Intelligent Route Guidance for Heavy Vehicles

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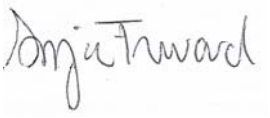
Released by: Sonja Forward Signature:  Date: 14 July 2007				
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List of abbreviations

Abbreviation	Meaning
ATIS	Advanced Traveller Information Systems
DSS	Decisions Support System
ERTICO	European Road Transport Telematics Implementation Coordinatioan Organisation S.C.R.L.
EU	European Union
FEHRL	Forum of European National Highway Research Laboratories
IRU	International Road Transport Union
ITIS	Intelligent Traveller Information Systems
ITS	Intelligent Transport Systems
LCPC	Laboratoire Central des Ponts et Chaussées (French Public Works Research Laboratory)
PTV	PTV Planungsbüro Transport und Verkehr GmbH
VTI	Statens väg- och transportforskningsinstitut (Swedish National Road and Transport Research Institute)

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0 Executive summary

Many of the proposed implementations presented in the survey were seen as important. This might, however, reflect the effect of the sample. While an exact response rate was not possible to calculate it was nevertheless low and it could, therefore, be argued that those participating in the survey had an interest in such issues and regarded them as important. Indeed, follow-up contact with non-respondents revealed that some found such a system to be of little use and, as a result, they were not interested in participating. Even so, it was still possible to draw conclusions about which questions were considered more important than others. For instance, drivers believed it was important that the journey was planned in such a way as to prevent them from not being able to enter an area, either because of restrictions on truck size or because the time of arrival was outside permissible hours. Planners also considered this important, along with nature of the goods being delivered. In sum, it was generally the case that in terms of informational content and needs, there was a great deal of agreement between drivers and planners. Importantly, the information these groups agree on can relatively easily be provided by other user groups (e.g., traffic information providers and centres, weather service providers).

The differences between planners and drivers arose, however, with regard to the managerial needs associated with an HGV management and route guidance system. Drivers were not particularly enthusiastic about communication with the head office, whereas planners considered such communication to be very important. Drivers also found it less acceptable that head office could monitor them during a journey. From the perspective of a future heavy route guidance system, these differences are of paramount importance especially if a guidance system is developed as a policy tool with the aim of reducing accidents and other harmful effects on the environment. One possible way to resolve this issue might be to make explicitly clear to drivers what the benefits of greater management and monitoring for them are and to emphasise that the interest from planners is not in micromanagement or in restricting the freedoms associated with being a HGV driver. Additionally, different incentives could also be considered. For example, safe and environmentally friendly driving, which is argued to be more likely to result from the use of a HGV management and route guidance system than without such use, could be rewarded with a bonus, thereby encouraging greater take-up and less resistance.

Indeed, previous research has shown that drivers actively desire and seek out feedback in many cases. Thus, it is not unreasonable to expect that feedback regarding the achievement of safer and more environmentally friendly driving could be given in a manner acceptable to drivers, particularly when coupled with a bonus. Another possible means by which to increase acceptance is to provide drivers with the freedom to choose the elements they wish to see displayed or the elements they wish to utilise in a heavy vehicle route guidance system. The

idea is that all information can be made available to drivers, with the choice regarding which information to have readily accessible being left to the driver him- or herself. Such personalisation appears to be the latest development within the field of advanced traveller information systems and it is a trend that parallels developments in other fields (e.g., online shopping sites that remember the preferences and selections of returning visitors). The freedom to tailor the information to which one has default access should also increase acceptance by limiting the number of unwanted and neutral features with which a user needs to deal.

The following sections provide more detail on the above by summarising the key findings from both the interview and the survey study. The results from the interview study illustrate the problems experienced with route guidance systems in the past, along with the potential benefits and disadvantages of such systems, and the requirements for any future implementation to be realised.

Interviews

Past problems

- *driving performance* (e.g., jack-knifing, overloading)
- *route quality* (e.g., traffic jams, dangerous roads, low/unknown tunnel heights)
- *cargo discharge and take-over* (e.g., warehousemen not discharging goods, conditions at the cargo-transfer site)
- *the navigation system per se* (e.g., too much choice, inter-operability concerns, a lack of information from other countries and a lack of both static and dynamic/real-time information).

Benefits:

- *economic benefits* (e.g. less fuel consumption, less driving time, less wear and tear on roads and vehicles, fewer accidents and less time in congestion, fewer unloaded trucks on roads, a better optimisation of transport)
- *environmental benefits* (e.g., less pollution, less wear and tear of tyres, fewer trucks on the roads)
- *societal effects* (e.g., increased cooperation and pan-European harmonisation of rules, reduction of accidents and improved ease of finding the correct route)

Disadvantages

- less communication between drivers
- drivers being permanently monitored
- longer transportation times (through the avoidance of sensitive areas, urban areas and the like).

Needs for future implementation

- some degree of obligation or a decision at the European level
- a cost-benefit analysis of the system
- protection of driver privacy (i.e., the system should not be used to track and act as an informer on driver behaviour)
- fiscal advantages and that the system should not be too expensive

The results from the survey study summarise the aspects of a route guidance system that 80% or more of the participants indicated to be important or very important. That is, for example, what information do participants wish to know when planning a route, or when a journey is already underway? Results are organised according to participant group: driver vs. planner.

Survey

	Drivers	Planners
Pre-trip planning	• Bridge/tunnel height restrictions • Bridge weight restrictions • Delivery place arrival/opening hours • Current European roadwork information	• Bridge/tunnel height restrictions • Delivery place arrival/opening hours • Current European roadwork information
Desired support during journey *(drivers only)*	• Accidents • Congestion • Worksites • Temporary lorry bans • Unsuitable infrastructure • Guidance on an alternative route	
Monitoring and management	• Warning other vehicles of hazards	• Driver location (for security) • Adherence to selected route • Delays • Adherence to rest-time rules • Detected tiredness: stop, suggest nearby parking area • Resting-time violation: stop, suggest nearby parking area • New route • (Un)Loading difficulties • General location of vehicle • Vehicle axle loads • Overloading of truck

1 Introduction

All European countries are experiencing ever-increasing traffic volumes, particularly with respect to the volume of freight transport on roads. This demand is expected to grow even more significantly in the next decade. Additionally, the increasing gross weights and changing load configurations of heavy goods vehicles (HGVs) has led to accelerated pavement fatigue and damage to bridges, as well as creating major traffic management problems regarding safety maintenance and congestion reduction. *Truck operators* face the combined challenges of reducing ever-increasing fuel costs and maximising efficiency and profitability, while at the same time maintaining safety. *Truck drivers* have the additional tasks of ensuring compliance with driver working-hour regulations and finding appropriate, safe and secure rest areas. Finding the means by which to reduce the costs associated with increasing traffic volumes is a major challenge for the road research community, as well as for road authorities and road operators.

Therefore, an advanced route guidance and advice system for HGVs would be a valuable tool for deriving the safest and — through the inclusion of other aspects such as vehicle capacity, environmental impacts, vehicle operating costs, and impacts on road and bridge deterioration — the most cost-effective routes for road freight transport through Europe both for companies and society at large. Such systems have been variously referred to as Advanced Traveller Information Systems (ATIS) (e.g., Adler et al., 2005; Saricks et al, 1997), Intelligent Transportation Systems (ITS) (e.g., Gärling et al. 2004; Golledge, 2002), and Decision Support Systems (DSS) (e.g., Igbaria et al., 1996). Depending on the focus of the system, any or all of the following could be potentially achieved: travel-time and/or travel-distance minimisation; minimisation of schedule delays; minimisation of the number of turns; minimisation of arterial road usage; minimisation of roadway classification changes; minimisation average volume to capacity ratio; minimisation of standing queue delays; fuel consumption minimisation; driver comfort maximisation through the suggestion of nearby recreational facilities, restaurants and rest-stops (see, e.g., Adler et al., 2005; Ericsson et al, 2006; Kantowitz et al., 1997). Just as important as the substance or content of the information that is provided, is the timeliness of such information (Mannering et al. 1995).

Research on information technology and its relevance for transportation has a surprisingly long history. Adler and Blue (1998) provide a historical overview, noting three distinct periods. The first period, roughly covering the 1960s and 1970s, saw the development of traveller information systems as an attempt to disseminate information using communication technologies so as to improve flow at localised points in a network or make travellers aware of special incidents and events resulting in non-recurring congestions. The period

spanning the 1980s and up to the present saw the development and inclusion of many new technologies in ATIS so as to provide travellers with information in terms of dynamic route-guidance, real-time traffic information and traveller services information. The future period, according to Adler and Blue (1998), will be characterised by the integration of artificial intelligence with ATIS so as to create Intelligent Traveller Information Systems (ITIS). The idea here is that in the same way many web sites remember a regular visitor's preferences and previous purchases in the case of internet shopping, ITIS should be able to learn a user's profile of interest so that basic information and preferences need not be specified prior to each trip.

ITIS is a natural extension of the observation that the travel choices people make often reflect their knowledge of the travel environment and their personal preferences. Naturally, the scope for such freedom (e.g., in terms of destination, route or trip timing) is likely to be more limited in the case of HGVs and goods delivery and pick-up. Nevertheless, the potential remains in many cases to select the information one wants presented in such a system. Ignoring the technological and system design issues for the time being, which are important but less relevant for the present paper (for a review, the reader is directed to Dingus et al., 1996, and Lee et al., 1997), ITIS suggests the need for greater consideration of the user in the design and implementation process. More specifically, how can such systems be developed such that acceptance and usage is forthcoming?

There are many potential reasons as to why such intelligent route guidance system may be ignored or actively opposed by their intended target groups. Price is certainly an issue that may prevent take-up even if the system solves a longstanding problem. Ng et al. (1995) found that dispatchers were willing to pay much more for an ATIS than commercial drivers who, in turn were willing to pay more than private drivers. This difference was attributed to the fact that dispatchers work for companies in which the system can be integrated as unit and utilised throughout the organisation, whereas commercial drivers can work for companies and/or independently. Another reason for resistance to route guidance systems may be that organisations that are unreceptive to change may, in turn, be comprised of individuals showing great resistance to system implementation (Kantowitz et al., 1998). There are also marketing issues: a system may fail if no-one is aware of its existence. There are, of course, design issues in that any route guidance system that is difficult to use will not be greeted with acceptance. Users that perceive such a system to be an invasion of privacy or an impingement on their freedom may also display resistance (Kantowitz et al, 1998). Finally, and perhaps most obviously, any system that is designed without the end user in mind and that does not meet the informational needs of the intended users will not be accepted (Davis, 1993).

Previous work by Kantowitz et al. (1997) revealed that safety information was perceived as highly desirable. Drivers wanted information on, for example, hazards or road conditions. Also important for long-haul drivers was information on the condition of the vehicle and its cargo, and the possibility of voice or message communication. So, too, was information on route navigation, route selection and guidance, and route scheduling. Less important was information on services and amenities. The present research goes beyond this work by also examining the company point of view (as embodied in planners and dispatchers) and not just that of drivers.

Given the wealth of information that such a system can provide, together with the nature of the information (i.e., real-time, quickly developing) it is not unreasonable to expect that there may be errors on occasion. Research has shown that system trust and compliance with system recommendations to be rather robust amongst users (e.g., Fox & Boehm-Davis, 1998). Naturally, these are greatest when there are no errors, but even at accuracy level of 70% compliance and trust are acceptable. This is important, given that system trust is one factor behind acceptance and usage of a route guidance system.

Other work has shown that socioeconomic characteristics of travellers, their habitual travel patterns, commute congestion levels, and attitudes towards in-vehicle technologies significantly influence importance ratings for different types of information and the preferences for timeliness of information delivery (Mannering et al, 1995). For example, the more often a driver uses major highways, the less advanced notice (in terms of distance) is needed, presumably because such drivers develop a strong familiarity with their route and a better awareness of alternative routes and variations in roadway conditions. As another example, drivers with irregular departure times were less likely to consider an in-vehicle display as important, presumably because they were more likely to use pre-trip and not in-vehicle information.

Feedback, which can be defined as information provided by external agents on one's performance (Kluger & DeNisi, 1996), is also another system feature considered positively by users given the potential to improve safety performance or to receive positive recognition of a job well done (Huang et al., 2005). Feedback on performance (e.g., average speed, schedule delay, brake usage) can in many cases be easily collected using present technology. Research has shown that drivers' major concerns with technology feedback are the potential for transgressions of one's privacy and for one to become too reliant on technology such that deterioration in one's safe driving skills occurs (Huang, et al. 2005). It appears that the source of the feedback (i.e., person or technology) is less important but the feedback must be delivered by a knowledgeable source, and it must be valid and accurate to a certain degree (consistent with the aforementioned work on errors). Feedback has only been examined with respect to the driver. It would be interesting to see how feedback

to planners might be received and, indeed, feedback between planners, the head office, and drivers might be perceived.

In one of the very few studies examining different ATIS user groups — private vehicle drivers, commercial vehicle drivers, and commercial vehicle operators or dispatchers — Ng et al. (1995) found that dispatchers valued the possibility for personal communication more than actual traffic information. This is not surprising, as a reliable two-way communication system is needed if dispatchers are to perform their tasks effectively (e.g., updating drivers about incoming orders or changes in destination as is often the case for taxi companies). In contrast, traffic information was rated as more important by commercial vehicle drivers and personal drivers.

The implications of this brief review are that user needs and preferences need to be considered to design an effective and acceptable route guidance system. A great deal of information can potentially be included, which may or may not be attractive to all users. Indeed maximising the features of an ATIS will not maximise acceptance and usage. Even if unwanted features are avoided, the inclusion of too many neutral features may increase complexity and, in turn, reduce driver acceptance (Kantowitz et al., 1997). Future trends leading to the development of ITIS (cf. Adler & Blue, 1998) may be one way to ensure that many features are available while at the same time giving users the freedom to choose which information they wish to have access to during a trip. The accuracy of information is important, even though users tolerate some errors. This is important given that real-time information (e.g., congestion, road accidents) is error prone. Feedback is also important. However, feedback has thus far only been examined for drivers. It is worthwhile examining how feedback and communication between drivers and planners and the head office is perceived.

The focus of the present research is determining what users (i.e., truck drivers, route planners, dispatchers, logistics experts) of an intelligent route guidance system perceive as important information that should be made available and what information they perceive as acceptable to collect and/or monitor. This links well with the objectives of the HeavyRoute project. Extending the research reviewed above, road-user needs, vehicle operating costs and environmental costs will be able to be taken into full account as a result of using the HeavyRoute system. The same also applies to maintenance costs for road owners/managers arising from deterioration of roads and bridges and their impact on road safety. Working with all major stakeholders (with FEHRL and ERTICO as partners with unique links to road authorities, industry, and suppliers), the unique aspects of HeavyRoute will pave the way for the future large-scale development of a robust pan-European system.

As part of the development process of the proposed HGV system, the user and stakeholder groups likely to benefit are identified and interviewed in order to assess their needs and desires. For example, infrastructure operators/owners are likely to require information about current and predicted traffic problems to support the decisions they need to make with respect to infrastructure operation and maintenance. As another example, the wider economic, environmental, and social issues that public authorities deal with must also be considered.

The aim of this deliverable, therefore, is to identify the requirements for the proposed new HGV management and route guidance system, taking into consideration various key groups including: *HGV drivers*, who deliver goods on the basis of navigation and fleet management instructions; *dispatchers* or *planners*, who plan, monitor, and if necessary re-plan journeys; *logistics companies*, who are responsible for the transport of goods. These groups rely either directly or indirectly on information from: *traffic information providers*, who are responsible for collecting and processing traffic-related data within a given geographical area; *traffic information centres*, who provide end users with traffic information for further use (e.g., in an intelligent HGV management and route guidance system); *traffic managers*, who observe the current traffic situation and make decisions regarding the actions to be taken. This list is not exhaustive; other equally important groups include the general public, road authorities, all levels of government, map providers, weather-information providers, and infrastructure managers/owners. However, attention in this report focuses specifically on drivers and planners (and the logistics or transportations companies for whom they work), as the goal is to ascertain what information these users require in a HGV management and route guidance system; information that to a large degree comes from traffic information providers and centres, as well as traffic managers.

Various key needs will be addressed. Firstly, *route planning before the journey* will be addressed. This is an off-board or back-office system used for planning the route before the journey. Secondly, *driver support during the journey* will also be addressed. This is an on-board system designed to support the driver during the journey. Another need to be considered is the *monitoring of HGVs during the journey*. Such monitoring may involve, for example, speed regulation in various critical situations, as well as the use of real-time data on roads, loads and on the current journey (data that are transferred from the on-board system for road, bridge and traffic management). Finally, *fleet and vehicle management applications*, which deal with maintaining control and contact with the fleet, will also be examined.

Bearing in mind the later stages and work packages in the current EU project, the requirements to be identified need to be both functional (guiding system design tasks) and non-functional (examining boundary conditions, as well as commercial, legal, and institutional requirements).

In order to achieve the objectives of the work undertaken and presented in this deliverable (i.e., to identify user needs of an intelligent heavy vehicle management and guidance system) a two-step procedure was used. Firstly, a series of structured interviews were conducted with various stakeholder groups across four countries (Austria, Belgium, France, Sweden). These were designed to gauge the breadth of views, needs, and opinions held by stakeholders. The answers from the pilot study were also used to inform and guide the questionnaire used in the next stage. The second stage of the work was more quantitative in nature and involved sending questionnaires out to drivers and dispatchers/planners and requesting them to rate the importance of various types of information and support that could potentially be provided in the form of an intelligent HGV management and guidance system. This report is divided into two parts, the first presenting the results from the interview study and the second the results from the survey.

2 Part I. Interview study

2.1 Method

Sample

28 stakeholders took part in the study (Austria=7, Belgium=3, France=12, Sweden=6). They were drawn from a wide variety of sectors: HGV drivers (7); planners and representatives of logistics companies (5); management (2); road authorities (2); road safety engineers (1); experts in the areas of traffic, roads, bridges, and/or telecommunications (10) and stakeholder's representatives (1). Some input was also provided from former projects in Germany and Belgium.

Procedure

The stakeholders were contacted either by phone or by person and asked if they were willing to participate. If they agreed, the interviewer would arrange a meeting, which in most cases was located at the interviewee's place of work. Upon arrival, the interviewee was fully briefed about the aims of the interview, which was carried out in their native language. Each interview lasted about 45 minutes and was tape-recorded. The procedure of each interview was the same; the complete interview guide is included in Annex 1.

Given the limited sample size and the main purpose of interviews as a pilot study, results will focus on answers provided to questions not covered in the survey questionnaire.

2.2 Results

Problems encountered in the past

Interviewees' experiences of past problems associated with HGV management and route guidance can be grouped into four broad categories of problems affecting: i) *driving performance* (e.g., jack-knifing, overloading); ii) *route quality* (e.g., traffic jams, dangerous roads, low/unknown tunnel heights); iii) *cargo discharge and take-over* (e.g., warehousemen not discharging goods, conditions at the cargo-transfer site), and iv) *the navigation system per se* (e.g., too much choice, inter-operability concerns, a lack of information from other countries). In a sense, the experiences of interviewees suggest that there is a general lack of both static and dynamic/real-time information associated with present systems.

Perceived benefits of a route guidance system

Interviewees endorsed the potential for intelligent route guidance systems to provide a wide range of benefits and effects. The expected *economic benefits* of an intelligent HGV guidance system related to less fuel consumption, less driving time, less wear and tear on roads (and vehicles), as well as fewer accidents taking place. Not unrelated to these benefits is the expectation that there would be less time spent in congested traffic conditions, fewer unloaded trucks on roads, and a better optimisation of transport. The perceived *environmental benefits* had to do with less pollution and less wear and tear of tyres. Fewer trucks were also expected to be on roads. However, the concern was raised that the environmental benefits may come at the expense of longer transportation times (presumably through the avoidance of sensitive areas, urban areas and the like). Finally, the *societal effects* of an intelligent HGV route guidance system were less overwhelmingly positive. While there was the expectation of increased cooperation and pan-European harmonisation of rules, together with the provision of better information to reduce accidents and assist the driver to find the correct route, there was also a concern that there would be less communication between drivers and that drivers would be permanently monitored.

Future implementations

Interviewees were asked about the constraints that might apply to the future implementation of a HGV management and route guidance system. Interviewees mentioned the need for some degree of obligation or a decision at the European level, as well as the need for a cost-benefit analysis to be conducted. There was also mention of the need to protect driver privacy (i.e., the system should not be used to track and act as an informer on driver behaviour). Finally, the economic case was seen as important to assisting implementation. More specifically, interviewees believed that fiscal advantages were needed and that the system should not be too expensive.

3 Part II. Survey study

3.1 Method

Sample

The sample consisted of 138 HGV drivers and 41 planners from five different countries. Table 1 shows the responses according to country and research institute. The combined sample was overwhelmingly male: 167 males, 10 females (2 respondents did not indicate their sex).

Table 1. Responses according to respondent, country and research institute

	Responses	
Research Institute	Planner	Driver
Austria (Arsenal)	10	42
Belgium (ERTICO)	6	13
Germany (PTV)	3	1
France (LCPC)	0	40
Netherlands (Navteq)	8	15
Sweden (VTI)	14	27

The age of the sample as a whole was evenly distributed, with 12% of the sample born in 1946 or earlier, 24% from 1947 to 1956, 27% from 1957 to 1966, 21% from 1967 to 1976 and 16% in 1977 or later.

The age distribution of the *driver* sample showed that 69.1% were born in 1966 or earlier and, related to this, the average experience of respondents was 16.8 years (SD = 12.1). The majority (56.9%) have experience delivering goods internationally. In the previous 6 months 70.5% of the drivers had also frequently delivered goods to new destinations (once a week or more regularly).

The age distribution of the *planner* sample tended to be younger than the driver sample with 53.7% being born in 1967 or later. This is also reflected in the average experience of planners in the sample: 14.0 years (SD = 12. 6).

Procedure

In general, transportation companies listed in phone directories or specialised transportation Internet directories were searched, relevant companies identified, with initial contact being made by e-mail, regular post or by telephone. An

indication of agreement to participate resulted in questionnaires and a prepaid return envelope for filled questionnaires (and in some cases ball-point pens as a small token of thanks) being distributed to each company's point of contact, who also distributed individual questionnaires to planners and drivers. An exception to this general procedure was the French driver sample, which was contacted in person at two different parking lots near the A6 French motorway. The slight national variations in procedure coupled with the fact that distribution mainly went through a company's point of contact (e.g., it is impossible to know exactly how many questionnaires were distributed by each contact) make it difficult to calculate an exact response rate, although in many cases a great deal more questionnaires were sent out than were received. For example, VTI sent questioners to 14 companies (21 were contacted and 7 refused to participate) with a total of 584 drivers and 61 planners. How many questionnaires were distributed to these employees and how many employees refused to participate could not be determined, although the response rate can be argued to be low. This apply to all partners except for the French one who collected data directly from the participants (response rate approximately 80%). For exact, more detailed descriptions, the reader is requested to contact the responsible research partner for each country.

Annex 2 contains the driver and planner questionnaires. A total of 175 questionnaires were returned. Where possible, a follow-up was conducted to discover the reasons for non-participation. The two most common reasons given had to do with insufficient time and a lack of interest given the belief that such a HGV management and route guidance system was not needed by the individual or company in question (e.g., trips were mostly made to places that were well-known by the driver or company).

3.2 Results

In the questionnaire, drivers and planners were requested to rate the importance of various types of information and support that could potentially be provided in the form of an intelligent HGV management and guidance system. The first part of the results deals with the responses from drivers, the second part with those responses from planners, with the third part comparing and contrasting responses from these two groups.

3.2.1 Drivers.

Pre-trip route planning

Drivers were asked how important it was for them that the pre-trip route planning considered a number of different factors before choosing the best route. The results showed that drivers believed height restrictions on bridges and in tunnels, as well as weight restrictions on bridges, to be of the utmost importance when planning a route. The same applied to information regarding

European road works and the arrival/opening hours at the place of delivery. All other factors were seen as relatively important with the exception of routes with fewest curves/slopes and routes with best evenness quality. Table 2 summarises the average importance of factors considered, together with the percentage of respondents who indicated that a factor was *very important* or *important*.

Table 2. Driver importance of various factors pertaining to pre-trip route planning

Question	Description	N	M	SD	% respondents selecting *very important* or *important*
Road and bridge conditions					
A1.1	Bridge/tunnel height restrictions	134	3.6	0.6	94.0
A1.2	Bridge weight restrictions	134	3.4	0.8	86.6
A1.3	Street size in urban areas	135	3.0	0.9	68.9
A1.4	Roundabout dimensions	132	2.7	1.0	54.5
A1.5	Route with fewest curves/slopes	134	2.1	0.9	32.1
A1.6	Route with best evenness quality	134	2.3	0.9	43.3
Rules/regulations on the route					
A2.1	Speed-limit regulations	134	2.9	0.9	71.6
Access time and restrictions					
A3.1	Access periods in cities	132	3.1	1.0	74.2
A3.2	Delivery place arrival/opening hours	133	3.3	0.9	82.7
A3.3	Restrictions: goods, vehicle type	129	3.0	1.0	75.2
A3.4	Restrictions: vehicle characteristics	128	3.0	1.0	75.8
Other information					
A4.1	Current European roadwork info.	131	3.3	0.7	88.6
A4.2	Delivery place: available parking	135	3.1	1.0	76.3
A4.3	Nature of transported goods	131	3.1	1.0	75.6
A4.4	Own personal preferences	127	2.5	1.1	52.8

Notes. N = number of valid responses; M = mean value (responses range from 1-4, with a high value indicating that respondents believe this factor to be important); SD=standard deviation

Support during the journey

The majority of drivers believed support during the journey in the form of various recommendations and en-route information to be important. The exception to this general rule is information and recommendations regarding the nearest services and amenities, notably hotels, garages/workshops, and restaurants, which were regarded as less important. However, information

about parking lots and secure resting places was something a large proportion found important.

An overwhelming majority of drivers considered information on environmental conditions to be an extremely important form of support during the journey, particularly information on accidents, congestion, worksite locations, temporary lorry bans, and the presence of any unsuitable infrastructure. Related to this, was drivers' indication that guidance on any alternative route (presumably as a response to unexpected, poor environmental conditions) was very important. With regard to rules and regulations the most important aspect was maximum axle loads. Table 3 summarises driver views regarding the importance of various aspects of en-route support.

c. HGV monitoring and management during the journey

Drivers were also asked about the *importance* of communication with the head office and other drivers, and if it was *acceptable* that head office had access to certain en-route information about them and their vehicle during the journey (see Table 4). The results show that most drivers see the importance of en-route communication between the head office and their HGV, although the communication with other drivers appeared to be more important. During the journey drivers could be warned about different obstructions on the road, with drivers finding it especially important to be warned about congestion. Nevertheless, the results also demonstrate that levels of acceptability for access to driver and vehicle information by the head office are relatively low amongst drivers, particularly for information regarding speed and adherence to the selected route. (As will be seen later in the section dealing with planner responses, this is precisely the type of information planners consider to be very important).

Table 3. Driver importance of various aspects of support during the journey

Question	Description	N	M	SD	% respondents selecting *very important* or *important*"
Recommendations to follow rules/regulations					
B1.1	Appropriate speed for road conditions	134	2.9	0.9	68.7
B1.3	Obligations: snow chains, winter tyres	127	2.9	1.0	66.1
B1.4	Minimum inter-vehicle distances	135	2.9	1.0	68.1
B1.5	Maximum axle loads	135	3.1	0.9	76.3
Recommendations concerning environmental conditions					
B2.1	Accidents	136	3.5	0.7	94.9
B2.2	Congestion	136	3.5	0.6	96.3
B2.3	Severe weather conditions	136	3.1	1.0	75.7
B2.4	Severe road conditions	135	3.0	0.9	68.9
B2.5	Worksites	136	3.3	0.7	89.0
B2.6	Temporary lorry bans	136	3.5	0.6	93.4
B2.7	Unsuitable infrastructure	135	3.6	0.7	94.1
Recommendations for dealing with poor environmental conditions					
B3	Guidance on an alternative route	118	3.4	0.6	94.1
Recommendations concerning nearest services and amenities					
B4.1	Parking lots, secure resting places	136	3.0	0.9	75.0
B4.2	Petrol stations	136	2.6	1.0	52.9
B4.3	Stopping place (time to, distance from)	135	2.8	0.9	65.9
B4.4	Emergency phone	136	2.4	1.0	45.6
B4.5	Garage/workshop	134	2.2	1.0	33.6
B4.6	Restaurant	134	2.3	1.0	36.6
B4.7	Hotel	129	1.7	0.9	14.7
Information about own HGV					
B5.1	Lateral position (lane keeping)	132	2.6	0.9	59.1
B5.2	Axle load	133	3.0	0.9	75.2
B5.3	Distance to vehicle in front	136	2.8	0.9	66.9

Notes. N = number of valid responses; M = mean value (responses range from 1-4, with a high value indicating that respondents believe this factor to be important); SD=standard deviation

Table 4. Driver importance (acceptability) of en-route HGV monitoring/management

Question	Description	N	M	SD	% respondents selecting *very important* or *important*
Communication with head office or other drivers					
C1.1	Incoming orders during journey	136	2.8	0.9	69.1
C1.2	Delivery completion	136	2.6	0.9	61.0
C1.3	Warning other vehicles of hazards	137	3.2	0.8	83.9
Feedback of information and sending of an alert					
C2.1	Detected tiredness: suggestion of nearby parking area	136	2.9	1.0	66.2
C2.2	Resting time violation: suggestion of nearby parking area	136	3.0	0.9	73.5
C2.3	Non-adherence to selected route: suggestion of ways to get back on track	136	2.8	0.9	69.1
C2.4	Violations of speed regulations	134	2.8	0.9	65.7
C2.5	Violations of load regulations	133	2.9	0.9	71.4
C2.6	Warnings of rollover risk	135	2.9	1.0	70.4
Acceptability regarding head office access to information[*]					
C3.1	Own location (for transport security)	136	2.7	1.0	65.4
C3.2	General positioning of vehicle	136	2.5	1.0	61.0
C3.3	Speed	135	2.2	0.9	38.5
C3.4	Adherence to selected route	135	2.3	0.9	46.7
C3.5	Own physical condition (tiredness)	134	2.5	1.1	52.2
C3.6	Delays	135	2.9	0.8	75.6
C3.7	Adherence to resting-time rules	136	2.8	0.9	70.6
C3.8	Vehicle axle loads	136	2.8	1.0	66.2

Notes. N = number of valid responses; M = mean value (responses range from 1-4, with a high value indicating that respondents believe this factor to be important); SD=standard deviation. The right-most column for items C3.1 through C3.8 indicates the percentage of respondents finding head office access to such information as “very acceptable” or “acceptable”

d. Other factors influencing driver perception of route guidance systems

It is conceivable that the system being assessed in the survey might be of more use to drivers who often delivered goods abroad. Hence, statistical comparisons were performed comparing drivers delivering goods abroad with

those not delivering goods abroad. Only results significant at the (Bonferroni-corrected[1]) level of $p < 0.05$ or less are reported.

The results showed that with regard to pre-trip planning drivers delivering goods abroad considered it more important to be informed about restrictions for certain vehicles according to their characteristics in respective countries. They also argued that it was more important that the system provided them with information about the nearest garage/workshop and that it warned them if the infrastructure was unsuitable (i.e., tunnel height, load limits of bridges). In contrast, drivers who did not deliver goods abroad believed that it was more important for the system to inform them about violations of resting times and to suggest nearby parking. They also thought it was more important to be informed about whether or not they violate speed regulations as compared to drivers delivering goods abroad.

Although desirable, tests were not conducted to see if any differences existed across countries. The main reasons for this decision centred on the small sample size for certain countries and on the difficulty in interpreting (possibly randomly significant) differences. Additionally, it is not entirely clear how one might interpret potential differences — for example, in terms of the importance of information regarding the nearest garage/workshop or vehicle axle loads — between drivers from different countries.

3.2.2 Planners

Pre-trip route planning

Planners' responses with respect to the importance of factors considered in pre-trip route planning were assessed. The average importance of factors considered in pre-trip route planning, together with the percentage of planners indicating that a factor was *very important* or *important*, are presented in Table 5.

Planners believed height restrictions on bridges and in tunnels, information regarding European road works, and the arrival/opening hours at the place of delivery to be particularly important in the planning of a route. Even so — excluding routes with fewest curves/slopes, routes with best evenness quality and roundabout dimensions — all other factors were still seen to be important or very important by the majority of planners in the context of pre-trip route planning.

[1] The more tests that are conducted on the same set of data, the more likely it is that a test will be found to be significant; a phenomenon referred to as the inflation of the overall Type I error rate**.** A Bonferroni correction makes it less likely that any single test achieves statistical significance by maintaining the overall Type I error rate at 0.05, thereby minimizing the chances of erroneously accepting an observed difference as not-equal-to-zero when in fact (in the population) it is equal to zero.

Table 5. Planner importance of factors pertaining to pre-trip route planning

Question	Description	N	M	SD	% respondents selecting *very important* or *important*
Road and bridge conditions					
A1.1	Bridge/tunnel height restrictions	40	3.5	0.8	85.0
A1.2	Bridge weight restrictions	39	3.2	0.9	76.9
A1.3	Street size in urban areas	39	3.0	0.7	71.8
A1.4	Roundabout dimensions	41	2.4	0.9	43.9
A1.5	Route with fewest curves/slopes	40	2.1	0.7	25.0
A1.6	Route with best evenness quality	39	2.1	0.7	23.1
Rules/regulations on the route					
A2.1	Speed-limit regulations	39	3.0	0.8	66.7
Access time and restrictions					
A3.1	Access periods in cities	39	3.1	1.0	69.2
A3.2	Delivery place arrival/opening hours	40	3.4	0.7	90.0
A3.3	Restrictions: goods, vehicle type	39	3.1	0.8	76.9
A3.4	Restrictions: vehicle characteristics	39	2.8	0.8	66.7
Other information					
A4.1	Current European roadwork info.	38	3.1	0.9	78.9
A4.2	Delivery place: available parking	39	2.6	0.8	59.0
A4.3	Nature of transported goods	40	3.1	1.0	75.0
A4.4	Driver personal preferences	39	2.5	0.9	48.7
A4.5	Additional information (e.g., emissions, total fuel usage)	38	2.5	0.9	57.9

Notes. N = number of valid responses; M = mean value (responses range from 1-4, with a high value indicating that respondents believe this factor to be important); SD=standard deviation.

b. HGV monitoring and management during the journey

In general, the majority of planners seemed to consider most important any information that ensured the safe transport of the goods without necessarily reverting to the micromanagement of individual drivers. This is why, for example, driver location, adherence to the selected route, delays and adherence to resting-time rules was considered important, while less important was driver speed. Similarly, upon detection of tiredness or resting-time violations planners wished to be able to communicate alerts to drivers, they wished to communicate information about new routes or even warn drivers of any loading/unloading difficulties; but less important was the communication of

alerts when drivers violated speed regulations. Planners also wished to know about the general location of the vehicle, its axle loads, and whether or not the HGV was overloaded. The results are summarised in Table 6.

Table 6. Planner importance of en-route HGV monitoring/management

Question	Description	N	M	SD	% respondents selecting *very important* or *important*
Communication new information with drivers					
B1.1	Incoming orders	38	3.2	1.0	71.1
Information about drivers					
B2.1	Driver location (for security)	40	3.6	0.7	87.5
B2.2	Speed	41	2.7	0.8	58.5
B2.3	Adherence to selected route	41	3.1	0.7	82.9
B2.4	Driver physical condition (tiredness)	41	3.1	0.8	75.6
B2.5	Delays	40	3.7	0.5	100.0
B2.6	Adherence to resting-time rules	38	3.5	0.6	97.6
Communicating alerts to the driver					
B3.1	Detected tiredness: stop, suggest nearby parking area	39	3.2	0.8	79.5
B3.2	Resting-time violation: stop, suggest nearby parking area	38	3.2	0.8	84.2
B3.3	Non-adherence to selected route: suggest ways to get back on track	39	3.0	0.9	71.8
B3.4	Violations of speed regulations	38	2.7	0.8	57.9
B3.5	New route	39	3.1	0.7	87.2
B3.6	Loading/unloading difficulties	39	3.7	0.5	97.4
Information about vehicle					
B4.1	General positioning of vehicle	39	3.4	0.8	89.7
B4.2	Centre of gravity height	38	2.7	0.9	65.8
B4.3	Vehicle axle loads	39	3.3	0.7	89.7
B4.4	Poor truck stability/loading	38	3.1	0.8	73.7
B4.5	Fuel consumption	39	3.0	0.7	74.4
B4.6	Overloading of truck	39	3.4	0.8	82.1
B4.7	Driver brake usage	39	2.7	1.0	56.4

Notes. N = number of valid responses; M = mean value (responses range from 1-4, with a high value indicating that respondents believe this factor to be important); SD=standard deviation.

3.2.3 Drivers and planners compared

While questions were individually tailored to drivers and planners alike, there was considerable overlap in the questions posed to both groups, thereby enabling a comparison of responses. Only results significant at the (Bonferroni-corrected) level of $p < 0.05$ or less are reported.

With regard to pre-trip planning, information about parking at place of delivery was considered more important by drivers than by planners. Thereafter, all significant differences arose in the area of en-route HGV management and monitoring. While a comparison is not exactly appropriate given the measurement of acceptance (by drivers) on the one hand and of importance (for planners) on the other, it is nevertheless the case that *planners believed access to such information was more important than drivers' acceptance of such access to information*. This finding applied to the physical condition of drivers (and, related to this, the ability to communicate an alert to drivers in the case of detected tiredness), driver speed, adherence to the selected route as well as to resting-time rules, whether any delays are experienced, driver location (for transport security), the general location of the vehicle, and vehicle axle loads. The results are summarised in Table 7.

Table 7. Importance of en-route HGV monitoring: drivers vs. planners

Description	Drivers Mean (SD)	Planners Mean (SD)
Location (for transport security)	2.7 (1.0)	3.6 (0.7)
General positioning/location of vehicle	2.5 (1.0)	3.4 (0.8)
Speed	2.2 (0.9)	2.7 (0.8)
Adherence to selected route	2.3 (0.9)	3.1 (0.7)
Physical condition (tiredness)	2.5 (1.1)	3.1 (0.8)
Delays	2.9 (0.8)	3.7 (0.5)
Adherence to resting-time rules	2.8 (0.9)	3.5 (0.6)
Vehicle axle loads	2.8 (1.0)	3.3 (0.7)

Notes. All results significant at a level of $p < 0.05$ or less. Mean values range from 1-4, with a high value indicating that respondents believe this factor to be either important (planners) or acceptable (drivers); SD=standard deviation

In a separate module in the questionnaire, drivers and planners were also asked to rank the route attributes *quickest, safest, most reliable, most convenient,* and *cheapest*. Table 8 shows three different measures of central tendency in the sample as a whole and for each subsample. These are the mean (i.e., average), the median (i.e., the middle value when all scores from all respondents are ordered from lowest to highest; in the case of an even number of respondents the average of the two middle responses is taken as the median), and the mode (i.e., the most commonly assigned rank amongst

respondents). Strictly speaking, when dealing with data that is comprised of rank orders it is inappropriate (and potentially confusing) to examine the mean. It is nevertheless included as an additional source of information. Statistical analyses and interpretation are based on median and mode values.

Table 8. Rankings of importance of route attributes

	Route attributes									
	Quickest		Safest		Most reliable		Most convenient		Cheapest	
Sample	Mdn	Mod	Mdn	Mod	Mdn	Mod	Mdn	Mod	Mdn	Mod
Drivers	3.0	2	3.0	2	1.0	1	4.0	5	3.0	3
Planners	3.0	2	3.0	4	1.0	1	5.0	5	3.0	2
Total	3.0	2	3.0	4	1.0	1	4.0	5	3.0	3

Note. Ranks range from 1 (most important) through 5 (least important). Lower values indicate that the attribute is *more* important (i.e., more highly ranked); Mdn = Median; Mod = Mode

Table 8 shows that the most highly ranked route attributes was *most reliable*, with the *most convenient* route being most consistently lowly ranked. The importance of the remaining route attributes fell between these extremes, with some minor variations as one considers drivers or planners. More specifically, the route attributes *quickest* and *safest* both had mode ranks of 2 for drivers, with the cheapest route being most commonly assigned a rank of 3, whereas the route attributes *quickest* and *cheapest* both had mode ranks of 2 for planners, with the safest route being most commonly assigned a rank of 3. Wilcoxon-Mann-Whitney tests were performed to more closely examine whether there were any differences between driver and planners. No significant differences were found. In other words, despite small differences, planners and drivers tended to assign similar ranks to the various attributes (i.e., they concurred on importance).

4 Discussion

The present research used an in-depth interview study of key stakeholders and a questionnaire study of drivers and planners in order to identify what potential users of an intelligent HGV management and route guidance system need most and what information they consider to be most important. Taken together, the studies reveal a commonly perceived need for such a system and recognition of any associated benefits, as well as potential areas of conflict in relation to any potential system implementation.

Interview study

The interview study demonstrated that key problems associated with HGV management and route guidance in the past have been associated with the lack of both static and dynamic/real-time information associated with driving performance, route quality, and cargo discharge/delivery. Additionally, there has also been concern with the inter-operability of systems both within and between countries. These factors together might be a partial account for why the present research failed to find any standout HGV management and guidance system on the market, instead finding 13 different systems currently in use by the 18 interviewees. It might also account why some thought there was too much choice on the market.

Even so, a clear message originating from interviewees was the need and the desire to have a HGV management and route guidance system given the wide and varied economic, environmental and social benefits associated with such systems. Economic effects, such as less fuel consumption, driving time, congestion and fewer unloaded trucks, were prioritised with environmental benefits also being important to the extent they were compatible with economic benefits (e.g., less fuel consumption and congestion). Social effects of HGV management and route guidance systems were less appreciated (e.g., increased cooperation and pan-European harmonisation of rules) given the perceived risk that drivers could be permanently monitored. The importance of economic effects was also revealed in the questionnaire survey.

Survey study

The most highly ranked route attribute was *most reliable*, with the *most convenient* route being most consistently lowly ranked. The importance of the remaining route attributes fell between these extremes, with some minor variations as one considers drivers or planners. No significant differences were found: planners and drivers tended to be in agreement regarding the importance of the route attributes examined.

Planners and drivers were also in agreement when it came to the importance of various factors in pre-trip route planning. The majority of factors dealing with access time and restrictions, en-route rules and regulations, as well

as road and bridge conditions were considered important or very important. Less important was information that can be construed as being within the control of the vehicle and/or vehicle manufacturers (in terms of vehicle design and vehicle handling): roundabout dimensions, route with fewest curves/slopes, and route with best evenness quality.

Route attributes that were ranked most highly were *most reliable*, *cheapest*, and *quickest*. The only difference found amongst drivers and planners was in the case of the relatively lowly ranked attribute of route safety, with drivers tending to assign a higher rank (i.e., consider more important) than planners.

Planners and drivers were also in agreement when it came to the importance of various factors in pre-trip route planning. The majority of factors dealing with access time and restrictions, en-route rules and regulations, as well as road and bridge conditions were considered important or very important. Less important was information that can be construed as being within the control of the vehicle and/or vehicle manufacturers (in terms of vehicle design and vehicle handling): roundabout dimensions, route with fewest curves/slopes, and route with best evenness quality.

This finding ties in nicely with the kind of information drivers considered to be most important regarding support during the journey: information about environmental conditions, particularly those which might affect the ability to perform the task at hand (e.g., accidents, congestion, unsuitable infrastructure). Drivers also indicated that route guidance on alternative routes, presumably in response to such environmental conditions, was also important. The type of information considered not as important had to with the presence or location of nearby amenities (e.g., hotels, petrol stations), a finding that is compatible with the findings of Kantowitz et al. (1997). It might be that drivers found such information unimportant or that choices related to such factors were a matter of each driver's personal preferences and freedom. However, a notable exception was information about parking lots and secure resting-places. One conceivable interpretation is that this finding reflects the fact that many drivers travel alone without the support or backup of networks and large companies. Another is the fact that a high number of lorry loads are stolen in Europe. According to a recent report by the European commission lorry loads to the value of EUR 8.2 billion are annually stolen in Europe (Flandersnews.be, 2007). This figure might even be higher if one considers that such incidents might be under-reported by companies due to fear of increased premiums. Lorry drivers are also threatened in 15% of cases, and in another 15% of cases the lorry itself is stolen.

Despite general agreement, some differences were also found between drivers delivering goods abroad and those dealing solely with domestic deliveries. Not surprisingly, drivers delivering goods abroad found information about conditions abroad to be more important than drivers not delivering goods internationally. More specifically, drivers involved in international deliveries considered information about the nearest garage/workshop and unsuitable infrastructure as more important, which might reflect the fact that they are less familiar with the area. In contrast, drivers involved in domestic deliveries were

more interested in a system which informed them about resting times, nearby parking and whether or not they violated speeding regulations. Such differences are not as easy to understand as the previous differences, although they may reflect other differences between the two groups such as experience with the aforementioned.

The notion that being a HGV driver has an appealing freedom aspect is perhaps also seen when one examines information to do with en-route HGV monitoring and management. This is precisely where differences between planners and drivers are at their greatest. More specifically, planners believed access to information they perceived as necessary to management process was important (e.g., the physical condition of drivers, driver speed, adherence to the selected route as well as to resting-time rules, the general location of the vehicle, and vehicle axle loads) but drivers believed that access to precisely this information was not entirely acceptable. Such insights were also alluded to in interview findings regarding the social effects of HGV management and route guidance systems. Interestingly, these findings are also compatible with previous research by Ng et al. (1995) showing that dispatchers valued communication capabilities (i.e., aspects of an ATIS that are needed for effective monitoring and management) more than traffic information, whereas the converse was true for commercial drivers.

Implications for system implementation

It appears then that drivers and planners tend to agree in terms of the need for a HGV management and route guidance system and any benefits such a system may bring with it. They are also in agreement with regards to the importance of the majority of information that such a system needs to collect and the information such a system can provide. However, care needs to be taken in the implementation and development of any such system because some of the information planners see as important corresponds to a level of access that drivers find unacceptable. The issue here is how to allay driver fears of monitoring and supervision while concomitantly satisfying planner needs to ensure reliable, speedy, and cheap delivery.

One possible way to resolve this issue might be to make explicitly clear to drivers what the benefits of greater management and monitoring for them are and to emphasise that the interest from planners is not in micromanagement or in restricting the freedoms associated with being a HGV driver. Additionally, different incentives could also be considered. For example, safe and environmentally friendly driving, which is argued to be more likely to result from the use of a HGV management and route guidance system than without such use, could be rewarded with a bonus, thereby encouraging greater take-up and less resistance. Another possibility is to provide users with the freedom to choose the information they wish to have access to, a feature that defines the next generation of traveller information systems (Adler & Blue, 1998). This is not to say that some information is ignored or not available. Quite the contrary, all information is available but the individual user selects which information to access on the basis of personal preferences, needs, experiences, and so on.

Conceivably, this might lead to a situation where drivers and planners/dispatchers involved in the same delivery access different information. This need not be a problem, so long as the information can be simultaneously transferred (verbally or visually) whenever communication is initiated between the two parties so that no misunderstanding occurs. If anything, this might prove valuable in that drivers do like receiving feedback (Huang et al, 2005) and there is the potential for a driver or planner to adjust the information they access in the future on the basis of such interaction (i.e., a form of learning process). Finally, the freedom to tailor the information one has default access to will also increase acceptance of any such system by limiting the number of unwanted and neutral features with which a user needs to deal (Kantowitz et al., 1997)

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Annex 1. Interview guide

Stakeholder and User Requirements

Interviews will be held in five European countries (Austria, Belgium, France, The Netherlands and Sweden). PTV has promised to carry out 2-3 interviews. NAVTEQ will provide contacts with their customers and IRU should be contacted for interviews.

Participants:

Approximately 10 persons will be interviewed; 3 truck drivers, and an appropriate number from the following groups: logistic companies/freight carriers, local authorities, road infrastructure owner/road authorities.

Initial call

We are carrying out some interviews in connection with an EU funded project called Heavy Route. The aim of this project is to develop an advanced route guidance system for HGVs. This cannot be done without consulting the users. I would therefore like to interview you and find out what your requirements are. The interview will take about 45 min and I can visit your place of work. (If they agree decide on practical matters). At the end of the conversation ask them to think some more about route guidance system until you meet.

Please note that the introduction should not be too detailed since we want to find out what their views are. Do not mention any specific requirements or that it could have economic, societal and environmental effects.

Interview guide

Start with reminding them about the project. Tell them that the interview will be recorded but that any personal details will be treated with strict confidentiality. *Questions in italic should be asked if the topic has not already been discussed.*

1. With regard to route guidance of HGVs what problems have you encountered in the past?
2. What kind of route guidance of HGVs do you currently use? *(date of purchase, date when map was last updated, if it is an on-board system)*
3. What are the main advantages concerning this system?
4. What are the main disadvantages concerning this system?
5. If we now look at your future requirements what would you consider being most important with regard to:
    a. Pre-trip route planning?
    b. Driver support during the journey?
        What about supports increasing traffic safety?
    c. HGVs monitoring and management during the journey?
6. Can you think about any other effects from an intelligent HGV guidance system?
    What about economic benefits?
    What about environmental benefits?
    What about the society?
7. How important is it that the system also has societal, environmental and economic effects
8. Can you foresee a reduction in road and bridge deterioration and if so what would the economic benefits be from that? *(Only to road owners/operators)*
9. In your opinion how would a future system be implemented?

Finally some information about the person:

10. How long have you been working in this field?

To be filled in by the interviewer:

What country is the person working in?

What type of organisation/branch of business does he/she work in?

Annex 2. Surveys

Planners

NAME AND LOGO OF YOUR INSTITUTION and EU LOGO

Help us to improve the system which plan the route for heavy goods vehicles

Planners Questionnaire

You have been chosen to take part in a study dealing with route guidance. The study is for the EU project HeavyRoute, which is partly funded by the European Commission (http://heavyroute.fehrl.org). The aim of this project is to develop an advanced route guidance system for heavy goods vehicles (HGV). The system will for the first time take into full account road user needs, vehicle operating and environmental costs as well as maintenance costs for the road owner/manager due to deterioration of roads and bridges. Working with all major stakeholders, including the industry and suppliers, the results of this project will pave the way for future large-scale development of a robust pan-European system.

We therefore turn to you and hope that you will find the time to fill in the following questionnaire which can provide us with vital information on what you as a HGV tour planner need. Perhaps I should also say that your response is strictly anonymous.

When you have completed the questionnaire, please return it in the pre-paid envelope provided, to the address indicated on the envelope. If you have any questions about this survey you can contact:

Your contact person

Tel:

Thank you for co-operating in this important project.

When you plan a trip a number of factors are considered. What in your opinion would you need in order to plan the best route for your HGV drivers?		Very important	Important	Less important	Not important at all	No opinion
A	**How important are the following factors when you are planning a route:** (*Please, put an "x" in the cell that corresponds best with your opinion).*					
A.1	**Road and bridge conditions**					
A.1.1	Height restrictions of bridges or tunnel					
A.1.2	Weight restrictions of bridges .					
A.1.3	Size of streets in urban areas					
A.1.4	Dimension of roundabouts					
A.1.5	Route with least curves and slopes					
A.1.6	Route with the best evenness quality					
A.2	**Rules and regulations on the route**					
A.2.1	Regulations with regard to speed limits					
A.3	**Access time and restrictions**					
A.3.1	Access period in cities					
A.3.2	Arrival and period of opening at place of delivery					
A.3.3	Restrictions for certain vehicle types or goods in different countries (e.g. HGVs > 7.5 tons are not allowed to use the motorway during night time)					
A.3.4	Restrictions for certain vehicles according to their characteristics in different countries (e.g. weight, engine/EURO-classification)					
A.4	**Other information**					
A.4.1	Up to date information about road works in Europe					
A.4.2	Available parking at place of delivery					
A.4.3	The nature of the carried goods (e.g. Dangerous goods)					
A.4.4	Personal preferences of the driver					
A.4.5	How important would it be if the system also could provide you with information other than travel time (e.g. total fuel consumption, emissions, tools, impact on infrastructure and associated costs for alternative routes)?					

In <u>general</u> when planning a journey how would you rank the following alternatives? 1 indicates that it is the most important one and 5 that it is the least important one.

❑ the *quickest* route even if the driver needs to use more inconvenient short cuts

❑ the *safest route with regard to other road users* (e.g. avoiding residential areas)

❑ the *most reliable* route to ensure arrival at a specified time

❑ the most *convenient* even if it is longer (i.e. a trip using mainly main roads thus avoiding narrow, uneven roads with weak shoulders and areas with speed restriction)

❑ the *cheapest route*

PART B – HGVS MONITORING AND MANAGEMENT DURING THE JOURNEY		Very important	Important	Less important	Not important at all	No opinion
B.1	**How important is it for you to communicate with the drivers about the following:**					
B.1.1	Information about incoming orders					
B.2	**How important is it for you to have the following information about the driver:**					
B.2.1	Their location in order to ensure secure transportation					
B.2.2	Their speed					
B.2.3	If the driver follow the selected route					
B.2.4	Their physical condition (tiredness)					
B.2.5	Delays					
B.2.6	If they follow the rules about resting times					
B.3	**How important is it that you can communicate with the driver about the following:**					
B.3.1	In case of detected tiredness tell them to stop and suggest a nearby parking area					
B.3.2	In case of violating the resting times tell them to stop and suggest a nearby parking area					
B.3.3	Inform them that the selected route is not followed and suggest ways to get back on track					
B.3.4	Inform them that they violate speed regulations					
B.3.5	Inform them about a new route					
B.3.6	Inform them about difficulties in loading/unloading					

B.4	How important is it for you to have the following information about the vehicle:					
B.4.1	Positioning and location of the vehicle in general					
B.4.2	Centre of gravity height					
B.4.3	Axle loads, gross weight					
B.4.4	Poor stability of the truck related to loading					
B.4.5	Fuel consumption					
B.4.6	Trucks overloading					
B.4.7	Information about the drivers use of the brakes					

Part C. Background information about yourself

1. Please state your sex

- ❑ Man
- ❑ Woman

3. Your date of birth?

- ❑ …….-1946
- ❑ 1947-1956
- ❑ 1957-1966
- ❑ 1967-1976
- ❑ 1977-…….

4. For how many years have you been planning routes for drivers?

_____

5. What type of transports do you plan for (long/short distance, across borders, etc.)

_____

6. Any other comments that you'd like to make about a future route guidance system?

_____
_____
_____
_____
_____
_____
_____

THANK YOU FOR YOUR CO-OPERATION

Drivers

NAME AND LOGO OF YOUR INSTITUTION AND EU LOGO

Help us to improve route guidance systems for heavy goods vehicles

Drivers Questionnaire

You have been chosen to take part in a study dealing with route guidance. The study is for the EU project HeavyRoute, which is partly funded by the European Commission (http://heavyroute.fehrl.org). The aim of this project is to develop an advanced route guidance system for heavy goods vehicles (HGV). The system will for the first time take into full account road user needs, vehicle operating and environmental costs as well as maintenance costs for the road owner/manager due to deterioration of roads and bridges. Working with all major stakeholders, including the industry and suppliers, the results of this project will pave the way for future large-scale development of a robust pan-European system.

We therefore turn to you and hope that you will find the time to fill in the following questionnaire which can provide us with vital information on what you as a frequent HGV driver need. Perhaps I should also say that your response is strictly anonymous.

When you have completed the questionnaire, please return it in the pre-paid envelope provided, to the address indicated on the envelope. If you have any questions about this survey you can contact:

Your contact person

Tel:

Thank you for co-operating in this important project.

Before you start your journey the trip needs to be planned. For some of you this only means that you will be given an address and a map. However, in order to prevent problems during the journey you might need a plan which considers a number of different factors. The following questions deal with pre-trip route planning with the aim to provide you with the best route.		Very important	Important	Less important	Not important at all	No opinion
A	**How important is it for you that the Pre-trip route planning has considered the following factors <u>before</u> choosing the best route:** (*Please, put an "x" in the cell that corresponds best with your opinion).*					
A.1	**Road and bridge conditions**					
A.1.1	Height restrictions of bridges or tunnel					
A.1.2	Weight restrictions on bridges					
A.1.3	Size of streets in urban areas					
A.1.4	Dimension of roundabouts					
A.1.5	Route with the least curves and slopes					
A.1.6	Route with the best evenness quality					
A.2	**Rules and regulations on the route**					
A.2.1	Regulations with regard to speed limits					
A.3	**Access time and restrictions**					
A.3.1	Access period in cities					
A.3.2	Arrival and period of opening at place of delivery					
A.3.3	Restrictions for certain vehicle types or goods in different countries (e.g. HGVs > 7.5 tons are not allowed to use the motorway during night time)					
A.3.4	Restrictions for certain vehicles according to their characteristics in different countries (e.g. weight, engine/EURO-classification)					
A.4	**Other information**					
A.4.1	Up to date information about road works in Europe					
A.4.2	Available parking at place of delivery					
A.4.3	The nature of the carried goods (e.g. Dangerous goods)					
A.4.4	Your personal preferences					

In <u>general</u> how would you rank the following alternatives? 1 indicates that it is the most important one and 5 that it is the least important one.

❑ the *quickest* route even if you need to use more inconvenient short cuts

❑ the *safety of other road users* (e.g. avoiding residential areas)

❑ the *most reliable* route to ensure arrival at a specified time

❑ the most *convenient* even if it is longer (i.e. a trip using mainly main roads thus avoiding narrow, uneven roads with weak shoulders and areas with speed restriction)

❑ the *cheapest route*

PART B – SUPPORT DURING THE JOURNEY		Very important	Important	Less important	Not important at all	No opinion
B.1	**How important is it for you that the system makes recommendations to you about the following rules and regulations**					
B.1.1	Appropriate speed considering conditions of the road (skid resistance, risk for roll-over or jack-knifing, etc.)					
B.1.3	Obligations of snow chains or winter tyres					
B.1.4	Minimum inter vehicle distances (considering real skid resistance of the pavement surface, load of the lorry and speed, i.e. stopping distance)					
B.1.5	Maximum axle loads					
B.2	**How important is it that the system warns you about the following conditions:**					
B.2.1	Accidents					
B.2.2	Congestions					
B.2.3	Areas with severe weather conditions					
B.2.4	Areas with severe road conditions					
B.2.5	Worksites					
B.2.6	Temporary lorry bans					
B.2.7	Unsuitable infrastructure (dimensions, height of tunnel, load limits of bridges, etc.)					
B.3	**How important is it for you that in addition to being warned about the above conditions the system also leads you on an alternative route:**					

B.4	**If needed how important is it that the system is able to inform you about the nearest:**					
B.4.1	Parking lots, secure resting places					
B.4.2	Petrol station					
B.4.3	Place to stop including time and distance					
B.4.4	Emergency telephone					
B.4.5	Garage, workshop					
B.4.6	Restaurant					
B.4.7	Hotel					
B.5	**How important is it for you to have the following information about your HGV:**					
B.5.1	Information about the lateral position of the vehicle (lane keeping)					
B.5.2	Information about the axle load of the trucks					
B.5.3	Information about the distance between your truck and the vehicle in front					

PART C – HGVS MONITORING AND MANAGEMENT DURING THE JOURNEY		Very important	Important	Less important	Not important at all	No opinion
C.1	**How important is it for you to communicate with the head office or other drivers about the following:**					
C.1.1	Information incoming orders during the journey					
C.1.2	Inform the head office when the delivery has been done					
C.1.3	Possibility to warn other vehicles of hazards					
C.2	**If needed how important is it that this information is fed back to you and an alarm is sent out:**					
C.2.1	In case of detected tiredness tell you to stop and suggest a nearby parking lot					
C.2.2	In case of violating the resting times tell you to stop and suggest a nearby parking lot					
C.2.3	Inform you that the selected route is not followed and suggest ways to get back on track					
C.2.4	Inform you that you violate speed regulations					
C.2.5	Inform you that you violate load regulations					
C.2.6	To be warned of rollover risk (in this case, the maximum recommended speed is then communicated to the driver)					

C.3 How acceptable is it for you that the head office has the following information about you and your vehicle:		Very acceptable	Acceptable	Less acceptable	Not acceptable	No opinion
C.3.1	Your location in order to ensure secure transportation					
C.3.2	Positioning and location of the vehicle in general					
C.3.3	Your speed					
C.3.4	If the selected route is followed					
C.3.5	Your physical condition (tiredness)					
C.3.6	Delays					
C.3.7	If you follow the rules about resting times					
C.3.8	The axle loads of your vehicle					

Part D. Background information about yourself

D.1. Please state your sex

- ❑ Man
- ❑ Woman

D.2. What kind of truck do you drive?

_____

D.3. What kind of goods?

_____

D.4. Your date of birth?

- ❑ …….-1946
- ❑ 1947-1956
- ❑ 1957-1966
- ❑ 1967-1976
- ❑ 1977-…….

D.5. During the last six months, approximately how often did you deliver goods to a new destination?

- ❑ Every day
- ❑ Several times a week
- ❑ Once a week
- ❑ Once a fortnight
- ❑ Less than once a fortnight but sometimes every month
- ❑ Less than once a month but sometimes during last 6 months
- ❑ Never

D.6. Do you deliver goods abroad

- ❑ Yes
- ❑ No

D.7. For how long have you been driving a HGV? _____ years

D.8 Are there any other comments that you'd like to make about a future route guidance system?

_____

_____

THANK YOU FOR YOUR CO-OPERATION