An international comparison of the effectiveness of traffic safety enforcement policies

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0. Introduction

Throughout the last decades in Europe, there has been a decline of the number of traffic deaths. Whereas 56,027 traffic casualties were deplored in 1991, in 2001 41,082 people lost their lives on European roads. There is a declining trend of accidents and deaths in traffic. One could therefore assume traffic safety in Europe is improving. Despite the reduction of deadly accidents, the number of casualties in traffic is still very high. Every year about 1.6 million people are injured in the 15 European member states[1] and 33 % need hospital treatment during their lifetime because of a road accident[2]. In fact, people risk their lives every day in the motorised jungle called traffic where the law of the fittest often rules.

Hence, improving traffic safety by reducing the number of traffic accidents is a priority for European policy makers. The European commission has formulated the objective of a 50 % reduction of traffic casualties by the year 2010[3]. These days there is a lot of public attention for traffic safety. The strive for increasing traffic safety is generally supported, so the time for action has come. Today, European policy makers inquire what the best options are in order to attain the postulated targets.

Not every government is equally successful in improving traffic safety. The grounds for these discrepancies are being explored throughout the paper. There must be some reason why one government succeeds in reducing traffic casualties while others are less successful. A reason can be found in the behaviour of human beings and in cultural differences. Once the grounds are exposed, the question emerges of what has to be done in order to attain the presumed goals in spite of the given differences. Therefore, if governments can discover the reasons for these differences, they can examine what kind of measures have to be implemented and to what extent. Inevitable questions in this context are as follows. Which is the optimal amount of action that has to be striven for, in order to achieve the desired goals? Will the same measures lead to equal results in every country, or are there fundamental inter-country differences that cause a different outcome – at least partially?

This paper presents a research into the causalities of inter-country differences from a behavioural point of view. Once the grounds are qualified, a research process that leads

[1] European Commission, *White paper: European Transport Policy for 2010:time to decide*, COM/2001/370, Sept 201, p 75.
[2] SARTRE, *The attitude and behaviour of European car drivers to road safety*, SARTRE 2, 1998, p 7.
[3] European commission, *White Paper: European Transport Policy for 2010:time to decide*, COM/2001/370, Sept 2001, p 66.

governments to the necessary insights in their particular situation can be developed. In that way, governments will be able to investigate the possibilities for general measures that have to be implemented in order to attain the presumed targets. This information is intangible to facilitate an effective policy. To what extent the measures have to be implemented is investigated by economic analysis, as is the behaviour of the traffic participants. In the end, policy making is also approached from an economic standpoint.

1. Study concerning the measures

By means of a literature study, an inventory of measures contributing to traffic safety in the best performing countries has been drawn up. The goal of this paper is to draw up the general conclusions of the measures taken by these best performing countries. An in depth analysis of the measures taken by those countries is not the aim[4].

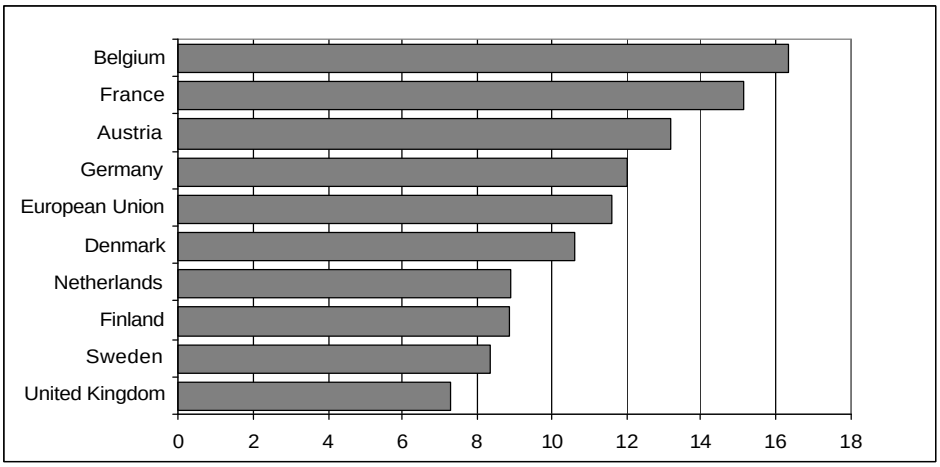
In their policy statement governments draw their goals and the outlines of the measures to be implemented to attain these goals. As they have limited resources, a selection of a limited number of measures has to be made. Inevitably, decisions have to be made regarding the selection of measures. The authorities will choose the ones that achieve the best results at the lowest cost. Research conducted in these best performing countries pointed out that the selected measures are effective in terms of increasing traffic safety[5].

Denmark, Great Britain, The Netherlands, Sweden, and Finland have been screened in this study. These were selected as best performing based upon the number of traffic deaths-cf. graph 1- which is lower than the average figure of the European Union. Belgium, Portugal, and Greece, on the other hand, score badly in terms of road safety. They have the highest score in traffic deaths.

[4] More information on the measures may be obtained in the following studies: Steunpunt Verkeersveiligheid bij stijgende Mobiliteit, *aanpak verkeersonveiligheid in de best presterende landen*, BIVV vwz, Brussels, 2002; European Commission, *White paper: European Transport Policy for 2010:time to decide*, COM/2001/370, Sept 2001; Deben L., *Naar een optimaal verkeershandhavingsbeleid Vlaanderen: een rechtseconomische analyse van lessen uit de veiligste landen*, rapport, Vlaams Steunpunt Verkeersveiligheid bij Stijgende Mobiliteit, Diepenbeek, 2003.

[5] http://www.atsb.gov.au/road/research/crreport.cfm; Department for transport, a cost recovery system for speed and red light cameras – two year field evaluation, research paper, 2003. http://www.roads.dft.gov.uk/roadsafety/cameras/redlight/pdf/cameras.pdf; Zaidel D.M., The impact of enforcement on accidents, meta-analysis, Escape, 2002.

Graph 1: Deaths 30 days per billion motor vehicle kilometers - 2000



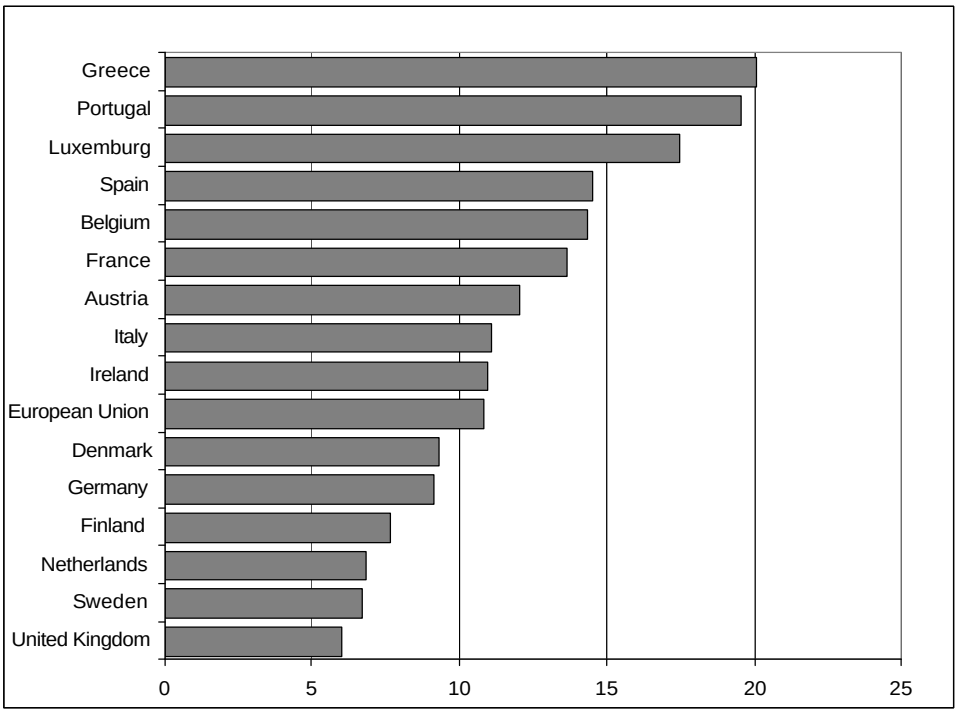
Source: BIVV, *best performing countries*, in Vlaamse stichting Verkeerskunde, Introductiecursus Verkeersveiligheid, lesson 1, Brussels, 2002, p 4.

Table 1: Number of deaths 30 days per 100.000 inhabitants

Countries	Deaths/100 000 2000	Deaths/100 000 1999
Austria	12	13.4
Belgium	14.4	13.7
Denmark	9.3	9.7
Finland	7.7	8.4
France	13.6	14.4
Germany	9.1	9.5
Greece	21	20.8
Ireland	11	11
Italy	11.1	11
Luxemburg	17.5	13.5
Netherlands	6.8	6.9
Portugal	19.6	21.1
Spain	14.5	14.6
Sweden	6.7	6.6
United Kingdom	6.0	6.0

Source: figures for 2000: *trends in road fatalities in OECD member countries*, IRTAD, OECD transport division, RTR programme; Figures for 1999: BIVV, *Ongevallengegevens voor de Europese unie – 1999*, jaarverslag verkeersveiligheid 2000, Brussels, 2001, p 56.

Graph 2: Number of deaths 30 days per 100.000 inhabitants - 2000.



Source: BIVV, *The best performing countries*, in Vlaamse Stichting Verkeerskunde, introduction course traffic safety, lesson 1, Brussels, 2002, p 3

Of the countries depicted in graph 1, Belgium even had the highest number of casualties per billion motor vehicle kilometres in the year 2000. For this reason, the Belgian situation is used as a reference for a failing policy in terms of traffic safety. The measures implemented in Belgium will be compared to those taken by the best performing countries.

If the comparison of the measures implemented leads to the conclusion that countries at both ends of the graph make use of the same traffic safety regulations, the question emerges what the explanatory factors for the discrepancies are. As stated before, the effectiveness of the measures taken by the best performing countries has been proved in earlier studies. By implication, an explanation for the inter-country differences has to be sought outside the measures themselves.

1.1. Measures selected by the best performing countries

From the data available the conclusion emerges that almost every country has adopted the measures reviewed in this paragraph. They are merely an indication of a broad range of decrees undertaken by the governments of the involved countries as they are part of a cluster

of measures taken around the selected points of gravity, such as seat belt wearing, alcohol and speed.

Table 2: Comparison of seat belt wearing rates selected OECD countries - 2001

Countries	Urban roads-wearing rate (%)	Rural roads-wearing rate (%)	Motorways-wearing rate (%)	Front seat	Back seat
Austria	67	72	74		
Belgium				66	
Denmark	73	86	88		
Finland	78	92		90	
Germany	92	95	98		
Great Britain	88	93		91	79
Netherlands (2000)	74	86	87		
Sweden (2000)				90	70

Source: OECD Transport Division, *trends in road fatalities in OECD member countries*, IRTAD, RTR programme, 2001.

The use of seat belts is obligatory for all drivers and passengers in all the screened countries. In Sweden 90% of the drivers and 79% of passengers wear seat belts. In Finland 90% of the drivers wear their seat belts. In 2001, a Danish study pointed out that a nation-wide awareness campaign[6] resulted in an increase in back seat seat-belt use from 80% to 84%.

Speed is another important component of traffic safety policy, as it is one of the main causes of traffic accidents. A reduction of the average speed by 1% results in a 3% decrease of the number of collisions[7]. Confronted with this knowledge, governments have lowered speed limits and raised the number of speed checks. In some countries, like Sweden, speed limits are adapted to human tolerance for mechanical forces. At places with high collision risk between pedestrians and other road users speed has to be reduced to 30 km/h. In other places higher speed limits are allowed, but the circumstances have to be taken into consideration when adapting speed. In rainy weather conditions, for example, the driver has to lower his speed.

[6] Deben L., *Naar een optimaal verkeershandhavingbeleid Vlaanderen: een rechtseconomische analyse van lessen uit de veiligste landen,* rapport,Vlaams Steunpunt Verkeersveiligheid bij Stijgende Mobiliteit, Diepenbeek, 2003, p 19.

[7] BIVV, *Handleiding bij het opstellen van een handhavingplan: snelheidshandhaving*, BIVV vzw, Brussels, 1999, p 7.

Table 3: Change of speed limits and the effect on the number of deadly accidents

Year	Country	Limit From… → to…	Average decline of speed	Decline of number of deadly accidents
1985	Switzerland	130 km/h → 120 km/h	5 km/h	-12 %
1985	Switzerland	100 km/h → 80 km/h	10 km/h	-6 %
1985	Denmark	60 km/h → 50 km/h	3-4 km/h	-24 %
1989	Sweden	110km/h → 90 km/h	14,4 km/h	-21 %

Source: ETSC, *reducing traffic injuries resulting from excess and inappropriate speed*, Brussels, 1995

Table 4: maximum speed allowed on specific road types

Country	Urban roads Max km/h	Non urban roads Max km/h	Highway Max km/h
Netherlands	30-50	80	100-120
Denmark	30-50	80	110
Sweden	50	70-90	110
Great Britain	48	96-112	112
Finland	50	80-100	100-120
Belgium	30-50	70-90	120

Source: SWOV, kennisbank: http://SWOV.nl/kennisbank/index.htm; Zaidel D.M., *Enforcement needs on European roads*, ESCAPE, Technical Research Centre of Finland, deliverable 1(WP1), 2002, p 32; Steunpunt Verkeersveiligheid bij stijgende Mobiliteit, *aanpak verkeersonveiligheid in de best presterende landen*, BIVV vwz, Brussels, 2002, p 10, 17, 35, 44. European Commission, *White paper: European Transport Policy for 2010:time to decide*, COM/2001/370, Sept 201, p 79

Most other countries, Great Britain for instance, apply speed limits by type of road. In these countries, speed is also limited to 30km/h in urban areas where the presence of pedestrians is significant[8]. As the table shows, maximum speed by type of road is approximately the same in every investigated country. In urban areas no more than 50 km/h is allowed, in non urban

[8] Deben L., *Naar een optimaal verkeershandhavingsbeleid Vlaanderen: een rechtseconomische analyse van lessen uit de veiligste landen*, rapport, Vlaams Steunpunt Verkeersveiligheid bij Stijgende Mobiliteit, Diepenbeek, 2003, p 20

areas most speed limits are set between 70 and 90 km/h. On highways, they lie between 100 and 120 km/h.

Alcohol is an important factor in traffic safety. It is common knowledge that drinking and driving don not go together. In the reviewed countries alcohol BAC (blood alcohol concentration) limits range from .02% in Sweden to .08% in Great Britain. Most countries state a BAC limit of .05%. In several countries, a reduction from 0,5% to 0,2% is being discussed, especially regarding young drivers.

Table 5: Survey of BAC limits in the discussed countries

Country	initial BAC limit		last introduced BAC limit	
	Year	blood g/l	Year	blood g/l
Belgium	1975	.08	1994	.05
Denmark	1976	.08	1998	.05
Great Britain	1967	.08		
Finland	1977	.05		
Netherlands	1974	.05		
Sweden	1941	.08	1990	.02

Source: Behrensdorff I, *"Medicinal and illigal drogs among Danish Drivers"*, Danmarks TransportForsking, report 3, 2001, p 71.

The countries cited above inflict severe punishments on violation of alcohol limits. They use a wide range from fees ranging from withdrawal of the drivers' license to imprisonment up to two years. Rehabilitation courses or driver improvement courses are optional in several countries in exchange for a reduction of the punishment.

Literature states that in all countries overall traffic enforcement has been augmented during the last years and they all strive for a quick settlement of the observed breaches[9]. With the number of persecuted violations, the number of court procedures has increased during this period. In order to relieve the strain of the courts, alternative settlements for minor offences are under investigation. Some countries like the Netherlands and Denmark have already implemented administrative fees in order to settle minor offences out of court. In some cases, private companies without further interference of public authorities dispatch these fees. When

[9] BIVV, *aanpak verkeersonveiligheid binnen de best presterende landen*, Brussel, BIVV vzw, 2001,p 61,64; SWOV, *politietoezicht: effecten en efficiency* http://SWOV.nl/kennisbank/index.htm

an administrative sanction is not proposed by the authorities or not accepted by the offender, police forces pass the information on to the courts. Observed offences of severe violations of the law are sent to court and are sentenced. In their turn, they will sue the offenders. Under zero tolerance policy - used by the best performing countries - dismissal of charges is being discouraged, even for minor violations of law.

1.2. Measures of the Belgian government

Looking at the first graphs one notices the Belgian policy does not achieve the same results as the best performing countries do. The measures taken by Belgian government are concisely depicted in the same way as for the best performing countries.

In Belgium, the wearing of seat belts is obligatory for both driver and passengers. Speed limits are set by type of road, as is the case in most countries. On motorways, the maximum speed is 120km/h and in urban regions, where lots of pedestrians, speed limits are being lowered to 30km/h. The BAC limit in Belgium is set at .05%, the same limit as in other countries[10].

Traffic law maintenance has been increased recently by the implementation of new measures including the use of speed cameras. Punishments for observed violations of legislation have recently become more severe. The traffic safety law, consisting of high fines for violations of traffic laws and a form of administrative fee, was approved on 5.03.2003 and will soon be implemented[11]. As the law is still being adapted now, the impact of the more severe and faster punishment of violations on the number of traffic casualties in Belgium cannot be judged yet.

The comparison of these measures show that the governments of the best performing countries and Belgium have taken roughly the same measures. In fact, the Belgian government has been inspired by the traffic safety policy adopted in the best performing countries while drawing up it's own[12]. However, in Belgium this policy does not seem to be

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[10] Deben L., *Naar een optimaal verkeershandhavingsbeleid Vlaanderen: een rechtseconomische analyse van lessen uit de veiligste landen*, rapport, Vlaams Steunpunt Verkeersveiligheid bij Stijgende Mobiliteit, Diepenbeek, 2003, p 20; Staten-Generaal van de Verkeersveiligheid, *Verslag van het begeleidingscomité van de Staten-Generaal van de verkeersveiligheid aan het bestuurscomité*, dossiers 1-10, 2002. http://www.wegcode.be/actueel/pdf

[11] Belgische Kamer van Volksvertegenwoordigers, Wet houdende verschillende bepalingen inzake verkeersveiligheid, DOC 50 1915, aangenomen 07/02/2003. Gepubliceerd in Belgisch Staatsblad op 25.02.2003, nr 060,20030225.

[12] Ministry of the Flemish Government, *Mobiliteitsplan Vlaanderen,naar een duurzame mobiliteit in Vlaanderen, 1999*, Brussels, 2001, p 180. [12] Belgische Kamer van Volksvertegenwoordigers, Wet houdende

as effective as might be expected based upon the results of the best performing countries. Although Belgium has applied the same measures as the best performing countries, traffic safety has not improved as much as one would have expected.

1.3. Conclusion on the implementation of the effective measures

Although the authorities of the best performing countries manoeuvre in different settings, almost every country has implemented the same set of measures. This is an indication of the overall applicability of the decrees. Irrespective of local conditions, it has been proven that these measures can lead to a decrease of traffic casualties. In the case of Belgium, though, the same measures fail to be successful. This leads to the second establishment that the same measures are also conveyed in countries performing badly[13]. There is a call for an investigation of what premises has to be fulfilled for the selected measures to reduce traffic deaths.

2. Investigation of the premises

Different countries have different attitudes towards policy and rules. Why is it that the Netherlands is one of the best scoring countries, whereas its neighbour Belgium does not succeed in improving its situation? On the contrary, the results of empirical research show that Belgium has no reduction of traffic deaths[14]. Therefore, it is possible the same measures are perceived differently in other countries. Perhaps Dutch people accept the existence of rules and obey them while Belgians are unconvinced of the need for legislation.

The following paragraphs search for an explanation of the fact that given the same measures, some countries achieve satisfying results in the struggle against traffic casualties, whereas other countries don not manage to progress. The fact that neighbouring countries book different results does raise the suspicion that perhaps one of the decisive factors is a nation's culture.

Firstly, it has been investigated what impact individual attitude has on law obedience. If ther is a difference in attitude between people, this influences the personal consideration of the traffic participant. Before acting, each person makes his own calculus in order to determine if

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verschillende bepalingen inzake verkeersveiligheid, DOC 50 1915, aangenomen 07/02/2003. Gepubliceerd in Belgisch Staatsblad op 25.02.2003, nr 060,20030225, Memorie van Toelichting, p 18.

[13] Ministery of the Flemish community, *Mobiliteitsplan Vlaanderen, naar een duurzame mobiliteit in vlaanderen*, 1999, Brussels, 2001, p 181-182.

[14] The latest figures released show an increase of traffic deaths on Belgian roads with one percent.

he will act in the presumed way. If people have different perceptions of law-abiding behaviour, they will give compliance to legislation a different rating. Persons who don't value rules much are inclined to break them faster than people who think law obedience is important. Therefore it is important for governments to understand the principle of decision making of their inhabitants in order to know in what manner their people value legislation in general.

The attitude towards policy in general is an indication of a people's law-abiding culture. It shows if people are inclined to obey imposed rules. Investigation of nations' attitudes with regard to traffic legislation in particular, gives an elaborated view of the differences in people's law compliance. Besides, the investigation of attitudes in a traffic setting allows us to draw conclusions about the influence law abiding behaviour has on the road safety policy of governments. At least this theory is worth wile investigating.

2.1. Economic analysis of the behaviour of the traffic participant

By economic analysis of the behaviour of individuals, a reason for the careless behaviour of inhabitants and the failing of the measures in some countries is investigated. An explanation of the discrepancy between the behaviour of the Belgian people and the people of the best performing countries is also examined.

Every participant in traffic makes a personal calculus about his own perceptions of the benefits and costs of his behaviour. An individual bases its compliance of breaking of the law on this personal calculus. This is an important datum for government. When the authorities are given some insight in the benefits and costs someone has and the way they value these, they are able to estimate the enforcement measures necessary to change the attitude of their inhabitants. Therefore, governments need to understand the process of decision making of their inhabitants.

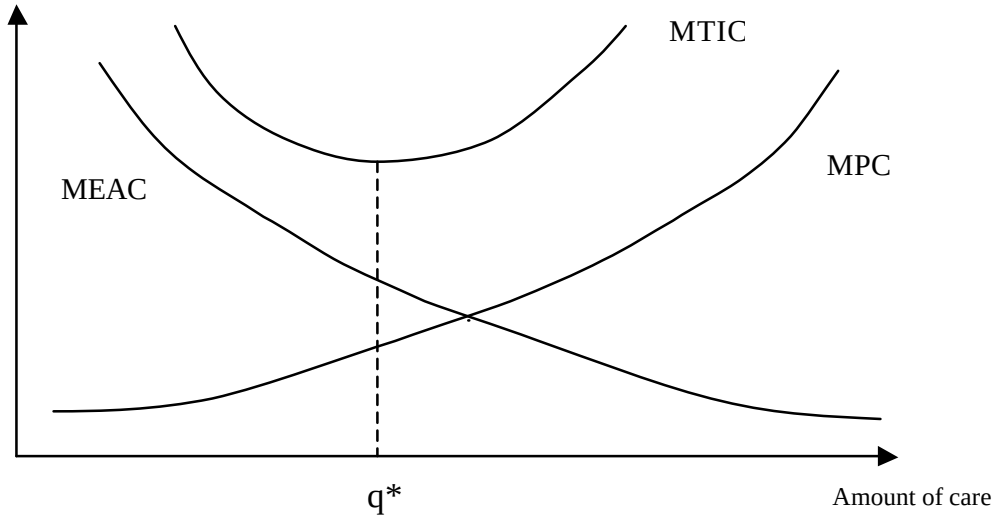
The economic analysis of the behaviour of the traffic participants presumes an individual who acts rational towards its objective[15]. Second assumption is the striving of the road user to maximise his profit, considering every relevant factor. The benefits that are obvious for the driver of a motor vehicle include the gain of time by the use of the vehicle, avoided care costs,

[15] Cooter R., Ulen T., *Law and economics,* Addison-Wesley, Amsterdam, 2000, p 24; Van Velthoven B.C.J., Van Wijck P.W., Recht en efficiëntie, Kluwer, Deventer, 2000, p 12.

the kick (of speeding)[16]. The increased risk of being involved in an accident, the increased risk of getting caught for violation of the law, the increased damage when an accident really takes place are his cost components. Translated to the care level every traffic participant has to consider, these costs create the following curves of costs.

The first cost curve, the curve of the marginal precaution cost MPC, which shows an increasing course, consists of the cost of the lost time due to taking precautionary measures and the cost of precautionary measures the driver takes. This implicates that the more care the driver exercises, the more time he has to spend and the more precautionary measures he has to take. For example, by lowering his speed the driver exercises more care, but at the same time he loses time because he does not get to his destination as fast as when he would be speeding.

Figure 1: The optimal level of care



The other curve is called the curve of the marginal expected accident cost MEAC. It reflects the cost coupled to the reduction of the probability of an accident and the decreased costs that occur when an accident takes place[17]. Its components are, amongst others, the decreased chance of an accident, the decreased chance of being caught, and the decreased

[16] Deben L., *Naar een optimaal verkeershandhavingsbeleid Vlaanderen: een rechtseconomische analyse van lessen uit de veiligste landen*, rapport, Vlaams Steunpunt Verkeersveiligheid bij Stijgende Mobiliteit, Diepenbeek, 2003, p 40-41.
[17] Deben L., *Naar een optimaal verkeershandhavingsbeleid Vlaanderen: een rechtseconomische analyse van lessen uit de veiligste landen*, rapport, Vlaams Steunpunt Verkeersveiligheid bij Stijgende Mobiliteit, Diepenbeek, 2003, p 44.

damage when an accident occurs. The curve slopes down, indicating that the expected accident cost decreases as precaution increases[18]. The probability of causing an accident drops as soon as the driver takes more precautionary measures; the overall damage decreases as well.

The addition of the marginal precaution cost and the marginal expected accident cost reflect the marginal total individual cost (MTIC). Depending on the personal appreciation of the individual, both cost curves are combined in order to minimise the total cost at the corresponding level of care q*[19]. q* is the efficient level of precaution, i.e. the amount where the cost of an additional unit of precaution equals the reduction of the damage cost[20]. As long as the individual has not attained this care level, he will exercise more care in order to reduce his chance of an accident. Once beyond this point is it not advisable for the individual to apply an extra unit of care.

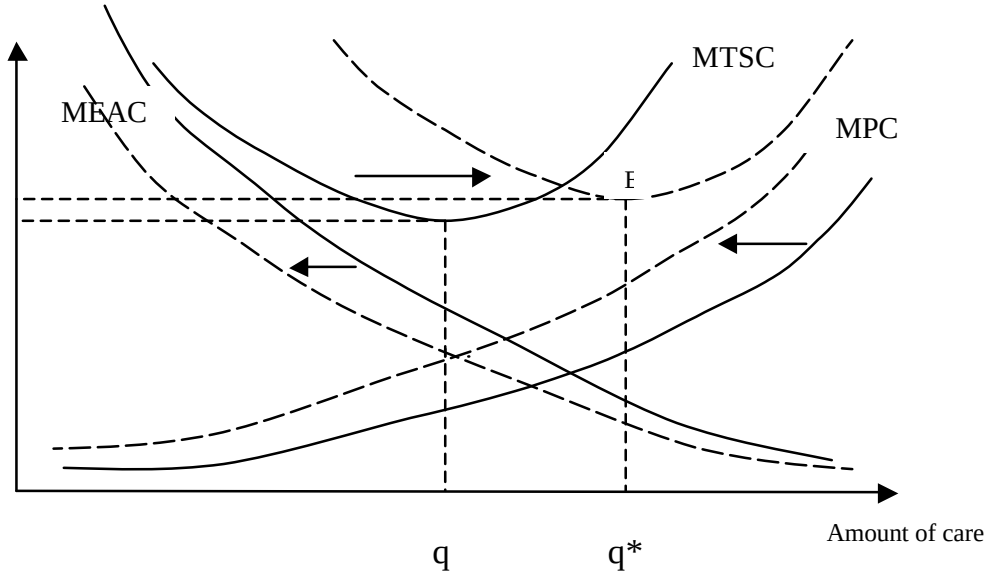
The sum of the cost curves of the individual shapes the total social cost. The costs consists of the private costs of the acting individual and the costs carried by other members and equal the costs carried by all members of society. In the same way as the individual calculus, the optimum of the society is set by minimising the costs of society. In a perfect market, the individuals will obtain a social optimal level of care by striving for their personal minimal costs. In this point, marginal social costs will be minimised.

The problem is that road users often make false considerations about their benefits and costs unconsciously. In a traffic setting a problem of information deficiency and external effects emerges. Often, people underestimate the risk they bear by being careless, called the 'this doesn't happen to me' mentality. They also tend to minimise their chances of being caught by the authorities. Therefore, the driver adapts a lower level of care than he should from a general point of view. The individual imposes costs he generates on society by adapting a low personal level of care. This leads to the situation that the costs for society exceed the private costs. In other words, the individual generates external costs, which have to be carried by society[21]. External effects are costs or benefits connected to the consumption or production of a good or service that fall upon others than the actor, without a counterbalance. For this reason traffic participation is cheaper for the individual than it is in reality. In a traffic setting, the driver imposes risks on other traffic participants by acting careless; thus causing

[18] Cooter R., Ulen T., *Law and economics,* Addison-Wesley, Amsterdam, 2000, p 300.
[19] Van Velthoven B.C.J., Van Wijck P.W., *Recht en efficiëntie*, Kluwer, Deventer, 2000, p 14.
[20] Van Velthoven B.C.J., Van Wijck P.W., *Recht en efficiëntie*, Kluwer, Deventer, 2000, p 183.
[21] Baily S.J., *Public Sector Economics, theory, policy and practice,* Palgrave, New York, 2002, p32

costs for other traffic participants because, consequently, they have to take more care to avoid an accident. Another example of external costs is the insecurity cost the driver generates by speeding through living streets.

Figure 2: Internalisation of the costs



Social welfare is better served with a lower level of unsafe behaviour or a higher level of precaution than the level the individual practices without including all his costs. In practice, however, the calculating road user acts differently than he would do when confronted with the real cost, using a sub-optimal level of care. If the individual would be forced to consider his real costs, as he does in the social optimum E, he would act more carefully. From this point of view, he has to calculate all his costs, shifting towards another personal optimum in correspondence with another level of care, from q to q*.

Bearing this knowledge in mind, the use of measures to internalise the costs the individual generates is the only solution a government can pursue. Application of the principle of internalisation leads to the allocation of the costs towards the person who has caused them. Increasing the cost the actor is confronted with up to the real cost of traffic participation leading to the alteration of his behaviour achieves internalisation. More precaution will be applied and therefore road safety increases for other participants. By internalisation of his costs, the actor contributes to a safer environment on European roads.

In order to obtain this result the government has to formulate a combination of tangible maintenance measures, leading to an incline of maintenance up to a level the individual actor

considers the costs he imposes on society. Government can do so by augmenting the fines or by increasing the chances of being caught when breaking the rules. In this manner, individuals receive enough incentives to accelerate their level of care and act safer in a traffic situation. On what level government should provide these incentives, is discussed in the next paragraph.

2.2. Comparison of attitude in different countries

Every government is confronted with profit maximising individuals who are inclined to obey the rules up to the point the benefits of compliance equal the cost. Governments, to alter behaviour in a desired direction, may use this characteristic, inherent to human nature. The next paragraph investigates the influence of cultural appointed attitude towards legislation on the possibilities of governments to change individual non-compliant behaviour.

2.2.1. Law-abiding attitude in general

In order to create an overview of the general attitude of citizens towards the imposed rules by their government, an indication can be sought in the corruption index of nations. In some countries, corruption is perceived as generally unacceptable, while in other countries corruption is perceived as almost normal. The corruption index is inversely proportional to the degree of law-braking behaviour in a specific country.

The corruption figures are an indication of the tolerance of a nation towards legislation evasion in general. It shows the size of the acceptance people have for rule breaking behaviour. The more corruption exists in a country, the stronger the indication residents reject legislation. It shows that during their search for options to solve their problems, people might take refuge in solutions that are forbidden by law. In nations with a low corruption index figure the cost of breaking the law as perceived by the inhabitants is lower than in nations with a high corruption index figure. When violations of the law are generally accepted, a problem may be easier to solved by breaking the law. In such an environment, law obedience could be costly and people are tempted to evade laws. Therefore, they are less law-obedient than people with a higher estimation of the law are. In the last case, breaking the law will impose more costs on people and therefore will not be done.

A glance at the corruption figures of countries demonstrates that Finland gets the highest score. So, it is the less corrupt country or most law abiding nation. Finland is followed by Denmark, Sweden, the Netherlands and the United Kingdom, also the best performing countries concerning road safety police

Table 6: Corruption perceptions index

Country	Rank 2002	Rank 1999	Score 2002	Score 2001	Score 2000	Score 1999
Finland	1	2	9.7	9.9	10.0	9.8
Denmark	2	1	9.5	9.5	9.8	10.0
Sweden	5	3	9.3	9.0	9.4	9.4
Luxembourg	7	11	9.0	8.7	8.6	8.8
Netherlands	7	8	9.0	8.8	8.9	9.0
United Kingdom	10	13	8.7	8.3	8.7	8.6
Austria	15	17	7.8	7.8	7.7	7.6
Germany	18	14	7.3	7.4	7.6	8.0
Belgium	20	29	7.1	6.6	6.1	5.3
Spain	20	22	7.1	7.0	7.0	6.6
Ireland	23	15	6.9	7.5	7.2	7.7
France	25	22	6.3	6.7	6.7	6.6
Portugal	25	21	6.3	6.3	6.4	6.7
Italy	31	38	5.2	5.5	4.6	4.7
Greece		36		4.2	4.9	4.9

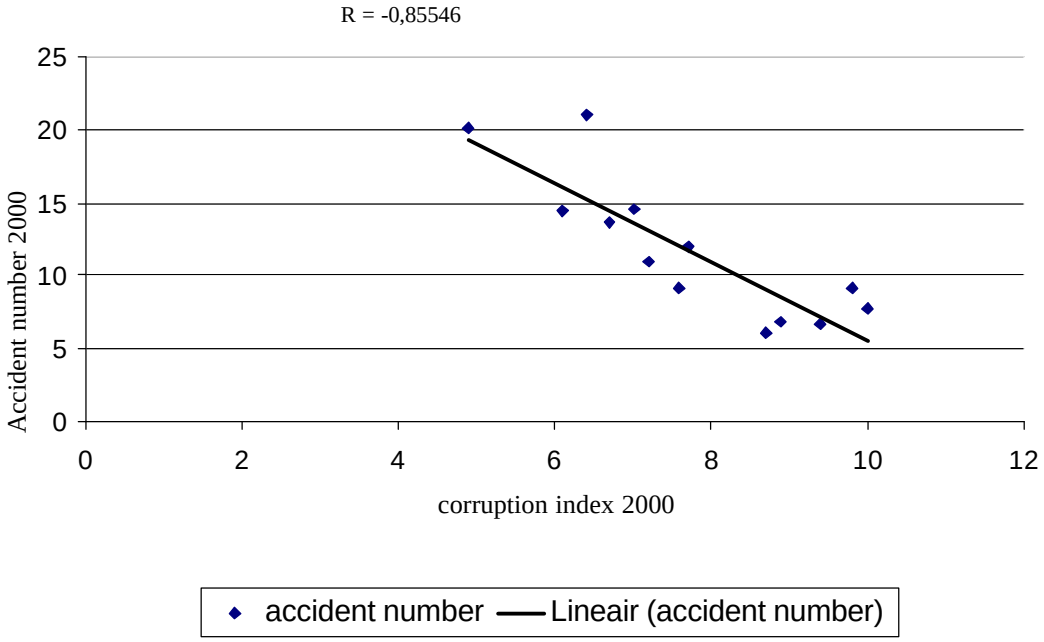
Source: *Transparency International corruption perceptions index*, Transparency International, Berlin, 2002. http://www.tranparency.org

Looking further down, Belgium occupies the twentieth place and scores in the bottom half of Europe together with Portugal, Italy and Spain. The figure shows very large differences in perceptions of corruption. It is obvious people of different countries have different ideas of using non-compliance with the law to obtain their set goals. While the idea of corruption in Finland is thought of as repulsive, in Italy it is much more accepted. When a person occasionally breaks a rule in Italy, other people will not condemn him for his behaviour. His costs of law evasion are lower than they would be in countries where he would be held responsible for this kind of action. Therefore he is much more inclined to grasp a forbidden solution than he would be if he were to be punished by society for such behaviour.

Comparing the results of the corruption index of 2002 with the graphs of the first paragraph, the conclusion is the order of the countries is the same for both graphs. Sweden, Finland, the Netherlands, and Denmark do well on both characteristics, whereas Belgium,

Italy, and Spain score badly. This might be an indication of a correlation between law-abiding behaviour and the success of the implemented measures[22]. The best performing countries succeed in improving their traffic safety, while it is obvious their inhabitants accept the existence of the necessary measures. The corrupt countries, on the other side, where people are not convinced of the necessity of compliance with imposed measures, don not perform well in traffic safety improvement. Governments can only achieve results by imposing measures if they are complied with. If this is not the case, governments can implement as many measures as they like, the measures will not be complied with. Because of the non-compliance the postulated goals will stand no chance of ever being attained. Although this reasoning is acceptable and subscribed by the figures, there is no decisive conclusion to be drawn from these figures without further investigation. A comparison of the corruption index with the accident figures underlines the assumption that there's a linear relationship between law-obedience and accident figures.

Figure 3: relation between corruption index and accidents (2000)



[22] There has to be calculated a correlation figure of several years in order to know if there's a significant relationship between the 2 variables.

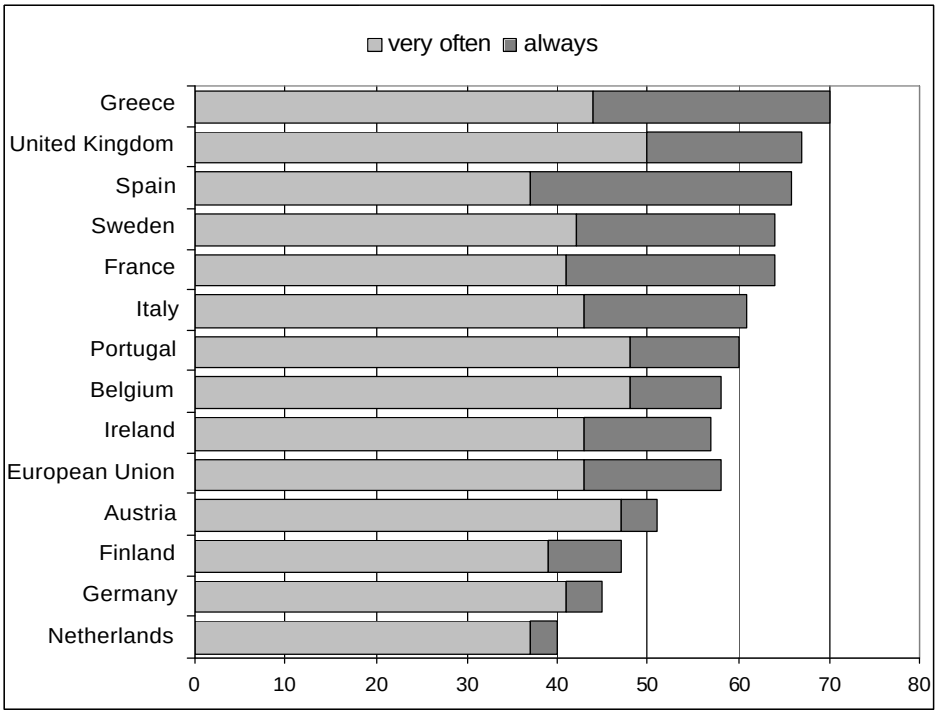
Law obedience in general is already an indicator of the relationship between the implementation of measures for traffic safety and the results they attain. Further investigation of the attitude of nations towards traffic legislation is carried out.

2.2.2. Attitude towards alcohol legislation

The attitude towards legislation on a traffic setting is being explored by the usage of research concerning alcohol legislation. The attitude towards alcohol legislation demonstrates the attitude cultivation of traffic participants in general. The SARTRE 2 project examined the attitude of the various countries towards legislation concerning traffic safety by investigating various traffic legislation areas. Amongst the examination of other topics, the attitude towards speed and seat belt legislation, one of the topics she did research on was the attitude towards alcohol legislation.

The research showed that over 40% of interviewed drivers are convinced that drinking and driving often cause road accidents. The variations between countries are not extreme. The ratings are higher for Greece, United Kingdom, France, Sweden, and Spain. Low ratings can be observed in The Netherlands, and Finland

Graph 3: Perception of drivers about drinking and driving as the cause of road accidents

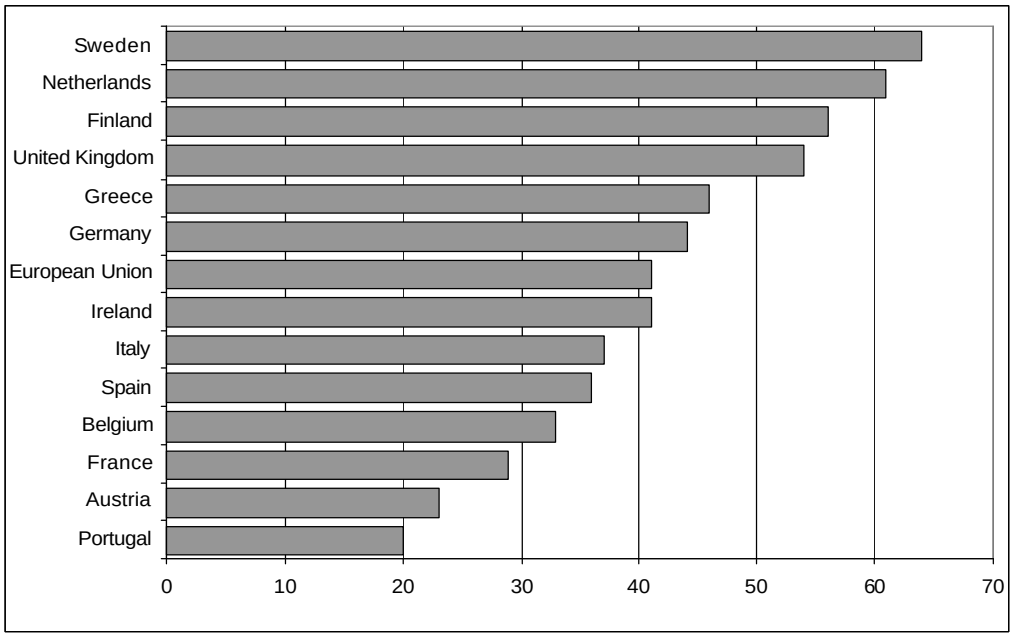


Source: SARTRE 2, *The attitude and behaviour of European car drivers to road safety* , 1998, p 52

In general, the figure shows there is a general conviction among drivers that drinking is one of the main causes of accidents[23]. As a large number of drivers are convinced drunk driving is a cause of accidents. They should normally be pleased to find their government acting on their opinion. The authorities act on drivers' behalf by implementing legislation that discourages this dangerous behaviour.

In order to investigate this assumption, the opinion of drivers on legislation imposing a ban of alcohol on the road was asked. More than 40 % of the drivers in the EU want a ban of alcohol on the roads, as the next graph indicates. The rejection of alcohol on the roads is very pronounced in the best performing countries, i.e. Sweden, the Netherlands, Finland, and the U.K[24]. In Belgium, France, and Portugal, very few drivers support a ban of alcohol on the roads[25]. As mentioned at the beginning, these are also the countries that score badly at improving traffic safety. The results show that, although there is consent regarding alcohol's bad influence on roads, this does not automatically lead to an indulging attitude towards legislation that forbids this undesired behaviour.

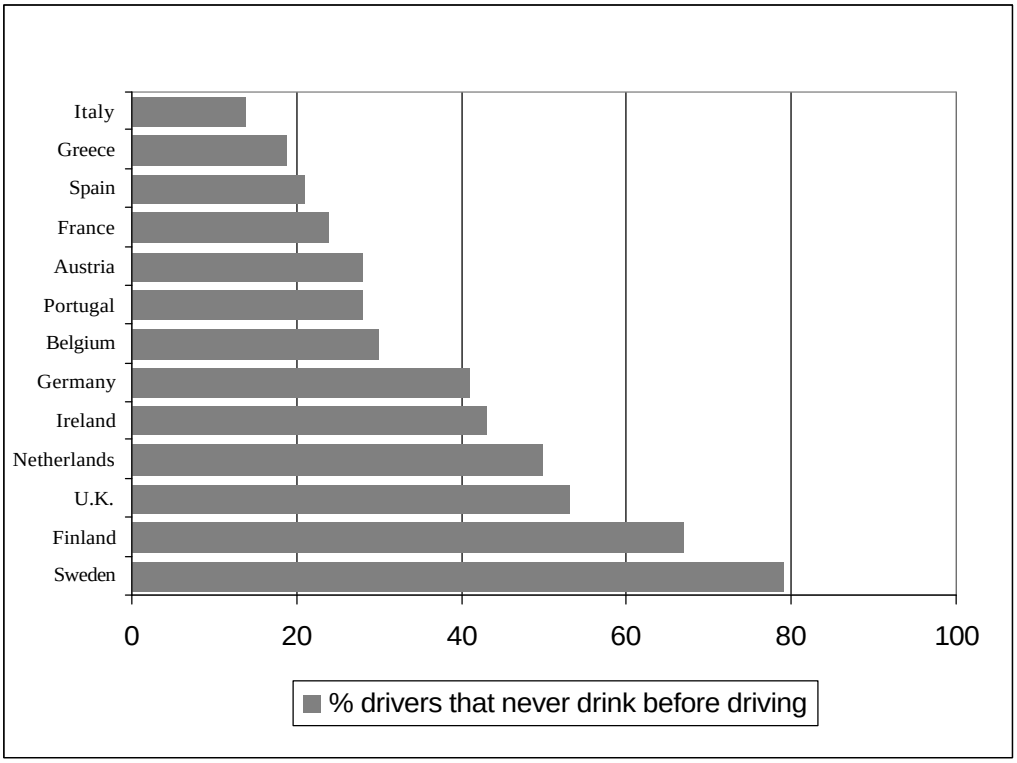
Graph 4: Support of alcohol ban on roads by drivers in %



source: SARTRE 2, The *attitude and behaviour of European car drivers to road safety*, 1998, p 53

[23] SATRE 2, The attitude and behaviour of European car drivers to road safety, SARTRE, 1998, p51.
[24] SATRE 2, The attitude and behaviour of European car drivers to road safety, SARTRE, 1998, p53.
[25] SATRE 2, The attitude and behaviour of European car drivers to road safety, SARTRE, 1998, p53.

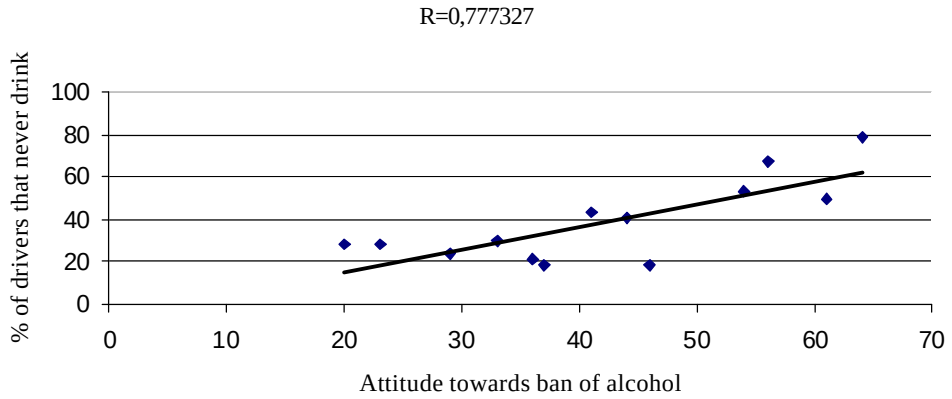
Graph 5: % drivers that never drink before driving



Source: BIVV, VIA SECURA, *Statistieken, Internationale enquete SARTRE II: rijden en alcohol in Europa,* Brussel, 1998, nr 45, p 15; SATRE 2, The attitude and behaviour of European car drivers to road safety, SARTRE, 1998.

The countries where citizens are not accepting legislation are the same ones that fail in improving traffic safety. A correlation between the attitude of the inhabitants towards imposition of legislation and the possibility of government improving traffic safety is proven by the correlation figures of the attitude of drivers towards drunken driving and the behaviour they display towards drinking before driving.

Figure 4: Relation between attitude towards the ban of alcohol and drunken driving



2.3. Conclusion

Studies show that people of various countries differ in their attitudes towards traffic safety measures and legislation in general[26]. The corruption figures indicate a correlation between the attitude of the nation towards legislation and the success of the undertaken traffic safety measures. As the corruption figures are an indication for the attitude towards law abiding behaviour in general, so is the attitude towards drunken driving an indication of the obedience for traffic legislation imposed by national governments.

Several studies have pointed out alcohol is one of the main culprits of traffic accidents. Besides this general knowledge of the destructive influence of alcohol on the ability to participate in traffic, the Sarte project has investigated the attitudes of the drivers towards imposed rules to ban the use of alcohol while driving. The outcome is that the attitude towards drinking and driving differs among countries. Whereas there is general consent about the danger drunk driving evokes on roads the part the authorities should play is open to discussion. There are a number of countries of which the inhabitants are convinced of the necessity of the ban of alcohol on the roads, whereas others are not. As the correlation figures indicate, the countries where the people are not convinced of the necessity of the government measures, are once more the ones with the largest number of traffic accidents

The overall conclusion of the studies is that the attitude towards legislation and therefore law-abiding behaviour differs from country to country. More over the conclusion can be drawn the countries with people accepting the braking of the laws are the same as these countries with high corruption figures and the ones the infliction of traffic legislation attains the least result. The countries with many drivers with a negative attitude towards imposition of legislation to reduce unsafe conditions, are the ones that score badly on improvement of their traffic safety. The population is not convinced interference of the authorities is necessary. The countries with a high percentage of drivers who accept legislation on the other hand are also the best performing countries in improving their traffic circumstances.

The different attitude of nations towards legislation plays a role in an individual's personal calculus. Depending on the nation someone's attitude will be more or less law-abiding This

[26] The SARTRE 2-study mentions the same conclusion on p 63: There's a need for the consideration of national and cultural differences. The study has also investigated attitude towards speeding and wearing of seat belts. SARTRE 2, The attitude and behaviour of European car drivers to road safety, SARTRE,1998, p 63.

leads to different outcomes in behaviour, depending on nationality. National government has to consider this different inter-country perception when determining its policy. Therefore, it is indispensable that each policy reflects on the decision-making process and the law-abiding behaviour the country's residents each time he attempts to guide the inhabitants' behaviour. For this purpose, the broad approach of traffic policy has to be taken into consideration, together with an amount of enforcement measures adapted to the particular situation.

3. Policy of governments

The former paragraphs have made it clear it is the task of governments to ensure an individual's behaviour is guided to safer conduct in traffic. A government has to do so by giving enough incentives. It can do so by maintenance measures to increase the costs of the participants' law-braking behaviour. The individual attitude can be changed towards socially desired behaviour by internalisation of the external costs the individual imposes on society. This internalisation is forced upon the actor by augmenting enforcement measures. The driver will act more carefully when there is more enforcement and, consequently, fewer deaths will be mourned.

As individual behaviour is influenced by culture, different cultures need adjusted amounts of enforcement to accomplish the same change of citizen behaviour. This fact has to be born in mind when the advocated policy is being determined. Governments can determine the amount of maintenance necessary to achieve the desired amount of law obedience by its people, based on the knowledge to which extent attitude alteration is necessary.

In the first part of this paper the amount of maintenance measures of best performing countries is investigated, followed by the Belgian situation. Then the desired amount of enforcement in order to achieve the postulated targets by the Belgian government is looked into. A conclusion may thus be drawn about the effectiveness of the investigated countries and how it could be improved.

3.1. Policy of the investigated countries

3.1.1. Best performing countries

All of the investigated best performing countries have implemented a zero vision policy by striving for a reduction of the amount of casualties on their roads up to the point of all

avoidable deaths[27]. They assume a shared responsibility of all traffic participants and do not tolerate any reckless behaviour. In order to attain the intended targets a complete scheme of measures has been drawn up by their governments, including different kinds of measures on various domains such as information, infrastructure, education and enforcement. In the short term, the best performing countries put their policy emphasis on the increase of enforcement measures. There is a general agreement that enforcement has to be increased and maintained at a high level in order to induce drivers to comply with rules handed out by the government. Reason for this is the governments' conviction that measures are useless without extorting compliance with the rules. This conclusion is based on the former analysis of human behaviour and several empirical studies.

Table 7: number of a-select breath tests and percentages of drunken drivers in Amsterdam, 1994-2000.

Year	Level of a-select supervision Number of tests	Percentage of drunken drivers
1994	35.000	7.8 %
1995	80.000	6.7 %
1996	85.000	5.7 %
1997	90.000	5.2 %
1998	90.000	4.7 %
1999	35.000	7.0 %
2000	35.000	6.8 %

Source: http://www.swov.nl/kennisbank/05_alcohol/politietoezicht_effecten_en_efficiency.htm

In the Netherlands, for example, SWOV inquired after the effects of the increase of a-select police inspection[28]. Drivers were subjected to an alcohol test regardless of their driving behaviour. In Amsterdam, daily a-select alcohol controls were performed from 1995-1998, resulting in over 80.000 tests per year. The increase led to a significant fall of the percentage

[27] Deben L., *Naar een optimaal verkeershandhavingsbeleid Vlaanderen: een rechtseconomische analyse van lessen uit de veiligste landen*, rapport, Vlaams Steunpunt Verkeersveiligheid bij Stijgende Mobiliteit, Diepenbeek, 2003, p ;[27] Ministry of the Flemish Community, *Mobiliteitsplan Vlaanderen, naar een duurzame mobiliteit in Vlaanderen*, 1999, Brussels, 2001, p. [27] BIVV, *aanpak verkeersonveiligheid binnen de best presterende landen*, Brussel, BIVV vzw, 2001,p 61,64; Elvik

[28] SWOV, *Study of drunken driving in Amsterdam* , 2000, http://www.swov.nl/kennisbank/05_alcohol/politietoezicht_effecten_en_efficiency.htm

of drunken drivers from 7.8% in 1994 to 4.7% in 1998. In 1999, the number of tests was reduced with 50%. This led to a rapid increase in drunk driving. In the fall of 1999 both surveillance as well as the number of drunken drivers was back at the initial level.

There's a large approbation of the proclaimed rules as well as high enforcement in the best performing countries. Drivers accept and support new government initiatives. This leads to the second conclusion that the authorities of the best performing countries have succeeded in convincing their people of the necessity of the legislation.

3.1.2. Belgium

Belgium, in comparison to the policy of the best performing countries, indeed sets the same goals. As could be expected from the study of the implemented measures, the Belgian government supports a zero vision policy. The results of the undertaken measures, however, are not as successful as in the best performing countries. Despite many efforts by the government in the legislation area, the Belgian government has not succeeded in reducing deadly traffic accidents. The total amount of traffic victims showed a reduction of 4 % in 2001. In that year, 66.780 victims fell on Belgian roads, compared to 69.431 victims in 2000. The latest figures, however, also show an increase of fatal accidents on Belgian roads by 1% in 2001, from 1,470 in 2000 to 1,486 in 2001. The obvious conclusion is that a lot has to be done in order to attain the set goal of a reduction of 50 % reduction in traffic deaths by the year 2010 in Belgium[29].

Although the Belgian government strives for the same targets as the best performing countries do, it does not succeed. The arrears in enhancement compared to the leading countries are one of the most important reasons for the discrepancy. Looking at the avilable enforcement figures, we see a descending trend of the number of observed violations. In the year 1993, there were 789 000 suits by the police against 672 600 in 1999. The figures for speed control show the same decline. In 1997, 12 million vehicles were checked for speed. The figure was only 10 million in 1999, a decline of 12%[30]. Additionally the Belgian people are not very law-abiding as the quoted studies show. At this moment, efforts are being made to increase the enforcement level as the Belgian government shares the conviction that only by increasing the level of maintenance it will reach the set targets.

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[29] NIS, FOD Economie,KMO,Middenstand en Energie, Verkeersongevallen-2001, http://www.statbel.fgov.be/press/pr072_nl.asp

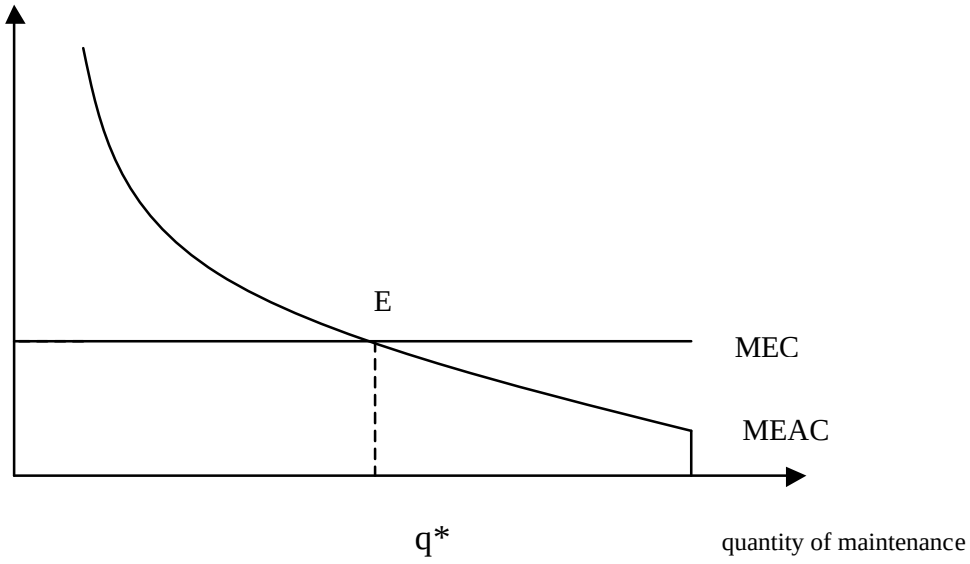
[30] BIVV, Snelheidshandhaving, Handleiding bij het opstellen van een handhavingsplan, BIVV vzw, Brussel, 1999, p 9.

3.2. The amount of enforcement

This paragraph explores the aspirated amount of enforcement given the targets and circumstances. By the determination of its policy, the government fixes a desired reduction of accident fatalities within a certain time, with a corresponding level of enforcement.

In an efficient setting, governments are not prepared to reduce traffic deaths at all costs. Presuming the additional cost of maintenance is always the same, the marginal enforcement curve MEC follows the depicted course. The declining curve shows the marginal expected accident cost MEAC, pointing out the value of traffic casualties that are saved by the additional used unit of maintenance. The curve has a crack at the point where the last victim is saved. The optimum E shows the amount of maintenance measures where one additional unit of enforcement saves one additional human life. As soon as the marginal cost exceeds this optimum, from an efficiency point of view, there is no use in applying more maintenance to save that human life. The corresponding amount of maintenance q* is the demanded amount the government has to provide.

Figure 5: maintenance level in an efficient setting

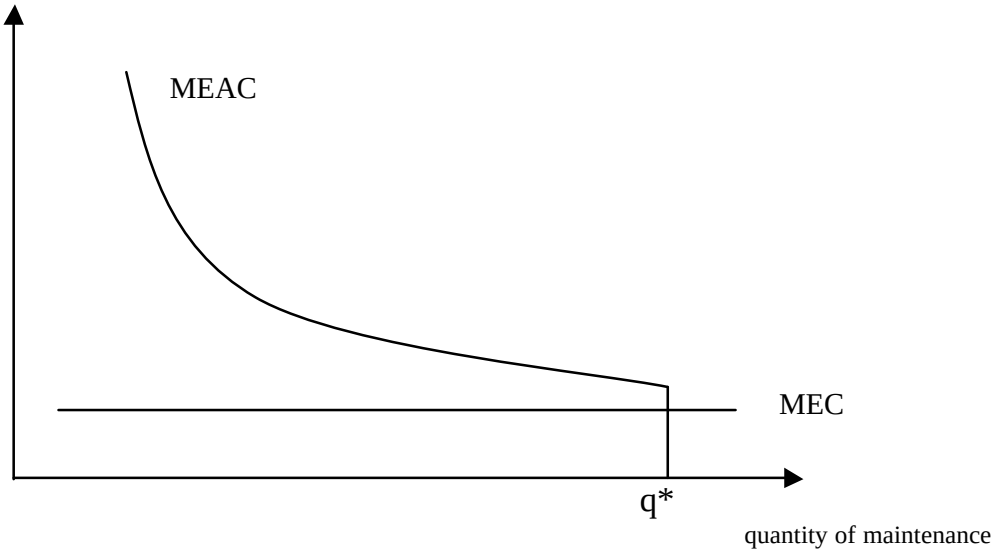


As explained in the previous paragraph, the policy statements of the investigated countries explicitly aim for the reduction of avoidable traffic deaths. On the other hand, a policy based on the efficient level of enforcement is prepared to accept a certain amount of casualties, namely these of which the saving imposes too large a cost on society. This optimal amount of enforcement is not enough to reduce the number of traffic fatalities desired by the best

performing countries. The premise of the efficient policy that allows a number of avoidable traffic deaths is unacceptable from their point of view. In order to attain the set goals, they are willing to go beyond the efficiency point and to invest a larger amount of means in enforcement measures.

Zero vision policy as applied by the best performing countries, has the denial of the validation of a human life in terms of money as its starting point. Accepting every additional saved human life MEAC as justified from a social point of view, governments do not look solely at efficiency, but also take other relevant factors into account. The benefits of saving an additional human life, in their opinion, always exceed the maintenance costs used for saving this life. Since there can never be an optimal point where society accepts a number of casualties, effectiveness is being looked at, not efficiency.

Figure 6: maintenance level in a zero vision policy



3.3. The amount of enforcement by the policies

All countries are convinced that strict maintenance is a necessary stipulation for law obedience, regardless the attitude of road users. Nonetheless, the amount of enforcement necessary to force drivers to comply with rules can vary a lot. First of all the personal value of traffic participation varies. Secondly, the culture of law obedience is a factor in the displayed behaviour. Governments that are aware of the negative attitude of the people towards legislation know that it will be very hard to ensure law-abiding behaviour. They have to make a larger effort than other authorities.

The efficiency strategy invests in maintenance up to the optimal level. If the cost of saving an additional life exceeds this point, the necessary measures in order to save this life will not be taken, as they can not be justified for society. Zero vision, on the other hand, gives priority to the reduction of traffic deaths and is, therefore, willing to accept a larger cost for the enforcement measures. The high level of maintenance within a vision zero policy implies a very high cost for the law-breaking citizen, who will be less inclined to do so. In addition, government is settled by the actual reduction of traffic casualties. The increase of the individual cost, together with the acknowledgement of traffic safety as a social problem, leads to an intolerant atmosphere towards careless behaviour of drivers. Society does not accept members' deviant behaviour.

Table 8: Available enforcement figures of investigated countries 2000[31]

Countries	Population Milj	fines (1000)	Chance to get a fine	Number of alcohol tests (1000)	Chance to get a alcohol test	% of drivers tested for alcohol in 1999	% drivers over the limit in 1999
Austria	8.0	3.550	0.44	100	0.01		
Belgium('99)	10.0	627	0.06	163	0.02		
Finland	5.1	378	0.07	1.400	0.27	40 %	0.2
France	58	6.000	0.1	7.200	0.12	25 %	1.7
Germany	81.5	3.500	0.04				
Greece	10.7			260	0.02		
Ireland	3.7	90	0.02	17	0.004		
Netherlands	15.4	4.700	0.3	500	0.03	6 %	4.4
Norway	4.5	414	0.09				
Portugal	10	930	0.09				
Spain	39.4	1.900	0.05	2.400	0.06		
U.K.	59.4	3.700	0.06	860	0.01		

Source: Zaidel M., Makinen T., *Indicators of police enforcement in 12 countries*, in Traffic enforcement in Europe: effects, measures, needs and future, Escape project, oct 2002, p 57; ETSC Police enforcement strategies to reduce traffic casualties in Europe, ETSC, May 1999, P 20; Deben L., *Naar een optimaal verkeershandhavingsbeleid Vlaanderen: een rechtseconomische analyse van lessen uit de veiligste landen*, rapport, Vlaams Steunpunt Verkeersveiligheid bij Stijgende Mobiliteit, Diepenbeek, 2003

[31] The calculation of the chances to get a test or to get fined is calculated on the base of the total population of a country, whereas the percentges of the tested drivers and drivers look to the number of drivers in a country.

Proceeding on the figures, the statement is made the best performing countries succeed, as they intend to, in organising their maintenance policy in an effective way. Once measures are implemented, a high level of enforcement is applied to achieve the maximum effect. The costs for law-abiding behaviour are lower than the cost for individuals to evade legislation. For this reason, the implemented measures work in the best performing countries. Their citizens are obliged to comply with the imposed legislation. As previously stated, these countries have a law-abiding population. Consequently, they can use a lower amount of enforcement than countries with non-compliant citizens. Therefore, even for countries with a law-abiding population, a high level of maintenance is indispensable to achieve results.

Badly performing countries, such as Belgium, also strive for this level of enforcement, but are not yet successful in doing so. A further increase of the amount of enforcement measures is necessary to compel their citizens to obey the selected traffic improvement measures. Moreover, confronted with a non-compliant population, the Belgian government should be well aware of the additional amount of enforcement necessary to make sure the population has no chance to evade the legislation. Consequently, the Belgian government should increase the level of enforcement up to an even higher level than other countries in order to attain the same results. Up to this moment, Belgium has not been able to induce the necessary maintenance measures, although efforts in that direction have been taken. If the reasoning of this paper is correct, the increase of the amount of maintenance will have an effect on the number of traffic deaths over time. This should lead to better traffic safety on Belgian roads and to a reduction of traffic casualties.

4. Conclusion

Because of the empirical findings, the conclusion may be drawn that the investigated countries all make use of the same measures in order to improve their traffic safety. However, as the last paragraph indicates, they differ in the applied amount of maintenance and their population's attitude towards legislation.

The best performing countries have a lead concerning the level of maintenance. Their strategy is to accept high costs to save additional human lives. They are prepared to exercise more maintenance than is necessary from an efficiency view in order to do this. In this manner, the externalities are internalised through the imposition of a high cost for non-compliance with the imposed laws. It depends on the individuals' calculus how much enforcement has to be exercised. Therefore, governments also have to consider their citizens' attitude towards legislation. When a negative attitude is observed, the government already

knows individuals will try to break the rules. Therefore, the imposed cost has to be higher to achieve the same results as with law-abiding citizens. In that case, the maintenance level has to be drastically increased for policy to be effective.

Belgium is the example of a country with an ineffective traffic policy. Research a low level of maintenance combined with a negative attitude towards traffic laws shows in Belgium. The Belgian government must therefore know that a large increase of maintenance is needed, if it ever wants to achieve the set goals. Even more than the best performing countries, it has to invest in enforcement measures. This is the only solution to force individuals to comply with the laws and to give the measures a chance to be effective.

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