopedists
14 years	25%, 31% and 40% (resp. Italy, Spain and France)
16 years	39% and 51% (resp. Belgium and Netherlands)

Table 2.7. *Percentage of deaths in the age group 14-18 year-olds and 16-18 year-olds as % of all killed mopedists*

These figures don't give the impression that an early start with moped riding at the age of 14 results in more deaths between 14 and 18 years when compared with a start at 16. A further analysis of these data will be given in *Chapter 6 'Discussion' (Section 6.1)*.

2.5. Crash and behavioural studies in some countries

2.5.1. Denmark (crash study)

In 1994 a new type of moped was introduced in Denmark, the 'scooter-45'. In 1999 the number of registered scooters in Denmark increased from 0 to nearly 60,000.

The 'old' type of moped in Denmark is a so-called light-moped with a maximum speed of 30 km/h and a minimum age of 16 years for riding. The new scooter has a motor of max. 50 cc and the legal vehicle speed limit is 45 km/h. The requirements for riding the scooter are severe in Denmark: a minimum age of 18 years and a driver's licence are necessary (the same as those for a motorcycle or a car). The low price of the scooter makes the purchase attractive. As was mentioned for other countries, also in Denmark it is very easy to tune up the scooter. With only a simple modification of the engine a maximum speed of 70 km/h or more can be reached.

Two studies were carried out into the development in crashes of this new scooter type.

1. The first was the study of the Odense University Hospital (Barsi, Faergemann & Larsen, 2002). The aim of the study was to examine the consequences of the introduction of the scooter-45 and to make a comparison with the 30 km/h-moped and the motorcycle. The study was carried out during 1996 - 2000 and was concentrated at the Odense University Hospital. In the study a significant rise in the annual crash rate for both mopeds and scooter-45s was found. This rate is the number of traffic casualties per 100,000 inhabitants of Odense. For scooter-45s and motorcycles, the highest crash rates were observed in the age groups 20 – 29 years. For mopeds, this was in the age group up to 19 years. The number of serious casualties was 8% for both scooter-45 and motorcycle, and 5% for moped crashes.
2. The second study was made by the Danish Transport Research Institute (Lund, 2002). The crash analysis revealed that most of the scooter-45 drivers involved in a crash, had 'only' a car licence. However, the type of driving licence can only explain small differences in the crash rates. Speed measurements showed that the mean speed is close to 50 km/h. This means that more than half of the 45-moped drivers are speeding. The analysis showed almost the same crash characteristics as an earlier study. Risk calculations show that the crash risk of a 45-moped driver

(and also that of a motorcyclist) is 50 times higher than that of a car driver. The number of crashes with motorized two-wheelers increased over the last years, while in the same period other traffic crashes decreased. Therefore, a special effort is needed to improve traffic safety for these riders.

2.5.2. Austria (crash study)

During the 1990s in Austria, two new moped measures were introduced. They are discussed here, together with their effect on the number of casualties (Vavryn, Winkelbauer & Esberger (2001)).

1. In 1992 the moped theory certificate was introduced. A study was made of the effect on 16 and 17 year olds. It was established that, during the period 1987-97, the number of deaths and injured in those age groups was reduced with about half.
2. Furthermore, in November 1997, the minimum age for riding a moped was lowered from 16 to 15. *Table 2.8* shows the effect of this measure on the number of casualties up to 15 years old, and for the 16 and 17 year olds, each separately. The numbers of killed and injured for the period 1998-2000 are compared with 1990-1996.

	Av. 1990 – 1996	1997	Av. 1998 – 2001
Deaths among:			
0 – 15 year-olds	0.7	0	1.3
16 year-olds	8.4	8	7.0
17 year-olds	7.4	6	1.8
Injured among:			
0 – 15 year-olds	40	34	115
16 year-olds	1090	1107	1249
17 year-olds	871	774	892

Table 2.8. The annual average number of deaths and injured during the before-and-after period of the introduction in 1997 of the measure allowing 15 year-olds to ride a moped (source: Vavryn, Winkelbauer & Esberger, 2001).

Table 2.8 shows that the number of deaths among the 0-15 year olds rose slightly. During the period 1998-2001 there was an average of 1.3 a year; during the period prior to 1997 the average was 0.7. The number of injured for this age group increased considerably (nearly 200%) during the period after 1997 in comparison with the previous period.

There was a slight decrease in the number of deaths among the 16 year olds after 1998 (a decrease in average of 8.4 to 7). On the other hand, the number of injured rose by 15%.

There was a particularly strong decrease in the number of deaths among 17 year olds (from 7.4 to 1.8) but, on the other hand, the number of injured rose slightly. The Austrian researchers do not give an explanation for this difference.

2.5.3. France (crash study)

Also in France the crash risk for two-wheelers has been studied (Carré & Filou, 1994). Users of two-wheelers (cyclists, mopedists and motorcyclists), along with pedestrians, are the most vulnerable categories of road users in an injury crash. In France, contrary to pedestrians, they have not derived any great benefit from recent safety improvements. Over the past ten years, the use of motorized two-wheelers in France has strongly decreased (the number of mopeds was 4 million in 1985 and 2 million in 1996).

The population groups representing the highest risk, differ according to the category of two-wheelers concerned: children and elderly people for bicycles, teenagers for mopeds, and young adults (males) for motorcycles. Related to the driver characteristics, age is the most distinctive factor.

Mopeds are typically ridden by adolescents (12% are 14-15 years old and 29% are 16-17 years old; these figures are consistent with the 1998 CARE-figures of *Table 2.6*). It is remarkable that mopeds are more often borrowed from the owner than other types of two wheelers (30% of the cases). The researchers are making the connection that due to this phenomenon, the mopedist does not necessarily have sufficient driving experience (the driver does not know the vehicle and feels less responsible for it than if it were his own).

The peak in the number of killed moped users (drivers and passengers) is around the age of 17 years. The number of deaths is seven times higher than for other age groups. As a result of a crash analysis, researchers found that inexperience of mopedists is no doubt a cause of crashes. One type of manoeuvre is especially mentioned related to this inexperience of mopedists, and that is turning.

In this report we find the most recent data of wearing helmets for France: in 1993, 89% of the mopedists wore a helmet. From a remark in the report that the wearing of the helmet has now become customary, we can conclude that in 1993 the situation was better than in previous years. But for passengers the situation still is bad. The reason is that the helmet is not obligatory for moped passengers. However, it is not permitted to have passengers older than 13 years on a moped. Among the victims (killed and injured), a larger proportion of users (especially passengers) were not wearing a helmet: 1 out of 9 mopedists and 1 out of 3 of the passengers. For drivers and passengers not wearing a helmet, the severity of the crash (death per 100 casualties) is 2.5 times higher for mopedists (and 2.2 times higher for motorcyclists) than for users wearing a helmet.

The 'solutions' that French researchers found for lowering the risk of this category of two-wheelers, are not new: improving the visibility of the two-wheeler, but this means that two-wheeler safety largely depends on the skill and vigilance of car drivers. Technical solutions for improving the visibility of two-wheelers in traffic for car drivers, however, are not easy to find, and are in themselves insufficient. Car drivers, the automobile industry, and road authorities must not consider road safety only from the car occupants' point of view.

A second crash study gives more details about the division by age of killed mopedists (Carré, Filou & Ziani, 1996).

The percentage of killed mopedists with ages of 14-15 years and 16-17 years, respectively amount to 11% and 22% of the total number of killed mopedists (figures from 1995; these figures are consistent with the 1998 CARE-figures of *Table 2.6*). In the part of the report that describes the

comparison with the international situation, the authors pay little attention to the influence of the minimum age of riding and the number of casualties divided by age. They state that it is standard that the age with most casualties is close to the age at which it is permitted to ride. But also in the group of riders with an age of 50 years and older, there are a lot of casualties. This is related to the extent of vulnerability and competence to ride.

In the conclusions, the problems with the number of casualties and the low age of 14 years at which moped riding is permitted in France are discussed. Most European countries have a minimum age of 16 years for riding a moped. Besides France, Italy, Spain and Switzerland apply the age of 14 year as the minimum age for riding a moped.

The French authors suggest some measures to decrease the risk for mopedists:

- anti-tampering measures;
- registration plates for mopeds (has been realized as from 1 January 2004);
- raising the age from 14 to 16;
- the introduction of a practical examination.

2.5.4. *Switzerland (behaviour study)*

In Switzerland, a behavioural study was carried out in which young mopedists and cyclists between 14 and 18 years were involved (Hubacher & Ewert, 1994). Also in Switzerland the minimum age for riding a moped is 14 year. In Switzerland young cyclists and mopedists between 14 and 18 years have quite a high casualty rate. In roughly 60% of the crashes, they themselves cause the crash, mainly as a result of violation of traffic regulations. Lack of attention is the next most important factor.

The research method consisted of three parts:

- a questionnaire about demographic and vehicle related data (age, gender, number of crashes, etc.);
- another questionnaire related to attitudes such as risk behaviour;
- students were asked to keep a record of every journey during a two-week period.

The analysis was carried out separately for cyclists and mopedists. The most important finding was that female mopedists are 7 times more likely to have a crash than female cyclists and 2.5 times more likely to have a fall (male mopedists only have 2 to 3 times more crashes than male cyclists). This is surprising according to the Swiss researchers, considering the fact that the attitudes expressed by female mopedists are more favourable to safety than those of female cyclists; this means that attitudes cannot provide the explanation for the higher risk of female mopedists. It may be that girls are less adept at controlling a moped than boys (girls are also much less interested in technical matters than boys); at the relatively high moped speeds this would increase the risk of a fall or crash. The difference may be due to the fact that boys have already become familiar as cyclists in exploring limits. The fall and crash rates cannot be solely explained by time and route-related exposure.

One other important result was related to the male mopedists' attitudes and traffic behaviour of mopedists, and the supposition that attitudes have an effect on behaviour. For example, mopedists who said that they frequently ignore traffic regulations and take risks, display a higher risk of a crash; this does not apply to cyclists. Further results suggest that the mopedist tends to

use his or her vehicle to “document a hedonistic life-style” and does not use it purely as a means of transport. This shows for instance, in a higher proportion of journeys to disco establishments/restaurants than for cyclists. Furthermore, those who pay for their moped themselves believe that they can achieve recognition/respect with the moped. They also see riding on a moped as an experience/adventure, more often violate traffic rules, and take more risks. Such attitudes and patterns of behaviour, which are detrimental to road safety, are not apparent in the case of cyclists.

The researchers concluded that the training of mopedists – at the moment this is only done by means of a simple theory test – ought to be improved in two ways: there should be intervention with a view to affecting attitudes, as well as practical driving instructions to improve control of the vehicle. For the time being it is not possible to say whether this would be possible if made obligatory.

3. A1 category motorcycles (125 cc) in Europe

3.1. EU-legislation of the A1 category in the European countries

A European guideline of 1991 (91/439/EEG) makes it possible to distinguish an extra driving licence category: category A1 for a light motorcycle with a cylinder volume of up to 125 cc and a maximum power of 11 kW. At this moment, every member state is free to make its own demands for driving licences of this new category, provided that the minimum age is not lower than 16 years.

Since 1996, many EU countries apply the 'step-up' process for young motorcyclists during the driving course for motorcycles (A category). This process is now as follows:

- Candidates younger than 21 have to pass an exam on a light motorcycle (< 25 kW but > 120 cc).
- Those who are 21 or older can choose the type of exam. If, however, they choose an exam for a light motorcycle, they may not, during the following 2 years, upgrade and ride a heavier motorcycle. After these 2 years, they upgrade to a heavier motorcycle without again having to take an exam.

The European Commission is planning to harmonize the law concerning licence category A1. This means that every member state will be obliged to include this category in their laws. At this moment, a new proposal of the European Commission concerning the harmonization of the driving licence demands is being discussed; this includes the minimum age of 16.

The new proposed categories are (22 October 2003):

- A1: light motorcycles, < 125cm³ or power < 11 kW with power/weight-ratio < 0.1 kW/kg
- A2: motorcycles, power < 35kW with power/weight-ratio < 0.2 kW/kg and not derived from a vehicle with more than double its power
- A: motorcycles

The rules and conditions for these categories are:

- A1: age 16 years with theory and practical test;
- A2: age 18 years with theory and practical test (no theory test if holder has category A1);
- A: 21 years for progressive access, if a minimum of 3 years experience on an A2 vehicle (restricted practical test only);
- A: 24 years for direct access (theory and practical test).

In this chapter, only the aspects of the (old) A1-category (125 cc) are discussed. Legislation and results of crash studies will be presented to determine the safety of this category.

The light 'step-up' motorcycle category A2 is not treated. This category is intended more for 'real' motorcyclists with an age of 18 year and older.

3.2. Present legislation of the A1 category in European countries

The questionnaire, used for mopeds, also contained some questions for the licence category A1.

We received information from the same countries as in the case of the mopeds. But the information is different from that about the mopeds. Apart

from the minimum age, questions were asked about tests, driving with a car licence, and the intentions to change the rules.

In the cases in which a country did not send in the information, we could get the minimum age for riding a 125 cc-motorcycle from a CD-ROM of the Commission International des Examens de Conduite Automobile, CIECA (2001). This Commission gathers information about all licence categories from European countries and neighbouring countries.

The information gathered, is displayed in the *Table 3.1*.

Country	Min. age	Practical test for transforming from A1 to A-normal		Car driving licence also permits driving a 125 cc motorcycle		Are there intentions to change one or more of the rules?
		Yes/No	If yes, After how many years?	Yes/No	If yes, After how many years?	
Austria	18	No	-	Yes also 6 hrs training	5	No
Belgium	18	-	-	Yes if licence before 2001	-	No
Denmark	A1 is no separate category: A1 motorcycles are part of category A2					
Finland	16	-	-	No	-	-
France	16	No	-	Yes	2	Perhaps car licence
Germany	16	No	-	Yes (if licence before 1980)	-	Yes (if ≥25 years old, permission for riding 125 cc)
Luxemburg	16	Yes	-	No	-	No
Netherlands	A1 is no separate category: A1 motorcycles are part of category A2					
Norway	16	Yes	2	Yes (if licence before 1979)	-	No
Portugal	16	-	-	-	-	-
Spain	16	No	-	Yes	2	-
Sweden	16	-	-	No	-	No
Switzerland	18	Yes (2003)	2	Yes (2003, also 8 hrs training)	-	No
Un. Kingdom	17	Yes	-	Yes (L-plates)	-	Yes (a new motorcycle test)

Table 3.1. Legislation data for A1-category (125 cc) in different European countries. It describes the situation in 2003; regulations implemented in the period 1998-2003 are mentioned in the table (source: SWOV questionnaires in 2003; CIEA, 2001).

We received the information from 14 countries listed in *Table 3.1*. Italy did not send in information about motorcycles; the CIECA also has no information from Italy.

Denmark and the Netherlands are two of these 14 European countries that do not apply the licence category A1: this means that there are 12 countries of which the information can be discussed.

Eight of the 12 countries have a minimum age of 16 years. Only one country has chosen for 17 years (UK). Austria, Belgium, and Switzerland have the same age (18 years) for the 125 cc-motorcycle as for the 'normal' motorcycle.

Table 3.1 shows that it is necessary in three countries that a practical test is taken before the 125 cc-motorcyclists can ride on a normal motorcycle.

Only in three countries (Finland, Luxemburg, and Sweden) it is not possible to ride a 125 cc-motorcycle if you have got only a B-licence (licence for a car). The same applies in Belgium, Germany, and Norway, with the exception for people born before a certain date: they are free to ride with only a B-licence.

In three other countries there are restrictions: two countries ask for a practical training of 6 – 8 hours (respectively Austria and Switzerland) and one country for a training with L-plates (UK). In Austria one has to have been in the possession of this B-licence for five years.

In France and Spain one can ride with a B-licence on a 125 cc-motorcycle with the only restriction that one has this B-licence has to have been in possession of this B-licence for two years.

Three countries have intentions to change one or more rules:

- France: introduction of permission to ride a 125 cc-motorcycle with a B-licence;
- Germany: if one has reached the age of 25 year, and has a B-licence, it will be permitted to ride a 125 cc-motorcycle;
- United Kingdom: introduction of a mandatory motorcycle test.

Due to the new proposal of the European Commission (22 October 2003) these countries need to reconsider the changes, because their intended rule change is not in accordance with the new proposal.

3.3. Size of fleet in Germany

In the 1980s the light powered 80 cc motorcycle was very popular in Germany. The number increased to more than 400,000 (Schulz, 2000). Also the number of crashes increased immensely. This resulted in a large increase of the insurance premium. This, in turn, caused a drop in the number of light-powered motorcycles to 168,000 in 1991.

The change in the number of light-powered motorcycle started in 1996 with the introduction of the European driver licensing for the 125 cc motorcycle (see *Figure 3.1*).

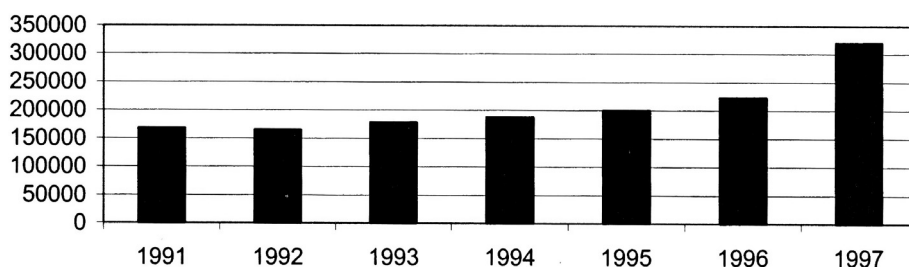


Figure 3.1. The influence of the introduction of the European driver licensing for the 125 cc motorcycle in 1996 on the number of light powered motorcycles in Germany (Schulz, 2000).

Young people from 16 years old are permitted to ride a 125 cc-motorcycle after obtaining the driving certificate. Moreover, drivers with a car licence can also drive the 125 cc-motorcycle if they have obtained their licence before 1st April 1980.

In Figure 3.2 the development of the number of motorcycles is given from 1994, with a distinction by age of the owner. Although both figures do not give the same data (Figure 3.1 gives the number of light powered motorcycles and Figure 3.2 all types of motorcycles), both figures indicate the upward trend for the 125 cc motorcycle. An important part of the explanation is that the growth has its origins in the European change in driver licenses for the 125 cc motorcycle in 1996 (Assing, 2002).

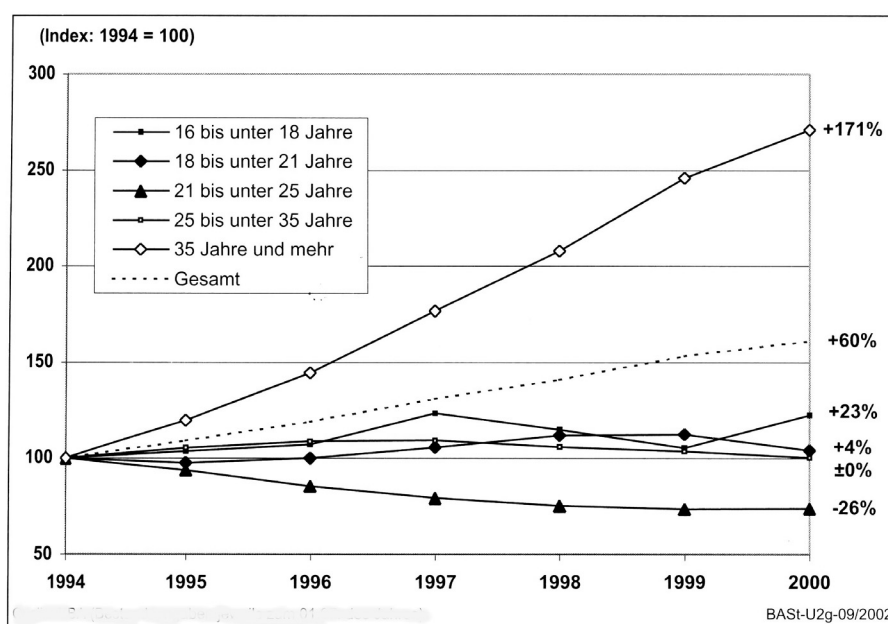


Figure 3.2. The development of the number of motorcycles between 1994 and 2000 with a distinction by age of the owner (1994=100); (source: Assing, 2002).

The immense growth of the number of motorcycles in the age group of 35 years and older is shown in Figure 3.2 (an increase of 171%). The age group 16 – 17 year olds gives an increase of 23% compared with 1994. Only

in the age group 21-24 years the number of motorcycles has decreased with 26%.

More detailed information with a distribution by age for 1997 is given in *Table 3.2* (Schulz, 2000; see also *Section 3.4.1*). The share is given of the light-powered motorcycle fleet (so also motorcycles with more than 125 cc). Due to the fact that the 16-17 year olds are only allowed to ride a 125 cc, the 13% mentioned in *Table 3.2* concerns the 125 cc-motorcycle in possession of 16-17 year olds.

	16-17	18-21	22-30	31-40	41-50	51-60	≥ 61	Total
Motorcycle fleet (%)	13	16	5	17	30	14	5	100

Table 3.2. The share of the light-powered motorcycle park for different age groups (1997; Germany); (source: Schulz, 2000).

3.4. Crashes and casualties in some European countries

3.4.1. Germany

Schulz (2000) has calculated the relation between the number of light powered motorcycles and the involvement of this type of motorcycle in crashes for the different age classes. The crash data are from the German state Nordrhein-Westfalen, but the number of motorcycles divided by age group is federal data. In terms of shares of the total numbers of motorcycles, the author pointed out that a previous investigation had established that the shares of Nordrhein-Westfalen match the federal shares.

Table 3.3 gives the shares in %s of the motorcycle fleet and also the involvement in crashes in %s for the different age groups.

	16-17	18-21	22-30	31-40	41-50	51-60	≥ 61	Total
Motorcycle fleet (%)	13	16	5	17	30	14	5	100
Involvement in crashes (%)	44	12	10	14	12	6	3	100

Table 3.3. The shares of light-powered motorcycle park and involvement in crashes (both in %s) for different age groups (1997); the fleet data is from Germany and the crash data from the state Nordrhein-Westfalen (Schulz, 2000).

Although the match of the shares of the light-powered motorcycle park between Germany as a whole and the state Nordrhein-Westfalen is not perfect, the difference in crash involvement between the age group 16-17 year and the rest is large. The age group 16-17 year has an involvement in crashes of 44%, while only 13% of the light powered motorcycle park belongs to this age group. In all other age groups, the percentage of involvement in crashes is lower than the percentage in the motorcycle fleet, with the exception of the age group 22-30 years. But for this group the figures are not so extreme as for the youngest group. The conclusion can be

drawn that crash involvement of 16 and 17 year olds is much higher than that of the other age groups, particularly if the share of motorcycles in this age group is taken into account.

Of course the growth in the number of motorcycles is of influence on the number of injury crashes (*Figure 3.3*).

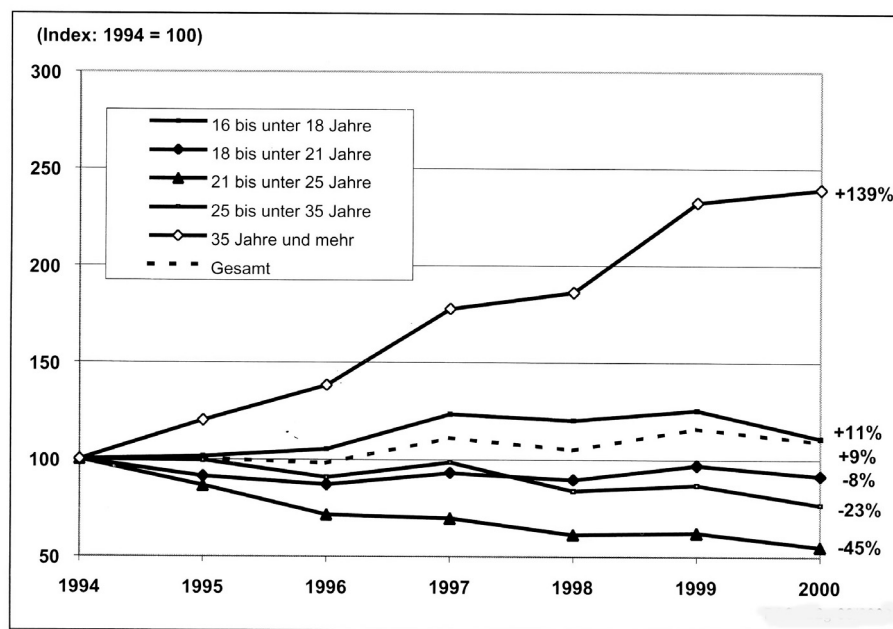


Figure 3.3. *The trend in the share of injury crashes for different age groups from 1994 (1994=100) (source: Assing, 2002).*

In the age group of 35 year and older, the number of crashes increased by 139% in 2000 compared with 1994. The increase in the age group 16–17 years old is 11% (an increase of 25% in the period 1997-1999). All other age groups shows a decrease in the number of crashes. On average the total number of crashes increased by 9% over the period 1994-1999.

To calculate the injury rate for driving a light-powered motorcycle, the number of casualties had to be related to the number of vehicle-kilometres (the best way) or to the number of motorcycles (the second best way). For the German situation we got only the rates based on the numbers of deaths and the numbers of motorcycles (see *Figure 3.4*). In this figure the rate is given in absolute values per year (no index).

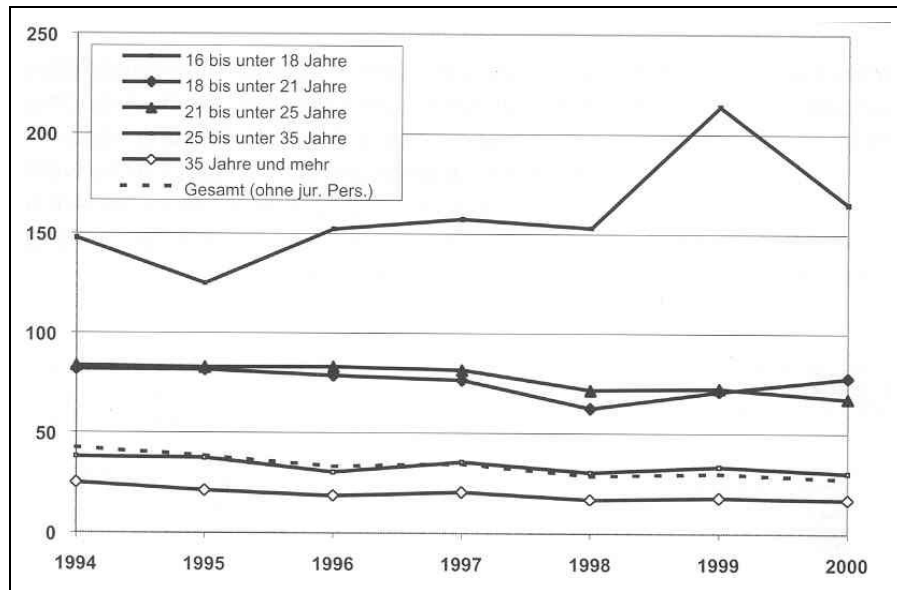


Figure 3.4. The rate for riding motorcycle per age group expressed in the number of killed motorcyclists per 100,000 motorcycles (source: Assing, 2002).

The numbers are highest in the age group 16 –17 years: in 2000 more than 165 motorcyclists per 100,000 motorcycles were killed in this age group. The group with the lowest rate is the group of 35 year and older, with a rate of 17 killed motorcyclists per 100,000 motorcycles. So the rate for the youngest group is about 10 times higher than for the eldest group.

Taken into account that the low age group (16-17 years) is only permitted to ride on a 125 cc motorcycle, it is plausible that the rate can be attributed to this type of motorcycle.

3.4.2. Austria

During the 1990s, apart from measures for mopeds, some new measures were also introduced for motorcycles and the A1-category in Austria. The measures are mentioned here with their effect on the number of casualties (Vavryn, Winkelbauer & Esberger (2001a & b).

1. In 1992 the graduated driving licence for motorcyclists was introduced. This meant that, for the ages 18-24, at least 2 years riding on a light-motorcycle was required before being allowed to take an exam to ride a heavy (heavier) motorcycle. From 24 years old onwards, one was directly allowed to ride a heavy (heavier) motorcycle. A crash study showed that this measure decreased the number of deaths in the 18-19 age group by about two-thirds and the injured by 75%; in the age group 20-24 these were both halved. The total number of all motorcyclist deaths and injured remained more-or-less stable (annual numbers of 75-100 deaths and 2400-3000 injured).
2. As a result of an EU regulation, there already was a different supply of motorcycles in 1995, with a greater emphasis on motorcycles and scooters of up to 125 cc.

3. On 1st November 1997, it became law that motorists could ride a A1-category (<125 cc and <11 kW) motorcycle after having had a (car) driving licence for 5 years and after having followed a 6 hour practical driving course. This was ratified by entering code 111 in the driving licence.

This resulted in the following increase of the number of code 111-holders:

1997: 0
1998: 3,800
1999: 8,000
2000: 9,900 (October)

Obviously, the number of <125 cc-motorcycles also increased:

1995: 15,000
1996: 16,000
1997: 18,000
1998: 24,000
1999: 30,000
2000: 35,000

The number of casualties also increased, but it was not possible to make a clear distinction in the type of motorcycle involved in the crashes (125 cc or the light motorcycle).

If we focus on the ages of 23 and older, we see that in 1998, there was a doubling of the number of injured riders of a light-motorcycle compared with 1997 (from 21 to 43 injured riders). From 1997 to 2000 an increase in the number of injured by a factor 8 is found (from 21 to 179 injured riders). We should, however, mention that two effects are intertwined here: the effects of the 125 cc motorcycle and those of the lighter motorcycle category as a step towards the heavier category.

In their study of the history of licence categories about the EU-plans for the 125 cc motorcycle in Austria, researchers Vavryn, Winkelbauer & Esberger (2001b) are of the opinion that the regulation of the light category of motorcycles is not in agreement with the desired situation in their country. The minimum age for riding a 125 cc motorcycle is now 18, and should stay 18 in their opinion. Moreover, motorists who want to change over to the 125 cc motorcycle must have a better practical training than is the case now.

3.4.3. *France*

In France the crash rate for two-wheelers was studied by Carré & Filou (1994). They found that light motorcycles (125 cc) are mainly ridden by the age group of 18-24 year (38%) and by the 30-65 age group (39%). Dangerous manoeuvres that are particular to the 125 cc category are overtaking and loss of control. The researchers have also made a link in the way of use of these 125 cc motorcycles: this type is often hired or they are company scooters. They are preferred by delivery people whose numbers have grown considerably in France over the past few years, and especially in Paris (hence the excess proportion of two-wheeler crash casualties in Paris: 27%, in contrast with the share of 17% for the entire country). The crash characteristics are category-related, but most of the two-wheeler crashes involve a car. Most of the two-wheeler crashes originate in a manoeuvre undertaken by a car driver.

3.4.4. *The Netherlands*

In 1995, SWOV carried out a study among nearly 400 motorcyclists who had been involved in a crash (Vis, 1995). Although the SWOV-study concerned all classes of motorcycles (from light to heavy) and is therefore not really suitable for this report, it is of interest to mention the results of the younger riders (18-24 years):

- They have a higher rate (about two times higher than older riders);
- They relatively often choose a sports motorcycle;
- The risk of riding a sports motorcycle (usually with a relatively high power or high power/mass) is, in general, greater (about twice that for recreational motorcycles);
- They exceed the (urban) speed limit relatively often (viz. 50%);
- Riders of sports motorcycles commit relatively more speeding offences, especially if there is a high power/mass; this applies to them (i.e. the younger riders) even on sports motorcycles with a lower power/mass;
- A relatively large proportion has a sportive and fast driving style (based on their own answers in the survey of those involved in crashes with motorcycles);

Among other things, SWOV concluded that the potential risk is influenced by a 'dangerous' combination of age, 'sportive' driving style, and a sports motorcycle.

4. Rates of motorized two-wheelers and other transport

In the previous chapters we saw that riding two-wheeled motorized vehicles results in a large number of casualties. In order to find opportunities or alternatives for riding this category of two-wheelers, insight in the rates level of other ways of transport is important. In *Table 4.1* these figures are shown for the Dutch situation. Because the risk of the different modes of transport is strongly dependent on the age of the driver, the rate is subdivided by age group. This report focusses on the young riders, so the figures in the table are given till the age of 39 years. For all age groups (groups younger than 15 years and older than 39), but also for the absolute values of the number of casualties and the numbers of vehicle-kilometres, see *Appendix 2*.

Mode of transport	Risks for different age groups of the riders			
	15-17	18-19	20-29	30-39
Bicycle	0.17	0.14	0.12	0.09
Light-moped	2.93	2.12	1.16	0.91
Moped	2.37	1.58	1.78	1.26
Motorcycle	-	1.16	0.89	0.76
Car	-	0.12	0.07	0.03

Table 4.1. The rates as the number of casualties (drivers plus passengers) per billion vehicle-kilometres for different age groups of the riders in the Netherlands (casualties: death and in-patients); (1995 t/m 1997); (source: SWOV, CBS and the Dutch Ministry of Transport).

In *Table 4.1* low rates for the bicycles and cars are shown. These values are a factor 10 to 20 lower in comparison with the rates of the motorized two-wheelers. The values for the motorcycle are lower than those for both types of moped (an average of 55% lower).

The ratio of riding a light-moped is higher than riding a moped. At first sight this is strange because the standard vehicle speed for the light-moped is 25 km/h and for the moped 45 km/h. But the difference in the Dutch situation is the wearing of a helmet. For the moped the helmet is obligatory but for the light-moped it is not.

5. Problems and measures for mopeds

In the questionnaire (*Appendix 1*) questions were asked about the problems with mopeds. Specific moped problems were also found in the literature. The problems are: tuned-up mopeds, separation of mopeds from other traffic, registration plates and documents, practical test for mopedists, obligatory helmet use, raising the minimum age for riding a moped. These problems and their measures (if reported) for the different countries are discussed in this chapter.

Measures can be implemented at different levels e.g.: legislation, education and information, emphasis on other modes of transport, and technical measures. The best way to decide on the implementation of a measure is to make an assessment of the effect of the measure in terms of the number of casualties that can be saved. Recently, such a calculation was carried out for different measures for the Dutch situation: e.g. anti-tampering, separation of mopeds from other traffic, introduction of registration plates, driving licence, obligatory helmet wearing, raising the age from 16 to 18 (Schoon, 2003). The results of this SWOV-study will also be discussed in this chapter.

5.1. Tuned-up mopeds

5.1.1. *Problems with tuned-up mopeds (results questionnaires)*

The questionnaire also asked about problems with tuned-up mopeds. *Table 5.1* shows the answers that were given.

According to *Table 5.1* eight of the eleven countries which had sent in their information have problems with tampered mopeds. Most of the countries take police action against these offences.

5.1.2. *Measures concerning tuned-up mopeds*

Police efforts are necessary to reduce the number of tuned-up mopeds. In the opinion of SWOV, these efforts are only effective if scare campaigns are also conducted to warn about confiscation of the registration certificate or even the confiscation of the vehicle itself.

The following supporting measures can also be carried out:

- better European anti-tampering regulation¹;
- a sales prohibition of tuning-up components;
- punishing dealers who are guilty of tuning up (self-regulation by the branch and/or action by judges, as in France)².

¹ SWOV has shown that the present anti-tampering regulation is not effective (van den Berg & Gevers, 2001). When a (light-)moped is sold, the dealer will tune it up for about €50 if the buyer asks for it. In the meantime, the EU has also become aware of the fact that the regulation needs to be improved, and wants to study how this can be done.

² In France in July 2002, 9 moped dealers were convicted of tuning-up mopeds. The court indicated to the dealers that they endanger the lives of mopedists by enabling them to ride faster than the moped was designed to go (Via Secura, 2001).

Do you have troubles in your country with tuned up (tampered) mopeds?		
Country	Y / N	Kind of problems / measures
Austria	Yes	There are roadside checks by specialized personal with appropriate equipment
Belgium	Yes	An inquiry has shown that 69% of the 25 km/h-mopeds and 38% of the 45 km/h-mopeds had been tampered with. Measures: fines, the confiscation of parts of the moped, ban from driving (Via Secura, 2001)
Denmark	Yes	Speed measurements indicate that 45 km/h mopeds drives on average 50 km/h; there are also problems with 30 km/h mopeds: owners are sent to a Vehicle Inspection Office
France	No	
Germany	Yes	Police checks whether mopeds are tuned up
Netherlands	Yes	Police checks; the confiscation of parts of the moped; implementation of registration plates
Norway	Yes	Fines; the commencing date for driving licences can be postponed
Portugal	No	-
Sweden	Yes	No special actions for the moment
Switzerland	Yes	With M-category (30 km/h), but the population is very small
Un. Kingdom	No	

Table 5.1. *Problems with tuned-up mopeds in different European countries (source: SWOV questionnaires in 2003).*

5.1.3. *The effect of anti-tampering measures (the Netherlands)*

Assumption for the calculation

For the time being it is assumed that a quarter of the present number of mopeds is tuned up; this assumption is based on police controls.

Extent of casualties for the calculation of the effect of measures

The number of casualties related to a certain measure (the target group) differs for the different measures. For the anti-tampering measures the number of casualties are not only the moped casualties, but also the casualties amongst their crash opponents.

In *Table 5.2* the total number of casualties in one year in the Netherlands is given. It concerns the annual average during 2000 and 2001. Two years are taken because of the large fluctuations in the annual numbers. The number of in-patients refers to the grossed-up (real) numbers because of the under-registration. Annually there are 93 deaths and 2691 in-patients (hospital casualties) among mopedists and 18 deaths and 602 in-patients among their crash opponents (see *Table 5.2*).

Year	Mopedists		Light-mopedists	
	Deaths	In-patients (grossed-up)	Deaths	In-patients (grossed-up)
2000-2001	76	2335	17	357

Table 5.2. *Total number of casualties in the Netherlands as annual average in 2000 – 2001 (Source: AVV/BG).*

Effectiveness of the measures

No research is known about the effectiveness of anti-tampering. However, SWOV has assessed that certain (light) mopeds types have a higher casualty crash rate (Bos, 1999).

	Moped with gears	Other mopeds	Light-moped	Bicycle with auxiliary engine	Total
Rate	1.13	0.16	0.21	0.09	0.19

Table 5.3. *Casualty rates by moped type for mopedists in 1997/98 per 100,000 kilometres travelled.*

Table 5.3 shows that the rate is considerably higher for mopeds with gears, of which it is assumed that a larger number has been tuned up, than for other mopeds. This also applies to light mopeds when compared with bicycles with auxiliary engines. It is estimated that the measure to combat the tuning up of (light) mopeds by registration plates and enforcement, has an effectiveness of 20%. Judging by the Table 5.3 data, this reduction percentage is more an underestimation than an overestimation.

Reduction of the number of casualties among mopedists

It was calculated that measures concerning anti-tampering will result in the saving of 17 deaths and 494 in-patients.

5.2. Separation of mopeds from other traffic

5.2.1. Results questionnaires

The questionnaire asked for measures about the separation of mopeds from other traffic (see Table 5.4).

Six of the eleven countries from which we received the questionnaires, have taken measures to separate mopeds from other traffic. And these six countries all have both the light-moped and the moped on their roads, with the exception of UK. This means that in almost all countries, within the built-up area the light-mopeds must use the cycle tracks and the mopeds must use the roads.

Outside the built-up area, only in Belgium and the Netherlands the situation is different from the other countries. In these two countries it is not allowed for either type of moped to use the road if bicycle lanes are present.

Do you have measures to separate mopeds from other traffic?		
Country	Y / N	Kind of measures
Austria	No	-
Belgium	Yes	Within the built-up area: class A-mopeds (25 km/h) must use the cycle tracks and class B-mopeds (45 km/h) the road. Outside the built-up area: both classes must use the cycle tracks
Denmark	Yes	30 km/h mopeds follow the rules for bicycles and 45 km/h mopeds follow the rules for motorcycles, but are not allowed on motorways etc.
Finland	No	-
France	No	-
Germany	No	Mopeds are not allowed on dual carriageways
Netherlands	Yes	Within the built-up area: light-mopeds must use the cycle tracks and mopeds the road. Outside the built-up area: both classes must use the cycle tracks
Norway	No	-
Portugal	No	-
Sweden	Yes	Class 2 mopeds (25 km/h) are allowed on bicycle lanes, higher speed mopeds are not
Switzerland	Yes	M-class (30 km/h): use of bicycle lanes and ways; other class (50 cc): road
Un. Kingdom	Yes	Several tests are carried out around the country where motorcycles (including mopeds) are allowed to use bus lane

Table 5.4. *Measures to separate mopeds from other traffic in different European countries (source: SWOV questionnaires in 2003).*

5.2.2. *The measure and effect of mopeds on the road (the Netherlands)*

On 15th December 1999, the measure was taken in the Netherlands that mopeds within the built-up area were no longer allowed to use the bicycle lane. It became compulsory to ride on the main road between the fast traffic. Light-mopeds could remain on the bicycle path because officially the speed permitted for light-mopeds does not exceed 25 km/h. This measure was introduced in the framework of 'Sustainably Safe' as a result of the practical investigations carried out by SWOV in three Dutch local councils in the early 1990's¹.

Effect of the measure

An assessment was made, based on the number of casualties in 2000 and 2001. In this evaluation of the measure, the years 1998+1999 were compared with the years 2000+2001. For both periods the development of the number of casualties under mopeds within the built up area was compared. As a check, the development of the number of casualties under

¹ At the introduction of the measure the Ministry of Transport did not change the speed limits: a 45 km/h-moped is allowed to ride max. 30 km/h within the built-up area, while the max allowed speed for cars within built-up area is 50 km/h. This was the reason for SWOV to advise the Ministry to increase the maximum permitted speed for mopeds within built-up area to 45 / 50 km/h (see for this advise *Section 5.2.3*).

mopeds outside the built-up area was determined, and that of the light-mopeds casualties within and outside the built-up area.¹

	Deaths	In-patients (hospital casualties)	Light casualties
Moped, within the built-up area	14,8%	15,7%	26,4%
Moped, outside the built-up area	1,3%	6,2%	15,7%
Light-moped, within the built-up area	-10,5%	6,2%	25,5%
Light-moped, outside the built-up area	-8,3%	-1,1%	30,1%

Table 5.5. *The decrease of the casualties among mopeds and light-mopeds in 2000+2001 compared to 1998+1999 in terms of percentage; a negative percentage indicates an increase in the number of casualties (source: SWOV).*

From the first row of *Table 5.5*, it appears that the measure 'mopeds on the road' has had a considerable effect particularly under the fatal crashes and in-patients (hospital casualties). The decrease in the number of casualties (corrected for the general development) amounts to approximately 10 - 25%.

5.2.3. SWOV recommends increasing speed limit

At the introduction of the measure 'mopeds on the road' the Ministry of Transport did not raise the speed limits for mopeds from 30 to 45 km/h. This means that mopeds officially are too slow in relation to the fast (car) traffic. 'Officially' is due to the fact that most of the mopedists ride at the maximum speed with their vehicle and equal the car speed.

This undesirable situation had to be tolerated by the police. This was the reason that the Ministry of Transport requested SWOV to investigate what the effects on road safety would be if the speed limit for mopeds on the main road within the built-up area was increased to equal that of the speed of vehicles (i.e. 50 km/h).

SWOV advised that mopeds keeping to the 30 km/h speed limit results in an unsafe situation.

This advice was based on a SWOV study carried out in three Dutch boroughs, as a test in 1993. From speed measurements carried out at that time, it appeared that mopeds on the main roads had an average speed of 45 km/h. That of the cars was 50 km/h. Thus the mopeds could keep pace to some extent with the fast traffic; from behavioural observation it appeared that 80% of the mopeds rode between the fast traffic and thus also took in a left-hand position at crossroads. Since it is known from crash research that many collisions occur between motor vehicles turning right and mopeds going straight ahead, it is therefore safer if the moped rides in the stream of traffic. It logically follows that the speed limit of 50 km/h is safer than 30 km/h because it results in a smaller difference in speed between mopeds and cars. In the present situation mopeds usually ride at top speed and authorities take no counteraction.

¹ This manner of determining the effect is somewhat rough because it shows the progress in all moped casualties within the built-up area, without differentiating between the specific locations where the measure is carried out or not.

Based on these research results SWOV has advised that the speed of mopeds should be the same as the speed of fast traffic. This means that on 30 km/h roads within the built-up-area both the mopeds and vehicles keep to the 30 km/h speed limit, and on 50 km/h roads they both keep to the limit of 50 km/h. In the exceptional situation where mopeds have to use the bicycle path within the built-up-area, the speed limit of 30 km/h must be observed.

5.3. Registration plates and documents

5.3.1. Result of the questionnaires

Based on the information from the questionnaires, we saw that in 6 of the 15 countries investigated, mopeds must be provided with formal registration plates and documents (see *Section 2.1* and *Table 2.1*).

Particularly for making the distinction between light and normal mopeds, we can imagine that in countries with both types of moped, the introduction of registration plates is the most popular possibility. But according to the questionnaire information this is not always the case.

After many years, the Dutch government has decided on the implementation of registration plates from 1 September 2005. In *Section 5.3.2* the issue is discussed in detail. Recently (April 2003), the implementation of registration plates from 1 January 2004 was decided on in France; their motivation is given in *Section 5.3.4*.

5.3.2. Problems with the identification of light and normal mopeds (the Netherlands)

In the Netherlands, all mopeds presently have to carry Third Party insurance. To be able to check this, the mopeds (light and normal) all have a small insurance plate on the back of the vehicle. The insurance plate does not, however, indicate whether it is a moped or light-moped.

On the front mudguard, the difference between a light and a normal moped is indicated: a yellow plate for mopeds and an orange plate for light-mopeds. This is meant to make it possible to determine at a distance which traffic rules apply; each type has different ones. However, since the popularity of the scooter-shaped moped and light-moped, these plates sometimes are removed by the owners, or the yellow plates are replaced by orange ones. This is because no helmet is required on a light-moped. The police find it difficult to establish whether a vehicle is a moped or a light-moped; this is only possible by means of a type approval number which has been stamped 'somewhere' in the frame.

The introduction of registration plates and certificate can solve these identification problems. It also makes enforcement easier and police efforts can be more efficient.

To determine whether or not a (light-)moped has been tuned up, the police are allowed to confiscate the registration certificate. The owner is then given time to put everything right, after which the registration certificate will be returned. In case of repeated offences, the (light-)moped itself will be confiscated.

5.3.3. *Implementation of registration plates (the Netherlands)*

In the Netherlands there has been a lot of discussion about introducing a registration (number) for mopeds and light-mopeds.

There were three main problems which had to be solved:

1. How to deal with stolen mopeds and scooters: should a stolen (light-)moped be 'legalised' by registering it?
2. How to deal with tuned up (light-)mopeds?
3. The costs should remain low because (light-)mopeds are also owned by people with a limited income.

Apart from new (light-)mopeds, the existing ones will also need to be provided with a registration number. The original idea was to give the existing (light-)mopeds a safety test in order to solve the tune up problem. Only if a (light-)moped had been approved, it would then get a registration number. However, partly because of the large costs involved, this idea has been abandoned. At present, only a registration check by the moped dealer is necessary

5.3.4. *Implementation of registration plates (France)*

On April 1st 2003, the French government decided to introduce obligatory registration for mopeds and scooters with a cylinder volume of less than 50 cc. This regulation has been implemented from January 1st 2004. It is estimated that, in France, there are about 1 million mopeds and scooters with a cylinder volume of less than 50 cc. The scooters are particularly popular among the young. Partly because of this, there is a large number of severe and fatal crashes with scooters. In 2001 more than 400 scooter riders were killed in French traffic.

The introduction will be phased: the licence number obligation applies to newly delivered vehicles as well as all two-wheelers that any time after January 1st 2004 are offered for sale second-hand. Sale of these will only be allowed to take place after the original owners have ensured that they have been registered. The costs of this will be limited to about €5.

It is expected that the process of practically all mopeds and scooters being registered will take about 7 years. This means registering some 170,000 vehicles a year.

It is also expected that the introduction of the number plate obligation for mopeds and scooters can increase the surveillance of the behaviour of their riders. Additional advantages of this obligation are: increasing and speeding up the chance of finding stolen vehicles, and more possibilities for arresting street thieves (these thefts are often committed from a moving scooter).

5.4. **Practical test for mopedists**

5.4.1. *Result of the questionnaires*

In *Table 2.1* with the results of the questionnaires we saw that 8 of the 15 countries have no practical test for the light-moped; four of these countries do have a practical test for the normal moped.

The questionnaire did not ask for the reasons why there is no practical test. In the Netherlands this issue was discussed in 2002 in a national

commission. Half of the organisations were against it (it is too expensive and/or it is a barrier for buying a moped) and half were in favour of it.

5.4.2. *Inexperience of mopedists in France*

In *Section 2.5.3* it is mentioned that in France mopeds are more often borrowed from the owner than other types of two-wheelers (30% of the cases). The researchers are making the connection that due to this phenomenon, the mopedist does not necessarily have sufficient driving experience. From crash analysis, researchers found that inexperience of mopedists is no doubt a cause of crashes. Turning is a type of manoeuvre which is particularly mentioned as being related to this inexperience of mopedists (Carré & Filou, 1994).

According to the results of the questionnaires in France, a training and practical test is obliged, but in the training and test only have a short duration of three hours.

5.4.3. *The effect of the practical test for mopedists (the Netherlands)*

Effectiveness of the measure

For the Dutch situation a calculation was made of the effect of a practical test in terms of the number of casualties saved. One can say that the effect of a practical test on crash reduction is not known; the estimation is that the effect will be low. An assessment indicates that a larger effect is to be expected of raising the barrier for buying a moped. If a test is compulsory, fewer potential mopedists will buy a moped. The assumption is a total effectiveness of 10% for this barrier effect, as well as for the practical test.

Reduction of the number of casualties among mopedists

The number of casualties is a total of 30 deaths and 1177 in-patients among the 16 and 17 year old riders and passengers of (light-) mopeds and their crash opponents. An effectiveness of 10% gives a saving of 3 deaths and 118 in-patients.

5.5. **Obligatory helmet use**

5.5.1. *Result of the questionnaires*

The questionnaires' results (see *Section 2.1* and *Table 2.1*) show that only in the Netherlands there is no compulsory helmet use for light-mopeds (max. 25 km/h). For the Dutch situation it was calculated how many casualties can be saved if all young light-mopedists use a helmet.

5.5.2. *The effect of the helmet use for light-mopedists (the Netherlands)*

If the wearing a helmet is mandatory, there will be some mutations in the use of the mode of transport. The assumption is made that 25% of the light-mopedists will continue to ride a light-moped and will wear a helmet. 60% of the light-mopedists will choose a moped, and the final 15% will choose the bicycle or public transport.

Effectiveness of the measure

The measure affects young light-mopedists. 'Young' is arbitrarily defined as the 16-24 year olds.

The effectiveness of the helmet measure is calculated on 23% as the result of the weighted average of the 3 categories below.

- For the 25% of the light-mopedists who choose to continue on a light-moped, the helmet effectiveness is calculated to be 25% (Huijbers & van Kampen, 1985).
- For the 60% of the (light-)mopedists who choose a moped, the calculation for this age group uses a slightly lower rate (factor 1.1) than that of the light-moped.
- For the other 15% that chooses the bicycle or public transport, the rate is also (much) lower; in this case about a factor 15 less. *Appendix 2* gives a survey of rate data (the number of deaths and in-patients per million kilometres travelled) for the various modes of transport and ages of road users.

Reduction of the number of casualties among light-mopedists

The number of casualties which can be used for the calculation of the effect of compulsory helmet use is low: among the 16-24 year old light-mopedists and their passengers there are 2 deaths and 115 in-patients annually.

The number of casualties that can be saved is 1 death and 27 in-patients.

5.6. Raising the minimum age for riding a moped

5.6.1. *The effect of raising the age from 16 to 18 (the Netherlands)*

Raising the age is the most radical measure: it affects not only the 16 and 17 year olds, but also the older age groups. If a 16 or 17 year old has not bought a (light-)moped, a large share of the 18 year olds and older age groups will no longer ride a (light-)moped either.

Assumption for the calculation

In the case that the minimum age becomes 18 years, an estimation had to be made of the use of alternative modes of transport for the mopedists. Making an estimate is speculative, but in order to make a calculation we assume that all 16 and 17 year olds will choose the bicycle or public transport. Furthermore we estimate that 50% of the 18-24 year olds will no longer ride a (light-)moped but choose either the bicycle or public transport (20%), the car (20%), or the motorcycle (10%).

We also assume that 10% of those of 24-64 years old will no longer ride a (light-)moped. Those of 65 years and older will mainly ride a bicycle with auxiliary engine; the measure has no effect on them. The different assumptions mean that a separate calculation is needed for each age group.

Number of casualties for effect calculation

1. (Light-)mopedists < 17 years old, and their crash opponents:
 - 34 deaths and 1356 in-patients;
2. (Light-)mopedists 18-24 years old, and their crash opponents:
 - 23 deaths and 771 in-patients;
3. (Light-)mopedists 25 -64 years old, and their crash opponents:
 - 26 deaths and 920 in-patients.

Effectiveness of the measure

The different modes of transport have different rates. For the values is referred to the *Appendix 2*.

- All 16-17 year old (light-)mopedists change over to the bicycle and public transport. Their rate is lowered by a factor 15. The effectiveness for this group is 90%.
- For 50% of the 18-24 year old (light-)mopedists nothing changes. Of the other 50%: 20% choose the bicycle and public transport (rate lowered by a factor 13), 20% choose the car (rate lowered by a factor 23), and 10% choose the motorcycle (rate lowered by a factor 2). The weighted effectiveness for the 18-24 year old (light-)mopedists is, therefore, 42%.
- 10% of the 25-64 year old (light-)mopedists choose the bicycle or public transport (rate lowered by a factor 10). The effectiveness for this group is 9%.

Reduction of the number of casualties among mopedists

The number of casualties that can be saved is 44 deaths and 1668 in-patients. This reduction is divided as follows:

- 16-17 years old: 32 deaths and 1261 in-patients;
- 18-24 years old: 10 deaths and 324 in-patients;
- 25-64 years old: 2 deaths and 83 in-patients.

5.6.2. *The effect of raising the age from 16 to 17 (the Netherlands)*

Raising the minimum age for riding moped to 18 year (see previous section) was considered too high by the Dutch Ministry of Transport. In their opinion it is better to raise the age to 17 years. This measure is a part of the plans of the Ministry of Transport for novice drivers (cars and mopeds), and was launched at the end of 2002.

The motivation for these plans lies in the fact that the crash rate of novice drivers and riders is disproportionately high. This rate for drivers between 18 and 25 years and young mopedists has remained stable in the last 15 years, whereas the rates of other groups show a decline.

The plan of the Ministry of Transport, called "Plan 17", comprises the following measures:

- novice car drivers: extensive instruction and a graduated licensing;
- mopeds and light-mopeds: increase of the minimum age from 16 to 17 years, addition of a danger recognition test to the theory examination, the introduction of registration plates, and the increase of the speed limit for mopeds from 30 km/h to 50 km/h with the exception of the 30 km/h zones.

This plan has been evaluated by the Transport Research Centre (AVV) and it has been estimated (Vlakveld, 2002) that:

- with the car measures, 13 fatal car crashes and more than 300 casualties with hospital treatment could be avoided;
- the measures for moped and light-mopeds resulted in a saving of 23 fatal crashes en 1000 in-patient casualties;
- together with these measures it is necessary to have effective enforcement, information, and good and cheap public transport for the youth in order to make "Plan 17" successful.

SWOV has carried out a cost-benefit analysis of the measures. The result is that the cost-benefit ratio is very favourable (Wesemann, 2002). At this moment a public debate is being held on "Plan 17". The plans for novice drivers are, in general, favourably considered. However, the branch organisations for moped and light-mopeds are opposed to increasing the age limit for moped and light-mopeds from 16 to 17 years.

5.7. Study of the support for the measure 'raising the minimum age for riding moped'

5.7.1. Motivation and realization of the study

Of all the measures that can be implemented, raising the minimum age for riding a moped from 16 to 18 (or to 17) is the most radical. The Netherlands government and the SWOV commissioned a study of whether there was public support for this measure.

We describe this study comprehensively because the opinions of those most concerned (the young and their parents) are important for making an assessment of the feasibility of the measure.

The study was carried out by an agency specialized in youth communication (Young Works, 2002). In their study, the most important question was: How does the youth in the Netherlands (urban as well as rural) view the use of the moped and what are, for them, the most important (negative) consequences from raising the minimum age from 16 to 18? In addition, the parents of the youths participating in the study were also asked what they thought of this measure.

The study consisted of a qualitative part (discussion panel) and a quantitative part (questionnaire).

a. Qualitative study

The qualitative study consisted of four discussion panels with 16-19 year olds. Two of these panels contained city youth (who lived within 10 kilometres from their place of education or work) and two panels consisted of rural youth (who lived more than 10 kilometres from their place of education or work). Questions asked were, among others: why they do or don't ride a moped? Are their 'fun' aspects involved or only matters of necessity? What do the young think about raising the minimum age from 16 to 18? The parents' opinions were also discussed; the youths were asked beforehand what their parents' opinions were.

All panels involved discussion about the opinions of the young themselves; but also regularly about the situations in their immediate neighbourhood, or how they estimated the opinion and behaviour of others of the same age (i.e. friends and classmates) to be.

b. Quantitative study

The quantitative study consisted of a survey via Internet. Secondary school pupils could log on to an educational project 2-3 times a week in their own digital file. Before beginning their digital project, the pupils received the possibility of voluntarily participating in the study.

The total research group contained 637 respondents of 13-16 years old.

They were given five multiple-choice questions to answer. These were:

1. How many kilometres do you live from school?
2. When you become 16, are you planning to have a light-moped or moped to ride?
3. What is the most important reason for wanting a light-moped or moped?

4. The Minister of Transport has the idea of raising the minimum age for riding a light-moped or moped from 16 to 18. If this happens, how will you go to school or work after you are 16?
5. The expectation is that this measure can prevent 1250 severely injured and 30 killed riders a year. What do you think of this measure of the Minister?

5.7.2. Results

a. Qualitative study

The necessity of riding a moped

In the panels there were no youths who would really have problems resulting from raising the age to 18. However, the group of (potential) moped users sees this as having something taken away from them which they had been very much looking forward to. In the first instance, they confused this pleasure (the fun aspect) with the necessity. Those confronted with the idea of raising the minimum age (riders as well as non-riders) reacted very emotionally, with a loud 'no', in the first instance. They regarded mopeding at 16 as an acquired right of their age group, whether they want to use it or not. The new measure gave them the feeling that their (potential) freedom was being restricted; and this incites resistance.

They all agreed that a moped was only really necessary for a very small group: those with a certain disability so that they can't ride a bicycle, or the few young who live so isolated that a bicycle and public transport are no solution. After repeatedly saying that the measure could save 30 lives and 1250 severely injured a year, most of them could see that raising the age did have a point. They began to think more differentiated about it.

Alternatives for the measure

All groups were also asked whether they could think of better measures as an alternative for raising the minimum age. Especially the moped owners had a number of suggestions. An often-mentioned alternative was the introduction of practical lessons and a practical driving test for mopedists. The theory exam was considered very insufficient; the young thought it much too easy.

Also mentioned were: more control of speeding by mopedists, preventing tuning up, allowing mopeds to drive as fast as cars, and lowering the minimum age for light-mopeds to 15 (in order to gain more experience before riding a moped).

The panel discussions also covered safety matters and safety perception of mopedists (both users and non-users) and their parents. They were surprised by the number of offences tolerated by parents and government, and that there was hardly any action taken. The tuned-up (light-)mopeds are considered to be an extreme situation, as nearly all types of mopeds can ride faster than allowed.

Predicted problems concerning the measure

A realistic problem that the young brought up is that of riding illegally. If the minimum age is raised, the under-18s will still continue to ride. Many indicated that they themselves will continue to do so if such a measure indeed comes. Also the fact that a number of panel members had already started riding a moped long before they were 16 confirmed this opinion. Of

course this will cause dangerous traffic situations and can result in more problems occurring with uninsured youths who cause damage.

Parents' opinions

A number of parents would prefer to forbid their child to ride a moped. Most of them do not have such an influence on their children. Some parents stimulate their children to ride a moped. Some parents even tolerate their son or daughter riding a moped before their 16th birthday.

The vast majority of the parents though it was a good idea to raise the minimum age to 18. Their arguments were that it would save a lot of crashes and that someone of 18 is more responsible than someone of 16 years old. The parents that thought it was a bad idea, argued that 'some are sensible at 16 and others not yet at 18'. According to them, age is not all that important; it's all about a sense of responsibility.

b. Qualitative study

Sample

Table 5.6 shows the composition of the sample that answered the questionnaire, by age and sex. The total group was from schools throughout the whole of the Netherlands. The variable 'urban' and 'rural' is not given here because it's mainly about how far the children live from school.

The wish to ride a moped

Of those between 13 and 16 who at that moment, did not (or weren't allowed to) have a moped, 48% answered that they would like to ride one when they are 16. For boys this was approximately 15 percent points higher than for girls. The percentage of boys wanting a moped is about 20 percent points higher than the actual moped ownership among 16 year olds (circa 30%). There are, therefore, reasons why about 20% of those wishing to ride one cannot translate this wish into reality. The qualitative study showed that financial limitations play a large part ("mopeding is just expensive").

Number of study participants (absolute numbers)	Sample numbers			Sample percentage		
	Total	Boys	Girls	Total	Boys	Girls
13 years	109	58	51	17.1	9.1	8.0
14 years	80	34	46	12.6	5.3	7.2
15 years	312	68	244	49.0	10.7	38.3
16 years	46	22	24	7.2	3.5	3.8
< 13 years and >16 years (rest)	90	51	39	14.1	8.0	6.1
Total	637	233	404	100	36.6	63.4

Table 5.6. *Sample composition (source: Young Works, 2002).*

Of those living less than 10 kilometres from school, there were as many who did not feel the need to have a moped as those who did. It is noticeable that among those living further than 10 kilometres from school, there were nearly 20 percent points more respondents who wanted a moped: 64% in comparison with an average level of 47% of those living less than 10 kilometres from school. The need among girls living further than 10

kilometres from school was the same as among the group living less than 10 kilometres away. It appears that, for boys, a distance of 10 kilometres is a sort of critical border, above which the wish for a moped increases significantly.

Alternatives for riding a moped

As was expected, most (54%) of the youth who wanted to ride a moped when they become 16, chose the bicycle as an alternative if the minimum age was raised to 18. The second choice (40%) was public transport. Distance, here, played an important part. The further they live from school the more they chose public transport. At a distance of less than 2 kilometres, 21% go to school by public transport (as an alternative), and at a distance of further than 10 kilometres, the percentage is 61%. The choice of public transport is at the expense of the bicycle.

Motives for riding a moped

Table 5.7 shows the motivation for wanting to ride a moped. 62% of those wanting a moped on their 16th birthday, answered that their reason for this was 'practical' (because it's necessary to get somewhere). 34% gave 'fun' as their reason (because it's nice to ride a moped). Just a few gave 'to belong to a group' as their reason. This pattern is approximately the same for girls as for boys.

Reason to want a moped	Boys	Girls	Total	n
Practical	59,9%	63,3%	62,0%	290
Fun	35,8%	33,1%	34,2%	160
Belong to group	4,3%	3,6%	3,8%	18
Total number (n)	187	281	486	

Table 5.7. Reason for wanting a moped by 13-16 year olds that want to ride one when they are 16 (source: Young Works, 2002).

Opinion about the measure

Table 5.8 shows that those who were planning to ride a moped once they are 16 (upper part of table) were less positive about the measure than those who were not planning to ride a moped (lower half of table). 27% of those with such an intention thought it was a good idea, against 43% of those without the intention. 11% of this last group thought it a bad idea, whereas nearly 25% didn't know. 21% of those planning to ride a moped didn't know (especially the girls) whereas 40% of the boys thought it was a bad idea. Table 5.8 also includes the variable 'distance from school'. Up to 10 kilometres, this distance doesn't seem to play a clear role when forming an opinion. It is striking that more (i.e. 36%) of the group who both plans to ride a moped when older than 16 and who lives more than 10 kilometres from school, think it is a good idea than the group living closer (25%). Among the group not planning to moped later, there is much less distinction between the distance from school and the opinion about the measure; an average of 40% thought it was a good idea.

The group that is planning to ride a moped think that the measure is a:	Boys	Girls	< 2km	2-5 km	5-10 km	> 10 km	Total	N
Good idea	25.2%	28.5%	20.0%	29.2%	26.2%	35.6%	27.2%	72
Mediocre idea	23.4%	17.1%	23.8%	24.6%	14.8%	13.6%	19.6%	52
Bad idea	40.2%	33.5%	31.3%	38.5%	41.0%	35.6%	36.2%	96
Do not know	11.2%	20.9%	25.0%	7.7%	18.0%	15.3%	17.0%	45
	n = 107	n = 158	n = 80	n = 65	n = 61	n = 59	n = 265	
The group that is not planning to ride a moped think that the measure is a:	Boys	Girls	< 2km	2-5 km	5-10 km	> 10 km	Total	n
Good idea	40.4%	43.8%	42.6%	48.3%	37.5%	39.3%	42.9%	81
Mediocre idea	25.0%	19.7%	27.9%	23.3%	20.0%	3.6%	21.2%	40
Bad idea	9.6%	11.7%	6.6%	3.3%	12.5%	35.7%	11.1%	21
Do not know	25.0%	24.8%	23.0%	25.0%	30.0%	21.4%	24.9%	47
	n = 52	n = 137	n = 61	n = 60	n = 40	n = 28	n = 189	

Table 5.8. *Opinions of 13-16 year-olds about the measure that raises the minimum age to 18 years (Young Works, 2002).*

6. Analysis and discussion

6.1. Mopeds

6.1.1. Analysis of the relation between minimum age of mopedists and light-mopedists and safety

The 15 EU countries that returned the questionnaire have a minimum age for riding a moped or light-moped of 14 to 16 years. Denmark is the only country with a minimum age of 18 years. Crash data with a distribution of casualties by age was received from some European countries. This enabled us to compare the different minimum ages. Seeing the EU plans to harmonize European driving licence categories, this was a useful analysis.

To make this analysis we used data from the CARE database. There was only sufficient crash data available from five countries to analyse the moped or light-moped deaths for the ages 14-18 years (see *Section 2.4*). This data is given in the table below.

European countries	Minimum age moped riding	Number of killed mopedists by age in years						Killed mopedists all ages
		14	15	16	17	18	14-18 ^{*)}	
Spain	14	10	17	31	32	25	115 (31%)	373
France	14	23	24	49	56	33	185 (40%)	458
Italy	14	14	27	50	41	37	169 (25%)	675
Belgium	16	2	2	8	10	8	30 (39%)	78
Netherlands	16	0	1	17	10	17	45 (51%)	89
Total/average		49	73	162	150	120	554 (33%)	1705

^{*)} Percentage: the number of 14-18 related to the killed mopedists all ages

Table 6.1. For five European countries, the number of killed mopedists in 1998 for different ages (source: CARE, 2002).

Table 6.1 shows that the Netherlands has relatively the most killed mopedists younger than 19 years (51%) and Italy the least (25%). No conclusions can be drawn about any relation between the minimum age and the share of under 18 year-old deaths from this table, because the share of killed mopedists older than 18 determines the share of those younger than 18. However, what is of importance is the distribution of deaths among the ages of 14-18 years. To obtain this data for those killed younger than 18 years old, *Table 6.2* expresses the data from *Table 6.1* as 100% and the number of deaths of those younger than 14-18 years is given as a percentage of this total.

European countries	Minimum age moped riding	Percentage killed mopedists by age in years related to the total number of killed mopedists by the ages of 14-18 years						Killed mopedists (abs.)
		14	15	16	17	18	14-18	14-18
France	14	12.4%	13.0%	26.5%	30.3%	17.8%	100%	185
Italy	14	8.3%	16.0%	29.6%	24.3%	21.9%	100%	169
Spain	14	8.7%	14.8%	27.0%	27.8%	21.7%	100%	115
Belgium	16	6.7%	6.7%	26.7%	33.3%	26.7%	100%	30
Netherlands	16	0.0%	2.2%	37.8%	22.2%	37.8%	100%	45
Total/average		9.0%	13.1%	28.5%	27.4%	22.1%	100%	544

Table 6.2. For five European countries the percentage of killed mopedists related to the total number of killed mopedists in the age of 14-18 year (figures 1998; source: CARE, 2002).

The data in Table 6.2 shows that in the countries with a minimum age of 14 years, about a quarter of the under 19 year olds killed are 14 and 15 year olds. In all the countries in the table, the most deaths have the ages 16 and 17; only the Netherlands has a second peak of the 18 year olds. Because this data only concerns one year (1998), we have to take large fluctuations into account, especially for the Netherlands and Belgium.

6.1.2. Discussion

With the data presented here we can only determine that by lowering the minimum age from 16 to 14, about a quarter of those killed below the age of 19 will occur among the 14 and 15 year olds.

If with a minimum age of 14 (absolute) there will be fewer deaths among the 16, 17, and 18 year olds, because of a possible learning effect, we cannot know because there is no exposure data. It could, however, be so that a (light-)mopedist who starts at 14 will have a lower death rate in the years afterwards. An indication of this can be found in the Dutch death rate figures in Appendix 2. For example, for a 15-17 year old mopedist the death rate is higher than that of an 18-19 year old (the Dutch death rates are 2.4 and 1.6 deaths and in-patients per million kilometres travelled respectively). For a light-mopedist these figures for both age groups are 2.9 and 2.1 respectively. If we compare these rates with those of cyclists of the same age (0.17 and 0.14 respectively), we can determine that the rates for cyclists are more than a factor 10 lower than those for mopedists and light-mopedists. Such high rates for mopedists can also be found in the foreign references as included in Table 2.5.

Considering the risk (low death rates) for 15 - 17 year old cyclists, the absolute number of casualties among the 14 - 19 year olds will increase if the minimum moped or light-moped age is lowered to 14. This is even the case if the rate for 16 and 17 year old mopedists goes down slightly when they begin riding a moped or light-moped at the age of 14.

At the moment there is a discussion in the Netherlands about raising the minimum age for (light-)mopedists. For the Dutch situation, it has been

calculated that raising the minimum age from 16 to 17 will save 23 deaths (Vlakveld, 2002); and raising the age from 16 to 18 will save 44 deaths (Schoon, 2003). This is 20% and 40% respectively of the total number of (light-)mopedists killed.

Whether the age should be raised to 17 or 18 years has to do with the European harmonization of driving licences (of motorized two-wheelers), or with the wish of some European countries to be able to decide this for themselves (see *Section 6.3*).

Changing the minimum age for driving a vehicle is always controversial; this is also the case for raising of the minimum age for (light-)mopeds. On the one hand, the supporters look at the road safety aspect and, on the other hand, the opponents consider the reduction in sales and in mobility of young persons.

First of all the size of the group which the measure affects is discussed. Then some support among the teenagers (affected by the measure) and their parents is presented.

a. Use of mopeds or light-mopeds

Recently a number of surveys has been done in the Netherlands about the numbers and use of mopeds or light-mopeds (Bos & Schoon, 1998; NIPO, 2002; Dutch Statistics CBS). For the 16 and 17 year old (light-)mopedists the picture is as follows:

- 25% of the 16-17 year olds have a moped or light-moped;
- 32% of all moped or light-moped kilometres are travelled by 16 and 17 year olds;
- in the age group of 16-18 years old the most-used mode of transport is the bicycle with 49%, followed by public transport with 20%; the moped or light-moped is used most by only 13%.

b. Some support of teenagers for the measure

In the Netherlands it has been investigated what the teenagers (and their parents) think about raising the minimum age for riding a moped or light-moped from 16 to 18 years. One survey aimed at this subject (Young Works, 2002) confirmed that it was a sensitive subject. However, the teenagers as well as their parents are prepared to weigh the safety aspect heavily and, because of this, are less fiercely opposed to raising the age. It was to be expected that boys have a stronger moped yearn than girls, and that they were more opposed to raising the age. The distance from home to school appeared to play a role in this, but only if it is longer than 10 kilometres.

For the situation in the Netherlands, various other measures have had their casualty savings calculated. Among these, dealing with the problem of tuning-up moped or light-moped scored the highest for reducing the number of deaths. Many measures make it possible to save relatively many mopedist and light-mopedist in-patients.

Since the introduction of the scooter-shaped mopeds in the Netherlands (45 km/h-scooter and 25 km/h-scooter), it is hardly possible to visually distinguish between the two types. An idea is to abolish the present category of the scooter-shaped light-moped, so that there will only be a 45 km/u-moped and a 'bicycle with auxiliary engine' left. This last category should at least have pedals and large wheels, with an auxiliary engine of a limited

cylinder volume; but due to the European harmonization of vehicles, it is difficult to realize this.

Other European countries are also discussing measures. In Austria there is a discussion going on about raising the minimum age again from 15 to the 16 years it was before. There is also discussion about whether there should be an obligatory practical and theoretical exam (Vavryn, Winkelbauer & Esberger, 2001).

In France, researchers have also been discussing whether to raise the minimum age for mopedists from 14 to 16 years and the introduction of a practical exam (Carré, Filou & Ziani, 1996). Swiss researchers support better driving lessons (Hubacher & Ewert, 1994).

The tuning-up problem is a point of discussion in most of the European countries studied. The EU has become aware of the fact that the regulation needs to be improved, and wants to study how this can be done.

French researchers are making a point of the poor visibility of mopeds (Carré & Filou, 1994). This is an aspect that also applies to motorcycles.

6.2. 125 cc motorcycles

Approximately half the European countries allow riding a 125 cc motorcycle at 16 years old. Making an analysis of the influence of these minimum ages on crashes and casualties was virtually impossible because there was no exposure data for the individual countries. Moreover, the crash statistics often include the 125 cc motorcycle in the total group of 'light motorcycles' or 'motorcycles'. But the little that is known, will be discussed here.

6.2.1. *Exposure and crash data*

In the references examined, only German data on 125 cc motorcycle possession were found.

During the period 1994-2000 there was a rapid growth in the number of motorcycles in Germany, especially among the 16-17 year olds (a growth of 23%) and among those of 35 years and older (a growth of even 171%). As far as the young group is concerned, the growth can only be attributed to the introduction of the 125 cc motorcycle in 1996. The extra rapid growth of the group of 35 years and older can also be attributed to the 125 cc motorcycle because motorists who have had a B driving licence since before 1980, were permitted to ride one (Assing, 2002).

Such a growth was also accompanied by an increase in the number of crashes. The increase was 11% (2000 compared with 1994) among the 16-17 year olds and 139% among the 35+ years.

For the light motorcycle, the rate per age group can differ considerably. In Germany in 1997, the 16-17 year olds possessed 13% of the light motorcycles; this is the 125 cc group. 44% of this age group was involved in crashes with light motorcycles. In comparison, the 41-50 year old possessed 30% of the light motorcycles and 12% was involved in these crashes.

In Germany, the rates for all motorcycle categories are a factor 10 higher for the youngest age group than for the 35+ years; this is based on possession and not on vehicle kilometres. This rate comparison by possession is not a completely honest comparison. If older motorcyclists ride many more kilometres than the younger ones, this factor will be lower per kilometre travelled. Such data, however, does not exist.

Some estimate of use can, of course, be derived from crash data, but we must be very careful here of the difference in rate between the various age groups. French research shows that of all casualties of a crash with a 125 cc motorcycle, 38% were 18-24 years old and 39% were 30-65 years old (Carré & Filou, 1994). In France, 16 is the minimum age for riding a 125 cc motorcycle, but the 16-17 year old share of the casualties unfortunately cannot be calculated.

In Austria, an increase was determined of the number of injured of 23 years and older, among motorcyclists of the lighter category motorcycles. During the period 1997-2000 the increase was with a factor 8 (an increase from 21 to 179 injured; Vavryn, Winkelbauer & Esberger, 2001a). A distinction here between the 125 cc category and the other categories of light motorcycles is also not possible.

6.2.2. Discussion

The Austrian researchers Vavryn, Winkelbauer & Esberger (2001b) are of the opinion that the regulation of the light category of motorcycles is not in agreement with the desired situation in their country. The minimum age for riding a 125 cc motorcycle, which is now 18, should stay 18. Moreover, motorists who want to change over to the 125 cc motorcycle must have a better practical training that is now the case. The Netherlands government is not in favour of introducing an A1 driving licence category with a minimum age of 16 years. Also two or three other European countries are not in favour.

We will have to further discuss the consequences of lowering the minimum age and the low threshold for car drivers being permitted to ride a light motorcycle, by using death and in-patient rates.

a. Lowering the age from 18 to 16 years

A shift is expected from the moped to the 125 cc motorcycle. The road safety advantage is that there will be a good driving training beforehand. This means that the change from the moped to a 125 cc motorcycle will not have much effect on road safety in terms of number of casualties. It could even be advantageous if the rates for a motorcycle are lower than those for the moped. This is true for the Netherlands.

However, there will be less safety if, other than the mopedists, there are extra 125 cc motorcyclists. German data indicated the popularity of this motorcycle.

It is also disadvantageous for road safety if many teenagers obtain a motorcycle driving licence at a young age. In the 'old' situation, in which a mopedist did not yet have a motorcycle driving licence, the change over at 18 or 19 was made more often to a car than a motorcycle. In the 'new' situation, a 16 year old will obtain a motorcycle driving licence immediately, and will probably continue to ride a motorcycle for a number of years. Seeing the great difference in rates between riding a motorcycle and driving a car, the balance will be extremely negative.

There is, possibly, a (small) advantage: starting to ride a motorcycle at a later age, it is possibly favourable for road safety if one has learned to ride a motorcycle at a young age. We have, however, not seen any references about this.

b. Low threshold for car drivers

It is permitted in some countries to ride a 125 cc motorcycle if one has had a car driving licence for several years. The threshold for riding a motorcycle (one of the lighter categories) is hereby lowered considerably. A low threshold for being allowed to ride a motorcycle is not good for road safety. After all, in the age group 20-29 years the rate for riding a motorcycle is a factor 13 greater than for driving a car (see *Appendix 2*). For the age groups 30-39 and 40-49 the rates are even a factor 25 and 30 higher respectively. Here it should be noted that these rates apply to all categories of motorcycles (from light to heavy) and not specifically to the 125 cc. Even if the rate for a 125 cc motorcycle is lower than for all categories, it is considerably higher than for a car.

It is desirable that motorists receive a good training for riding a motorcycle. A good practical one can contribute towards lowering the rate for the 125 cc motorcyclist. Possibilities are: extra attention for anticipatory driving, training for danger recognition, and performing braking and avoidance manoeuvres at high speeds. As far as technical aspects are concerned, improvements can be made in motorcycles and scooters by installing ABS and a combined brake system.

7. Conclusions

The chance of being killed in a road crash as a mopedist or motorcyclist is high in comparison with, for example, a motorist or a cyclist. From various European databases, the risk of mopedists and light-mopedists being killed was determined. Such numbers could not be produced for the light, 125 cc category of motorcyclists because national and European databases do not make a distinction by motorcycle type.

For the Netherlands the number of casualties per million vehicle kilometres was also available. The differences in rate per vehicle type and age group are large.

The rates for bicycles and cars for example are a factor 10 to 20 lower in comparison with the rates of the motorized two-wheelers.

Using the results from the questionnaires distributed in the European countries, insight into the rules & regulations and problem areas was gained. Using the literature and European databases, an overview was made of moped safety. As far as the A1 motorcycle category is concerned, the literature study could provide specific crash study data for only a few European countries (among which Germany).

7.1. Light mopeds and mopeds

Legislation

The minimum ages for riding a light-moped (max. 25 km/h) and riding a moped (max. 45 km/h) differ strongly in the European countries. In the six countries where a light-moped is allowed, one country permits riding a light-moped at an age of 14 years; two countries have an age of 15 years and three an age of 16 years.

Riding a moped is permitted at the age of 14 years in three of the 15 countries. Of the other countries, 3 countries allow riding a moped at 15 years; 8 countries at 16 years, and one country (Denmark) at 18 years. Four countries have no theoretical test for mopeds; in two of them this concerns only light-mopeds.

Nine countries have no practical test for the light-moped; four of these countries do have a practical test for the normal moped.

Only three countries (Germany, Luxemburg, and Netherlands) have different speed limits for urban and rural: urban 25 or 30 km/h and rural 40 or 50 km/h.

Between all these 15 European countries, the Netherlands is the only country without compulsory helmet use for the light-moped.

In seven of the fifteen countries mopeds must be provided with formal registration plates and documents. In France this has been arranged recently and in the Netherlands it is planned for 2005.

Crashes and casualties

Only from France and the Netherlands data were received of the possession of mopeds. In the Netherlands a quarter of the 16-17 year olds has a (light-)moped and only 8% of the 18-24 year olds has a (light-)moped. In the age group of 16-18 years old the most-used mode of transport is the bicycle with 49%, followed by public transport with 20%.

In France, mopeds are typically ridden by adolescents (12% are 14-15 years old and 29% are 16-17 years old).

The southern European countries Italy and Spain, but also Germany and France, are countries with a lot of mopeds. As a consequence the absolute numbers of killed mopedists are also high in these countries.

The crash rate (the number of killed mopedists as a % of the total number of killed road users) gives high values for the south European countries Italy, Portugal and to a lesser degree for Spain. Only two countries (France and Belgium) have a median score in the crash rate, but a bad score in the vehicle rate (the number of killed mopedists per 100,000 mopeds).

Of the three European countries where the minimum age is 14 years, the European CARE database allowed us to determine the number of deaths among young mopedists. The share of the 14-15 year olds was lower than that of the 16-18 year olds. Whether the lower age group's rate is also lower is not known, because there is no known exposure data.

In Denmark in 1994, the scooter moped-45 was introduced. A significant increase in the incidence rate was measured during the period 1996-2000. The minimum age for this type of moped is 18 years and a driving licence is obligatory.

In Austria in 1992, the theory certificate was introduced. The number of 16-17 year old casualties during the period 1987-1997 was halved. In 1997, Austria lowered the minimum age from 16 to 15 years for the moped. Especially the number of 15 year olds injured increased a lot; it nearly doubled.

In France the minimum age for riding a moped is 14 years. The percentage-killed mopedists of 14-15 years old is lower than those of 16-17 years old (they account for 11% and 22% of the total number of killed mopedists, respectively). It is remarkable that mopeds are more often borrowed from the owner than other types of two wheelers (30% of the cases). The researchers are making the connection that due to this phenomenon, the mopedist does not necessarily have sufficient driving experience.

French researches pay little attention to the influence of the minimum age of riding and the number of casualties divided by age. They said that it is standard that the age of most casualties is close to the age that it is permitted to ride. In spite of this, the problems with the number of casualties and the low age of 14 year are discussed.

In Switzerland a behaviour study was carried out in which young mopedists and cyclists between 14 and 18 years were involved. In roughly 60% of the crashes, they themselves cause the crash, mainly as a result of violation of traffic regulations, and of lack of attention. The most important finding was that female mopedists are 7 times more likely to have a crash than female cyclists and 2.5 times more likely to have a fall (male mopedists only have 2 to 3 times more crashes than male cyclists). The difference according to the Swiss researchers may be due to the fact that boys have already become familiar as cyclists in exploring limits.

Specific problems, measures and effects

The questionnaire asked about the specific problems with mopeds. Different European countries share the following problems.

- Tuned-up mopeds.

Eight of the eleven countries which sent in their information have

problems with tampered mopeds. Most of the countries take police action against these offences. Other measures are: better European anti-tampering regulation; sales prohibition of tuning-components; punishing dealers who are guilty of tuning up.

- Separation of mopeds from other traffic.
Six of the eleven countries from which questionnaires were received, have taken measures to separate mopeds from other traffic. In Belgium and the Netherlands mopeds must use the cycle track if present outside the built-up area. Separation of mopeds from other traffic inside the built-up area is effective: in the Netherlands an effect is found of approximately 10 - 25%.
- Registration plates and documents.
In 6 of the 15 investigated countries mopeds must be provided with formal registration plates and documents. In France the year of implementation is 2004 and in the Netherlands it will be 2005.
- Practical test for mopedists.
Ten of the 15 countries have a practical test for mopeds; most of the countries have no practical test for the light-moped. In a Dutch calculation a casualty reduction of 10% is used for the effect of a practical test. The assumption is that the barriers for potential mopedists buying a moped, for an important part contribute to this effect.
- Obligatory helmet use.
Only in the Netherlands there is no compulsory helmet use for the light-moped (25 km/h-moped).
- Raising the minimum age for riding a moped.
This is a very effective measure. In the Netherlands, plans for raising the age from 16 to 17 are discussed. This plan of the Ministry of Transport, called "Plan 17", for example also comprises the addition of a danger recognition test to the theory examination. In case of the Netherlands it is assessed that this plan will reduce the number of moped casualties and casualties among their crash opponents by about 20%.
When Austria, in 1997, lowered the minimum age for riding a moped from 16 to 15 years old, the number of those injured doubled. In Austria there is a discussion going on about raising the minimum age again from 15 to the original 16 years.
In France, raising the age from 14 to 16 years is being discussed by researchers. In a calculation of SWOV, the effect of the raising the age from 16 to 18 would result in a saving of about 40% of casualties.
Raising of the minimum age for (light-)mopedists is always controversial. On the one hand, the supporters of this measure look at the road safety aspects and, on the other hand, the opponents (i.e. the trade and the tourist organizations) view the loss of the (potential) number of (light-)mopedists and the reduction in mobility for young mopedists. A survey carried out in the Netherlands confirmed that it is a sensitive subject. However, the teenagers (and their parents) are prepared to weigh the safety aspect heavily and, because of this, are less fiercely opposed to raising the age. It was to be expected that boys have a stronger moped yearn than girls, and that they were more opposed to raising the age.
- Poor conspicuity of mopeds.
- French researchers are making a point of the poor conspicuity of mopeds. This is an aspect that also applies to motorcycles.

7.2. Motorcycle category A1

Legislation

Eight of the 14 countries from which data was received have a minimum age of 16 years for riding the category A1 motorcycle. One country has a minimum age of 17 years (UK) and three countries of 18 years. In Denmark and the Netherlands the A1 category is not separately regulated in the legislation. In eight of the 14 countries it is permitted to ride a 125 cc-motorcycle if one has had a B-licence (licence for a car) for some years. Some countries have their own restrictions: a practical training of 6 – 8 hours (Austria and Switzerland) or a training with L-plates (UK). Some countries have the intentions to change one or more rules. Now the new proposal of the European Commission has been published (October 2003), they will probably make an alteration in their plans.

Possession and crashes

It was not possible to make a review of crashes and casualties in the European countries due to the fact that in the crash statistics of the individual countries, the 125 cc motorcycle is not a separate motorcycle category.

Germany, Austria and France have some crash data related to the 125 cc motorcycle. Only Germany also has some data of possession of this category.

In Germany a rapid growth in the number of motorcycles took place in the period 1994-2000, especially among the 16-17 year olds (a growth of 23%) and those 35 years and older (a growth of even 171%). As far as the young group is concerned, the growth can only be attributed to the introduction of the 125 cc motorcycle in 1996. The extra rapid growth among the 35 years and older can also be attributed to the 125 cc motorcycle because, before 1980, car drivers with a B driving licence were permitted to ride one. The large growth was also accompanied by an increase in the number of crashes. The increase among the 16-17 year olds was 11% (2000 compared with 1994) and among the 35+ years 139%.

Traffic safety consequences

This report discusses the consequences of lowering the minimum age (from 18 to 16) and the low threshold for car drivers being permitted to ride a light motorcycle.

Lowering the age for riding a light motorcycle from 18 to 16 years

This measure gives a shift from the moped to a 125 cc motorcycle. Due to the possibilities of a good driving training, this will not have much effect on road safety. However, there will be less safety if, apart from the mopedists, there is an increase in other 125 cc motorcyclists. German data already indicate the popularity of this motorcycle, and the increase in the number of casualties.

After some years, lowering the age also creates a new group of motorcycle riders older than 18, which in the old situation were only car drivers. Seeing that the crash rate for riding a motorcycle is very high compared with the rate for driving a car, this aspects scores also negative.

The new proposal concerning the harmonization of licence categories of the European Commission includes a minimum age of 16 riding the A1 category. Seeing the negative results for traffic safety for countries which have a minimum age of 18 now, it is recommended to revise this rule.

The low threshold for car drivers

It is permitted in some countries to ride a 125 cc motorcycle if one has had a car driving licence for several years. A low threshold for being allowed to ride a motorcycle is not good for road safety.

The problem is the creation of a new group of motorcyclists without a thorough training and a test. But apart from the training and test, riding a motorcycle is risky. German crash data confirm this.

Dutch crash rates (death and hospital casualties per million travelled kms) also illustrate this. In the age group of 20-29 years, the rate for riding a motorcycle is a factor 13 greater than for driving a car, and for older groups the rates are even higher. Here it should be noted that these rates apply to all categories of motorcycles. But even if the rate for a 125 cc motorcycle is lower than for all categories, it is considerably higher than for a car.

It is recommended that in the new demands concerning the licence category A1, no rule is added that it is permitted to ride a 125 cc motorcycle if one has had a car driving licence for a number of years.

In general

The safety of motorcyclists can be improved by incorporate trainings and tests, extra attention for anticipatory driving, training of danger recognition, performing braking, and avoidance manoeuvres at high speeds. As far as technical aspects are concerned, improvements can be made in motorcycles and scooters by installing ABS and a combined brake system. Research is needed for the way to make motorcycles (and mopeds) more conspicuous.

References

- Assing, K. (2002). *Schwerpunkte der Unfälle von Motorradfahrern*. Bundesanstalt für Strassenwesen (BASt). Proceedings of the 2002 International Motorcycle Conference, Munich, Germany.
- Barsi, T., Faergemann, C. & Larsen, L.B. (2002). *Road traffic accidents with two-wheeled motor vehicles during a five-year period in Odense, Denmark*. Traffic Injury Prevention, Nr. 3, pp. 283-287.
- Berg, J. van de & Gevers, D.-J. (2001). *De effectiviteit van de EU-anti-opvoerregelgeving voor brom- en snorfietsen*. Afstudeerverslag van de HTS Autotechniek, Arnhem.
- Bos, J.M.J. (1999). *Verkeersonveiligheid van brom- en snorfietsers. Vergelijking van verschillende brom- en snorfietsmodellen*. R-99-18. SWOV, Leidschendam.
- Carré, J.-R. & Filou, C. (1994). *Accident risks for two-wheelers in France : safety of two-wheelers is largely subject to the skill and vigilance of car drivers*. Proceedings of the Fourteenth International Technical Conference on Enhanced Safety of Vehicles ESV, Munich, Germany, May 23-26, 1994, Volume 2, pp. 1264-1278.
- Carré, J.-R., Filou, C. & Ziani, A. (1996). *l'Insécurité des cyclomotoristes: situation française et internationale*. Rapport INRETS ; No. 211. Arcueil, Institut National de Recherche sur les Transports et leur Sécurité INRETS.
- CIECA (2001). *Guide on driver licensing*. CD-ROM. Commission International des Examens de Conduite Automobile, CIECA, Brussels.
- Department for Transport (2002). *Road accidents Great Britain 2001. The casualty report*. Department for Transport, London, United Kingdom.
- Hubacher, M. & Ewert, U. (1994). *Einstellungen und merkmale der Fahrzeugbenützung jugendlicher Velo- und Mofafahrer*. BFU-report 26. Schweizerische Beratungsstelle für Unfallverhütung BFU, Bern, Switzerland.
- Huijbers, J.J.W. & Kampen, L.T.B. van (1985). *Schatting van het effect van letselpreventiemaatregelen voor voetgangers, fietsers en bromfietsers bij botsingen met personenauto's*. R-85-36. SWOV, Leidschendam.
- Lund, H. (2002). *45-mopeds*. Report 1 – 2002. Danish Transport Research Institute (DTF). Lyngby, Denmark
- Ministry of Transportation (2002). *De rijbewijsrevolutie. Een discussienota over de toekomst van het rijbewijsbeleid*.
- NIPO (2002). *Jongeren & Verkeer; Een onderzoek naar verkeersveiligheid*. Rapport A-9556-7. NIPO, het marktonderzoekinstituut, Amsterdam.

Noordzij (SWOV), P.C., Forke (IfZ), E, Brendicke (IfZ), R. & Chinn (TRL), B.P. (2001). *Integration of needs of moped and motorcycle riders into safety measures*. Project funded by the European Commission DG VII. D-2001-5, SWOV, Leidschendam.

Schoon, C.C. & Custers, M. (2001). *Opgevoerde brom- en snorfietsen betrokken bij ongevallen. Interviewstudie naar de afhandeling van dergelijke ongevallen door politie en verzekeringsmaatschappijen*. D-2001-1. SWOV, Leidschendam.

Schoon, C.C. (2002). *Advies over (verhoging van) rijnsnelheden van bromfietzers als gevolg op de maatregel 'Bromfiets op de rijbaan'*. D-2002-7. SWOV, Leidschendam.

Schoon, C.C. & Goldenbeld, Ch. (2003). *Jonge brom- en snorfietsers: kan hun ongevallenkans sterk omlaag? Effecten van maatregelen en draagvlak onder jongeren en organisaties*. R-2003-13, SWOV, Leidschendam.

Schulz, U. (2000). *Zur Unfallverwicklung 16- und 17jähriger Leichtkraftradfahrer und die motivationalen und einstellungsmässigen Hintergründe (Accident involvement of 16- and 17year old riders of lightweight motorcycles and the motivational and attitudinal background)*. Proceedings of the 2000 International Motorcycle Conference, Munich, Germany. pp. 35-55

Vavryn, K., Winkelbauer, M. & Esberger, R. (2001a). *10 Jahre Stufenführerschein in Österreich. Eine umfassende Analyse des Unfallgeschehens bei einspurigen*. Kuratorium für Verkehrssicherheit, Vienna, Austria.

Vavryn, K., Winkelbauer, M. & Esberger, R. (2001b). *Unfallgeschehen Motorräder für Lenkberechtigungen der Klasse A1*. Kuratorium für Verkehrssicherheit, Vienna, Austria.

Vis, A.A. (1995). *De onveiligheid van motorrijden nader bekeken; Een beschrijving van de aard en omvang van het probleem*. R-95-69. SWOV, Leidschendam.

Godart, B. (2002). *Wie opdrijft, overdrijft*. Via Secura, Nr. 58, pp. 18-20. BIVV, Brussels, Belgium.

Vlakveld, W.P. (2002). *Effecten van "Plan 17"*. Ministerie van Verkeer en Waterstaat, Adviesdienst Verkeer en Vervoer, Den Haag, The Netherlands.

Wesemann, P. (2002). *Kosten-baten analyse van 'Plan 17'*. SWOV, Leidschendam.

Young Works (2002). *Van 16 naar 18. Kwalitatief onderzoek naar het draagvlak onder jongeren voor het verhogen van de minimumleeftijd voor scooters, brommers en snorfietsen van 16 naar 18 jaar. Met een aanvullende kwantitatieve meting onder 13–16-jarigen*. Young Works, Amsterdam.

Appendix 1 Questionnaire

Questionnaire mopeds and 125 cc motorcycles

17 February 2003

info: chris.schoon@swov.nl

The Institute for Road Safety Research SWOV is involved in a project to decrease the number of casualties with light motorized two-wheelers (mopeds and 125 cc motorcycles).

We are gathering details on measures from European countries.

From your country we would like to ask you for information concerning the following subjects. If you do not know the answers, please give me the e-mail address of one of your colleagues, or of a specialist from another institute in your country.

A. Legislation for mopeds with a division in light mopeds (≤ 25 km/h) and mopeds (≤ 45 km/h)

- * minimum age for riding a bike
- * compulsory theoretical test
- * compulsory practical test
- * speed limit (built-up areas)
- * speed limit (outside built-up areas)
- * compulsory helmet use
- * are mopeds equipped with registration number plates

Are there intentions to change one or more rules?

B. Legislation for A1-category motorcycles (125 cc)

- * minimum age of driving
- * practical test for transforming from A1 to A-normal (if so, after how many years?)
- * does a car driving license also include riding a 125 cc (if so, after how many years ?)

Are there intentions to change one or more rules?

C. Have you carried out (accident) studies concerning light motorized two-wheelers in your country. If so, please give the title of the report and the summary, and/or the name of the web site.

D. Do you have problems in your country with tuned-up (tampered) mopeds? If so, have you taken action against it?

E. Have you taken measures to separate mopeds from other traffic?

Appendix 2 Risk values for different transport modes and for different age groups in the Netherlands

Risk per transport modes	Age class										Total
	0-11	12-14	15-17	18-19	20-29	30-39	40-49	50-64	65+	onb.	
Bicycle											
Death + hospital casualties	709	834	685	292	881	690	894	1297	1906	50	8238
Travelled km's (mln)	5009	4039	4096	2094	7068	8032	7234	7152	3925		48649
Risk values	0.14	0.21	0.17	0.14	0.12	0.09	0.12	0.18	0.49		0.17
Light moped											
Death + hospital casualties	8	35	378	146	129	62	89	132	221	9	1209
Travelled km's (mln)		2	129	69	111	68	93	114	124		710
Risk values		17.50	2.93	2.12	1.16	0.91	0.96	1.16	1.78		1.70
Moped											
Death + hospital casualties	24	107	2434	907	952	340	291	274	210	29	5568
Travelled km's (mln)		10	1027	574	535	269	253	154	54		2876
Risk values		10.70	2.37	1.58	1.78	1.26	1.15	1.78	3.89		1.94
Brom-/snorfiets											
Death + hospital casualties	32	142	2812	1053	1081	402	380	406	431	38	6777
Travelled km's (mln)		12	1156	643	646	337	346	268	178		3586
Risk values		11.83	2.43	1.64	1.67	1.19	1.10	1.51	2.42		1.89
Motorcycle or motorscooter											
Death + hospital casualties	11	8	33	88	1201	966	462	185	22	12	2988
Travelled km's (mln)		17	185	76	1353	1272	798	333	31		4065
Risk values		0.47	0.18	1.16	0.89	0.76	0.58	0.56	0.71		0.74
Passenger car											
Death + hospital casualties	476	128	343	778	5185	3024	1961	2106	1969	167	16137
Travelled km's (mln)	33540	6038	5296	6632	76070	95466	86165	75852	30474		415533
Risk values	-	0.02	0.06	0.12	0.07	0.03	0.02	0.03	0.06		0.04

Table A1. The risk values (number of casualties per million travelled km's) based on the number of death and hospital casualties as average over the years 1995-1997 (Source: SWOV - BIS-V; AVV/BG; CBS – OVG).