REDUCING TRAFFIC INJURIES RESULTING FROM ALCOHOL IMPAIRMENT

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The European Transport Safety Council

The European Transport Safety Council (ETSC) is an international non-governmental organisation which was formed in 1993 in response to the persistent and unacceptably high European road casualty toll and public concern about individual transport tragedies. Cutting across national and sectoral interests, ETSC provides an impartial source of advice on transport safety matters to the European Commission, the European Parliament and, where appropriate, to national governments and organisations concerned with safety throughout Europe.

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Executive summary

Drink driving has been declining continuously in many countries over the last twenty years due to a greater awareness of health issues, the successful application of a range of traffic safety measures, and also as a result of economic recession.

However, research and experience internationally indicate that the combination of drinking and driving is still one of the most important factors that influence traffic safety. A small percentage of the EU driver population (5 per cent or less) under influence of alcohol at any time causes a significant proportion of serious and fatal injuries (around 20 per cent) in traffic accidents. A minor reduction of driving under the influence of alcohol would have a large effect on accident occurrence.

Effects of alcohol on driving performance*:* These range from anaesthesia after large amounts of alcohol to impairment of behavioural and cognitive capabilities after small doses. Alcohol may also decrease motivation to comply with safety standards, which may result in an active search for dangerous situations (such as competitive behaviour, or excessive speed). In general, all functions which are important in the safe operation of a motor vehicle can be affected by the levels of alcohol well below current legal limits operating in EU countries.

Alcohol use by drivers: Random breath testing at the roadside for scientific or enforcement purposes in several EU countries in the 'drink driving hours' indicates that typically around 5 per cent of drivers are over the legal limit, although one or two countries report a lower proportion of 1 per cent or less.

Alcohol as a contributory factor in accidents and injury: Alcohol plays an increasing role in accidents as accident severity increases. It is difficult from available data to get a precise indication of the role of alcohol in EU road accidents, but it has been estimated from in-depth studies that alcohol is generally a factor in around 19 per cent of injury accidents and 22 per cent of serious and fatal accidents. Data from accident studies indicate that the risk of accident relative to zero alcohol rises substantially for all drivers with a Blood Alcohol Concentration (BAC) of 0.70 promille and above. For young drivers, there is significant increased risk of accident relative to zero alcohol at a BAC of 0.20 promille and above.

Public attitudes to drinking and driving: There are many indications that attitudes towards driving above the legal limit have hardened over the last decade. In an attitude survey on traffic law violations amongst Dutch, Irish, Norwegian and Spanish drivers, participants rated driving with a BAC between 1.00 and 1.50 amongst the most serious traffic offences and crimes. Driving with a BAC slightly above the limit is rated at about the same level as exceeding the speed limit by more than 30 km/h. A Cross-European survey presented evidence of sympathetic attitudes towards the introduction of further countermeasures.

Characteristics of alcohol offenders and offences: The association between driving and drinking is typically a masculine phenomenon. Roughly two subpopulations of drivers are concerned: young male drivers (under 25 years), and more experienced male drivers (25-40 years). The second group appears to represent the main stake in terms of accident involvement.
A series of investigations has confirmed the contribution of the problem drinker. For example, a UK study of drinking-driving offenders found that two-thirds of the drink-driving offenders had BAC levels above 1.50, that 40 per cent of the offenders consumed 20 half liters of beer a week, and that driving after drinking was a regular habit for them.

Monitoring alcohol use by drivers: The availability of statistical information on levels of alcohol use in the driving population, the epidemiology of alcohol-related accidents and casualties, and on breath testing levels is essential for the identification of necessary countermeasures and the subsequent evaluation of them. The screening of random samples of drivers at the roadside to determine levels of alcohol in the breath is a well established method of determining alcohol levels. The research protocol established by the OECD (1978) is generally acknowledged to be state of the art in this field. Blood alcohol testing of hospital in-patients after road accidents provides further valuable information.

Countermeasures: It is widely acknowledged that a 'package' approach to countermeasures is necessary to secure reductions in drinking and driving. The main elements are:

A maximum legal limit: Despite advice from governments and safety organisations that the safest option is not to drink and drive, many drivers still look to the legal limit for guidance about safe drinking and driving levels. Currently, there are five different limits operating in EU countries: 0.20 0.40, 0.50, 0.70 and 0.80 promille. In setting a maximum legal limit the accident data and experimental study data should be explicitly taken into account. Accident data show that the risk of accident involvement for drivers increases substantially at a BAC of 0.70 relative to zero alcohol. Behavioural studies show that impairment of essential perceptual and motor functions can occur at levels below this.

Many countries have reduced limits to 0.50 promille or even lower and have found that, if introduced as part of a package of measures which include publicity and improved enforcement procedures, a reduction in the limit is likely to contribute to accident reduction. For example, results from random breath tests after lowering of the legal limit from 0.80 to 0.50 in the Australian Capital Territory showed a 90 per cent reduction in driving with BAC between 0.50 and 0.80, but also a 41 per cent reduction in the incidence of driving with BAC greater than 1.50. Opinion surveys of the EU population indicate support for a low limit (78 per cent).

A legal limit for young drivers: For young drivers, there is an increased risk of accident relative to zero alcohol at a BAC of 0.20 promille and above. Some

countries have indeed introduced a lower legal limit, usually 0.20 promille, for this group of drivers, e.g. Austria and several US States. Available evaluation studies show a substantial reduction in alcohol related fatalities in those age groups where such a limit has been introduced.

Publicity campaigns: As a prerequisite for all countermeasure activity, there is a need to encourage a climate of opinion that drinking and driving is a socially unacceptable activity. There is empirical evidence that publicity campaigns contribute to the required attitude change. For example, a Dutch study found that self-reported drinking-driving and attitudes towards driving above the legal limit became more negative over a period of five years of extensive anti drink-driving campaigns. These results are in line with the reduction in observed drinking-driving instances in the Netherlands and reflect experience elsewhere, such as in the UK.

Enforcement procedures: Evidentiary methods and enforcement procedures differ throughout the Union. In many EU countries, blood tests are still the only form of legal evidence for drink driving offences (ECMT, 1993). Results of breath tests are not yet accepted for evidentiary purposes in the majority of EU Member States. The chance of being breathalysed also differs widely across the EU countries. In general, however, the actual chance of detection for excess alcohol on one particular trip is low internationally.

Increasing the drivers' perception of risk of detection: There is wide agreement in the international scientific literature that increasing drivers' perception of the risk of being detected for excess alcohol is a very important element in any package of measures to reduce alcohol related crashes. There is strong evidence that high levels of breath testing reinforced by publicity is the key to achieving the goal of deterrence. Police powers, procedures, and the type of evidentiary equipment used all play a large part in determining the extent to which this objective can be reached.

Police powers and procedures: Detecting offenders and deterring potential offenders are the two main objectives of police action in relation to excess alcohol. Research and experience suggest that these objectives are most effectively met by a combination of highly visible systematic or random breath testing (to deter) and targeted testing elsewhere on the road network (to detect). Opinion surveys showed wide public support for intensified breath tests by the police.

Evidentiary aids and procedures:

- Evidential breath testing devices: while all Member States provide for the carrying out of tests for blood alcohol, the use of evidential breath testing devices has still to be introduced in many Member States. Experience with such devices in several Member States has shown a substantial increase in the number of breath tests.

- Passive alcohol sensors, a portable hand held flash mounted sensor which a police officer holds near the driver's face to take a sample of exhaled air while the driver responds to routine questions, offer good potential in mass testing procedures in those countries that cannot yet apply random breath tests.

Penalties: Penalties for excess alcohol differ across Member States, but generally range from heavy fines to prison sentences and are often combined with periods of disqualification.

Prison sentences: Experience with severe penalties such as prison sentences in Scandinavian countries, the USA, Canada and Australia indicates generally their lack of success in deterring drinking drivers or reducing recidivism.

Disqualification from driving: Research indicates that disqualification from driving after failing an evidentiary breath test or failure to take a breath test may deter drinking drivers, probably for reasons of the swiftness and certainty of the punishment.

Drivers improvement/rehabilitation courses: In many countries driver improvement courses have been available to offenders for a number of years, those relating to drink driving being most common. The actual assignment of offenders, the approach, content, instructor, price and length of the courses differ widely. The limited number of studies evaluating the incidence of reoffending after participation in a drink-driving rehabilitation course generally show a positive influence on the amount of recidivism.

Education in schools and driver training: Transfer of knowledge of the effects of alcohol on performance, the consequences for participating in traffic in general, and driving a motor vehicle in particular should have an important place in the curriculum. For school-aged children the topic could be easily set and is often set in existing health education or traffic safety programmes. In driver training more attention could be paid to alcohol and traffic, focusing on the relationship between drink driving and both performance and accidents. Emphasis should be put on the consequences for passengers and other road users, since people are inclined to underestimate the risk for themselves as a consequence of their own actions.

Engineering: Engineering measures specifically aimed at preventing drink-driving accidents are limited to in-vehicle devices monitoring the amount of alcohol consumption. One option is a BAC monitor, that registers the actual amount of alcohol in the blood and prevents the car from being started if a certain BAC level is reached. There have been favourable reports of reductions in recidivism, if introduced as a condition of the restoration of a suspended driving licence or allowing the driver to keep the licence. A reduction of 7 per cent injury accidents (including 16 per cent of deaths) might be expected from the general introduction of such monitors. Another option is to monitor driver impairment while driving, which has been studied in the DRIVE programme. A survey amongst drivers

revealed that in-vehicle devices to enforce drink driving offences are acceptable to 65 per cent of the drivers, whereas only 20 per cent of these drivers would accept in-vehicle devices in general.

Alternative land use and transport modes: Many drink-driving offences occur after visits to the pub or restaurant. These social events often take place far from residential areas in places difficult or impossible to reach by means other than a private car. Extra public transport and changes in the location of discos and other social establishments closer to where people live might help to decrease drink-driving.

Low-alcohol and alcohol free drinks: In recent years a variety of low-alcohol and alcohol free drinks has been brought on to the market. In some countries these drinks are popular alternatives when combining social activities with car driving. A more enthusiastic marketing approach aiming at a positive image of low and alcohol free drinkers and drinks as well as introducing a price advantage compared to the alcohol equivalents, for example by lower taxation levels, could further increase the market share.

Recommendations: In order to continue and even speed up the trend of a decline in drink-driving, a range of recommendations are made for action by the Commission, the European Parliament, and Member States:

Assessing the drink driving problem

- Encourage Member States to regularly apply random breath testing surveys to determine levels of 'over the limit' drinking and to analyse and publicise the results;

- Encourage Member States to analyse and publicise results of blood tests of fatal and hospitalised victims;

- Include BAC levels amongst fatalities as one of the variables in the CARE road accident database.

European legislation on legal limits and evidentiary proof

- Harmonise the maximum BAC level throughout the EU by requiring Member States to set their own legal limit of 0.50 promille or lower;

- Introduce a legal framework for the use throughout the EU of evidentiary breath testing equipment, manufactured to a recognised standard.

A package approach to countermeasures

- Develop EU guidelines on best practice in increasing the deterrent effect of police action, e.g. highly visible random breath testing checkpoints;

- Encourage long term, intensive anti drink-driving publicity campaigns backed-up by educational programmes for school-children and drivers trainees;

- Encourage a more enthusiastic marketing approach to low alcohol drinks, as well as the introduction of a price advantage compared to the alcohol equivalents;

- Encourage the provision of additional public transport in the 'drink drive hours' and changing the location of discos and other social establishments closer to residential areas.

Further research

- Determine the cut-off points as regards age and experience for a lower legal limit for young / inexperienced drivers;

- Study and further detailed knowledge for optimum levels of enforcement;

- Study and develop guidelines for best practice of alcohol rehabilitation courses;

- Study the format and feasibility of EU-wide introduction of in-vehicle devices to prevent drink-driving.

1. Aim and Scope

The aim of this review is to formulate from international research findings a set of recommendations and best practice to European and national policy makers on actions that could be taken to reduce the number of casualties in alcohol-related motor vehicle accidents.

Current knowledge is presented on the problem of alcohol impairment as a factor in accidents and the probability of accident involvement resulting from increased Blood Alcohol Concentration (BAC) levels, the effects of alcohol on driving performance and current practice in EU Member States in the management of countermeasures.

State of the art measures to reduce the number of casualties resulting from alcohol impairment are reviewed leading to recommendations for action at European and national levels.

BAC is expressed as 'pro-mille' (per thousand) throughout the report. No distinction is made between the Nordic 'Widmark' definition, which means one milligram ethanol per gram blood (weight by weight) and the definition in other European countries, namely milligrams per millilitre (weight by volume).

2. Alcohol consumption and mobility patterns in Europe

2.1. Alcohol and mobility

Research and experience internationally indicate that the combination of drinking and driving is one of the most important factors that influence traffic safety. As will be clear from this review, a very small percentage of the driver population (5 per cent or less) under the influence of alcohol at any time can cause a significant proportion of fatal and severe injuries in traffic accidents (around 20 per cent). A minor reduction of driving under the influence of alcohol would have a large effect on accident occurrence.

The dangers of drinking and driving have been recognised, particularly in public transport operated by professional drivers, where alcohol use is often prohibited and generally more restricted than in private transport. In private road transport, where there is the highest accident risk and where it is more difficult to control driver condition, regulators have generally been more cautious about the restriction of alcohol use when driving for reasons of public acceptability. However, a growing awareness that driving is more a matter of licence rather than a fundamental liberty as well as the gradual hardening of public attitudes towards drinking and driving both present new opportunities for reducing alcohol-related road casualties.

The modal split in mobility varies between European countries and is dependent on time of day and day of week as well as on trip purpose. The definition of mobility patterns is an important consideration in the identification of countermeasures.

Car driving is an important transport mode, but for short and urban trips, public transport, the bicycle and trips by foot can be more prominent. The car mode gains in percentage in the late hours, when available public transport decreases. For medium distance and longer trips the car mode increases, rising to the most important mode in low density areas with little public transport. Many restaurants, pubs and discos are located outside urban areas and are accessible by car only. Much activity in such places is somehow related to consumption of alcohol.

2.2. Alcohol consumption

Patterns of alcohol consumption differ widely in Europe. The cross-European SARTRE survey (1993) in 16 countries, including some Eastern European countries, found an average of 13 per cent of the respondents who reported drinking alcohol almost every day. This ranged from 1 per cent for the Swedish population to 40 per cent for Portuguese respondents. In general, Southern Europeans seem to drink more often than Northern Europeans. However, when people in Northern countries drink, they drink more. The average number of units (i.e. one glass beer (0,25 l), one glass of wine, one single spirit) consumed at any one occasion is highest in Ireland (4.52), followed by the United Kingdom (3.87), Belgium (3.36) and Sweden (3.16). In Italy (1.60), Austria (2.00) and Portugal (2.16) the average number of alcohol units per drinking occasion is lowest.

3. Blood alcohol limits in EU countries

Many countries have reduced the legal limit in the last decade and others are currently considering doing so. A Commission proposal for harmonisation of blood alcohol limits in EU countries to 0.50 is in existence. Current legal limits in EU countries range from 0.20 and 0.80 (see Table 1).

Table 1: Blood alcohol limits in the European Union (December 1994)

Country	Blood alcohol content in mg/ml	Country	Blood alcohol content mg/ml
Austria	0.80	Ireland	0.80
Belgium	0.50	Italy	0.80
Denmark	0.80	Luxembourg	0.80
Finland	0.50	Netherlands	0.50

France	0.70	Portugal	0.40
Germany	0.80	Spain	0.80
Great Britain	0.80	Sweden	0.20
Greece	0.50		

4. Alcohol use by drivers

The availability of statistical information on levels of alcohol use in the driving population, the epidemiology of alcohol-related accidents and casualties, and breath testing levels is essential for the assessment of the problem, the identification of countermeasure target groups and for the evaluation of countermeasures. In general two major methods for collecting this type of information are available: the screening of random samples of drivers at the roadside to determine levels of alcohol in the breath (see OECD, 1978, for a generally accepted research protocol) and blood alcohol tests following admission to hospital after a road accident.

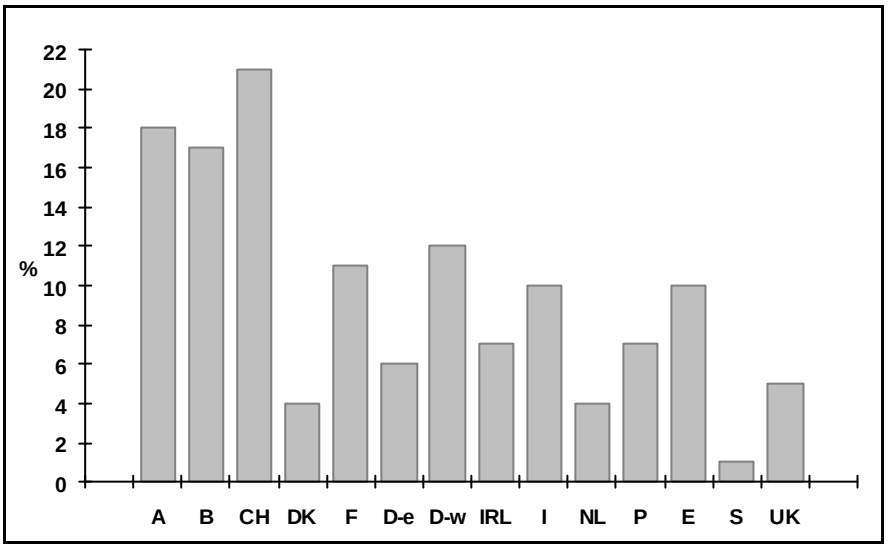
Unfortunately, neither of these methods are common throughout the EU Member States. Only some countries carry out regular surveys either for scientific purposes or for enforcement purposes, which provide a reliable picture of the drink-driving problem. In most countries, however, people are only tested if they have been involved in an accident or otherwise show typical behaviour. In order to promote greater understanding of the problem of alcohol-related accidents in the EU and the possibilities for effective action, such surveys should be carried out and the results publicised in a commonly agreed format.

Table 2 presents the results of random breath tests in a limited number of EU countries (and Australia for comparison), normally carried out in weekends during the evening and night hours, either for scientific surveys or as part of police enforcement. Figure 1 shows the self reported drinking/driving behaviour in all EU countries, which provides a further indication of the magnitude of the problem.

Table 2: Observed drinking driving patterns from random breath tests (over legal limit is underlined)

Country	**Year**	**% > 0.2 g/l**	**% > 0.5 g/l**	**% > 0.8 g/l**
Australia (McLean, 1994)	1993	19 (> 0.0 g/l)	<u>4.5</u>	1.5
France (Biecheler et al., 1993/1994)	1990s	18 (> 0.0 g/l)	4.5 (approx.)	<u>2.5</u> (approx.)
Germany (Friedel and Kroj, 1994)	1990s			<u>5.0</u> (approx.)

Great Britain (Everest et al., 1991)	1990			1.0
Netherlands (Mathijsen, 1994)	1992	9.7	4.3	2.1
Spain (DGT/ICSV, 1993)	1990s			2.0
Sweden (Laurell, 1994)	1990s	0.3 (approx.)	--	--



Source: Sartre, 1993

Figure 1: Percentage of respondents reporting to have driven when they might have been over the limit during the last month

Information on trends compiled from countries where random breath tests have been carried out on a regular basis, indicates that there has been a general decline in the number of people driving with a BAC above the legal limit. Whereas in the late seventies during weekend nights typically around 15 per cent of the drivers were observed to be above the limit, in the nineties this percentage is typically under 5 per cent, with some countries at one per cent or less (TRB, 1994).

5. The effects of alcohol on driving performance

Alcohol is a sedative drug which affects the central nervous system in a similar way to other anaesthetic drugs. The apparent stimulation that commonly results from alcohol usage is actually the result of a depression of brain mechanisms which normally moderate behaviour.

The consumption of large amounts of alcohol can result in anaesthesia. At the other extreme, very small, 'socially acceptable' doses of alcohol can affect various behavioural and cognitive capabilities, such as those related to driving perfor-

mance. All functions which are important in the safe operation of a motor vehicle can be affected by the consumption of alcohol. Significant decreases in performance have been observed in both laboratory tests and on-the-road tests with BAC levels well below 0.50 (e.g. Brookhuis et al., 1994; Moskowitz and Robinson, 1986; Smiley and Brookhuis, 1987). The specific effects of alcohol vary to a great extent according to the level of intoxication. In addition, it takes some time for alcohol to be cleared from the bloodstream. For example, at a BAC of 1.00 it takes more than three hours to reach a BAC of less than 0.50.

It is also very important to note that alcohol reduces the influence of 'inhibition' mechanisms which normally moderate behaviour. This might result in decreased motivation to comply with safety standards as well as a different interpretation of these safety standards. For example, very low doses of alcohol may lead to decreased motivation to stop drinking. Somewhat higher doses may lead to aggressiveness and/or loss of social responsibility, resulting, for example, in an active search for dangerous situations, such as competitive behaviour, or excessive speed. At the same time, the ability to cope with such situations is also affected. With respect to safety, BACs at which drivers' motivations are affected but where drivers are not yet aware of their decreased driving skills are particularly dangerous. In many cases these BACs may well be under present legal limits.

6. Alcohol impairment as a contributory factor in accidents and injury

Unfortunately, the data on alcohol-related accidents or casualties are incomplete, largely because in the majority of countries the police do not routinely test BAC levels of accident involved drivers. In addition, those countries that generally test for alcohol after an accident use different methods, analyses and ways of publishing the data. Direct international comparisons are therefore not possible at the present time. However, a general picture emerges of the important role played by alcohol in road accidents, particularly in severe accidents.

The famous Grand Rapids study carried out in 1962-63 (Borkenstein et al., 1964) is still used as the main source of reliable information on alcohol, accidents and accident risk. The study looked at drivers who were to blame for their accidents, compared to a control group of randomly selected drivers. Based on this, Evans (1991) calculated that 11.5 per cent of the accidents (including property damage only accidents) were alcohol related. From the same data, he calculated that 19 per cent of the injury accidents and 22 per cent of the fatal or serious injury accidents were alcohol related. This clearly shows that alcohol plays an increasing role as accident severity increases.

The greater role of alcohol in serious accidents is re-inforced by experience in Great Britain, where estimates from the Department of Transport indicate that in 1992 illegal (over 0.80) levels of BAC were present in 5 per cent of all injury accidents

and in 10 per cent of fatal accidents (Department of Transport, 1993). In the Spanish province of Catalonia a post-mortem blood analysis of 125 fatally injured road users showed that 57 per cent had alcohol in the blood, 36 per cent of them with a BAC of over 0.80 (Generalitat de Catalunya, 1993). French accident data of 1992 show that 8 per cent of drivers involved in an injury accident and 22 per cent of drivers involved in a fatal accident had a BAC level over the legal limit of, at that time, 0.80 (Fontaine and Gourlet, 1994).

The Grand Rapids study indicated that the relative risk of involvement in a traffic accident is 1.5 times higher with a BAC between 0.50 and 0.90 and rapidly increases with higher BACs (Table 3). The finding of relative risk of less than one for BAC levels between 0.01 and 0.49 is probably the result of the disproportionate representation of some subgroups of drivers in particular BAC intervals. Subsequent reanalyses of the Grand Rapids data showed a steady increase in risk with increasing BAC levels for all subgroups (Allsop, 1966; Hurst, Harte and Frith, 1994). The relative risks are substantially higher for young drivers and inexperienced drinkers, who have sharp increases above the 0.20 level (Allsop, 1966).

Table 3: Relative risk of driver involvement in police-reported accidents

BAC	Relative Risk
0	1
0.01-0.49	0.93
0.50-0.90	1.52
1.00-1.49	5.7
1.50-1.99	17
$\geq$ 2.00	22

Source: Borkenstein et al., 1964

At that time, on the basis of the Borkenstein data it was concluded that although the risk increased from a BAC level of 0.50 onwards, the difference with a zero BAC level was statistically not significant. However, more recently the data of the Grand Rapids study have been examined again, using a more appropriate statistical procedure that asked whether crash risk *increased* with alcohol consumption rather than *differed* (i.e. an applied one-tailed statistical test as opposed to a two-tailed test). The conclusion of this analysis, supported by analysis of an Australian data set, was that BACs above 0.50 but below 0.80 significantly increase relative crash risk. (Traffic Authority of New South Wales, 1985).

It is important to note that these accidents include property damage only crashes, and that the relative risks for injury and fatal accidents are substantially higher, in

particular for young drivers. A Canadian study (Warren, 1976) found that the risk of involvement in a fatal accident with a BAC over 0.80 compared to a zero BAC level was 165 times higher for 16-17 year old drivers and 70 times higher for 18-19 year old compared to, for example, 17 times higher for 30-34 year olds.

As was mentioned in the beginning, the available data are limited. Compulsory blood alcohol tests following admission to hospital would allow for a more complete, reliable and up-to-date picture of the role of alcohol in injury accidents in European countries. It would form a much better and wider basis for identification and evaluation of countermeasures than just the BAC levels of fatally injured drivers, which in theory, though not always in practice, are assessed in most countries.

7. Public attitudes towards drink driving

There are many indications that attitudes towards driving above the legal limit amongst the driver population have, in general, hardened. In an attitude survey on traffic law violations amongst Dutch, Irish, Norwegian and Spanish drivers (Rothengatter, 1993) drivers rated driving with a BAC between 1.00 and 1.50 amongst the most serious traffic offences and crimes. Driving with a BAC slightly above the limit was rated at about the same level as exceeding the speed limit by more than 30 km/h. There were substantial differences between countries, with Dutch and Norwegian drivers rating alcohol-related offences significantly more serious than Spanish and Irish drivers.

Similar findings were obtained in a study of the social acceptance of enforcement (Rothengatter et al., 1991), in which the driver's attitude towards driving after four glasses of alcohol appeared to be more negative than towards any other violation. Alcohol offences are rated highest in requiring immediate sanctions without discretionary police powers. The current system of breathalyser testing is acceptable to 98 per cent of drivers and over 60 per cent of drivers would find an electronic in-vehicle system monitoring alcohol-induced impairment acceptable. These figures are considerably lower for all other offences (e.g. 64 per cent and 45 per cent respectively for fatigue monitoring).

8. Characteristics of alcohol offenders and offences

The description of the characteristics of alcohol impaired drivers comes from three types of studies: roadside surveys, studies of offenders and home interviews. The results, which are very similar across EU countries, show that drinking and driving is a social phenomenon with the following main features:

- The association between driving and drinking is typically a masculine phenomenon.

- Roughly two subpopulations of drivers are concerned: young drivers (under 25 years), and more experienced male drivers (25-40 years). The second group appears to represent the main stake in terms of accident involvement.

- Whatever the age and the social background they have characteristics in common:

  the driving activity is clearly part of a way of life that includes a daily consumption of wine, beer and even spirits and a high daily mobility for a variety of reasons (work and leisure); they often drive at night, especially during the weekend;

  the habitual driving behaviour is marked by a tendency to commit other road violations (especially linked to speeding) and by intolerance towards other drivers when their speed or their driving space is affected.

- These drivers are often involved in alcohol-related accidents because of an interaction between different risk variables (annual mileage and percentage of weekend and night-time driving; drinking habits; speeding).

- Accident data and analyses show that drinking drivers are overrepresented in two types of accidents:

  single vehicle accidents, in rural areas, at bends; at night, during weekends, during leisure trips, with several passengers on board; in poor weather conditions; this type of accidents is especially linked with the group of young drivers;

  accidents occurring at night, on weekends, in built-up areas, at intersections, between several vehicles, during leisure trips; in normal weather conditions; this type of accidents is more linked with the group of young or experienced drivers, whose driving behaviour implies conflicts in urban areas.

Whatever the quantities of alcohol consumed and whatever the circumstances, the underlying motivation is the same. Drivers think they can drive normally after having consumed alcohol and they do not acknowledge the increased threat to their own and others' safety. They refuse, consciously or subconsciously, to conform to safety regulations that represent an infringement on their habitual lifestyle. Because there is an overlap with other fields of action and other forms of social life, the driving task seems to be divested of its safety requirements.

There is considerable evidence that 'problem drinkers', that is people who habitually drink heavily and drive, form an important subgroup of drink-driving offenders. Since the Grand Rapids study (Borkenstein et al., 1964), a series of investigations has confirmed the contribution of the problem drinker. Thus in Birmingham, Clayton et al. (1980) conducted interviews with a group of drink-driving offenders, 44 per cent of whom had been apprehended as a result of an accident. They found that two-thirds of the drink-driving offenders had BAC levels above 1.50, that 40 per cent of the offenders consumed more than 10 liters of

beer a week, and that driving after drinking was a regular habit for them. Data for all of England and Wales in 1984 show that 25 per cent of motorists who were found to be positive on the evidential test had BAC levels of 2.00 or above (Jones and Everest, 1987). A study in Nottinghamshire surveyed accident involved drivers and drinkers. Three-quarters of the drivers and riders who were over the legal limit admitted to drinking five or more units of alcohol on each drinking occasion, while 13 per cent claimed a consumption of over 13 units on each occasion.

The experiences in other countries have been similar. An Australian study of hospitalised road accident casualties found that '.... persons with BAC above the legal level had a pattern of frequent, heavy drinking, combined with frequent driving after drinking' (Ryan and Salter, 1979). In Canada (Donelson, 1985), 38 per cent of fatally injured male drivers who were tested for alcohol in 1982 had BACs above 1.50. Fifty per cent of the fatally injured drivers of either sex were tested after single-vehicle accidents and had BACs exceeding 1.50.

9. Drinking/driving countermeasures

9.1. Introduction

As noted in Section 4, drink-driving has been declining continuously in many countries during the last twenty years. It is generally acknowledged that the reduction in alcohol-related accidents can at least be partly explained by increasing awareness of general physical health issues and related decreases in alcohol consumption as well as by the economic recession, potentially affecting both alcohol consumption and mobility. In addition, the decline in drink-driving can be ascribed to the successful application of a range of traffic safety measures.

Several important reviews have been conducted highlighting the need for further action and giving an overview of effective measures that could be taken. There is international agreement that a 'package' approach produces the maximum benefit (e.g. OECD, 1978; Council of Europe /Benjamin, 1990; ECMT, 1993).

In this Section countermeasures are treated individually. It should be noted, however, that the growing use of the 'package' approach in many Member States and elsewhere, often makes it difficult to assess reliably the effectiveness of a single measure.

9.2. Blood alcohol limits

A maximum legal limit

Despite advice from governments and safety organisations that the safest option is not to drink and drive, many drivers still look to the legal limit for guidance about

safe drinking and driving levels. Currently, there are five different limits operating in EU countries: 0.20, 0.40, 0.50, 0.70 and 0.80.

The available accident data show that the risk of accident involvement is substantially higher at a BAC level of 0.70 or higher. Experimental studies show that amounts of alcohol below this level can lead to impairment of essential perceptual and motor functions. In addition it may result in decreased motivation to comply with safety standards of driving. Therefore it must be concluded that a legal limit of 0.70 or higher does not reflect available accident and behavioural data. Taking into account the legal limits currently in existence in the EU, it is suggested that a limit of 0.50 is the maximum that should be supported.

Many countries have acknowledged the findings of accident and behavioural studies in their legislation and have indeed set limits at 0.50 or less. These include: Australia, Belgium, Finland, Greece, the Netherlands, Norway, Japan, Portugal, Sweden and some US States. Many have found that, if introduced as part of a package of measures including publicity campaigns and improvements in enforcement, then a reduction in the limit is likely to contribute to accident reduction. For example, results from random breath tests after lowering of the legal limit from 0.80 to 0.50 in the Australian Capital Territory showed a 90 per cent reduction in driving with BAC between 0.50 and 0.80, but also a 41 per cent reduction in the incidence of driving with BAC greater than 1.50 (Brooks and Zaal, 1992). If introduced in isolation, then its influence is likely to be small.

Opinion surveys of the EU population indicate support for a low limit (78 per cent), whereas a zero limit is supported by an average of 38 per cent (SARTRE, 1993). The wide public support for lower limits might reflect the increased general concern regarding drink driving accidents, and as such be another reason for Member States to reduce the maximum legal limit to values that better mirror the data on the role of alcohol in road accidents.

A legal limit for young drivers

Young, inexperienced drivers have a markedly higher risk of involvement in an alcohol related accident providing justification for a lower limit for this group. Some countries have introduced a lower legal limit, usually 0.20, for young and inexperienced drivers, e.g. Austria and several US States. Almost half of European drivers are in favour of such a measure (SARTRE, 1993). Available evaluation studies show a substantial reduction in alcohol related fatalities in those age groups where such a limit has been introduced. Stewart and Voas (1994) cite data from Hingson (1992) who found a 42 per cent decrease in fatalities for young drivers in low BAC US States compared to a 29 per cent in US States that did not introduce a lower BAC limit. In one State, where the introduction of a lower BAC for young drivers was accompanied by intensive publicity campaigns a reduction of alcohol-related fatalities for the affected age groups of 50 per cent was found (Blomberg, 1992, cited by Stewart and Voas, 1994).

9.3. Publicity campaigns

As a prerequisite for all countermeasure activity, there is a need to encourage a climate of opinion that drinking and driving is a socially unacceptable activity. There is empirical evidence that publicity campaigns contribute to the required attitude change. For example, a Dutch study found that self-reported drinking-driving and attitudes towards driving above the legal limit became more negative over a period of five years of extensive anti drink-driving campaigns (Söder, 1991). These results are much in line with the reduction in observed drinking-driving instances in the Netherlands and reflect experience elsewhere, such as in the UK.

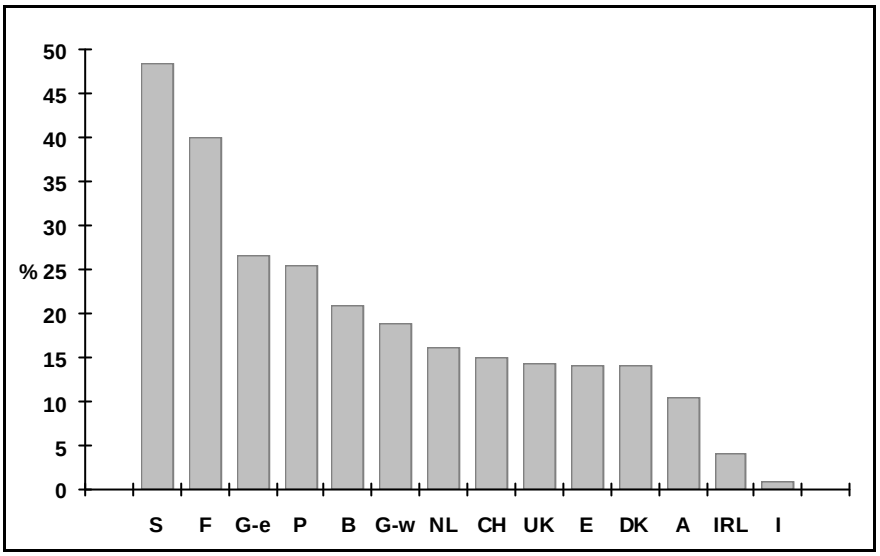
9.4. Enforcement procedures and evidentiary methods

Currently, evidentiary methods and enforcement activities differ throughout the Union. In many EU countries, blood tests are still the only form of legal evidence for drink driving offences (ECMT, 1993). Results of breath tests are not yet accepted for evidentiary purposes in the majority of EU Member States.

The chance of being breathalysed also differs widely across the EU countries (SARTRE, 1993): on average, 19.6 per cent of drivers have been tested at some time, ranging from 48.4 per cent in Sweden to 0.9 per cent in Italy (See Figure 2). However, in general, the actual chance of detection for excess alcohol on one particular trip is low internationally.

Another difference between countries is found in the strategy of testing. Whereas in Austria over half of the tests carried out appeared to be over the limit, in Sweden this was the case in just over 2 per cent of the tests (SARTRE, 1993). This would mean that in Sweden alcohol tests are used to deter people, whereas in Austria tests are merely applied if there is a suspicion of excess alcohol. In some countries it is not allowed to breathalise people unless there is 'a reasonable cause for suspicion' by law.

There is wide agreement in the international scientific literature that increasing drivers' perception of the risk of being detected for excess alcohol is a very important element in any package of measures to reduce alcohol related crashes. Police powers, procedures and the type of evidentiary equipment used all play a large part in determining the extent to which this objective can be reached. The lack of statutory powers, needlessly complicated and time-consuming evidentiary procedures strongly reduce the effectiveness of enforcement.



Source: Sartre, 1993

Figure 2: Percentage respondents reporting to have been breathalysed

Police powers and procedures

Detecting offenders and deterring potential offenders are the two main objectives of police action in relation to excess alcohol. Research and experience suggest that these objectives are most effectively met by a combination of highly visible systematic or random breath testing at roadside checkpoints (to deter) and targeted testing elsewhere on the road network (to detect).

While there is no clear evidence that the operation of a detection policy alone has a significant impact on accidents, there is evidence that a deterrence policy is associated with large reductions in alcohol-related accidents. Broughton (1993), for example, reported that Police Forces with high breath-test rates tend to have a falling trend for drink driving accidents, compared with forces with low test rates. The immediate criterion for the success of a deterrent policy is a high proportion of negative breath testing, indicating that most drivers are staying below the limit.

The principal types of breath testing powers used are as follows:

a) Breath testing after reasonable cause for suspicion

This includes both power to stop and breath test if there is reasonable cause for suspicion that alcohol has been consumed, and power to stop drivers at random followed by breath testing if there is reasonable cause for suspicion that alcohol has been consumed. This method is mainly focused on detection with little potential for deterrence, since it is difficult to publicise the reason for the stop in advance.

b) Random breath testing

This means power to stop and breath test randomly at highly visible roadside checkpoints sometimes accompanied by publicity. Random breath testing can

also mean the power to stop and breath test drivers at random on the road network with little use of highly visible roadside checkpoints. The empirical data available show clearly the highest efficiency of the former type of random breath testing (Kearns et al., 1987; Cavallo and Cameron, 1992; Verschuur and Noordzij, 1988).

There is wide public support for intensified breath testing by the police (SARTRE, 1993).

Evidentiary aids and procedures

a) Evidential breath testing devices

While all Member States provide for the carrying out of tests for blood alcohol, the use of evidential breath testing devices has still to be introduced in many Member States. Evidentiary breath tests have the advantage of reducing the amount of time police officers have to spend in the police station, allowing more time for more breath tests to be conducted. Introduced into the UK in 1983, evidential breath testing devices more than doubled the number of breath tests over a period of 10 years to 530,000 tests in 1992. In France the number of tests have been increasing by nearly a factor 6 from the introduction in 1983 until 1991. There is an international standard for breath testing equipment (OIML).

b) Passive alcohol sensors

The passive alcohol sensor is a portable hand-held flash mounted sensor which a police officer holds near the driver's face to take a sample of exhaled air while the driver responds to routine questions. It indicates whether a driver has been drinking and as such provides a cheap and quick screening method. Results of the first major field test in Charlottesville (USA), indicated a doubling of the detection rate for drivers with BACs above 0.5 and substantially reduced the unnecessary detention of drivers who did not drink (Jones and Lund, 1986). Careful application is necessary, since in extreme weather circumstances the sensors may be less reliable. Nevertheless, such devices offer good potential to increase enforcement rates in those countries where random breath testing is legally not (yet) allowed.

c) Self-testing

Bars and catering establishments in New South Wales, Australia have provided self testing coin-operated breath machines for drivers since 1982. Over 8 million tests world-wide are now being taken. There is no evidence that self-testing on such machines leads to additional drinking up to the legal limit, rather that they discourage excess without curtailing drinking at lower levels (Breakspeare, 1990). Experiences in the Netherlands with these machines show that the accuracy is often limited due to improper use.

Compulsory blood alcohol tests

The usefulness of compulsory blood alcohol tests following admission to hospital has already been noted in Section 6 in relation to the problem of a lack of reliable

data on the role of alcohol in traffic accidents. In addition to this, experience in Victoria, Australia in the 1970s indicates that compulsory blood alcohol tests can add to the deterrent effect of a package of measures (Trinca, 1986).

9.5. Penalties

Penalties for driving with excess alcohol differ across Member States, but generally range from heavy fines to prison sentences and are often combined with periods of disqualification. While severe penalties tend to be a popular countermeasure for policy makers and public alike, evidence for the deterrent effect of penalties per se is virtually non-existent.

Prison sentences
Experience with severe penalties such as prison sentences in Scandinavian countries, the USA, Canada and Australia indicates generally their lack of success in deterring drinking drivers or reducing recidivism (Ross, undated).

Disqualification from driving
Research indicates that disqualification from driving after failing an evidentiary breath test or failure to take a breath test is most useful of all sanctions (Törnros, 1993). It may deter drinking drivers, probably for reasons of the swiftness and certainty of the punishment (Ross, undated). In principle, license withdrawal effectively removes offenders from the road, although driving whilst disqualified occurs frequently.

Drivers improvement/rehabilitation courses
In many countries driver improvement courses have been available to offenders for a number of years, those relating to drink-driving being most common. The actual assignment of offenders, the approach, content, instructor, price and length of the courses differ widely (Spoerer et al., 1987). So do the consequences of participating in a course for the level of 'normal' punishment (fine, license withdrawal). Driver improvement courses are by definition applied when an offence already has been committed.

The number of studies evaluating the incidence of reoffending after participation in a drink-driving rehabilitation course are limited. However, data that are available from, for example, Austria (Zuzan, 1988), Germany (Winkler et al., 1988), the Netherlands (Lambregts, 1988), Sweden (Törnros, 1994) and Switzerland (Huguenin, 1988) generally show a positive influence in the amount of recidivism. For those offenders who are alcohol dependent the effects of rehabilitation courses appear to be less positive (Törnros, 1993).

9.6. Education in schools and driver training

Transfer of knowledge of the effects of alcohol on performance, the consequences for participating in traffic in general, and driving a motor vehicle in particular should have an important place in the curriculum. For school-aged children the topic could be easily set and is often set in existing health education or traffic safety programmes. For driver training, theoretical lessons are normally limited to traffic rules and behavioural codes. More attention could be paid to alcohol and traffic, focusing on the relationship between drink-driving and both performance and accidents, especially for young and inexperienced drivers. It is advised that emphasis should be put on the consequences of drink-driving for others, i.e. car passengers and other road users, instead of personal consequences, since people are inclined to underestimate the risk for themselves as a consequence of their own actions (Benjamin, 1990).

9.7. Engineering

Engineering measures specifically aimed at preventing drink-driving accidents are limited to in-vehicle devices assessing the amount of alcohol consumption. One option is a BAC monitor that registers the actual amount of alcohol in the blood and prevents the car from being started if a certain BAC level is reached. Such devices have been introduced in Victoria, Australia and in sixteen US States by the courts as a condition of the restoration of a suspended driving licence or allowing the driver to keep the licence. There have been favourable reports of reductions in recidivism (Breakspeare, 1990). It has been estimated that the overall introduction of a BAC monitor could potentially lead to a reduction of 7 per cent injury accidents, including 16 per cent of deaths (Broughton, 1994).

Another option is a personal 'smart card' which compares the normal behaviour of a particular driver with actual behaviour and in case of major discrepancies, for example caused by alcohol consumption, the driver gets a few minutes to park his car before the motor is switched off. In a feasibility study in the DRIVE programme Brookhuis et al. (1991) found that relevant behavioural parameters could be defined and measured. Further research is being carried out in the DRIVE II programme (Brookhuis et al., in press).

A survey of Norwegian, Dutch and Spanish car drivers revealed that in-vehicle devices to enforce drink-driving offences are (very) acceptable to 65 per cent of the drivers, whereas only 20 per cent of the drivers thought that in-vehicle devices in general were (very) acceptable (Rothengatter et al., 1991).

9.8. Alternative land use and transport modes

Many drink-driving offences occur after visits to the pub, the restaurant or to other establishments for leisure activities. These social events often take place far from residential areas in places difficult or impossible to reach by means other than a private car. In order to decrease the number of occasions in which alcohol might become a problem extra public transport and changes in the location of discos and other social establishments closer to where people live might help to decrease the number of opportunities for drink-driving.

Experiments with night time public transport in urbanised parts of the Netherlands have been successfully completed and transformed into regular services. Experiments with special shuttle buses to and from discotheques in rural areas did not have the number of interested people necessary to continue those services. However, experiments in Catalonia with weekend night shuttle buses from the inland to the coast and vice versa during the summer months were very successful.

9.9. Low-alcohol and alcohol free drinks

In recent years a variety of low-alcohol and alcohol free drinks has been brought on to the market. Most well known at this stage are low and alcohol free beers, but low alcohol wines and aperitifs are available as well.

In some countries these drinks are popular alternatives when combining social activities with car driving. A more enthusiastic marketing approach, aiming at a positive image of low and alcohol free drinkers and drinks as well as introducing a price advantage compared to the alcohol equivalents, for example by lower taxation levels, could further increase the market share.

Australian experience indicates that the consumption of light alcohol products can be encouraged. As part of a Northern Territory programme to reduce the incidence of alcohol-related problems in general, a levy was imposed on liquor with an alcohol content greater than three percent. Following the introduction of the levy the consumption of light alcohol beers increased enormously. In the year before the introduction of the levy, light beers accounted for only 0.3 per cent of the total beer consumption. In the year after the levy, light beers made up almost one third of the total beer consumption. Although part of the increase must be attributed to changes in the definition and production of low alcohol beers, it is estimated that over two thirds of the increase reflect changes in consumption patterns (Crundall, 1994).

10. Conclusions and recommendations

Over the last thirty years, there has been a vast amount of literature indicating that alcohol is a major contributory factor in road accidents. Alcohol not only directly influences driving skills, such as reaction times and perception, but also affects attitudes and motivation regarding risk taking which affect, for example, speeding. Since many Member States do not yet apply a standard procedure to assess the BAC levels of accident-involved road users, it is difficult to give a reliable indication of the magnitude of the overall problem and the exact benefit of successful attempts to reduce drinking and driving. However, from the data which are available it is clear that savings can be substantial.

In order to continue and even speed up the trend of a decline in drink-driving, ETSC urges the European Union and Member States to take adequate measures by legislation and regulation, by encouraging international best practice in enforcement, education and publicity, and by stimulating and financing further research where necessary. The most promising measures and areas for research are summarised below.

Assessing the drink driving problem

- Encourage Member States to regularly apply random breath testing surveys to determine levels of 'over the limit' drinking and to analyse and publicise the results;

- Encourage Member States to analyse and publicise results of blood tests of fatal and hospitalised victims;

- Include BAC levels amongst fatalities as one of the variables in the CARE road accident database.

European legislation on legal limits and evidentiary proof

- Harmonise the maximum BAC level throughout the EU by requiring Member States to set their own legal limit of 0.50 promille or lower;

- Introduce a legal framework for the use throughout the EU of evidentiary breath testing equipment, manufactured to a recognised standard.

A package approach to countermeasures

- Develop EU guidelines on best practice in increasing the deterrent effect of police action, e.g. highly visible random breath testing checkpoints;

- Encourage long term, intensive anti drink-driving publicity campaigns backed-up by educational programmes for school-children and drivers trainees;

- Encourage a more enthusiastic marketing approach to low alcohol drinks, as well as the introduction of a price advantage compared to the alcohol equivalents;

- Encourage the provision of additional public transport in the 'drink drive hours' and changing the location of discos and other social establishments closer to residential areas.

Further research

- Determine the cut-off points as regards age and experience for a lower legal limit for young / inexperienced drivers;

- Study and further detailed knowledge for optimum levels of enforcement;

- Study and develop guidelines for best practice of alcohol rehabilitation courses;

- Study the format and feasibility of EU-wide introduction of in-vehicle devices to prevent drink-driving.

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