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### **Executive summary of the alcolock field trial**

## **ALCOLOCK IMPLEMENTATION IN THE EUROPEAN UNION**

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# Alcolock implementation in Europe: A qualitative field trial<sup>1</sup>

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In order to study the feasibility of alcolock implementation in a European context, a qualitative field trial was conducted simultaneously in four European countries. The objective of this trial was to assess the practical, psychological, social and behavioural impact of alcolocks by interviewing the drivers about their experiences. Five groups of drivers drove with an alcolock for one year: Norwegian and Spanish bus drivers, German truck drivers and Belgian drink-driving offenders and alcohol dependent patients. Before, during and after the one-year trial-period, the drivers and their social surrounding were interviewed. From these interviews, and from the data recorded by the alcolocks, it appeared that alcolocks are relatively practicable in both commercial and non-commercial contexts. Using the device did not interfere significantly with the drivers' tasks and was generally evaluated as easy. The general acceptance of the alcolocks was good and remained high throughout the entire twelve-month period. In the commercial trials relatively few positive breath tests were recorded, whereas half of the offenders in the non-commercial trial recorded ten or more failed breath tests. The fact that almost no failed breath tests occurred while driving in the offender subgroup, illustrates a clear behavioural impact of the alcolock. From the interviews with the commercial drivers, it appeared that the truck drivers' clients reacted rather indifferently, whereas bus passengers had a positive attitude towards the devices. This confirmed the hypothesis that alcolocks may be marketed as an element of quality improvement. All together, the results showed that it is feasible to implement alcolocks in different commercial and non-commercial contexts, on the condition that the introduction of the devices, the inclusion process and the monitoring procedures are carefully prepared.

**Keywords:** Drink-driving; Interlock program; Alcohol ignition interlock; Alcolock

## 1. INTRODUCTION

Alcolocks have been used as a measure for drink-driving in the U.S. and Canada since more than two decades now (cf. Bax et al, 2001 or Beirness & Marques, 2004 for reviews). At present seven Canadian jurisdictions and 43 American states have legislation that allows the installation of interlock devices in the vehicles of DWI offenders. It is estimated that there are currently about 70,000 interlocks in use throughout North America (Beirness & Marques, 2004). These figures are in sharp contrast with the dawn of alcolock applications in Europe. Except for Sweden, where some 7,000 commercial vehicles are currently driving with alcolocks and where 1,500 drivers are or have been involved in an alcolock program for

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convicted drink-drivers (e.g. Bjerre, 2005), alcolocks had rarely been applied in Europe by the time the present project started. Therefore, the European Commission co-financed a European field trial in order to empirically test the feasibility of introducing alcolocks in European countries. By now, several pilot projects are also being prepared or conducted in European countries other than the countries participating in the present research (e.g. France, Holland, Great-Britain, Finland, etc., cf. Vanlaar & Mathijssen, 2005).

The European applications of alcolocks are still in a preliminary stage. Logically, the first step towards larger scale alcolock implementation in Europe consists of small-scale real life tests of alcolocks in different European countries in order to allow a first evaluation of the practicability and feasibility of alcolocks in a European context. In order to set this first step, we performed a qualitative analysis of the experiences of the drivers that used the alcolocks and of the reactions of their social surroundings to the alcolocks. Our analysis focussed on the impact of alcolocks on psychological, social, behavioural and practical dimensions. To assess the practical impact of the alcolock, we studied how the drivers experienced the daily use of the devices in their normal professional or non-professional environment. To assess the psychological impact of the alcolock, we studied the drivers' ideas, expectations and attitudes towards the alcolocks. To assess the social impact of the alcolocks we analysed the reactions of the drivers' social environment (e.g. persons living together with the drivers, clients of professional drivers etc.). The analysis of the behavioural impact of the alcolock focussed on the effect of the alcolock on the drivers' drinking and driving behaviour and attitudes.

The aim of our research project was merely to study the experiences of the drivers and their social environment, not to measure the effects of the alcolocks in terms of long-term behavioural changes or accident reduction, nor to evaluate the necessity of installing alcolocks. An estimation of the preventive effect of the alcolock on the occurrence of drink-driving can only be made by large scale quantitative studies that compare the incidence of drink-driving in alcolock-using experimental groups with the incidence of drink-driving in non-alcolock control groups. Our small-scale qualitative field trials are a preparatory step towards such large-scale research. Moreover, our field trial makes abstraction of the question whether it should be recommended or not to apply alcolocks in particular contexts. Such recommendations should be based on a cost-benefit analysis of all the effects of applying alcolocks, and hence goes way beyond the scope of our research. The perspective of our research was primarily to study how alcolocks can be implemented in practice once the decision is made to install them.

The purpose of the present pilot trial was not only to empirically test the feasibility of introducing alcolocks in European countries, but also to test whether the alcolocks could also be applied for other reasons than preventing convicted drink-drivers from recidivating. Inspired by the Swedish example, the consortium decided to also test the alcolock as a general preventive measure in commercial transport of goods and persons. There is no evidence that professional drivers (like truck, taxi or bus drivers) would be more likely to drive after drinking than other drivers. The reason why we focussed on the alcolock as a general preventive measure in commercial transport is that the consequences of accidents in commercial transport can be more severe than the consequences of accidents with non-commercial, private drivers. Reasons for this may for instance be that a lot more passengers could be involved in accidents with buses than in accidents with private cars, or that the impact of a heavy lorry can be more severe than the impact of an ordinary car. In our commercial trials, the role of the alcolocks was conceived as a primary prevention measure that contributes to traffic safety in general. In this sense, it can be seen as a means to increase the safety and the quality standards of the companies using the alcolocks.

Together with the field trials, a literature review was conducted aimed at identifying the most important factors influencing the implementation of alcolock programmes, participation

rates, and compliance with the programme conditions and - after the ending of the programme and removal of the alcolock - with drink-driving laws. The results of the literature review are complementary to the results of the field trial.

## **2. GENERAL METHODOLOGY OF THE FIELD TRIAL**

### **2.1 Design**

For a period of one year, alcolocks were installed in the vehicles of five groups of drivers in four different European countries. The target groups were Spanish and Norwegian public transport drivers, German goods transport drivers, Belgian convicted drink-drivers and Belgian alcohol dependent patients. All groups consisted of about thirty drivers, except for the Belgian alcohol dependent group, for which only seven participants could be selected. Before, during and after this period the participants' driving, drinking and drink-driving experiences were investigated by means of questionnaire-based interviews. A sample of related subjects of the target groups (passengers, company owners or family and friends, depending on the particular target group) was also interviewed. Together with the data logged by the alcolock devices, this allowed an in-depth analysis of the drivers' experiences with the alcolocks.

Since the main objective of the project was to assess the subjective experiences of the drivers that used the alcolocks, control groups were not necessary for our qualitative design. Although not essential to our main aim, a control group could nevertheless allow some control for the influence of the mere passage of time and possible external influences on the opinions of the drivers. Therefore, two of the national trials (both bus drivers trials) also included a small control group, that was also interviewed at the same time the target group drivers were interviewed. Given that the control group only fulfilled a secondary role in the project, a relatively lenient procedure for defining the control groups was judged sufficient (cf. *infra*).

### **2.2 Data collection**

In the course of the trial three different types of data were collected in all national field trials: (1) behavioural measurements registered by the alcolock's data logger, (2) the drivers' and related subjects' answers to standardised questionnaires and (3) the feedback provided by the collaborating partners and stakeholders in each of the national trials (e.g. company management, referring psychiatrists, etc.).

#### **2.2.1 Alcolock data**

The analysis of the behavioural impact of the alcolock was not only based on the answers to the questionnaires, but also on the results of the breath-tests that were recorded by the alcolock. The possibilities and limitations of the behavioural data depended on the specific types of devices that were used in each trial, as well as on the different parameter settings of each trial.

### 2.2.2 Interviews

The questionnaires translated the specific objectives of the project into standardised questions. Therefore, the questionnaires included questions measuring the psychological impact of the alcolock (e.g. ideas, attitudes, expectations, emotions, etc.), questions measuring the perceived behavioural impact on drinking and driving, questions probing the social impact (e.g. the reactions of the driver's acquaintances, the effect of using the alcolock on the drivers' social relations) and finally questions regarding the practical impact of the alcolock (e.g. alcolock-training, managing re-tests, technical qualities and defaults of the devices, etc.). The questions concerning the subjective impact of the alcolock were based upon relevant findings that can be found throughout the alcolock literature. Besides demographic parameters, reports on other mediating variables in the efficiency-research on alcolocks are rather scarce. Nevertheless, the existing reports formed a crucial lead for the selection of items. A few examples illustrate this. Marques, Voas, Tippetts & Beirness (1999) reported that alcolock drivers often presume that positive tests are caused by a malfunctioning of the device. We therefore questioned the participant's ideas on the reliability of the device. Likewise, reports on the fact that certain drivers indicate to find the re-testing procedure inconvenient and/or embarrassing (Marques et al., 1999) prompted for explicit questions on this topic. Besides this strategy, we also based the questionnaires on an analysis of the task of the driver and on the factors that are judged important in the literature on drink-driving recidivism (cf. Vingilis, 2000). We relied on previous research on alcolocks and on qualitative research on drink-driving (e.g. Freeman & Liossis, 2002; Fetherston, Lenton and Cercarelli, 2002) for the development of the questionnaires. Nevertheless, the majority of the questions measuring the subjective impact of the alcolock are questions that could not be derived from former research. The questionnaires also contained questions regarding drivers' attitudes towards traffic safety. These questions were derived from large scale attitude surveys (e.g. Cauzard, 2004). Questions regarding alcohol use were also taken from the AUDIT (Alcohol Use Disorders Identification Test, cf. Saunders, Aasland, Babor, de la Flunte & Grant, 1993). In all trials a standardised scale for measuring the acceptance of advanced transport telematics (Van der Laan et al., 1997).

### 2.2.3 Feedback from collaborating partners and stakeholders

We kept track of all the different partners and stakeholders' comments and demands throughout the entire project (e.g. goods transport company management, the attorney general's office, political obstacles encountered while implementing the project etc.). At regular intervals evaluation meetings were organised with company owners and management staff, judges, justice assistants, psychiatrists etc. As all these parties have key roles in the possible future implementations of alcolocks, their voices were considered as equally important as the drivers' experiences.

### 3. DESCRIPTION OF THE NATIONAL TRIALS

#### 3.1 The commercial trials

##### 3.1.1 Norway

The number of road accidents involving drunk bus drivers in Norway is not known, and neither is the number of people killed or injured as a consequence of such accidents. Nevertheless, an internet search showed that such accidents do occur. Moreover, bus accidents may involve large numbers of victims, and the potential for severe accidents is high. When incidents with drunk bus drivers are reported in the media, the drivers' company will get bad publicity. Consequently, alcolocks in public buses may be regarded as a measure to prevent road accidents due to drunk driving and to maintain the bus company image.

##### 3.1.1.1 Method

###### 3.1.1.1.1 Subjects and company

The Norwegian trial was carried out in Lillehammer, a town of some 25000 inhabitants in south-eastern Norway. All 14 buses carrying out in-town transport had alcolocks installed. All 30 drivers driving these buses were included in the project, thus excluding self-selection of specially interested or motivated drivers. The number of drivers varied a little throughout the period as some drivers quit their jobs, and some new drivers were recruited. In cases of sick leave and vacation, the drivers participating in the trial were replaced by drivers who normally would drive the regional buses in Lillehammer, which were not included in the project. 28 drivers were pre-interviewed and 24 drivers were post-interviewed. Twenty drivers participated in both interviews. All drivers in the trial group were men. The youngest driver was 24 years and the oldest was 56.

Originally, the drivers expressed concerns about suspicions of drink and driving and about possible delays caused by technical problems or false alarms. The TØI researchers therefore organised a field trip to a bus company in Falun, Sweden, that used alcolocks for a couple of years already without major technical problems. After attending this field trip, the company agreed to install the alcolocks.

In addition to the bus drivers, bus passengers in Lillehammer were interviewed about their knowledge and attitudes towards alcolocks. Moreover, the attitudes and opinions of the bus company management were observed and noted at all phases of the project. These interviews allowed an assessment of the usability and practicability of the alcolocks from the management's point of view.

A control group of drivers who did not use alcolocks in their daily work was also included in the Norwegian trial, namely the drivers in the same company in Moss, a town some 250 km south of Lillehammer. The control group consisted of about 30 drivers, although some drivers quit and new drivers were recruited during the project period. In the control group 14 drivers were pre-interviewed and 13 were post-interviewed.

###### 3.1.1.1.2 Materials

15 Dräger Interlock® XT Breath Alcohol Controlled Vehicle Immobilizers were installed in 14 buses. All buses were used by all 30 drivers. The drivers could not be

identified in the alcolock data, but by checking the work plans the manager could identify drivers with positive breath tests. The threshold value of the alcolocks was set to the Norwegian legal limit of 0.2 g/l BAC. The lockout period for the motor starter was set to one minute. The display only showed whether the test was passed and not the actual BAC level. The restart period in which the engine of the bus could be started again without having to make a new breath test was initially set to 45 minutes. After 6 months this period was reduced to 20 minutes. In the first period of the project all buses were equipped with an override switch. This additional feature was demanded by the company to avoid delays or cancellations caused by possible technical problems of the alcolock. The override switch was sealed, so that the use of the switch could be detected afterwards. Moreover, the alcolocks were programmed to display “in need of service” if the bus had been driven without a passed alcolock test. After about five months with no need to use the override switches, they were removed from the buses. Because the company judged that performing retests during driving would be difficult and embarrassing for a driver with a bus full of passengers, no running retests were required.

According to the contract between the bus company and the drivers’ unions, the local manager had access to the data in case of positive alcohol tests. The procedures and sanctions to be applied in case of test results above 0.2 g/l were identical to the sanctions the bus company has applied against attempts of drinking and driving for a number of years.

#### 3.1.1.1.3 Procedure

The alcolocks were installed stepwise over a period of three weeks in November and December 2004. Prior to the installation, the drivers followed an individual training and were interviewed a first time. At midterm, the individual face-to-face interviews were replaced by a group discussion. 15 of the 30 drivers participated in this discussion. In December 2005 the alcolocks were removed and the drivers were individually interviewed one last time. The alcolock data were downloaded monthly. During the trial the alcolock data were monitored by the company management. The use of the sealed override had to be reported and explained to the manager.

### 3.1.1.2 Results and discussion

#### 3.1.1.2.1 Interviews and evaluation meetings with bus drivers

##### Technical and practical aspects

The technical and practical aspects include the technical functioning, the reliability and the usability of the alcolock. Before the start of the trial, 93% of the target group drivers expected that the alcolock could “definitely” or “possibly” be used easily. After the trial also 93% found that the alcolock had been easy to use. Before the trial 75% of the trial group and 42% of the control group expected that the alcolocks might cause technical problems. After the trial this percentage was reduced to 33% in the trial group and to 38% in the control group. The higher expectations of technical problems in the trial group may indicate more concern for possible problems among the drivers who were actually going to use the devices. The larger reduction in the target group indicates that experience with alcolocks reduces the fear of technical dysfunctions. The technical problems the drivers did experience were long warming up time for the alcolocks during cold periods, poor heating of the buses during the



cold season because the bus engines could not be started in advance, and some false alarms due to mouth alcohol, after shave or cleaner containing alcohol.

Table 1 shows the perceived reliability of the alcolock measurements and appropriateness of the applied threshold of 0.2 g/l in the alcolock.

Table 1: Reliability of alcolock breath tests and appropriateness of the BAC-threshold. Percent

The alcolock measurement is reliable.		Trial group (%)	Control group (%)
Pre	“Yes, definitely” /	75	64
Post	“Yes, possibly”	85	77
A test is positive although no alcohol was consumed before.		Trial group	Control group
Pre	“Yes, definitely” / “Yes, possibly”	36	39
Post	“Yes, one or more times”	19	23

Before the test phase 74% of the target group and 64% of the control group were confident that the alcolock measurements are reliable. During the trial this confidence increased somewhat. Before the trial 36% of the target group and 39% of the control group feared that it might occur that a test would appear positive even when they did not drink any alcohol before. Nineteen percent of the target group actually experienced this one or more times. The results regarding the daily usability of the alcolock are summarised in Table 2.

Table 2: Aspects of everyday usability. Percent

The use of the alcolock is time consuming.		Trial group	Control group
Pre	“Yes, definitely” / “Yes, possibly”	63	21
Post	“Yes, definitely” / “Yes, possibly”	54	8
Problematic to handle the alcolock in addition to other devices and duties.		Trial group	Control group
Pre	“Yes, definitely” / “Yes, possibly”	18	7
Post	“Very problematic” / “Problematic”	4	8
The alcolock hinders in the daily work.		Trial group	Control group
Pre	“Yes, definitely” / “Yes, possibly”	14	0
Post	“Very much” / “Much”	8	23

Sixty-three percent of the target group, but only 21% of the control group thought the alcolock would be time consuming. In both groups these percentages decreased during the trial. After the trial, half the target group still found using the alcolock time consuming, whereas this percentage decreased to 8% in the control group. All together, almost nobody found it problematic to handle the alcolock in addition to other duties. Although some target group drivers expected the alcolock to hinder their daily work before the trial, almost nobody actually experienced hinder during the trial. In the control group, however, this percentage increased from 0% to 23%.

When asked how easy it is to circumvent the alcolock before the start of the trial, 39% of the target group and 38% of the control group answered that it is easy to circumvent the alcolock even without using the override switch. After the trial, this percentage decreased to 15% in the target group, but remained at the same level (39%) in the control group. Nineteen of the 24 (79%) target group drivers said they never used the override switch, and three said they had used it rarely. One driver claimed the alcolock did not work, and another driver said he failed the test although he had not been drinking. One driver did not state a reason, and two drivers did not answer this question. The override seal was broken only once.

### Acceptance

After the trial, 17 target group drivers said they were “very satisfied” and two were “satisfied” with the alcolock. Three were “neither satisfied nor dissatisfied”, and one was

“very dissatisfied”. 87% of the target group said it was OK if the company would buy the alcolocks, 9% were in doubt, and only 4% did think it was not OK. The usability and satisfaction subscale scores of the standardised acceptance scale are depicted in Table 3. The range of both subscales was from +2 (highest usability or satisfaction) to -2 (lowest usability or satisfaction).

Table 3: Results of the user acceptance scale. Mean scores.

Usability scale (mean scores)	Trial group	Control group
Pre	1.04	1.49
Post	1.37	1.11
Satisfaction scale (mean scores)	Trial group	Control group
Pre	0.57	1.11
Post	0.93	0.44

According to both subscales, the acceptance increased in the target group and decreased in the control group. Many drivers reacted to the questions included in these scales as not making sense, which discredits the validity of this standardised scale somehow.

Table 4 summarises the acceptance of the alcolocks with respect to traffic safety.

Table 4: Acceptance with respect to traffic safety (percent).

Alcolocks for bus drivers contribute to road safety	Trial group	Control group	
Pre	“Yes, definitely” / “Yes, possibly”	79	86
Post		79	85
All buses in Norway should have an alcolock	Trial group	Control group	
Pre	“Yes, definitely” / “Yes, possibly”	68	79
Post		94	85
Alcolocks are unnecessary because bus drivers do not drink and drive anyway	Trial group	Control group	
Pre	“No, not at all” / “No, perhaps not”	67	86
Post		77	69

In both the target and the control group, and before as well as after the trial a comparably high percentage of about 80% stated that alcolocks in buses contribute to road safety. Although only 68% of the target group agreed with the statement that all buses in Norway should have alcolocks before the start of the trial, this increased up to 94% agreement after participation in the trial. More than two-thirds of the drivers in both groups initially rejected the idea that alcolocks are unnecessary in buses, because bus drivers do not drink and drive anyway. This percentage increased for the trial drivers and decreased for the control group drivers.

The evaluation of the job-related aspects of driving with an alcolock is summarised in Table 5.

Table 5: Job-related aspects of acceptance

Alcolocks are good for the company’s image	Trial group	Control group	
Pre	“Yes, definitely” /	86	100
Post	“Yes, possibly”	92	77
Alcolocks are good for the image of bus drivers	Trial group	Control group	
Pre	“Yes, definitely” /	75	86
Post	“Yes, possibly”	63	62
Alcolocks improve the quality standard of the company	Trial group	Control group	
Pre	“Yes, definitely” / “Yes, possibly”	71	43
Post		63	54
The passengers suspect that the drivers have an alcohol problem when buses are alcolock-equipped	Trial group	Control group	
Pre	“Yes, definitely” /	57	7
Post	“Yes, possibly”	33	46

After the trial, there was almost unanimous agreement that alcolocks are good for the companies in the target group (92%). This percentage was somewhat lower in the control group. After the trial, the opinions about the impact of the alcolocks on the drivers' image were somewhat divided. Both in the target and in the control group about 60% agreed. A comparable percentage stated that alcolocks improve the quality standard of the company. Before the trial, 57% of the target group but only 7% of the control group thought that the passengers would suspect them of having an alcohol problem. After the trial, this percentage decreased to 33% in the target group and increased to 46% in the control group, which indicates that this suspicion is considerably reduced by actually using the alcolock.

### Drinking and driving habits and attitudes

The standardised questionnaires also contained several answers regarding drinking habits. There was a quasi-unanimity for all questions in all groups, indicating the drivers were a priori already convinced that drink-driving is an important road safety issue and agreed with the strict Norwegian legislation. Due to this ceiling effect, no effects of the alcolocks on these attitudes was observed.

#### 3.1.1.2.2 Alcolock data

Alcolock data were registered from the start of the trial in November 2004 through January 2006, even though the trial period ended in November 2005. The reason for a longer data period than trial period was that the bus company kept the alcolocks in the buses after the trial period as long as they were negotiating with the drivers' unions about maintaining the alcolocks in the buses. The alcolock data are summarised in Table 6.

**Table 6: Number of alcolock tests registered in Lillehammer buses**

Number of initial tests	12 792
Number of breath sample errors	1 613
Number of accepted tests	11 179
Number of lockouts (positive tests)	5
Number of accepted retests after one minute	4
Number of cases where a bus has been driven after positive test	1

In total, only five positive tests out of a total of 11179 technically accepted tests were observed. Four of these were followed by passed retests one minute later and had a reasonable explanation other than actual driving with BAC above 0.2 g/l. In one case the bus was driven with a broken override seal without a certain explanation. The driver said that he found the bus with the seal of the override switch broken, and the alcolock did not work. The data, however, showed that a test result of 0.43 g/l in the morning and several subsequent attempts to test in the course of the day. As it was impossible to prove what actually happened, the case was dismissed and not accepted as a positive test. All together, these alcolock data confirmed the target drivers' unanimous respect for the legal limits.

#### 3.1.1.2.3 Opinions of the company management and the drivers unions

Initially, the managers had three concerns: (1) acceptance from the drivers, (2) delays or cancellations caused by technical problems with the alcolocks, and (3) suspicion of drinking and driving among the drivers. After an alcolock demonstration in Sweden, both the union representatives and the managers were convinced that alcolocks were acceptable for a

trial period. As neither of these problems occurred, the company wanted to keep the alcolocks after the end of the trial. The drivers, however, would only accept to continue using the alcolocks if the company's regional buses (and not only the local buses) also had alcolocks installed. Moreover, the managers considered a regular use of alcolocks only as a realistic possibility if this were legally required as the cost of the alcolocks would signify a competitive disadvantage.

#### 3.1.1.2.4 Interviews with passengers

Two passenger surveys were carried out, one in the beginning of the trial period and one after the trial period. 120 bus passengers were interviewed in March 2005, three months after the start of the trial. 112 passengers were interviewed in December 2005, right after the trial period was over. The passenger interviews focussed on knowledge about alcolocks, attitudes and acceptance of alcolocks. The interviews were carried out from early morning until late evening, on different bus lines, and included men and women of all age groups except children. Women and students were overrepresented in the subject sample, which corresponds with the population of bus users in Lillehammer. Table 7 shows that a majority of the passengers knew about the alcolocks, and were satisfied with the dissemination of information about alcolocks.

Table 7: Passengers' knowledge of alcolocks (percent).

The buses in Lillehammer have recently/last year had a new safety equipment. Do you know what it is?	Alcolocks	Other measures	Don't know	N
March	72	1	27	120
December	63	10	27	112
All buses in Lillehammer have a poster about alcolocks. Did you notice this poster?	Yes	Not sure	No	
March	71	3	26	120
December	75	4	21	112
Do you think there has been enough information about the alcolocks to the people of Lillehammer?	Yes	No	Don't know	
March	60	31	9	120
December	81	14	5	112

The results to other questions showed that before as well as after the trial, more than 90% of the interviewed passengers agreed that alcolocks in buses are a good idea, that alcolocks are good for the company image and that alcolocks contribute to road safety. At both times only about 10% agreed that alcolocks made them suspect that the drivers may have drunk, about 80% indicated they would accept delays due to drivers testing positively. Delays due to technical problems with the devices were only acceptable for about 65% of the interviewees. Finally, only about 30% would be prepared to pay more for travelling by buses equipped with alcolocks. For none of these questions any noteworthy differences were found between the pre and post trial results.

In general the passenger surveys show that the passengers were very positive towards the alcolocks and would even accept delays caused by the alcolocks. The alcolocks made only few passengers suspicious of drink-driving.

#### 3.1.1.3 Conclusions and recommendations

The Norwegian trial showed that the alcolocks worked satisfactorily and were free of technical problems that would call for the installation of an override switch. The drivers accepted the alcolocks quite well, and so did the management and the passengers. The

drivers' initial fear of drinking-and-driving suspicion was a big issue for the drivers in the beginning, but was not confirmed by the passenger interviews. At the end of the trial the percentage of drivers worrying about this issue was reduced. Not a single case of a proven positive test was found during the trial period, indicating a high respect for the legal limit among the drivers. This may also be partly due to the individual monitoring of drink-driving attempts. The Norwegian experiences illustrate at the same time that the monitoring procedure calls for a legal framework. Due to the costs of alcolocks, private transport companies cannot be expected to install alcolocks in buses or other vehicles on their own initiative. The motivation for the use of alcolocks must either be general legislation or requirements in the tendering for public transport.

From the Norwegian pilot trial several suggestions and recommendations regarding future alcolock implementations may be made. Alcolocks used in public transport should have a high technical quality to avoid delays. To prevent problems due to technical malfunctions, a test or pilot phase before complete implementation is recommended. During this pilot phase, alcolocks with override switches are recommended to be installed in some of the vehicles. Further implementation will depend upon knowledge of the accident reducing effects and other possible positive effects of alcolocks in public transport. More research should be carried out to estimate the accident reducing effects of alcolocks in public transport and the cost-benefit ratio. A legal framework concerning rules for drivers driving vehicles with alcolocks should be developed. It is recommended to include the drivers from the very beginning of the implementation to ensure drivers' acceptance and to avoid practical problems. Failed tests should be easily to monitor without downloading and reading a lot of data. A message should be sent automatically to the operations manager that a positive test has occurred should be considered by the producers. The long warm-up time required in cold weather was one of the most annoying issues for the drivers. The manufacturers should try to reduce the time for warming up. In the Norwegian trial the attachment of the handsets to the dashboard of the buses was a problem, as well as the storage of the mouthpieces between tests.

### 3.1.2 Spain

A second pilot trial with bus drivers was conducted in the city of Valladolid, Spain. There are no specific data concerning driving under the influence of alcohol among professional drivers in Spain, but data concerning studies of the general population show that driving under the influence of alcohol in professional drivers is less frequent than among vehicle drivers in general. The installation of alcolocks in buses is primarily motivated by the aim to make public transport safer and be perceived as safer by the costumers. Like for the Norwegian drivers, it should be underlined that the installation of alcolocks in buses does not imply that drink-driving would be a common problem among bus drivers. The alcolocks were seen as a measure to improve the quality of the service and the safety standards. There was no practical knowledge about the use of alcolocks for various groups of road users in Spain before the start of the project, and neither is there specific legislation in Spain to apply alcolocks to drink-driving offenders.

### **3.1.2.1 Method**

#### **3.1.2.1.1 Subjects and company**

The core design of the Spanish trial was analogous to the design of the Norwegian trial, including both a target and a control group, and interviews with these groups of drivers as well as with the passengers and the company management. The alcolocks were installed in 15 buses covering local as well as regional connections. A target group of 30 drivers volunteered to use the buses in which the alcolocks had been installed. The control group consisted of 30 bus drivers of the same company that were not using the alcolocks. As the bus company where the study was carried out had over 100 bus drivers, after some time most of the control group drivers also had some degree of experience with the alcolocks. 1031 bus passengers of the buses on which alcolocks were installed were surveyed in November 2005. In order to assess the usability and practicability of the alcolocks from the management's point of view, several employees of the bus company with different responsibilities were also interviewed in the course of the project.

#### **3.1.2.1.2 Materials**

15 ACS WR3/V3 devices were used. The fail level was set at the Spanish legal limit of 0.3 g/l. The parameters were set in analogy with the Norwegian trial, with a restart period of 30 minutes, no running retests and a one-minute lockout period. Contrary to the Norwegian trial the override switches were not sealed and remained on the buses throughout the entire twelve-month trial. Also contrary to the Norwegian trial, the alcolock data were only accessible to the University of Valladolid and were only used for research purposes, which meant that positive breath tests or using the override switch had no consequences for the drivers.

For interviewing the drivers, standardised questionnaires analogue to the Norwegian questionnaires were used. The questionnaires were sent to the drivers and later mailed to the University for analysis. The pre-interview focused on the expectations about alcolocks and on the personal background of the drivers (including attitudes and behaviour regarding drinking and drink-driving). The mid-term and post-interview surveys focused on the actual experiences with the alcolock and the drivers' acceptance after six and twelve months of testing. The pre- and post interviews with the control group were similar to those of the experimental group. The passenger questionnaires were completely analogue to the Norwegian questionnaires.

30000 leaflets explaining the alcolock project and also containing recommendations to avoid drink-driving were distributed amongst the passengers from buses with alcolocks throughout the entire trial. 2000 copies of a booklet containing more details on drinking and driving were distributed at the end of the trial.

#### **3.1.2.1.3 Procedure**

The design of the Spanish trial is summarised in Table 8.

Table 8: Design of the Spanish trial

			Month												
			1	2	3	4	5	6	7	8	9	10	11	12	
<b>Alcolock devices</b>	Reading of data			x						x					x
	Ad-hoc interviews	interviews	x	x	x	x	x	x	x	x	x	x	x	x	x
<b>Bus drivers</b>	Experimental group (n=30)	survey	x						x						x
	Control group (n=30)	survey	x												x
<b>Bus passengers</b>	In-depth interview (n=50)	interview	x	x	x	x	x	x	x	x	x	x	x	x	x
	Cross-sectional (n=1031)	survey												x	
	University students (n=300)	survey													x
	Leaflets (n=30000)		x	x	x	x	x	x	x	x	x	x	x	x	x
	Booklets (n=2000)													x	x
<b>Key informants</b>	Company members	interview	x	x	x	x	x	x	x	x	x	x	x	x	x
	Unions	interview	x						x						x
	Experts in road safety	interview	x						x			x			x

The alcolock devices were gradually installed from November to December 2004. Prior to the installation the drivers were trained to use the devices. The data were downloaded according to the scheme presented in Table 8.

### 3.1.2.2 Results and discussion

#### 3.1.2.2.1 Interviews with bus drivers

The thirty target group drivers were all male, whereas the control group also contained three women. The demographic characteristics of both groups were comparable. The target group had slightly more professional experience (mean of 18 years) than the control group (mean of 10 years). About 10% had been implied in an accident with casualties as a professional driver. Sixty percent of the target group and 43% of the control group had been controlled by the police for driving under the influence as a professional driver.

#### Technical and practical aspects

At all three stages, 90% of the target group drivers said they felt able to use the alcolock easily after the training. Before the start of the trial, 37% of the target group was afraid the alcolock would cause technical problems. After having used the alcolock for 6 months, this percentage decreased to 6% and remained at the same level after 12 months. In the control group this percentage remained at 30% before as well as after the trial. Table 9 displays the answers to the questions regarding the experience of technical problems or inconveniences by the drivers.

Table 9: Technical problems of the alcolock

Technical problems of alcolock	Mid-term	Post alcolock
	Number of drivers reporting the problem	
Long warming-up time	11	13
Failure notice during/after a breath test	3	2
Bus could not be started despite successful test	2	2
Problems with handling/usage of the alcolock	4	1
Other : connection interrupted	1	0

Long warming-up time was mentioned most frequently. The other inconveniences are listed below. It should be noted that more than one reason could be given. Moreover, these self-declared problems should be interpreted cautiously, as no further information regarding

the exact magnitude and nature of the events were available. The garage had no record that any bus with the alcolock installed was unable to make its daily trip. Over a twelve-month period there was only one incident of the device failing to operate correctly. From these data it can be concluded that the all the alcolock proved to be very reliable.

Before the trial, 30% of the target group and 37% of the control group agreed that it is easy to circumvent the alcolock. After the trial, this percentage dropped to 17% in the control group but increased in the control group to 47%. This can be explained by the fact that the target group drivers knew that whenever the override switch would be used, this event would be recorded by the alcolock, and hence that it was impossible to cheat the device. When asked for the reasons why they used the override switch, only six drivers cited a particular reason at both the six-month and the twelve-month stage.

The perceived reliability of the measurement of the alcohol concentration by the alcolock remained at the same level in the control group (77% agreement before and 73% agreement after the trial), but decreased in the target group (from 83% agreement before to 60% at midterm and 70% after 12 months). This may be due to the fact that the test results of the alcolocks did not always confer with the expectations of the drivers that were using the devices. Although 13% of the target group expressed fear for false alarms before the trial, only 3% remained fearful after the end of the trial. The percentage of target group drivers that found the alcohol limit of the alcolocks too low increased from 10% before the trial to 23% after the trial, which indicates that some breath tests may have proven positive although the drivers themselves expected the test to pass. In the control group, on the contrary, there were no marked differences between pre- and post percentages (20% and 13% respectively).

Before the trial, only 3% of the target group thought that using the alcolock would be time consuming. This percentage increased up 60% and 53% after six and twelve months respectively. Only 7% of the target group found that it was problematic to handle the alcolock in addition to other services and duties, and only 3% thought the alcolock hindered their daily work (post-interviews).

### Acceptance

The mean usefulness and satisfaction scores for both groups are depicted in Table 10 below.

Table 10: Mean usefulness and satisfaction subscores of the acceptance scale

	Usability scale Cronbach's alpha	Satisfaction scale Cronbach's alpha	Usability scale Mean scores	Satisfaction scale Mean scores
<b>Experimental group</b>				
Pre-alcolock (n 30)	0.706	0.518	-0.680	-0.413
Post-alcolock (n 30)	0.782	0.751	-0.907	-0.536
<b>Control group</b>				
Pre-interview (n 30)	0.724	0.767	-0.814	-0.423
Post-interview (n 30)	0.849	0.771	-0.379	-0.036

Most of the drivers in both groups agreed that alcolocks contributed to traffic safety. There were no noticeable differences between groups or phases (target\_pre=67%, target\_post=70%, contro\_pre=83%, control\_post=60%). The majority of both target and control groups agreed that all buses in Spain should have alcolocks installed. After 12 months, 73% of the target group, but only 53% of the control groups agreed. After 12 months, only 20% of the target group, but 50% of the control group agreed that alcolocks are unnecessary because bus drivers do not drink and drive anyway. All together these results show that acceptance was high in both control and target groups, albeit slightly more pronounced in the target group.



About three quarters of the target group thought the alcolocks were good for the company's image both before (76%) and after (73%) the trial. In the control group this percentage decreased markedly from the pre- (97%) to the post-phase (47%). The positive effect of the alcolocks on the drivers' image decreased from 67% to 57% in the target group, and from 57% to 40% in the control group. The percentage of drivers thinking the alcolock improved the company's quality standards improved from 60% to 74% in the target group, but decreased from 77% to only 40% in the control group. Before the trial, one target group driver in two (50%) feared that passengers might suspect them to have alcohol problems because of the alcolocks. This decreased to 20% after the trial. In the control group also a decrease was observed, albeit less pronounced (from 47% before to 37% after the trial). Finally, none of the drivers in both groups, neither before nor after the trial, expressed that they intended to change their drinking habits because of the alcolocks. This is most likely due to their a priori positive attitudes towards drink-driving.

### 3.1.2.2.2 Alcolock data

The alcolock data are depicted in Table 11.

Table 11: Summary of alcolock data

Total number of initial tests		
13,884		
Initial Tests	Initial test lockouts	Initial test refusals
13,789	95	0
Initial test passed > 0 BAC (0.01-0.29 g/l)	Initial test failed 0.3-0.49 BAC	Initial tests high failed ≥ 0.5 BAC
11967	57	38

A total of 13884 valid tests were recorded. From these tests 95 proved above the threshold of the device, out of which 38 were above 0.5 g/l BAC. The override switch had been used 842 times, but according to the service centres the override switches were mainly used during maintenance by the service centre. An analysis of the failures to provide a valid test showed that 23% of the test attempts were invalid due to using an incorrect exhaling technique (e.g. inappropriate breath volume).

The software for analysing these data proved user friendly for research purposes (the data were not transferred to the company management). The clustering of positive events into episodes of several successive test attempts could only be performed manually. This analysis showed that a lot of the failed breath tests were clustered together. From ad hoc interviews with bus drivers, it could be derived that 92 out of the 95 failed tests were due to deliberate testing of the devices.

### 3.1.2.2.3 Evaluation of the alcolocks by the company management

Like in the Norwegian trial, the alcolocks were evaluated positively by the management, but too costly to keep them. The company's service system found no noticeable problems with the devices. From the trade union's point of view, the most crucial element was the procedures to monitor the data and the possible consequences of positive tests. These elements should be thoroughly discussed in the preparation of future alcolock implementations in Spain.

#### 3.1.2.2.4 Bus passengers

1031 bus passengers were interviewed about their opinions on alcolocks in buses and on their attitudes towards drink-driving. Sixty-eight percent of the sample were women, only 53% had a drivers license and 41% travelled by bus daily or almost daily. 99% of the sample agreed with the statements that drink-driving is a major cause of road accidents and that driving with a BAC above the legal limit represents a severe risk of causing an accident. 50% agreed that the legal limit for bus drivers should be lower. 53% thought the likelihood of being controlled for drink-driving is low and 49% found that the drink-driving rules were insufficiently enforced. These data show that bus passengers are aware of the risks of drink-driving.

Despite the fact that explanatory leaflets had been distributed amongst the passengers, 82% said to have had no information about the alcolocks, 16% had heard about the alcolock but did not receive sufficient information and only 2% found they had received sufficient information. The attitudes of the bus passengers towards the alcolocks were almost unanimously positive:

- 92% thought the installation of alcolocks in buses was a good idea
- 93% thought they were good for the company's image
- 90% thought the use of alcolocks in buses improved road safety
- 89% agreed that alcolocks improved the company's standard of quality
- 86% agreed that they improved the bus drivers' image
- 86% disagreed that alcolocks are unnecessary since bus drivers do not drink-drive anyway
- 52% disagreed that the alcolock was easy to circumvent, 22% agreed

91% disagreed with the statement that alcolocks are installed because the driver has drink-driving problems. This is a crucial result, and disconfirms the fear of the drivers and the company that alcolocks would be perceived negatively by the passengers.

#### 3.1.2.3 Conclusions and recommendations

Using the alcolock appeared easy and did not interfere with the drivers' tasks. Practical problems were very rare, and in the end the drivers were very confident that the device would not fail. Nevertheless, the alcolock was found time consuming and the warm-up time was evaluated as too long. But, in general, the alcolock was evaluated positively by the drivers and well accepted. The alcolock data revealed 95 failed breath tests. Ad hoc interviews revealed that these were due to deliberate attempts to test the devices. Within the present framework, possible failed tests had no consequences. Future alcolock implications with an individual monitoring of the test results should develop a legal framework for attempts to circumvent the system. The bus passengers as well as the company management were in favour of the alcolocks. The management did not decide to keep the devices because of the elevated costs of keeping the devices.

From an organisational point of view, the Spanish trial learned that more political support is needed at high levels before a nationwide alcolock program could be implemented. Before that, a cost-benefit analysis of the effect of the alcolock in buses should be performed. If it should be decided to implement alcolocks for bus drivers a legal framework regarding the test results recorded by the devices should be developed, including a study of data protection issues and of the accuracy of the breath alcohol volume measurements.

### 3.1.3 Germany

Like in the previously discussed countries, Germany has no legislation for alcolock programs. The objective of the German trial was to test the practicability of alcolocks as a primary preventive measure for truck drivers, following the same rationale as the other two commercial trials.

#### 3.1.3.1 Method

##### 3.1.3.1.1 Subjects and company

The German trial was conducted in two goods transport companies, a smaller one with only 19 drivers and a large company that employs several hundred of truck drivers. The smaller company included all their drivers. For the large company, 15 drivers volunteered to participate. The drivers are hence referred to as the compulsory and the voluntary group respectively.

Two persons of the management staff of each company were interviewed after the end of the twelve-months alcolock period in order to assess the usability and practicability of the alcolocks from the management's point of view.

##### 3.1.3.1.2 Materials

As some trucks were used by several drivers, 27 Dräger Interlock® XT devices in combination with 8 additional hand-sets were sufficient for all the 34 participating drivers. Each driver used an individual handset which allowed to define the origin of all the data. The threshold value was set at .3 g/l BAC. Although being below the legal limit of 0.5 g/l, a BAC of 0.3 g/l can lead to a criminal offence in case of an accident or suspicious driving behaviour. The lockout period was set at 5 minutes. The restart period was set at 20 minutes. All devices were equipped with an override switch. The drivers were instructed they could only use the override in case of malfunctions. In the company with obligatory participants the override was sealed, in the voluntary company it was not. No running re-tests were demanded. Only the research staff at BASt had access to the alcolock data. The drivers were informed about the confidentiality of data.

For the interview with the drivers before the start of the trial, after six months and at the end of the trial, standardised questionnaires analogous to the formerly described questionnaires were used. The pre-interview focussed on the expectations about alcolocks and on the background of the drivers, the midterm and final questionnaires focussed on the actual experiences of the drivers. In addition to these interviews, ad-hoc telephone interviews were conducted if drivers failed a test above 0.5 g/l.

##### 3.1.3.1.3 Procedure

The procedure was analogous to the other commercial trials. The devices were installed in September and October 2004. In parallel, the drivers took part in the alcolock training session. The face-to-face pre-interviews were carried out prior to the installation of the devices. The midterm questionnaires were mailed to the drivers in March 2006 and returned it by May at the latest. The alcolock data were downloaded every few months, and the devices were calibrated in April 2006. Ad-hoc interviews were carried out whenever a driver

performed a test above 0.5 g/l BAC. In September and October 2006 the face-to-face post-interviews with the drivers were conducted and the devices were removed from the trucks.

Some alcolock-equipped trucks were operated by several drivers. When all these drivers participated in the trial, which was mostly the case, each driver used an individual handset which allowed to identify the origin of the data in the record. In a few exceptional cases, an alcolock-equipped truck was used both by participating, alcolock-using drivers as well as by non-participating, non-alcolock-using drivers. In these cases, which only occurred in the voluntary company, the participants activated the override switch at the end of their shifts and the non-participating drivers drove the truck while using the override. This increased the number of untested engine runs in the voluntary company.

### 3.1.3.2 Results and discussion

#### 3.1.3.2.1 Interviews with bus drivers

The participants were male drivers with a mean of 18 years of professional experience. According to the self-reported data, less than half of all drivers (n=15) had not been penalised for traffic offences as a truck drivers in the past 5 years. Six drivers dropped out of the study at different points in time and for different reasons. In the compulsory company four drivers had to quit for external reasons. One driver quit immediately after the pre-interviews because he was too long abroad during the installation period, two drivers quit because they only drive very short distances and a fourth driver quit because he switched jobs. In the voluntary company two drivers deliberately chose to stop participating.

#### Technical and practical aspects

After the alcolock training but before the installation of the devices, 94% expected that the alcolock would definitely or possibly be easy to use. After the trial, all the drivers stated the alcolock was easy or very easy to use. Table 12 summarises the technical problems the drivers experienced.

Table 12: Technical problems

Technical problems	Midterm	Post
Long warming-up time	15/28 (54%)	10/28 (36%)
Failure notice during / after a breath test	11/29 (38%)	10/28 (36%)
Truck could not be started despite of successful test	4/29 (14%)	6/28 (21%)
Insufficiently secure attachment of the handset	4/29 (14%)	2/28 (7%)
Retest requests while driving, failed tests after eating menthol candy, defect handset connection, error messages displayed, continuous beeping of the device or other problems	4/29 (14%)	11/28 (39%)

The most often cited technical problem was that the warm-up time was evaluated as too long by the drivers. As the warm-up time decreased with increasing temperatures, the decreased in the last months may be due to the fact that the first months of the project were winter months. It is noteworthy that long warming-up time is not a technical malfunction of the device per se, but the required time for warming up is evaluated as being unpleasantly long by the drivers.

Before the trial, 74% of the drivers were confident that the alcohol volume measured by the devices was reliable. After the trial, 64% of the drivers said the alcolock measurements were reliable or very reliable. Although 47% of the drivers expected that it would happen that a test would appear positive although they did not consume alcohol, only 7% (two drivers) actually experienced this. Before the trial, only 9% found the threshold too low, this increased up to 32% after the trial, which may be due to the fact that some drivers actually

experienced the device blocked the engine. From the interviews, it appeared that the alcolock was relatively usable. Only 29% found the alcolock time consuming, only 14% found it problematic to handle the alcolock in addition to other services, and only 11% thought the alcolock hindered their daily work.

Before the trial, 62% expected it would be easy to circumvent the system (even without using the override). After the trial, still 39% continued to find it easy to circumvent the system. The reasons for using the override are depicted in Table 13.

Table 13: Reasons for using the override switch

Reason	No. of answers (Midterm)	No. of answers (Post)
Loading/unloading at a customer's site	5	3
Shunting actions	4	5
Technical problems	4	11
When another driver (non-participant) uses the truck	4	0
Heating / air condition use / Reloading the battery / electric current necessary	2	6
Too many tests	2	0
Physiological reasons (not enough breath, illness)	2	0
Forgot handset	2	1
No time	1	0
Eating a candy (menthol)	1	1
After drinking alcohol	0	4
Too long warming-up time	0	1
Eating an alcohol-containing praline	0	1

After using the alcolock for one year, 61% of the drivers said to be satisfied (or very satisfied) with the device, whereas 18% of the drivers said they were (very) dissatisfied. 61% were willing to continue driving with the alcolock after the trial, whereas 36% were unwilling to continue using the alcolock professionally.

The results of the acceptance scale sub-scores are depicted in Table 14.

Table 14: Mean results of user acceptance scale

Usability scale (mean scores)	Obligatory	Voluntary	All
Pre	0.77	1.37	1.04
Post	0.81	1.29	1.04
Satisfaction scale (mean scores)	Obligatory	Voluntary	All
Pre	0.12	0.58	0.32
Post	-0.22	0.85	0.28

Although there are differences between the obligatory and the voluntary subgroups, the usability scores fluctuate around 1, indicating a good subjective usability of the devices, whereas the satisfaction scores fluctuate around .3, indicating a rather neutral satisfaction. From the between group differences, it appears that the voluntary group seems to accept the alcolock better.

#### Acceptance with respect to traffic safety

Before (85%) as well as after the trial (82%) about 80% of the drivers said that alcolocks contribute to traffic safety. The vast majority of the drivers agreed with the statement that all trucks in Germany should have an alcolock (85% before and 79% after the trial). Equally, about 90% disagreed with the statement that alcolocks are unnecessary because truck drivers do not drink and drive anyway (94% before and 93% after the trial).

#### Professional and social aspects of acceptance

The majority of the drivers thinks that alcolocks are good for the company's image (82% before, and 75% after the trial) and for the truck drivers' image (74% before and 64%

after the trial). On the other hand, after the trial only half of the truck drivers thinks that alcolocks improve the quality standards of the company (46%). From these data, it appears that the participants are more convinced of the image-enhancing effect than of the performance-enhancing effect of the alcolocks. Contrary to the evaluation of the image-enhancing effect of alcolocks for the truck drivers themselves, almost half of the drivers thinks costumers might often or very often think that drivers have an alcohol problems because of the alcolocks (47% before and 43% after the trial). After the trial, 36% said clients and colleagues reacted positively towards the device, and 21% said they reacted negative. This 21% is entirely due to the obligatory group, as none of the voluntary drivers said other reacted negatively, whereas 40% of the obligatory group said other generally reacted negatively. This may indicate that the more a driver is confident with himself and the device, the better he can deal with negative reactions of other towards the device.

### Drink-driving habits

Most drivers think that the laws for drinking and driving should be stricter (82% pre, 75% post), that drinking and driving is major cause of road accidents (71% pre, 82% post) and that driving with an alcohol concentration above the legal limit implies a severe risk of causing an accident (100% pre, 96% post). Most drivers state that the likelihood of encountering an alcohol control is low (74% pre, 68% post) and only a quarter thinks that drinking and driving is enforced sufficiently (26% pre, 29% post). These attitudes reflect a generally positive attitude towards drink-driving prevention. These attitudes remained stable over time and were not influenced by the alcolock experience.

In order to evaluate the possible influence of the alcolock on their drinking habits, these were also questioned, but no differences between the pre- and post measurements were observed. Most drivers report to consume alcoholic beverages less then 4 times per month. At all three survey points we asked whether the drivers intended (pre-survey) or actually did change (midterm- and post-survey) their alcohol drinking habits because of the alcolock. Except for one driver, none of the drivers changed his drinking habits because of the alcolock. Before the trial, 14 drivers declared that they drive after drinking alcohol less than 1 day per week as a non-professional driver, only 8 did so after the trial. Driving regularly after drinking (one or more days per week) was indicated only by one or two drivers both before and after the trial. Possibly the alcolock experience lead to a change in the drivers' sensitivity for drinking and driving, so that there is a tendency that drivers actually less drive after having consumed alcohol or that they are less willing to admit this behaviour.

#### 3.1.3.2.2 Alcolock data

A total of 56,705 initial test requests were recorded, of which 34,376 were refused by the drivers, 22,229 passed and 100 failed: 49 with a BAC between 0.3 and 0.49 and 51 with a BAC of 0.5 g/l or more. The override was used on 14,130 occasions. Only 4 drivers, all from the obligatory company, never used it. In total 42% of all engine runs were untested engine runs, meaning that motor activity was registered without having performed a breath test. The percentage of untested engine runs proved a lot smaller in the obligatory group (13%) than in the voluntary group (66%). It should be taken into account that these untested engine runs are also due to the fact that non-participating drivers used the override all the time. For many cases it is unclear whether the switch was used to circumvent the alcolock or because a non-participating driver used the truck.

The relatively high percentage of test refusals was due to several factors. Firstly, if a breath test is not provided within 2 minutes it records a test refusal every two minutes that

elapse. As some drivers might have started the ignition of the vehicle and thus activated the device and then left for other tasks, this happened quite frequently. A second reason was that the device kept recording data whenever the override was used. The device also records breath-testing errors, which occurred predominantly in the beginning of the trial period and mainly referred to incorrect blow-suck-technique.

The 51 failed tests over 0.5 g/l were caused by 13 drivers. The majority of these drivers recorded only one single high BAC event, which seems to confirm the drivers' own declaration that they intentionally tested the device. The high BAC events were more or less equally distributed over the entire twelve-month period. From the ad hoc interviews it appeared that deliberate attempts to test the system were the most frequent cause of high BAC events.

### 3.1.3.2.3 Interviews with the company management

The management of both companies evaluated the alcolock positively as a useful instrument to prevent drink-driving and hence contribute to traffic safety and the quality standards of the company. No major technical or logistic problems were met, nor were there any interferences with the regular work process, except that the restart period of 20 minutes might be too short. It was also discussed that future alcolock-applications need to carefully evaluate the circumvention prevention elements of the system. More stringent procedures for using the override and the application of running retests need to be considered. Furthermore, the management sees the need for more publicity and information about the devices in future alcolock applications. Moreover, the most important issue for both companies was that a legal framework for the implementation of alcolocks in commercial transport companies needs to be studied.

### 3.1.3.3 *Conclusions and recommendations*

Like in the other trials, the alcolocks were very well accepted by all involved parties and the application worked technically and practically well. Although positive tests occurred, these seemed mainly due to deliberate attempts to test the devices. For future applications it is recommended to include all the drivers of the company in order to facilitate the implementation and to avoid discrimination of particular (subgroups of) drivers. Also, future applications will need to be carefully prepared in accordance with all the involved parties in order to optimise the acceptance of the devices. Most importantly, a clear legal and deontological framework to identify the conditions of alcolock use in commercial transport companies will need to be developed.

### 3.1.3.4 *General conclusion of the commercial trials*

The experience in all three commercial trials showed that the devices were reliable and rarely caused any problems. Moreover, the participating commercial drivers experienced no hinder from the devices in the execution of their daily tasks and accepted the alcolocks very well. Since the circumvention features in our trials were chosen in order to minimise the chances of such interferences, it needs to be investigated in future research whether this conclusion also holds when running retest or other features are introduced.

Despite some initial concerns and worries, the psychological acceptance of the devices remained high throughout the entire twelve-month period. Most of the drivers assume the

alcolock has an image-enhancing effect, both on the image of the company as on the image of the drivers themselves.

The behavioural effect of the alcolock appeared to depend to a large extent on the monitoring procedures. In the Norwegian trial, where the alcolock results were individually monitored, almost no failed test occurred, whereas in the other two trials, where the results were only analysed for research purposes and the failed tests had no other consequences, failed tests did occur more frequently. According to the drivers, however, almost all these tests were the consequence of deliberate attempts to test the system. The present methodology did not allow to assess the impact of the alcolock on drinking and drink-driving habits. From the attitude measurement it appeared that the professional drivers had such positive attitudes towards drink-driving prevention that it is hardly to improve.

Although the professional drivers originally were concerned that the clients would interpret the alcolock proving that the driver has a drink-driving problem, these worries decreased over time and only continued to exist in a marginal subgroup after the end of the trial. The implementation of alcolocks needs to go hand in hand with additional efforts to inform the public about the rationale behind. On that precondition it seems that alcolocks can be marketed as a quality assurance feature.

For future alcolock applications, it needs to be reminded that the decision to install alcolocks ultimately should depend on a cost-benefit analysis of the effects of the alcolocks of the particular context in which it is introduced. Our trials illustrate that if enough energy is spent in the preparation of the device introduction and the inclusion of the drivers, alcolocks are generally well accepted and positively evaluated. It still needs to be shown, however, whether alcolock programs with stricter conditions will be equally positively evaluated. From all the commercial trials, it appeared that a legal and deontological framework regarding the conditions of alcolock use in commercial transport companies and consequences of possible positive tests or attempts to circumvent the system needs to be developed. Since our research only involved a few specific consequences and a limited amount of drivers, the generalizability of these results should however be subject to further research.

### **3.2 The non-commercial trials (Belgium)**

As most of the quantitative studies on alcolocks studied the effectiveness of the alcolock as a means to prevent drink-driving recidivism, a group of drink-driving offenders was also included in the project. By studying the experiences of offenders, we tested the applicability of the alcolock as a measure for drink-driving offences in a European societal context through an analysis of the subjective impact of the alcolock on the same dimensions that were studied in the commercial trials.

A second group of private, non-commercial alcolock users that was included in Belgium were alcohol dependent patients. The original aim of the non-commercial trials was to not only focus on the functions of the alcolock as a tool for secondary prevention of drink-driving, but also to investigate whether it could be feasible to apply alcolocks as a primary prevention tool for persons with an augmented risk to engage in drink-driving behaviour. To this end, we wanted to include thirty alcohol dependent patients that had never been convicted for drink-driving. This would allow studying the applicability of the alcolock as a means of primary prevention for drink-driving in a group of non-commercial, private drivers.



### 3.2.1 Method

#### 3.2.1.1 Subjects

##### 3.2.1.1.1 Participants

In collaboration with six judicial departments, the aim was to include 30 drink-driving offenders. More specifically, the aim was to include 15 repeat offenders and 15 first offenders who had been caught with a BAC above 1.2 g/l. For the inclusion of participants, the collaborating judges were asked to exclude drivers that showed manifest signs of alcohol problems or dependency and to include a group of drivers that was as heterogeneous as possible with regards to relevant parameters such as age, gender, educational background etc. The framework in which the alcolock was proposed to the offenders was that they were given the opportunity to opt for an alternative measure (which consisted of the twelve-month alcolock programme) instead of the traditional license suspension in combination with a fee. A final criterion, on which the researchers were unable to gain much information, was that the judges had to evaluate the alcolock as an appropriate measure for the offence and offender. Because of this criterion, the selection of participants can by no means be regarded as the result of a random procedure (cf. procedure).

In order to include 30 alcohol dependent patients without prior drink-driving offences, we asked six specialised psychiatrists to propose the alcolock program to alcohol dependent patients which - in their expert opinion - could benefit from the participation in the pilot trial. The framework being that the patients could benefit from using the alcolock for one year without costs if they accepted the programme conditions. In order to be able to participate in the trial the patients had to fulfil the DSM-IV-R criteria for alcohol dependence (American Psychiatric Association, 2000). Moreover, the psychiatrists were originally instructed to exclude patients that had been caught for drink-driving. Since it was impossible to find enough voluntary candidates according to these criteria, the inclusion criteria were revised in the course of the trial (cf. infra).

##### 3.2.1.1.2 Related subjects

In order to study the social impact of the alcolock, we intended to interview a close family member of each participating driver after the end of the twelve-month alcolock period. The relatives were selected by asking the participants which person was psychologically the most close to them, and to ask the drivers to ask this person to participate in the final post-alcolock interview.

#### 3.2.1.2 Materials and interventions

##### 3.2.1.2.1 Alcolock device

All Belgian participants used the WR3 ACS alcolock-device. The minimum amount of exhaled breath was 1.5 litres, which implies a continuous expiration for about 5 seconds. Just like in the commercial trials, the display of the device did not display the alcohol content of the breath tests, to avoid using the alcolock as a breath-testing device by participants and their acquaintances. The threshold was set at 0.2 g/l BAC, following the recommendation of the

European feasibility study (Bax et al., 2001, p. 42). The devices were programmed to demand regular retests at randomised time intervals with a mean time interval of twenty minutes between retests. And also programmed in such a way that a number of days after specific programme violations (e.g. positive breath tests while driving, attempts to start the car without prior breath test etc.) the engine was permanently blocked unless the participant obtain the permission from the supervising authorities to reprogram the device. The WR3 device had no emergency override button in our trial. The alcolock data were downloaded at the service centre on regular time intervals: two-weekly in the first month of participation, monthly from the second to the sixth month, and bi-monthly after the sixth month.

#### 3.2.1.2.2 Documents

Before participation in the study, the participants received a detailed explanatory brochure, explaining the purpose of the study, the different phases of the study, the costs of participation (completely free, but damage to the device is at the expense of the participant) and the rules they were supposed to respect when they participated. The participants were required to sign an alcolock convention prior to the installation. This convention stipulated: no drinking and driving (i.e. complying with the breath alcohol concentration limit value of 0.2 g/l BAC), not driving a car without alcolock, no cheating, performing running retests in safe conditions, etc. The contract also stipulated that the participant is entirely responsible if another person should drive the vehicle equipped with the alcolock. Thus, if an acquaintance of the participant should take the wheel and perform a positive breath test, this would be regarded as if the driver himself tested positively.

As in the commercial trial, the participants were interviewed with standardised questionnaires tailored to the specific target group and phase in the project.

#### 3.2.1.2.3 Driver improvement course

A specific element to the Belgian trials was that the drivers followed an ad hoc driver improvement course immediately before the installations of the devices, and after 6 months of participation. The pre-alcolock course consisted of a broad discussion of drink-driving and the anticipation of effectively using the alcolock. The second session, organised after six months of participation, was designed to maximise the possibility of transferring the habit of dissociating drinking and driving to the period after the alcolock was going to be removed. In the sessions a group discussion of participant's actual experiences with the alcolock during the first six months was also held.

#### 3.2.1.3 Procedure

In each of the phases of the field trial, different procedures were followed depending on the target group (offenders vs. patients). In the offender subgroup, different procedures were followed in different legal departments.

(1) Preparation of inclusion. For offenders, prior to the offender's appearance before the court, the judges studied the driver's legal file and evaluated the appropriateness of a twelve-month alcolock trial as an alternative measure for the infraction to be judged. The judges also made a first evaluation of the extent to which the driver's profile and characteristics met the inclusion criteria for offenders. For patients, the usefulness of

participation in the trial for the treatment of the patient was evaluated by the psychiatrists, together with an evaluation of the inclusion criteria.

(2) Inclusion. For offenders, in half of the judicial departments, a short informative procedure was followed. This implied that the judges postponed the verdict for one week in order to give the driver time to reflect upon his possible participation in the trial on the basis of an explanatory brochure and a copy of the alcolock convention. After this time the candidate finally decided whether he or she to accepted the alcolock. In the other judicial departments, the judges proposed a social inquiry in order to evaluate whether the alcolock could possibly be proposed as a probation condition. The potential participants could either accept or refuse the social inquiry. During the social inquiry, a probation assistant assessed whether participation in the alcolock trial could be considered as a well-adapted sentence in light of the individual's particular circumstances. Based upon the social inquiry the judge finally decided whether a subject could participate in the alcolock trial. At the end, in all legal departments, the participants sent the signed convention to the BRSI, and the field trial began.

For patients, a simple and straightforward informative procedure was followed, in which the patients was informed about the project and possibly discussed participation with his treating psychiatrist. If the patient accepted, they sent the signed convention to the BRSI and their field trial began.

(3) Start of the field trial. All participants followed the pre-alcolock Driver Improvement session first. Next, the participants attended an alcolock training programme and were interviewed a first time while the devices were being installed at the service centre. For the offenders, the information gathered in the interviews was treated strictly confidentially, which meant that the participants were assured that interview data that revealed breaching of the terms of the contract would not be communicated to anybody inside or outside the legal system. Confidentiality is a necessary precondition to realise a genuine in-depth exploration of participant's psychological and behavioural changes. For the patients, the psychiatrists found it necessary to be completely informed about the drivers' experiences. The patients were therefore informed that a copy of the interview would be sent to his psychiatrist.

(4) Follow-up and data monitoring during the field trial. The alcolock data were downloaded in the service centres according to the time schedule described above. The researchers forwarded the data that were posted on the manufacturers' website and forwarded all new alcolock data to the probation assistants and psychiatrists regularly. For offenders, the probation assistants evaluated continuously whether it was necessary to inform the probation commissions about certain events and the probation commission ultimately decided about the participant's further participation in the trial in case of non-compliance with the probation conditions. For patients, the psychiatrists discussed the logged data with their patients during therapy. After six months of participation, the drivers followed the second driver improvement session and were interviewed once more.

(5) End of the field trial. At the end of the twelve-month field trial, the devices were removed and the drivers were interviewed once more about their alcolock-experiences. At the same time, a relative of the participant was also interviewed when possible.

### 3.2.2 Results and discussion

#### 3.2.2.1 Inclusion

Although the original intention was to include 30 convicted drink-drivers and 30 alcohol dependent patients without a drink-driving record, we only succeeded in including 7 patients. In collaboration with several judicial departments in both Wallonia and Flanders, it was no problem to include 33 convicted drink-drivers. Table 15 illustrates the differences between the intended and the actual distribution of participants over subgroups and communities.

Table 15: Intended and actual distribution of participants over subgroups

INTENDED					ACTUAL				
		Group					Group		
		Patients	Offenders	TOTAL			Patients	Offenders	TOTAL
Community	Dutch	15	15	30	Community	Dutch	3	14	17
	French	15	15	30		French	4	19	23
	TOTAL	30	30	60		TOTAL	7	33	40

According to the doctors quite a number of these patients originally showed some interest in participating in the project, but finally did not volunteer. An argument that was put forward often was that the patients did not want to risk exposing their use of an alcolock (and hence their alcohol dependence) to others. An equally often cited argument was that the shared use of a family car would oblige their family members to use the alcolock. We do not have exact figures on the number of patients to which the alcolock was proposed, but a rough estimate is that for each included patients about four patients turned down the offer. Because of our problems to include sufficient patients, the inclusion criteria were defined less strictly after the first four months of trying to include patients. Instead of excluding patients with a drink-driving history, we also included patients that were motivated to participate in the trial because of the fact that the alcolock programme allowed them to plead an alternative measure in court. Due to this revision of the inclusion criteria, we finally managed to include seven patients. Due to this revision of the inclusion criteria, we ended up with a very high overlap between the offender and the patient subgroups instead of with two mutually exclusive groups. Since the alcolock data and the interviews revealed that a high percentage of the offenders showed signs of severe alcohol problems, we finally analysed the data of all the non-commercial participants as one group.

The large majority of the offender subgroup consisted of drivers who had been sentenced several times for driving under the influence of alcohol. The reason for this was that even when caught with a high blood alcohol percentage, the period of license suspension was usually much shorter than the one-year alcolock period for first offenders. Drivers with a history of drink-driving offences, on the other hand, were facing longer periods of license suspension. Due to this, the drivers themselves, as well as the judges, were more inclined to choose for the alcolock in those cases.

As illustrated by Table 16, we succeeded in including a sufficiently heterogeneous group with respect to age, gender and professional background:

Table 16: Demographic characteristics of the participant group

Frequency distribution of gender		Frequency distribution of ages		Frequency distribution of highest degree of education	
	n %		n %		n %
Male	33 82.5	30-	4 10	Primary school	7 17.5
Female	6 15.0	30+	5 12.5	Secondary school	22 55
Not interviewed	1 2.5	40+	13 32.5	Further education	10 25
TOTAL	40 100	50+	13 32.5	Not interviewed	1 2.5
		60+	3 7.5	TOTAL	40 100
		70+	1 2.5		
		Not interviewed	1 2.5		
		TOTAL	40 100		

### 3.2.2.2 Course of the trial

Except for three exceptions, all the drivers stayed in the program for the entire twelve-month period. One driver stopped participating after 90 days because he was not able to perform the breath tests anymore due to a serious medical breath problem, for which a medical attestation was available. Another driver stopped participating after 79 days because he was sentenced to jail. Only two drivers were rejected from the program by the probation commission. One driver left the program after 250 days because the alcolock data showed that he did not respect his supplementary probation condition of complete soberness. Another driver was rejected from the program just at the end of the twelve-month period because the data revealed that he did not respect the alcolock program conditions.

### 3.2.2.3 Alcolock data

#### Valid versus invalid tests

Due to the three exceptions described above, the mean average days of participation in the trial was not 365, but 336. On average the drivers registered 3327 attempts to perform a breath test, of which (on average) 2385 proved valid and 942 invalid. On average, each driver performed 9.9 test attempts per day, of which 7.1 were accepted for analysis and 2.8 were rejected as invalid. With 7.1 breath test results per day, the alcolock data provide very detailed information on the drivers drinking and drink-driving habits.

On average, 72% of all tests attempts were valid. This average varied from a minimum of 37% to a maximum of 95 percent. Three drivers had an average of less than 50% valid tests, which indicates that these drivers experiences serious problems in performing valid breath tests. From the interviews, we learned that this was due to the high demands the tests imposed on the drivers' breath capacities. As already mentioned, one driver even had to stop participating because of to serious medical breathing problems. For another driver, who was not included in the analyses, the device had to be removed immediately after installation, because he appeared unable to perform the breath test correctly due to a seriously diminished breath capacity.

#### Pre- versus retests

The distribution of the valid tests over pre- and retests for all the participants together are depicted in Table 17.

Table 17: Distribution of valid test over pre- and retests

	PRE-TEST	RETEST	TOTAL
Pass ( $t < 0.2$ g/l)	56974	37516	94490
Fail ( $0.2 \text{ g/l} \leq t < 0.5$ g/l)	<b>590</b>	<b>26</b>	<b>616</b>
High Fail ( $0.5 \text{ g/l} \leq t$ )	<b>275</b>	<b>4</b>	<b>279</b>
All tests	57839	37546	95385
Total fail + high fail	865	30	895
Percent Fail	1.52%	0.08%	0.95%

In the non-commercial trials, 61% of all valid tests were performed before the car was started (57839 valid pretests), while the remaining 39% of all valid tests were executed while driving the car (37546 valid retests). As expected a lot more pre-tests proved positive than retests: before starting the car 590 tests between 0.2 g/l and 0.5 g/l were recorded (fail), and 275 tests above 0.5 g/l (high fail). This results in a total of 1.5% of positive tests before starting the vehicle. While driving (and by definition after performing an alcohol tests below 0.2 g/l) *only* 26 tests between 0.2 g/l and 0.5 g/l and only 4 tests above 0.5 g/l were recorded. Theoretically, all these positive tests might as well be caused by one participant as be evenly distributed over all the participants. An analysis of the breath test results per participant, revealed that only five out of 40 participants did not record a single positive test, 2 participants only recorded one positive tests, 15 participants recorded 2 to 8 positive tests, and 18 of the 40 participants recorded 10 or more positive tests.

One might wonder how it is possible that positive tests still occur despite the fact that a test below 0.2 g/l was necessary to be able to start the car. A first possibility is of course that the participants asked somebody else to perform the breath tests before starting the car, hoping to get home without having to perform a retest. Another possible cause of positive retests is drinking while actually driving. Delayed alcohol metabolism might also account for some of the positive retests. The interviews we did with the participants regarding these incidents revealed that it is very hard to prove a participant has actually tried to circumvent the system. As a matter of fact, none of the participants seemed to recall the occurrence of the positive retest or attributed it to the intake of food shortly before performing the retest. The maximum alcohol test results recorded while driving at least seems to exclude the systematic circumvention of the system after heavy drinking, as only one of the four high fail retests was above 1 g/l, and concerned a retest which was most likely due to the presence of alcohol in the ambient air according to the manufacturer.

### Maximum BACs

An analysis of the maximum pre- and retest BACs for each participant revealed that all 4 high fail re-tests were caused by four different participants. On three occasions the blood alcohol level while driving was between 0.5 g/l and 0.8 g/l, and only once it was above 0.8 g/l (in that case 1.35 g/l). 20 out of 40 participants at least performed one test above 1 g/l. The maximum blood alcohol level measured in the course of the entire trial was of 2.22 g/l.

### Days with positive tests

Since the general results might give a distorted picture of the occurrence of positive tests due to the fact that some participants tried over and over to perform a passed test, we also analysed the number of days on which positive tests occurred for each participant. This analysis revealed that the positive tests were less clustered in groups of positive tests as the participants claimed themselves: 5 drivers did not have a single day with a positive test, 20 drivers had between one and 9 days on which one or more failed tests occurred and 15 drivers

had 10 or more days on which positive tests occurred. This shows that the 895 failed tests were more spread over different days than the interviews (cf. *infra*) showed. By dividing the total number of positive tests for each participant with the number of days on which failed tests occurred for each participants, we observed that on average 1.6 positive tests were recorded on days on which positive tests occurred. This illustrates that the high number of positive tests in our trial is not due to the fact that the participants systematically tried over and over to pass the test (notwithstanding the fact that one can observe this happening from time to time).

### Time of day

Finally, Table 18 illustrates the distribution of fails and high fails over morning and not-morning hours.

Table 18: Test results as a function of time of day

	Morning (5am-11am)	Not morning	Total
Pass	21769	72721	94490
Fail	<b>186 (30% of fails)</b>	<b>430</b>	<b>616</b>
High Fail	<b>108 (39% of high fails)</b>	<b>171</b>	<b>279</b>
Valid tests	22063 (23%)	73322	95385
Total Fail + High Fails	294 (33% of fails)	601	895
Percent failed	1.33%	0.82%	0.94%

The results in this table show that although only 23% of all valid tests were registered in morning hours, 39% of all tests above 0.5 g/l were registered in the morning hours. These ratios are also reflected in the fact that a higher percentage of failed tests was recorded in the morning hours (1.33%) than during the rest of the day and night (.82%).

### **3.2.2.4 Interviews**

#### Practical impact

A first practical element the researchers were personally confronted with very often since the participants often called the BRSI to signal technical problems with the devices, was that the alcolock devices did not always function correctly or as expected. In the interview after 6 months, only 6 out of 37 interviewees said the alcolock never caused technical problems (16%), 19 indicated that technical problems occurred rarely (51%), 3 checked "sometimes" (8%) and 9 checked "often" or "very often" (24%). A more informative question was how many days the participants were unable to use their car due to technical problems. Given that participants were asked to indicate only entire days they could not use their care, the table below is impressive:

Table 19: "How many days were you unable to use your car because of technical problems? .... days

Number of days	n	%
0	21	56.8
1 to 4	10	27.0
5 to 10	4	10.8
>10	2	5.4
<b>TOTAL</b>	<b>37</b>	<b>100</b>

Sixteen of the 37 interviewees (43%) could not use their car due to technical problems with the device for one or more days. Six of them (16%) were unable to use their car for five or more days. From telephone conversations we had with the participants at the occasion of these technical deficiencies, it became clear that different sorts of problems occurred, in

descending order of frequency: Battery went flat after several days of not using the car, the alcolock did not accept the breath test or required more than 20 test attempts, dysfunctional handset connection, dysfunctional display, and others.

On average, the participants had their handset replaced 2.24 times. The incidence of technical problems did very strongly decrease during the second half of the project. In this period only two drivers were unable to use their car for one or more days due to technical problems. The provider acknowledged that some of these reported technical problems were due to the fact that the WR3 device was tested in the field for the very first time in the Belgian trials, but still contested other self-reported problems as being due to participants disrespecting the program conditions or miscomprehension of the instructions for use.

The incidence of technical problems did not seem to effect the participant's appreciation of the alcolock system. After 6 months, the large majority of participants indicated to be rather satisfied with the alcolock, as shown in the following table, together with the appreciation after 12 months:

Table 20: How satisfied are you with the alcolock device until now?

		1	2	3	4	5	very dissati sified	no reply
6 month interview	n	4	23	5	4	0		1
	%	11%	62%	13.5%	11%	0%		3%
12 month interview	n	8	16	9	3	0		0
	%	22%	44%	25%	8%	0%		0%

Regarding the ease of using the alcolock, the results of the interviews after 12 months indicate that the drivers did not experience major difficulties using the system:

- Half of the drivers found it embarrassing to perform breath tests so often (17/37, 46%)
- Only 2 participants doubted the reliability of the breath test results (5.5%), and 30 of 37 participants (81%) found the measurement of the alcohol content by the alcolock reliable
- The large majority of participants (29/37, 78%) indicated that the alcolock did not alter their frequency of using the car, although 6 participants indicated that they used their car less often than without an alcolock (16%)
- With one exception, all the drivers performed the retests while driving almost always (97%)
- 28 of 37 respondents (76%) found it easy or very easy to use the alcolock
- Only 2 respondents (6%) thought the alcolock hindered them while driving

Most of the drivers indicate they would have made the same choice between the alcolock and a license suspension if they were given the choice again. At the post-alcolock stage, only two drivers indicated that would have opted for the license suspension if given the choice again. Both of these drivers did so because of the numerous technical problems they encountered.

### Psychological impact

The table below depicts the usefulness and satisfaction scores of the acceptability scale at the pre-, intermediate and post-alcolock phases:



Table 21: Distribution of usefulness and satisfaction scales before, during and after alcolock use

Subscale	PRE						6 MONTHS						POST					
	<-1	[-1,0[	0	]0,1]	>1	Mean	<-1	[-1,0[	0	]0,1]	>1	Mean	<-1	[-1,0[	0	]0,1]	>1	Mean
Useful (n)	0	0	0	8	31	1.5	0	1	1	9	26	1.3	0	2	0	14	20	1.4
%	0%	0%	0%	20.5%	79.5%		0%	3%	3%	24%	70%		0%	6%	0.0%	39%	56%	
Satisfying (n)	3	13	5	15	3	.05	1	6	13	15	2	.2	8	12	8	7	1	-.15
%	8%	33%	13%	38.5%	8%		3%	16%	35%	40.5%	5%		22%	33%	22%	19%	3%	

From this table it is obvious that the mean usefulness and satisfaction subscores did not alter significantly in the course of the trial. With a mean usefulness score of 1.3 to 1.5 this result indicates that the participants found the alcolock useful. The mean satisfaction score ranges from -0.15 to 0.2, indicating that the participants did not find the alcolock either satisfying nor dissatisfying.

According to the participants, the alcolock made them more aware of driving under the influence. At the intermediate stage 29 out of 37 participants (78%) agreed to this statement, and 26 out of 37 did so at the post-alcolock stage (70%). After twelve months of using the alcolock, 20 out of 37 interviewed participants agreed that the alcolock had been an aid for them (54%). Unexpectedly, and despite the fact that the alcolock had been imposed as an alternative measure for 30 of them, only 10 participants agreed that the alcolock was a punishment for them (27%).

### Behavioural impact

When asked whether the participant found the threshold limit at which the alcolock was set too low, twelve out of 36 participants (33%) are in favour of the lower alcohol limit, while the majority of 21 participants (58%) were in favour of a limit equal to the legal limit (0.5 g/l). Those who were against the zero-limit often explicitly named the low threshold of the device as an important disadvantage of the alcolock system.

Subjectively, most of the participants are convinced that the alcolock reduced their drinking overall. The majority of the participants thought they drank less because of the alcolock (23/36, 64%), and that the alcolock made them drink fewer units per week (21/36, 58%). From those who said this was not the case, the majority stated that they already stopped or diminished drinking before the start of the alcolock project. Although 20 out of 36 interviewed participants (56%) indicate to have changed their drinking habits to some extent, 16 say their drinking habits did not change at all (44%). This slight contradiction might be due to the fact that some participants did not take quantity into account while evaluating their changes in drinking habits. With regard to drinking during the day, 16 out of 36 participants indicate they drank less during the day because of the alcolock (44%).

The mean AUDIT score dropped from 8.8 in the pre-alcolock stage to 5.7 in the post-alcolock stage. Equally, the number of participants with an AUDIT score of 8 or higher dropped from 22 in the pre-interview (56%) to 11 (30%) in the post-interview. Based upon the self-reported number of drinks the participants declare to have per week, we do however doubt whether the participants are prepared to disclose their drinking behaviour honestly during the interviews. Only two participants (6%) admit to drinking, on average, more than two glasses per day during the year they were on the alcolock, which seems inconsistent with the high incidence of positive tests and of high fail tests shown in the alcolock data.

From the alcolock data it is obvious that the alcolock had a definite impact on the participants' drink-driving behaviour, as they showed that it prevented the participants from executing their intention to drive under the influence on 275 occasions (pre-tests above the legal limit). Apart from the fact that we are obviously unable to evaluate how frequently the

system was circumvented by using a non-alcolock equipped vehicle or by having somebody else perform the breath test, it is clear from the alcolock data themselves, that drink-driving still occurred incidentally. The four high fail retests illustrate this well.

Although the literature is clear about the disappearance of the preventive effect of the alcolock once it is removed, our participant had a different subjective opinion. When asked whether they thought their alcolock experiences would make them exceed the legal limit less often in the future, a vast majority of 27 out of 36 participants agreed (75%).

### Social impact

The most often discussed social aspect of using the alcolock did not appear straightforwardly in the questionnaires, but some participants declared to have been embarrassed on numerous occasions when outsiders saw them using the alcolock. This privacy-infringing aspect of the alcolock also came up during the interviews:

**Table 22: Evaluation of reaction of social environment to the alcolock**

<b>How often did it occur that other persons suspected that you have an alcohol problem because you are driving with an alcolock?</b>	never	1	2	3	4	5	very often	no reply	TOTAL
		n=18	n=9	n=5	n=1	n=2		n=1	n=36
		50%	25%	14%	3%	6%		3%	100%
<b>How did people (clients, colleagues) that noticed you are driving with an alcolock react to it?</b>	very positive	1	2	3	4	5	very negative	no reply	TOTAL
		n=10	n=9	n=16	n=0	n=0		n=1	n=36
		28%	25%	44%	0%	0%		3%	100%

Half of the participants (18/36=50%) never felt identified as an alcoholic due to the alcolock, whereas the other half thought this was sometimes the case (17/36=47%). According to three participants (8%) this was even often or very often the case. None of the post-alcolock interviewees found that other people reacted negatively to the fact that they were using the alcolock. Although some of the participants who evaluated the reactions towards the alcolock as neutral did so because some reactions were clearly positive, but other reactions were annoyingly negative as well.

We succeeded in interviewing a relative for 17 of the 36 participants that were still in the trial after 12 months (47%). These interviews revealed that the participant's family is often more inclined to admit the presence of serious alcohol problems or risky drink-driving behaviour than the participants themselves. Eighty-five percent (11/13) of the interviewed relatives who responded to these questions found the fact that the participant drove with the alcolock reassuring and 77% (10/13) found that the alcolock was an aid for the participant. In contradiction to these answers, only 6 out of the 17 relatives (35%) agreed that they would like the participant to continue to drive with the alcolock after the one-year trial. The most cited reason for this low percentage of agreement was that a lot of relatives feared technical malfunctions.

#### 3.2.2.5 Meetings with program supervisors

At the end of the field trial, two evaluation meetings were organised where all the partners that were involved in the judicial and in the medical part of the project were invited.

A first element that appeared from the evaluation by the different justice departments is that the monitoring of the alcolock results and discussing these results with the participants, is a time-consuming process that requires sufficient technical knowledge of the device and the results it records. Regarding the most appropriate inclusion process as well as regarding the

ideal follow-up of the participants, the evaluation meeting raised more question than answers. Some justice departments recommended a social inquiry before a participant can be included, other departments found that informing the candidates about the implications of the alcolock is sufficient and less time consuming. Some probation commissions only evaluated the positive retests above the legal limit as really problematic. The alcohol limit of the device was also evaluated equivocally. According to some justice departments it is best, in order for the driver to learn to dissociate drinking and driving, to fix the alcohol limit as close to zero as technically possible. Other justice departments, on the contrary, were more in favour of setting the alcohol limit at the legal limit of 0.5 g/l because they thought it could cause confusion to apply different rules for different persons.

From the meeting with the psychiatrists, the most important conclusion was that the alcolock was evaluated as particularly useful to prevent dangerous drink-driving behaviour in case of a relapse into drinking and a definite support for the social environment of the patients. At the same time the alcolock provided the opportunity to some patients to prove to their environment that they were actively working on their problem. On the other hand, the role of the alcolock in therapy for alcohol dependency was evaluated as very small.

### 3.2.3 Conclusions and recommendations non-commercial trials

From a qualitative study without a control group on a small sample of drivers we cannot formulate conclusions with a general validity beyond the present sample and situation. Therefore, the following conclusions should be understood as hypotheses to be taken into account in future alcolock applications in a European context.

*Practical impact.* Generally, the alcolock users were satisfied with the system and could use it relatively effortlessly. The large majority declared they would still choose the alcolock when given the opportunity to choose between the alcolock and an alternative measure. Due to several technical failures half of the participants were unable to use their car for one or more days. Fortunately, most of the technical problems disappeared in the last 6 months of the project. In future trials, the impact of technical problems may be prevented by foreseeing an override switch in combination with a strictly controlled procedure for using it. Participants with a diminished lung function experienced difficulties to deliver the five-second breath samples required by the alcolocks. On the basis of these results, the need for an a priori medical screening of participant's ability to perform breath tests needs to be evaluated.

*Psychological impact.* The acceptance scale sub scores indicate that the participants found the alcolock useful to very useful, and neither satisfying nor dissatisfying. As the alcolock data made clear that a lot of the participants continued to try to drive under the influence of alcohol (fortunately the alcolock made it impossible to do so) also after the first three months of alcolock use, the results indicate that the alcolock programme did not cause a lasting behavioural modification, even though the participant themselves perceived a beneficial effect on their intentions and attitudes.

*Behavioural impact.* The alcolock data made it obvious that the alcolock had a decisive impact on their drink-driving behaviour; as the 275 high fail pre-tests can be regarded as instances in which the driver would have started driving under the influence of alcohol if the alcolock would not have been installed. The self-reported interview data on the impact of the alcolock on drinking and drink-driving were difficult to evaluate. The improbably low self-reported alcohol use makes it difficult to believe that the self-reported behavioural changes are more than socially desirable answers or expressions of good intentions. Despite the high incidence of positive tests in the entire test group, only one

person was excluded from further participation in the trial because of the data logged by the alcolock before the end of the twelve-month trial. One reason for this is that some judicial departments argued that the fact that the alcolock prevents actual driving under the influence of alcohol rarely allowed the offender to breach the probation conditions. From the differences of opinion between different probation commissions, we recommend that the supervising authorities communicate the possible consequences of all program infractions clearly to the participant before the actual start of the trial. From the interviews with the patients, it seemed that a strong will to prove oneself in the face of the physician and in the face of the other family members is often a strong motivation to avoid positive tests.

*Social impact.* The most significant social impact of the device was that a lot of participants felt embarrassed when outsiders observed them while using the system. On the other hand, the participants evaluated other person's reactions as generally positive, or a mix of positive and negative reactions at worst. Overall, the participant's relatives appreciated the system positively. They felt reassured that the participant could not drink drive anymore, and often also observed a diminution of the participant's alcohol consumption. Even within the context of an in-depth qualitative field trial, it proved however very difficult to assess anything beyond the *self-reported* social impact of using an alcolock. Further research into the psychosocial consequences of using alcolocks is still necessary.

Based on these results, it is recommended that - on top of the best practices recommendations formulated elsewhere (e.g. Beirness (2001), Bax et al. (2001)), and on top of the recommendations formulated higher - special attention would be given to the following elements in future European applications of alcolocks for offenders:

- A clear definition of the inclusion criteria and a continuous monitoring of the application of the criteria in practice
- A very intensive training for program supervisors, allowing them to decide in discussions between participants and manufacturers regarding the causes of anomalies (technical problems vs. program violations)
- An efficient monitoring procedure that invests enough energy in the multiple lines of communication between all the parties involved in alcolock applications

#### 4. RESULTS OF THE LITERATURE REVIEW

Regarding the acceptance and implementation of alcolocks for drink-driving offenders, the following factors play an important role and should be addressed accordingly:

- The cost of alcolock programs to participants.
- Increased recidivism rates after alcolock removal from the vehicle.
- Opposition by the criminal justice system.

With respect to participation and compliance, the 'ideal' alcolock program for drink-driving offenders based on findings in the literature would be:

- Mandatory, successful completion of the program being a condition of full license reinstatement.
- Tailored to distinctive target groups (varying from first to alcohol-dependent offenders).
- Flexible in duration.
- Not preceded by a (lengthy) period of hard suspension.
- Administered by licensing authorities.
- Recorded on the driver's license.
- Regularly monitored, including medical assessments for alcohol-dependent drivers.
- Combined with some kind of rehabilitation.

Commercial alcolock programs seem to be easier to implement than offender programs. In Sweden, after the introduction of a small-scale demonstration project subsidized by the government, implementation was successfully left to market parties. Alcolocks were promoted as a tool for quality assurance. Discomfort to the drivers and the risk of economic loss to the fleet owners were minimized by programming the alcolocks' software accordingly. At an early stage, discussions were arranged between public and private parties and interest groups (like trade unions), and actual alcolock users and their social environment were informed.

## 5. CONCLUSIONS

All together, the European trials showed that it is feasible to implement alcolocks in different commercial and non-commercial contexts, but that a careful preparation of the inclusion process and the follow-up procedures is necessary. Due to the limited number of participants and contexts in which the devices were presently tested, these results and conclusions obviously need further confirmation in future research. The most important conclusions regarding the impact of the alcolock on the various dimensions we studied are that:

- Alcolocks appear to be relatively practicable in both commercial and non-commercial contexts. Within our study very few technical problems were encountered in any of the three commercial trials, whereas technical malfunctions of the devices occurred relatively frequently in the non-commercial trials. The most important conclusion regarding the practical impact of the devices is that the majority of the drivers found it easy or very easy to use the alcolock and experienced little or no hindrance from the device. In this respect, it needs to be underscored, however, that the programme requirements were less strict in the non-commercial trials. It still needs to be tested whether the use of alcolocks with optimal circumvention prevention features would still be experienced as equally usable by professional drivers.
- The general acceptance of alcolocks was good or very good in both commercial and non-commercial trials and remained high throughout the entire twelve months of the trial. The impact of the alcolocks on psychological aspects such as drinking habits or drink-driving attitudes was very difficult to assess with the present methodology. From the non-commercial trials there were indications that the alcolock programme had a positive impact on the drivers intentions, but no clear indications that the alcolock had a decisive impact on the driver's actual behaviour.
- Regarding the behavioural impact of the alcolock, the most striking difference between the commercial and non-commercial trials was the incidence of positive breath tests. In the commercial trials relatively few positive tests were recorded and almost all these tests seem to be due to deliberate tests of the device. All together the differences in the occurrence of positive tests seem mainly due to the procedures used to assure the follow-up of the results. At the same time, the field trial confronted us with an urgent need to develop clear legal and procedural frameworks for follow-up procedures.
- Regarding the social or sociological impact of the alcolocks, the truck drivers' clientele appeared in general rather indifferent towards the alcolock, whereas bus passengers had a generally positive attitude towards the devices. This confirmed the hypothesis that alcolocks may be marketed as an element of quality improvement. Contrary to the commercial trials, the privacy infringing aspect of the alcolock is

perceived as a crucial disadvantage of the alcolock by offenders and alcohol dependent participants.

- An additional review of the literature revealed the most important factors influencing acceptance, implementation, participation and compliance. These factors should also be taken into account when implementing large-scale alcolock programmes in Europe.

From the similarities and differences between commercial and non-commercial contexts for alcolock implementation, it became clear that the impact of the alcolocks depends on the specific circumstances in which the alcolock is used. With respect to these circumstances, the commercial or non-commercial character is only one element. The specific programme conditions that are defined for the alcolock users, the specific procedures used to follow-up the test-results and the possible circumventions, the specific consequences of all the possible events and the specific social or commercial environment and society in which the alcolock is used, are equally important factors determining the impact of the alcolock. All these factors will have to be taken into account in future commercial and non-commercial alcolock applications in Europe.

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<http://www.bivv.be/main/PublicatieMateriaal/research/catalogDetail.shtml?detail=718866192&language=nl> - About.

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