Large Scale Collaborative Project

7th Framework Programme

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Test communities final description

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LIST OF ABBREVIATIONS

ABBREVIATION	DESCRIPTION
ADAS	Advanced Driver Assistance System
CAA	Cockpit Activity Assessment Module
CAN	Controller Area Network
DFOT	Detailed Scale FOT
ECA	Environmental conditions assessment module
FLIR	Infra red camera
FOT	Field Operational Test
GPRS	General packet radio service
GPS	Global Positioning System
GSM	Global System for Mobile Communications
ICT	Information and Communication Technology
IMU	inertial measurement unit
LCD	Liquid Crystal Display
LFOT	Large Scale FOT
OBD-II	On-Board Diagnostics (interface)
PND	Personal Navigation Device
RAM	Random Access Memory
RDS	Radio Data System
SD	Secure Digital

ABBREVIATION	DESCRIPTION
SIM	Subscriber Identity Module
TeleFOT	Field Operational Tests of Aftermarket and Nomadic Devices in Vehicles
TMC	Traffic Message Channel
UTF-8	8-bit UCS/Unicode Transformation Format
ORN	Overall Risk Number
RNB	Behavioural Risk Number
RNL	Legal Risk Number
RNO	Organisational Risk Number
RNT	Technical Risk Number
FMEA	Failure Modes and Effects Analysis

REVISION CHART AND HISTORY LOG

REV	DATE	REASON
0.1	2011-03-04	First draft version of the deliverable
0.2	2011-03-10	Summary LFOT/DFOT update
0.3	2011-03-29	Format changes
0.4	2011-05-23	New inputs form partners integrated
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EXECUTIVE SUMMARY

The objective of this public document is to provide the final description of each test site and the different FOTs each site implemented in the TeleFOT project.

TeleFOT is a European co-funded large scale collaborative project. The main objective of TeleFOT is to create a European wide user community for long term testing and assessing mobile driver support functions and services while driving. To do this several Field Operational Tests (FOTs) will be set up all around Europe. These FOTs will be focused on the impact of technically mature ICT systems, and will evaluate safety, user acceptance, efficiency and deployment aspects that will be evaluated and compared among the different FOTs. The project FOTs will be divided into three test communities: Northern Community (Sweden and Finland), the Central Community (U.K., France and Germany) and Southern Community (Spain, Italy and Greece).

The main objective of TeleFOT SP3 is to design, develop and validate tests communities for Field Operational Tests including both large scale and detailed trials and covering the North, the Central and the South Europe, for the assessment of the introduction of nomadic devices to the vehicle environment. In that course, the current deliverable was prepared in collaboration between SP3 and the project management and describes the TeleFOT test communities, as these are being developed and set up within TeleFOT SP3.

More concretely, this deliverable will try to give a wider view of the different test communities and FOTs. Some of the contents shown per FOT and test community are as follows:

- Map of the area of the tests: the location that each test is planned to be performed is provided for all TeleFOT test communities;
- Functions tested: all functions are recalled and a mapping of functions tested and tests site is provided;
- Devices to be used: all nomadic devices to be used during the tests are recalled and a mapping of devices used and tests site is provided;
- Participants: the number and characteristics of the participants envisioned per test site and test are presented;
- Road type: the type of roads that will be addressed during the tests for each test site and test is presented
- Traffic conditions and interaction with other road users: the description of each test community and test site is concluded with the envisioned interaction of the driver with the other road users, taking into account the traffic conditions of the test area

The deliverable D3.3.2 is presenting the final FOTs descriptions and is an update of the former document D3.3.1 in which the preliminary FOT descriptions were presented. Furthermore, this deliverable will also update the overall description of the different FOT plans, updating also the information presented in deliverable 3.4.1 Field Operational Test plans.

1. INTRODUCTION

TeleFOT is a Large Scale Collaborative Project under the Seventh Framework Programme, co-funded by the European Commission DG Information Society and Media within the strategic objective "ICT for Cooperative Systems".

Officially started on June 1st 2008, TeleFOT aims to test the impacts of driver support functions on the driving task with large fleets of test drivers in real-life driving conditions.

In particular, TeleFOT assesses via Field operational Tests the impacts of functions provided by aftermarket and nomadic devices, including future interactive traffic services that will become part of driving environment systems within the next five years.

Field Operational Tests developed in TeleFOT aim at a comprehensive assessment of the efficiency, quality, robustness and user acceptance of in-vehicle systems, such as ICT, for smarter, safer and cleaner driving.

To reach these objectives, TeleFOT project is performing a series of Field Operational Tests (FOTs) which are wide and long-term road tests with a great number of subjects and huge amount of data. In TeleFOT there are two types of FOTs, the so called large scale and detailed FOTs (LFOTs and DFOTs respectively) and they will be performed in 8 different countries throughout Europe.

These long term tests aim to address the impacts of different functions all around Europe. A list of different functions – that will cover the impact areas envisaged in TeleFOT; safety, mobility, efficiency, environmental and user uptake impact assessment - are addressed in the different FOTs.

- Traffic information
- Speed limit information
- Speed alert
- Navigation support (static)
- Navigation support (dynamic)
- Green driving support
- eCall
- Forward Collision Warning
- Lane Departure Warning

In order to organize and coordinate the planning, set up and execution of the TeleFOT tests, a close cooperation between SP2, 3 and 4 was required, which proved to be very effective since the beginning of the project.

1.1. Scope of the deliverable

The deliverable reports the work performed in TeleFOT WP3.3, entitled "Test sites set-up". The main objective of this WP is to carry out the technical and organisational arrangements both at conceptual and material levels, enabling the start of the execution of the different FOTs at the project's different test sites.

More specifically, deliverable D3.3.2 is presenting an overview of the TeleFOT test sites descriptions along with the updated FOT plans. Each test site is presented in terms of their characteristics, their testing procedures and study design. This document is not written from scratch, it rather is a document that contains an update of the information provided both in documents D3.3.1 Initial test sites description and D3.4.1 Field Operational Test plans, which except the FOTs description and test plans followed it also provides an update of the Risk analysis and contingency planning based on the results of the FOTs set-up, piloting and execution phases.

2. TEST COMMUNITIES CONCEPTS

TeleFOT is an example of an FOT, or rather several FOTs. In order to define the key characteristics of the TeleFOT project and its different FOTs, it is necessary to first describe the following key concepts: field test, naturalistic study, experiment, and field operational test.

- By *field tests* is generally meant to test something, e.g. a product, under actual operating conditions or in actual situations reflecting intended use.
- By *naturalistic study* is most often referred to a study where researchers/corresponding observe and record some behaviour or phenomenon, often over a longer period of time, in its natural setting while interfering as little as possible with the subjects/participants or the phenomena.
- *Experiment* is defined as a test or trial carried out for the purpose of discovering something unknown or of testing a principle, supposition, etc.
- By *controlled experiment* is meant an experiment that isolates the effect of one variable on a system by holding constant all variables but the one under observation.
- A *Field Operational Test* is generally described as a test run under normal operating conditions in the environment typically encountered by the subjects and the equipment being tested. Normally a FOT involves a larger number of users using the systems and services in their daily life in actual use conditions.

The TeleFOT project consists of Large scale FOTs (L-FOTs) and Detailed FOTs (D-FOTs). L-FOTs are *naturalistic studies* in the sense that they are studies in which will be investigated normal, everyday, use of a set of nomadic and after market devices and different functions. The studies concern conditions in which the participants receive, use and react to functions and services provided to them and data is to be collected over a longer period of time from a larger number of participants. The studies are also *experiments* in the sense that tests are undertaken in order to find out the answers to questions and hypotheses posed. Nevertheless, they are not controlled experiments even though as rigid a test procedure is to be executed.

Also the D-FOTs will be carried out as experiments in the sense that the tests are undertaken in order to find out the answers to questions and hypotheses posed. However, even though not all D-FOTs may not be carried out as completely controlled experiments, the D-FOTs will be run with more control than the L-FOTs, e.g. will the participants be asked to drive certain routes, as well as under certain conditions. Furthermore, less vehicles and less participants will be involved but the vehicles will be equipped with additional equipment why more, as well as more detailed, data will be collected (e.g. on acceleration patterns, speed, petrol consumption, etc.) than will be the case in L-FOTs.

The L-FOTs constitute the core of the TeleFOT project. The main purpose of running L-FOTs and D-FOTs across different test sites, and in parallel, is to benefit from the particular strengths of the respective approaches, i.e. the higher ecological validity[1] of the naturalistic driving test results, providing evidence of behaviours and behavioural changes over time, and the higher reliability of the experiment, offering possibilities to identify more causal types of explanations to e.g. the drivers' behaviour than will L-FOTs. Thus, the D-FOTs will complement the L-FOTs, providing information for the analysis and interpretation of the results.

The different FOTs implemented within the project can be split into the so called *large-scale* and *detailed* FOTs into eight different Test Sites in seven member states across Europe. In order to coordinate the activities in the different FOTs, TeleFOT has grouped the Test Sites into three different Test Communities:

- Northern Test Community
    - Finland
    - Sweden
- Central Test Community
    - France
    - Germany
    - UK
- Southern Test Community
    - Greece
    - Italy

[1] Ecological validity concerns to which degree the experimental findings mirror what one can observe in the real world (ecology= science of interaction between organism and its environment). Ecological validity is whether the results can be applied to real life situations and not only to an experimental setting.

- o Spain

The organization of the different FOTs and Test Sites in communities facilitates both the coordination and management of all the activities of the project and the comparison of the FOTs results per geographical areas.

The following subsections will try to define the difference between large-scale and detailed FOTs within TeleFOT.

The following sections describe the TeleFOT FOTs, through the presentation of the test sites that are part of each test community. In each TeleFOT test site a list of FOTs (either large-scale or detailed) has been envisioned. For that reason, the FOTs that were set-up in each test site are presented. First the test sites of the Northern test community are presented, in which two test sites are build, namely the Swedish test site and the Finnish test site. Secondly, the Central test community is presented, in which three test sites are build, namely the British test site, the German test site and the French test site. Third, the Southern test community is presented, in which three test sites are build, namely the Italian, the Spanish and the Greek test sites. The presentation of all TeleFOT test sites, decomposed in FOTs presentation is provided in the following sections.

3. NORTH TEST COMMUNITY – SWEDISH TEST SITE

3.1. Large-scale FOT1: Stockholm City

3.1.1. LFOT1 Test Plan (applied)

Study design

The objective of the LFOT1 is to find out the impacts of a nomadic and aftermarket system that provides Speed info, Speed Alert, Traffic Info and Green Driving Support to the drivers of cars owned by different parts of Stockholm City authorities. The device/system is presently introduced in all vehicles as new vehicles are replacing old ones. The device logs data but not present any information to the user for a base line period of three months. The impact will then be measured against this baseline**.**

Reference case

A base line was used during which the device logs data, but does not present information to the participants. A three months baseline was planned.

Data collection

- **Logging –** The device itself is used as logger. Raw data is uploaded to a server through GPRS using the TeleFOT input data structure in order to facilitate later transfer to the TeleFOT data base.
- **Survey tools used –** TeleFOT standard questionnaires are distributed: Background Questionnaire and User Uptake Questionnaires.
- **Other data collection means used-** A number of semi-structured interviews with a selected number of participants.

Pilot conduction

- The pilot took place during May and June 2010.
- Five participants participated in the piloting.

Technical evaluation

The device was evaluated and improved during a period of a year. During this time the device was installed in approximately 300 cars. A lot of work has been done to improve the stability of the device to a point where it now works as intended.

FOT execution

The LFOT1 started on October 2010 and is planned to end on October 2011.

3.1.2. Map of the area of the tests

The test site involves cars from different car fleets of City of Stockholm. The cars are mainly used in Stockholm and the surrounding municipalities (refer to Figure 1).

Stockholm is the biggest town is Sweden with a population of 829,417 in the municipality (2009), 1.25 million in the urban area (2005), and 2 million in the metropolitan area (2009). It can be expected that most driving will be conducted on city roads.

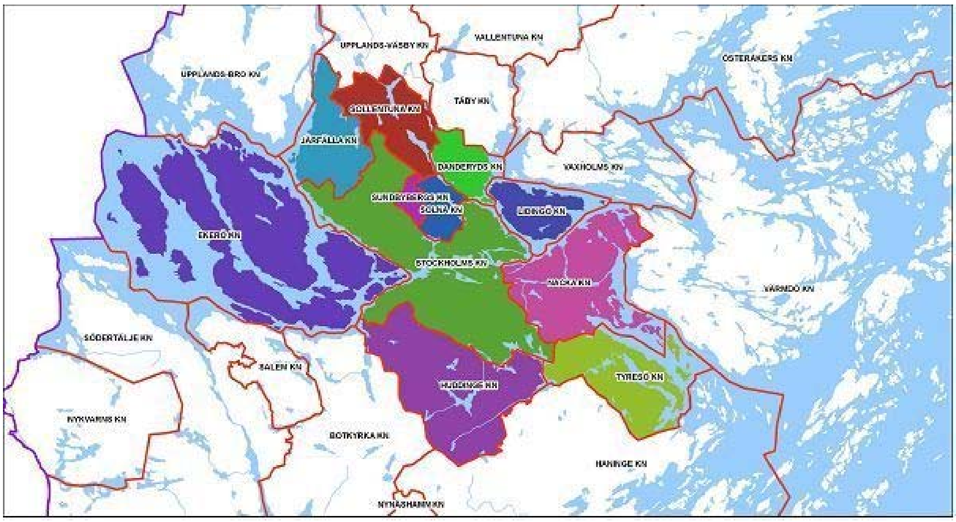


Figure 1: Map of the area of the Swedish FOT1 tests

3.1.3. Functions tested

The functions tested comprise real-time guidance on driving style and fuel efficiency with pre- and post-trip tutoring and feedback. The system also provides Speed Alert and Speed limit information. In addition to the real time information given to the driver on the screen, aggregated data is uploaded on a web site so that it is possible to see how much the whole fleet is speeding, how good they are at driving green etc.

3.1.4. Devices used

The device is an after-market device that is procured by the transportation authorities of City of Stockholm. The software is produced by the company Innova and is run on a PDA running Windows. The PDA is fixed to the car (see the following figure).

Figure 2: Device used in the Swedish LFOT1 (PDA)

3.1.5. Participants (No, characteristics, etc.)

One hundred (100) vehicles are included in the test (the City of Stockholm targets equipping about 1000 vehicles). Each vehicle is driven by several users, so some method for determining which participant drives which car must be developed (probably some simple roadbook or by cross referring to drivers journals). The recruitment was based on willingness to participate. Since the participants all drive in their profession, they will be driving quite long distances per year.

3.1.6. Road type

All road types are included. The road types used are determined by the participants. The character of the cars included in the test makes it probable that most driving is in city traffic.

3.1.7. Traffic conditions and interaction with other road users

All traffic conditions are encountered by the participants.

3.1.8. Weather conditions

Data collection took place over a 3 month base line period and a 6 month treatment period and all weather conditions experienced in that time are a factor in the study. In the Stockholm area it can be expected that most driving is done in snow free conditions.

3.1.9. Time of day and seasonal effects.

Exposure to time of day is determined by the participants. Some cars are used only during office hours, but others are used 24/7 according to their function.

3.2. Large-scale FOT2: The Navigation device with Green driving support

3.2.1. LFOT2 Test Plan (applied)

Study design

The objectives of the LFOT2 is to see the impact of a (relatively simple) Green driving support system (Garmin EcoRoute) on the TeleFOT impact areas.

Reference case

A base line is used where the participants drive with a logger, but without the device.

Data collection

- **Logging –** Data are logged by a separate logger, PerformanceBox by RaceLogic.

- **Survey tools used –** TeleFOT standard questionnaires are used.
- **Other data collection means used-** A number of semi-structured interviews with a selected number of participants.

Pilot conduction

The pilot took place during August-September 2010.
Five participants participated in the piloting. In addition to the functionality of the technical equipment and the data management, this was the LFOT where all questionnaires and travel diaries were piloted in Sweden.

Technical evaluation

The device as well as the logger were tested on May and worked without any problems.

FOT execution

The FOT started on October 2010 and ended on May 2011.

3.2.2. Map of the area of the tests

The test site includes all of Sweden, with participants recruited from the Gothenburg area. Most of the driving was therefore conducted in the Gothenburg area.

Figure 3: Map of the area of the Swedish FOT2 (and FOT3 & FOT4) tests

(Map of Sweden)

3.2.3. Functions tested

The functions tested comprise Speed limit information, Green driving support and Navigation (static).

3.2.4. Devices used

The device used in the Swedish L-FOT2 is the Garmin Navigator in the Nûvi series with EcoRoute (Figure 4). EcoRoute is a new part of Garmin's navigation software that gives indications on how "green" you drive based on GPS data (speed relative speed limits and rate of acceleration). EcoRoute also gives routing advice according to lowest fuel consumption and gives the user a possibility to compete in green driving.

Figure 4: Device used in the Swedish L-FOT2 (Garmin nüvi)

3.2.5. Participants (No, characteristics, etc.)

One hundred (100) users participated in the Swedish LFOT2. The recruitment was done via advertisements in Gothenburg's largest newspaper. The aim has been to stratify the group according to the target group for the device (slightly more men than women 60/40, between the ages of 25 to 65, with more than three years driving experience and driving more than 10000km/year).

3.2.6. Road type

All road types were included.

3.2.7. Traffic conditions and interaction with other road users

All traffic conditions were encountered by the participants.

3.2.8. Weather conditions

Data collection took place over nine months starting September 2010, and all weather conditions experienced in that time are a factor in the study. One could expect that most driving was done in snow free conditions, but there was certainly some snow and ice, quite a lot of rain, but also hot summer days encountered.

3.2.9. Time of day and seasonal effects.

Exposure to time of day was determined by the participants.

3.3. Large-scale FOT3: MOTION

This large-scale FOT has been concluded. The results of this Field Operational Test are provided in the MOTION final report.

3.3.1. LFOT3 Test Plan (applied)

Reference case

No base line existed in LFOT3

Data collection

- **Logging –** Logging was done on the server where all routing calculations etc. was done.
- **Survey tools used –**Questionnaires were filled in by the participants before, during and after the trial. The questionnaires were based on those used in SeMiFOT and FESTA since the TeleFOT questionnaires didn't exist at the time of execution.

Pilot conduction

The piloting was done with the involvement of five participants.

Technical evaluation

The device was evaluated and improved

FOT execution

The FOT started on May 2009 and ended on November 2009.

3.3.2. Map of the area of the tests

The test site included all of Sweden. Participants in the study were recruited from drivers all over Sweden (Figure 3).

3.3.3. Functions tested

The functions tested comprised Speed Alert and Speed limit information coupled to an existing off board navigation system (WisePilot and Telia Navigator by Apello). The users could decide the amount of speeding allowed before the device alerts, and the type of alert (aural and/or visual).

3.3.4. Devices used

WisePilot and Telia Navigator runs in any Java or windows capable mobile phone (Figure 5).

Figure 5: WisePilot by Apello

3.3.5. Participants (No, characteristics, etc.)

760 participants were recruited among Wisepilot's and Telia Navigator's existing customers. The majority were men with a high interest in technology, which corresponds to the actual customer base for the product.

3.3.6. Road type

All road types were included.

3.3.7. Traffic conditions and interaction with other road users

All traffic conditions were encountered by the participants.

3.3.8. Weather conditions

Data collection took place for over five months starting February 2009. All weather conditions experienced in that time were a factor in the study. Sweden has a great variation in weather according to season and from north to south. In the south it is snow free all but a few days/year while the northern parts can expect snow from November until May.

3.3.9. Time of day and seasonal effects.

Exposure to time of day were determined by the participants.

3.4. Large-scale FOT4: Traffic information through an Android app

3.4.1. LFOT4 Test Plan (applied)

Study design

The objectives of the LFOT4 is to see the impact of a traffic information app for Android smartphones.

Reference case

A baseline was used where the participants drioe with the app logging without presenting any information.

Data collection

- **Logging –** Data are logged by the smartphone app.
- **Survey tools used –** TeleFOT standard questionnaires are used.

Pilot conduction

The pilot took place during August 2010.

Technical evaluation

The functionality of the app was tested during August 2010 (during the piloting phase).

FOT execution

The FOT started on September 2010 and ended on May 2011.

3.4.2. Map of the area of the tests

The test site includes all of Sweden (Figure 3).

3.4.3. Functions tested

The function tested is traffic information in the form of dynamic travel times for different routing options

3.4.4. Devices used

The function is provided by an Android app.

3.4.5. Participants (No, characteristics, etc.)

500 participants were recruited by ads in mobile phone journals and through the Swedish traffic administration web page.

3.4.6. Road type

All road types were included.

3.4.7. Traffic conditions and interaction with other road users

All traffic conditions were encountered by the participants.

3.4.8. Weather conditions

Data collection took place over six months during which all weather conditions experienced in that time are a factor in the study.

3.4.9. Time of day and seasonal effects.

Exposure to time of day was determined by the participants.

4. NORTH TEST COMMUNITY – FINNISH TEST SITE

One Large-scale FOT is being executed in Finland (namely LFOT2). A second FOT was planned (namely LFOT1), but negotiations with companies owning vehicle fleets have not been successful. Also, with regards to DFOTs, also DFOT1, which was envisioned during planning of the Finnish detailed FOTs was abandoned. The main purpose of this detailed FOT (DFOT1), using the instrumented BMW 525dA E61 Touring, model 2008, would be to assist LFOT1. However, after assessment of the research questions, which would benefit of the use of the instrumented vehicle, no research questions were found that would need the special equipment, and hence this DFOT was cancelled.

4.1. LFOT2

4.1.1. LFOT2 Test Plan (applied)

Study design

In the Finnish LFOT1 test users have access to the following functions:

- Green Driving System, using EC-Tools DRIVECO module
- LATIS service, provided by Logica. The LATIS service provides the following functions: road weather and traffic information (content provided by Destia), speed limit info and speed alert. LATIS functions can be taken into use independently from each other. The LATIS service includes an FCD function, which gathers every second GPS position and speed information (and acceleration – dependent on the phone model) and sends it to Logica servers.

These applications run on Nokia S60 mobile phones. Both applications start automatically and simultaneously when the mobile phone detects the DRIVECO module using Bluetooth.

The study is a mixed design with before and after data; partly, data from one individual in different situations/time will be compared (in the before-after analysis of the experimental group) – partly, data between the groups will be compared (experimental and control/baseline group). Three groups of drivers are arranged:

- Control/baseline: Drivers with LATIS, including only traffic information (speed limit information and speed alert disabled)
- Experimental 1: Drivers with LATIS (speed alert disabled) and DRIVECO green driving application
- Experimental 2: Drivers with all functions, including also speed alert

The data were logged, but no information was shown during the first 4 weeks. Three weeks data from this period will be included in the analyses. Activation was built in the software package and happens automatically. The length of the follow-up is 13 months.

Participants have been recruited using e.g. newspaper advertisements. The participants are matched based on the background data (sex, age, driving experience etc) and then randomly selected to the three groups (exp1, exp2, cont).

Reference case

The baseline for the test is the LATIS basis service (i.e. LATIS with traffic information, but no speed limit info).

Data collection

- **Logging:** Logging is performed by the built-in FCD functionality of the LATIS function, which gathers location data every second and sends it to Logica server. In addition, the data gathered by the DRIVECO module will be stored (one line of data for the whole trip)
- **Survey tools used:** The questionnaires, harmonized by the TeleFOT consortium, are used, and as much as possible the LimeSurvey web tool. The travel diaries are sent three or four times during the test (at the start, in the middle and at the end of the test).
- **Other data collection means used:** none
- **Data process path (architecture):** The data on service use is gathered by the Logica server (for LATIS function) and by EC-Tools (via DRIVECO). The data is sent at regular intervals (weekly) to the Emtele-operated central server. The questionnaires are filled in at the LimeSurvey server, which is interfaced to the Emtele database. Travel diaries are filled in manually, and the data for all the users is sent to the Emtele server. VTT's software extracts journeys and driving performance indicators from the central database.

Pilot conduction

The piloting consisted of two phases: 1) testing the technical functionalities, in order to assure that the functions are stable, and then 2) testing the whole recruitment, use and evaluation chain. The technical testing started since early 2010 and the full pilot was scheduled for June 2010 and ended on August 2010. It consisted of 5 users and took place in Oulu (2 users), Tampere (2 users) and Espoo (1 user). Paper questionnaires were used. Questionnaire collecting feedback was used and complemented with interviews.

FOT execution

The large scale FOT started on September 2010 and will end on October 2011.

4.1.2. Map of the area of the tests

The functions and services tested in the Finnish Large-scale FOTs cover the whole country. However, the majority of the test users have been recruited from Oulu, Tampere and Helsinki regions due to partner organisation locations and for customer support.

Figure 6: Map of the area of the Finnish LFOT

4.1.3. Functions tested

LATIS™ is a Location aware traffic information solution for drivers. It is based on Logica's Enterprise Mobility framework. Logica's location aware traffic information solution is meant for organizations aiming to provide location relevant and real time information for drivers on the road. Traffic and road weather information are provided by Mediamobile Nordic. Mediamobile Nordic provides the following information:

- Accidents, major road works and other events that effect traffic flow and disturbances of ferries for national roads 1–999.
- Traffic Congestion along major roads
- Road weather: unexpected changes in weather conditions, such as black ice or snowstorms.

During the first months of 2009 (1–15.4.2009) the amount of messages sent was: 200 000 road weather related messages, 140 000 traffic congestion messages, 1500 accident messages and several hundred road works messages. Road weather and congestion messages are only valid for a short time, so that e.g. an hour long road weather condition can cause 4 messages being sent. The messages are approximately equally distributed over Finland, except for congestion messages, which have a major concentration in the Helsinki Metropolitan Area.

Figure 7: Mediamobile Nordic Traffic Information.

LATIS™ utilizes a built-in speech synthesizer to read aloud announcements of nearby incidents or other relevant info. On-line map service is used to display the user's position and the exact location of the incident. Current speed and speed limit are also displayed for users equipped with GPS. The current speed is read aloud, if it exceeds the speed limit. As the information exchange in LATIS™ works both ways by nature, all users produce also advanced FCD information. Manual "one button" reporting of traffic incidents enables even a limited number of users to effectively provide traffic information. LATIS™ mobile phone application works also on the background, enabling a simultaneous use of navigator software. It also reads aloud the incoming SMS messages.

The LATIS service is integrated with DRIVECO service provided by a Finnish company EC-Tools. DRIVECO personal is a green driving advisor for smart phones and an automatic driving diary. DRIVECO collects information on fuel consumption from a separate module connected to OBD-II vehicle interface. The module sends data over Bluetooth to a smartphone running DRIVECO software. Journey summaries are further collected from the smartphone to a web service for reporting and feedback. GPS logs can be used for generating a diary. The development of DRIVECO Personal is based on experience with driving guides for freight transport. Potential savings with green driving are around 10% (www.driveco.fi). The device also allows monitoring and reporting of CO2 emissions.

4.1.4. Nomadic Devices used

LFOT2 uses smartphones based on the Nokia S60 software platform, with built-in GPS receiver. In addition the Driveco module is used in the vehicle. Users who are recruited already own a device compatible with the tested functions.

Figure 8: DRIVECO OBD-II module and mobile phone application.

The participants of this LFOT were provided both with a DRIVECO module and LATIS application.

4.1.5. Participants (No, characteristics, etc.)

150 users were recruited mainly from the Oulu region, but also from Tampere and Helsinki regions. Users needed to have a compatible phone and vehicle, and were advised to have a flat rate telecom contract.

4.1.6. Road type

All road types are included in the test, i.e. urban, peri-urban and highway environments, in order to assess the functions under different road conditions. The road types used will be determined by the participants.

The total length of Finnish road network is 454 000 km, including

- Public Roads 78 000 km of which ~51 000 km is paved. This includes 13 300 km main roads (1–101, including 739 km of motorways) and 13 500 km regional roads.
- Streets 26 000 km
- Other roads (includes private roads, forest truck roads) 350 000 km.

The total amount of kilometres travelled is 53 billion in 2008, from which 67 % (35.6 billion km) on public roads.

Finns make an average of 3 trips a day and use 70 minutes to do so. The distance travelled per day is 42 kilometres per person (Tiehallinto, 2008). 76 % percent of the mobility is as driver of passenger of a passenger car, 15 % by public transport and 5 %

on foot or bicycle. The average amount of km driven in 2008 with personal vehicles was 16 800 km, with trucks 31 100 km and bus 47 200 km.

93 % of passenger traffic and 67 % of goods transport takes place on the roadways. Personal transport (total amount of km) has increased 62 % in the years 1980–2008, personal car transport 82 %. Finland has 3.15 million automobiles which includes 2.7 million passenger cars (Tiehallinto, 2009).

4.1.7. Traffic conditions and interaction with other road users

As mentioned above, different road types are addressed in the test. Consequently, the traffic conditions vary according to the environment and also according to the time of day. Therefore, all traffic conditions are encountered by the participants. The major congestions are during morning and afternoon rush hours in the Helsinki Metropolitan Area.

4.1.8. Weather conditions

The average temperature in Helsinki is -5.7 in February and 17.2 in July (average for 1900-2000, www.fmi.fi), in Sodankylä resp. -13,0 and +14,4. The average daily temperature is below zero on average (1900-2000) from end of November until the end of March in Turku and from mid October to the end of May in Sodankylä (www.fmi.fi).

6000–7000 km highways are mainly kept free of ice and snow with the help of salt. The other roads are partly or completely covered with a layer of compacted snow. Some 10 % of the annual vehicle mileage is generated on roads with a snow or ice covered surface. High volume roads are ploughed first and within two hours after it begins snowing. Other public roads are ploughed within six hours after snowfall begins.

During winter, from the beginning of December until the end of February, winter tyres are obligatory. Winter tyres can be used from the beginning of November until mid April. (www.tiehallinto.fi)

4.1.9. Time of day and seasonal effects

The length of day varies largely depending on the season and the geographical position.

During winter, from the beginning of November to the end of February, winter speed limits are in force. The limits can be lowered already in October and can remain in force through April due to exceptional road weather conditions.

4.2. DFOT 2 - eCall receiving and handling in PSAP

4.2.1. DFOT2 Test Plan (applied)

Study design

The main scope of the eCall FOT in Finland is to evaluate eCall receiving and handling in a Public Safety Answering Point (PSAP). The eCall test will assess the impacts of eCalls to the functions of a PSAP operator compared to the handling of a normal 112 emergency call. The study will cover the time frame from the receiving of the eCall in PSAP system until the risk analysis is done by a PSAP operator. Especially, utilisation of information delivered in the recently standardised eCall MSD (Mininun Data Set) message will be studied.

4.2.2. Functions tested

DFOT2 will include eCall receiving and handling in PSAP.The FOT is concentrated on the following issues:

- measure users (emergency centres) experiences when receiving eCall in PSAP. eCall-MDS messages will be simulated for different accident scenarios, which will be sent to the emergency call training centre. The impact on the risk assessment work of the emergency call centre personnel is evaluated. The assessment will estimate the handling speed of a eCall compared to a normal 112 emergency call.
- The study will also provide new information from PSAP operator point of view to eCall MSD content, visualisation of eCall message and possible needs for intelligent handling support of related eCall-messages, and benefits of eCalls vs. normal 112 emergency calls from a traffic accident.

4.3. DFOT3 - WP4.8 benchmarking tests

4.3.1. DFOT3 Test Plan (applied)

The test included usability tests of three devices. Both expert testing and field tests with 10 users have been carried out during 2009. The devices were: TomTom GO 630 Traffic, Nokia 6210 Navigator and NDrive G800R.

- None of the users have navigator of their own (three of them have tried friend’s or relative’s navigator). All of the users drive more than 10 000 km/year.
- The tests with the users started with various usability tests in a VTT car. Then the users continued to use the devices for 3 weeks as part of their normal life. Data was gathered through usage diaries, web questionnaires and interviews.

4.4. DFOT4 – TeleISA

4.4.1. DFOT4 Test Plan (applied)

TeleISA setup a field trial of a feedback system that provided driving behaviour feedback for novice drivers and their parents. Driving behaviour feedback included especially information about risky driving e.g. speeds compared to speed limits information. PPCT Finland PLC and VTT provided internet reporting feedback for the drivers. The actual field trial is already finished. It started with first logger installations in summer 2010 and the test was done during approximately 6 months. The analysis of the results has now started.

4.4.2. Functions tested

Feedback on driving behaviour (including speeding)

4.4.3. Devices used

Data acquisition from vehicles was implemented with GPS/GPRS loggers which collected information about driving and the driver with RFID-button. Data processing and analysis for feedback reporting was done by VTT in two week periods.

4.4.4. Area and test conditions

Mainly Helsinki and Tampere regions. Test conditions varied during the test from summer to winter conditions.

4.4.5. Participants

Around 30 novice drivers with their parents. The number of female and male novice drivers was equal and most of the novice drivers were between 18 – 20 years.

4.5. DFOT5 - TeleBUS Green driving application

A green driving application and loggers were installed to 15 busses on frequently operated Jokeri-route in the Helsinki Metropolitan area. DFOT-study was started in January 2011 and the results will be available in December 2011.

Impacts of the use of application will be studied e.g. on travel time, schedule realization, fuel consumption and passenger satisfaction based on logger data. Logger data is collected from all the drivers driving the 15 equipped busses. However, the green driving application is active to only those drivers who have been trained to use it.

Background information and some user uptake aspects have been collected from 119 drivers. Part of them has been and will be trained to use the application (test group of this study) and the others are a reference group of the study. The most experienced drivers have been interviewed as well to collect more detailed information of their user uptake. Passenger satisfaction information was collected from approximately 800 passengers of Jokeri-route.

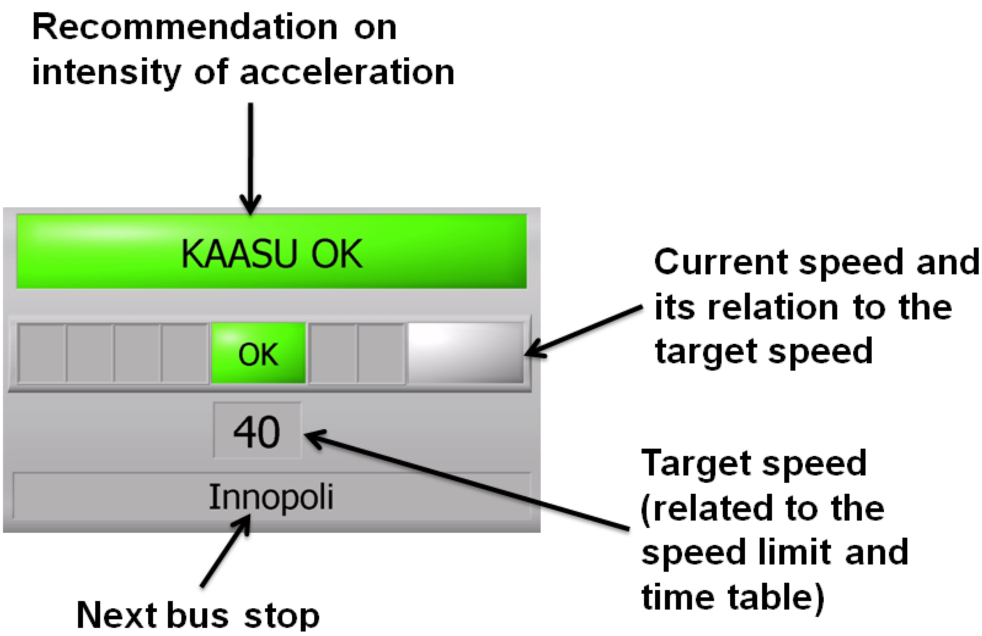


Figure 9: Display of green driving application of in Finnish DFOT5.

5. CENTRAL TEST COMMUNITY – BRITTISH TEST SITE

5.1. LFOT1: BLOM

5.1.1. LFOT1 Test Plan (applied)

Study design

This LFOT studies the impact of use of the BLOM N-Drive PND. This provides navigation support (static); speed limit information and speed alert. 80 participants use the system as their personal device for a fixed period. Impacts on safety, mobility, efficiency, environment and user uptake caused by initial introduction of the system plus changes in those impacts over time will be studied based on real use with no imposed tasks or use cases for the driver.

Reference case

A within subjects design is used. All participants undertook a control and an experimental phase in the FOT.

Data collection

An integrated logger built into the BLOM N-Drive system is used to collect the data. In addition and from findings through pilot trials a backup data logger is provided in the vehicle which captures journeys missed through the BLOM system.

Participants complete travel diaries for the first week of trial, at the 4 and 8 month point and at the end of trial at 10 months User uptake questionnaires will be completed Alongside the travel diaries at the same time periods.

It is likely that an exit interview will be conducted and focus groups held with selected participants.

Pilot conduction

The pilot was conducted during June/July/August 2010 with 5 participants.

The pilots helped define the data collection periods, contact points with the participants and fine tuning of the data collection protocols.

FOT execution

The full FOT commenced January 2011, culminating in September 2011.

5.1.2. Map of the area of the tests

The large scale test site involves drivers based in the East Midlands area (Nottingham/Leicester/Coventry).

Figure 10: Geographical location of UK LFOT 1

5.1.3. Functions tested

LFOT 1 will test the following functions provided by the BLOM system; namely, Speed Alert information, Speed limit information and Navigation support (Static).

5.1.4. Devices used

The BLOM N-Drive G800 is used during the FOT.

Figure 11: UK LFOT 1 - BLOM device

5.1.5. Participants (No, characteristics, etc.)

80 drivers representative of the driving population was recruited for LFOT1.

5.1.6. Road type

All road types are included in the LFOT. The road types used are determined by the participants since the tests operate in a naturalistic manner.

5.1.7. Traffic conditions and interaction with other road users

All traffic conditions are encountered by the participants in the large scale FOT.

5.1.8. Weather conditions

The weather conditions experienced in the large scale FOT are determined by the participants. No restrictions are made since the tests will operate in a naturalistic manner.

5.1.9. Time of day and seasonal effects

Exposure to time of day and seasonal effects are determined by the participants in the LFOT. No restrictions are made on the time of day or season since the tests operate in a naturalistic manner.

5.2. LFOT2

5.2.1. Test Plan

Study design

This LFOT will study the impact of use of Footlite system. The trials will recruit 30 participants to use the system as their personal device for a fixed period. Impacts on safety, mobility, efficiency, environment and user uptake caused by initial introduction of the system plus changes in those impacts over time will be studied based on real use with no imposed tasks or use cases for the driver.

Reference case

A within subjects design will be used. All participants will undertake a control and an experimental phase in the FOT

Data collection

The data logger specification is yet to be decided as device.

The frequency with which participants will be expected to complete the travel diary will be determined based upon the pilot study. User uptake questionnaires will be completed during the control phase, then at a mid point of the experiment phase and upon completion of the test.

It is likely that an exit interview will be conducted and focus groups held with selected participants.

Regarding the data process path (architecture) it is still to be decided.

Pilot conduction

The pilot will be conducted during October 2011.

The pilot will be designed so as to check the data flow, the logistics for data capture and transfer and the experimental methodology.

Travel diaries will aim to be completed continuously during the pilot phase to assess the level of information required and what level of completion would be appropriate in the full scale FOT to ensure adequate data for the analyses. User uptake questionnaires will be completed at the start, middle and end of the pilot.

Technical evaluation

The system technical evaluation of the device will be carried out and compared to the actual performance during use.

FOT execution

The full FOT will commence November 2011 for a duration of 6 months culminating in March 2001

The FOT will comprise 30 participants (depending upon start date) selected according to the demographics of the UK driving population if possible.

5.2.2. Map of the area of the tests

The large scale test site will involve drivers based in the East Midlands area (Nottingham/Leicester/Coventry).

Figure 12: UK Large FOT 2: Green Driving Support (Nottingham / Leicester / Coventry)

5.2.3. Functions tested

The functions tested in the large will comprise real-time guidance on driving style and fuel efficiency with pre- and post-trip tutoring and feedback. The system may also provide navigation advice and hazard warning.

5.2.4. Devices used

The device is a nomadic system (HTC smart-phone/PDA) running a bespoke application – the SMART Driving Advisor.

Figure 13: UK Large FOT 2: Green Driving Support

5.2.5. Participants (No, characteristics, etc.)

It is expected that 30 vehicles and units will be equipped with each vehicle being allocated to a single participant for a 3 month period. This will be repeated either 2 or three times to give in the regions of 60-90 participants for LFOT2.

5.2.6. Road type

All road types will be included in the large FOTs. The road types used in the large FOT will be determined by the participants, No restrictions will be made since the tests will operate in a naturalistic manner.

5.2.7. Traffic conditions and interaction with other road users

All traffic conditions will be encountered by the participants in the large scale FOT. No restrictions will be made on traffic conditions.

5.2.8. Weather conditions

The weather conditions experienced in the large scale FOT will be determined by the participants. No restrictions will be made since the tests will operate in a naturalistic manner.

5.2.9. Time of day and seasonal effects

Exposure to time of day will be determined by the participants in the large FOT. Seasonal effects will not be managed in the large scale FOT. It is likely that time of day effects will be controlled actively (i.e. day and night data collection if considered a significant factor in system usability). No restrictions will be made since the tests will operate in a naturalistic manner.

5.3. DFOT 1: BLOM

5.3.1. Test Plan (applied)

Study design

This DFOT involves using a subset of the participants from LFOT 1 to study in more detail those aspects of safety impact that cannot be sufficiently assessed in the LFOTs. Specifically these aspects are driver distraction and general driver and driving behaviour . The particular feature of this DFOT is that it will enable the assessment of changes of behaviour over time (i.e. it is a longitudinal study). The D-FOTs will be carried out at intervals throughout the LFOT and will tie in with the assessment periods for the user uptake questionnaire and travel diaries to enable a combination of results from the different data collection methods at each sample point.

Reference case

A within subjects design will be used. All participants will undertake a control and an experimental phase in the FOT. The control condition will be a study of natural behaviour prior to use of the system.

Data collection

An integrated logger built into the BLOM N-Drive system will be used to collect data. In addition, data will be collected using a Race Technology data logger. The system (DL2) can store data up to a maximum of 100Hz from a number of sources including its built-in high accuracy 20Hz GPS and 3g, 3 axis accelerometers. Analogue inputs can be configured through a range of sensors equating to 13 additional data sources such as wheel speeds, shaft speeds, engine speeds, temperatures, pressures, etc. The DL2 system can be fully integrated with a four channel video system allowing data overlay and analysis of multiple video channels.

Expandable inputs (13) for wheel speed, steering angle, damper pots, brake pressure, engine sensors, etc.

- Capable of detecting up to 100Hz update rate on all channels
- 20 Hz GPS
- Built in 3g 3-axis accelerometer
- Up to 50 hours of logging with 1 GB compact flash card

An eye tracker will also be used to log visual behaviour. This device allows data to be collected on glance behaviour, head position, eye movement and intersections with objects within the vehicle and driving environment, data is collected at 60Hz and is matched time/location stamped to the Race Technology/BLOM data

In addition paper based subjective data is collected from the driver, this is based on a level of 'concentration, required to make safe progress through navigation dependent junctions – this rating provides each manoeuvre with a risk surrogate which can be used to understand the visual and driver behaviour.

Data is kept securely at Loughborough University and is backed up centrally, paper records are also kept securely with all data sources referenced to articipant number – Data processing beyond this is yet to be decided.

Pilot conduction

The pilot will be conducted during January/Feburary 2011

There will be 5 participants in the pilot. The pilots will be designed so as to check the data flow, the logistics for data capture and transfer and the experimental methodology.

The pilots will assess the data capture from the eye tracker and the enhanced data logger (race technology) and modifications made as required. Scripting of the DFOT briefing will also be extensively piloted

Technical evaluation

A technical evaluation of the BLOM device will have been carried out in the LFOT1 procedure with the enhanced data logging assessed through the initial pilots.

FOT execution

The full DFOT will commence March 2011. It will run in parallel with LFOT1. The DFOT comprise a sub-set of the 79 participants undertaking LFOT1. Each participant will undertake a series of DFOTs. These will take place at the end of the control phase of LFOT1 on the first day of commencement of the experimental phase of LFOT1, at the midway point of LFOT1 and at the end of LFOT1. The sample size is well within the guidelines from SP2 for a DFOT and considered large enough for statistical conclusions to be drawn from the resulting data.

The participants will be required to follow a pre-set itinerary set by the experimenters within the N-Drive system. This will enable all participants to cover a fixed route to incorporate the road types and contexts defined for the study. Only a simple rating system will be imposed on the driver in order to make the behaviour as natural as possible to make it comparable to that which will be exhibited in the associated LFOT. A standardised risk questionnaire and NASA-TLX will take place after the end of the DFOT.

5.3.2. Map of the area of the tests

The detailed test site will involve drivers based in the East Midlands area (Nottingham/Leicester/Coventry).

Figure 14: Geographical region UK for DFOT 1, BLOM

5.3.3. Functions tested

DFOT 1 will test the following functions provided by the BLOM system; Speed Alert information, Speed limit information, Navigation support (Static).

5.3.4. Devices used

DFOT1 in the UK will use the BLOM N-Drive G800

Figure 15: BLOM N-Drive G800

5.3.5. Participants (No, characteristics, etc.)

Participants from LFOT1 will be recruited to also undertake a series of DFOTS. These are undertaken in the control phase of the LFOT study and key phases during the test part of the LFOT. This will enable learning effects associated with the device use to be analysed.

5.3.6. Road type

The DFOT uses a structured route that includes key points of interest to the analysis, in particular those where the device is expected to provide information and cause distractions. These include roundabouts, intersections and traffic merging.

5.3.7. Traffic conditions and interaction with other road users

Traffic conditions are actively sampled in the detailed FOT in an attempt to ensure a range of conditions is included and that the trials are able to keep to a reasonably efficient schedule. This may mean limiting exposure to particularly congested traffic.

5.3.8. Weather conditions

The detailed FOT is likely to take place in a wide range of conditions but with limited exposure to very extreme conditions to reduce participant exposure to unnecessary risk.

5.3.9. Time of day and seasonal effects

Exposure to time of day and seasonal effects are managed in the detailed FOT. It is likely that seasonal effects will be managed by selecting a 'neutral' time for data collection in the detailed FOT. Time of day will be controlled actively (i.e. day and night data collection if considered a significant factor in system usability).

5.4. DFOT 2

5.4.1. Test Plan (applied)

Study design

This DFOT involves using a subset of the participants from LFOT 2 to study in more detail those aspects of safety impact that cannot be sufficiently assessed in the LFOTs. Specifically these aspects are driver distraction, braking behaviour and manual operations of the device. The particular feature of this DFOT is that it will enable the assessment of changes of behaviour over time (i.e. it is a longitudinal study). The D-FOTs will be carried out at intervals throughout the LFOT and will tie in with the assessment periods for the user uptake questionnaire and travel diaries to enable a combination of results from the different data collection methods at each sample point.

Reference case

A within subjects design will be used. All participants will undertake a control and an experimental phase in the FOT. The control condition will be a study of natural behaviour prior to use of the system.

Data collection

The data logger specification for the green driving support device is yet TBD as device is still in development

In addition, data will be collected using a Race Technology data logger. The system (DL2) can store data up to a maximum of 100Hz from a number of sources including its built in high accuracy 20Hz GPS and 3g, 3 axis accelerometers. Analogue inputs can be configured through a range of sensors equating to 13 additional data sources such as wheel speeds, shaft speeds, engine speeds, temperatures, pressures etc. The DL2 system can be fully integrated with a four channel video system allowing data overlay and analysis of multiple video channels.

- Expandable inputs (13) for wheel speed, steering angle, damper pots, brake pressure, engine sensors, etc.
- Capable of detecting up to 100Hz update rate on all channels
- 20 Hz GPS
- Built in 3g 3-axis accelerometer
- Up to 50 hours of logging with 1 GB compact flash card

An eye tracker will also be used to log visual behaviour. (Specification TBD)

User uptake questionnaires will be completed during the control phase, then at a mid point of the experiment phase and upon completion of the test as part of LFOT2.

Data process path (architecture) is yet to be decided.

Pilot conduction

The pilot will be conducted during September 2011 in parallel with the LFOT2 pilot.

There will be 5 participants in the pilot**.** The pilots will be designed so as to check the data flow, the logistics for data capture and transfer and the experimental methodology.

The pilots will assess the data capture from the eye tracker and the enhanced data logger (race technology) and modifications made as required. Note however that much of this will already have been assessed in LFOT 1 and DFOT1.

User uptake will be assessed during LFOT2 pilot.

Technical evaluation

A technical evaluation of the Green Driving Support device will have been carried out in the LFOT2 procedure.

FOT execution

The full DFOT will commence October 2011. It will run in parallel with LFOT2. The DFOT will comprise part of the participants undertaking LFOT2. Each participant will undertake a series of DFOTs. These will take place during the control phase of LFOT2, at the commencement of the experimental phase of LFOT2, at the midway point of LFOT2 and at the end of LFOT2. The sample size will be well within the guidelines from SP2 for a DFOT and considered large enough for statistical conclusions to be drawn from the resulting data.

The participants will be required to follow a pre-set itinerary set by the experimenters within the N-Drive system. This will enable all participants to cover a fixed route to incorporate the road types and contexts defined for the study. No other additional tasks will be imposed on the driver in order to make the behaviour as natural as possible to make it comparable to that which will be exhibited in the associated LFOT. No additional questionnaires or interviews will take place (until after the end of the LFOT so as not to influence the participant’s opinions or behaviour in subsequent LFOT periods of use).

5.4.2. Map of the area of the tests

The detailed test site will involve drivers based in the East Midlands area (Nottingham/Leicester/Coventry).

Figure 16: Geographical region UK DFOT 2 Green driving support

5.4.3. Functions tested

The functions tested in the detailed FOTs comprise real-time guidance on driving style and fuel efficiency with pre- and post-trip tutoring and feedback. The system may also provide navigation advice and hazard warning.

5.4.4. Devices used

The device is a nomadic system (HTC smart-phone/PDA) running a bespoke application – the SMART Driving Advisor.

Figure 17: DFOT 2, Multi-function in-vehicle information system supported by back-office services.

5.4.5. Participants (No, characteristics, etc.)

Data capture equipment is allocated to a vehicle to support the detailed FOTs which will focus on system interface, safety, usability and acceptability issues. It is the intention that all LFOT participants for this function will also undertake a series of DFOTs during the course of their trial. These will be undertaken in the control phase of the LFOT study and key phases during the test part of the LFOT. This will enable learning effects associated with the device use to be analysed

5.4.6. Road type

The DFOT will use a structured route that will include key points of interest to the analysis, in particular those where the device is expected to provide information and cause distractions. These will include roundabouts, intersections and traffic merging.

5.4.7. Traffic conditions and interaction with other road users

Traffic conditions will be actively sampled in the detailed FOT in an attempt to ensure a range of conditions is included and that the trials are able to keep to a reasonably efficient schedule. This may mean limiting exposure to particularly congested traffic.

5.4.8. Weather conditions

The detailed FOT is planned to run in parallel to the large FOT, with 4 DFOTS per participant being conducted during their undertaking of the LFOT. This is likely to occur during spring when extreme adverse conditions are unlikely. Extreme conditions will be actively avoided to ensure participant safety.

5.4.9. Time of day and seasonal effects

Exposure to time of day will be managed in the detailed FOT. It is likely that time of day effects will be controlled actively (i.e. day and night data collection if considered a significant factor in system usability).

5.5. DFOT 3

5.5.1. Test Plan (applied)

Study design

This DFOT is not connected to any LFOT. It aims to study specific aspects of the safety impacts of the MobilEye device. This after-market device provides Forward Collision Warning and Lane Departure Warning / Lane keeping support. Specifically these aspects are driver distraction, braking behaviour, lane positioning and manual operations of the device.

Reference case

A within subjects design will be used. All participants will undertake a control and an experimental phase in the FOT.

Data collection

The data logger specification for the mobileye is yet to be decided.

In addition, data will be collected using a Race Technology data logger. The system (DL2) can store data up to a maximum of 100Hz from a number of sources including its built in high accuracy 20Hz GPS and 3g, 3 axis accelerometers. Analogue inputs can be configured through a range of sensors equating to 13 additional data sources such as wheel speeds, shaft speeds, engine speeds, temperatures, pressures etc. The DL2 system can be fully integrated with a four channel video system allowing data overlay and analysis of multiple video channels.

- Expandable inputs (13) for wheel speed, steering angle, damper pots, brake pressure, engine sensors, etc.
- Capable of detecting up to 100Hz update rate on all channels
- 20 Hz GPS
- Built in 3g 3-axis accelerometer
- Up to 50 hours of logging with 1 GB compact flash card

An eye tracker will also be used to log visual behaviour. (Specification TBD)

User uptake questionnaires will be completed during the control phase, then at a mid point of the experiment phase and upon completion of the test as part of LFOT2.

Data process path (architecture) is yet to be decided.

Pilot conduction

Details for the pilot for DFOT3 are still in development.

Technical evaluation

A technical evaluation of mobileye will be undertaken in accordance with Task 4.10.

FOT execution

Details for the execution of DFOT3 are still in development.

5.5.2. Map of the area of the tests

The DFOT 3 test site will comprise drivers living, and driving within, the East Midlands area (Nottingham/Leicester/Coventry).

Figure 18: Geographical region UK DFOT 3

5.5.3. Functions to be tested

The functions to be tested in DFOT 3 are Forward collision warning and Lane departure warning.

5.5.4. Devices to be used

The Mobileye aftermarket device will be used in this D-FOT

Figure 19: UK DFOT 3: Mobileye

5.5.5. Participants (No, characteristics, etc.)

It is anticipated that the DFOT will comprise 40 participants sampled representatively from the driving population.

5.5.6. Road type

The DFOT will use a structured route that will include key points of interest to the analysis, in particular those where the device is expected to provide information and cause distractions. These will include roundabouts, intersections and traffic merging.

5.5.7. Traffic conditions and interaction with other road users

Traffic conditions will be actively sampled in the detailed FOT in an attempt to ensure a range of conditions is included and that the trials are able to keep to a reasonably efficient schedule. This may mean limiting exposure to particularly congested traffic.

5.5.8. Weather conditions

The detailed FOT is likely to take place in a wide range of conditions but with limited exposure to very extreme conditions to reduce participant exposure to unnecessary risk.

5.5.9. Time of day and seasonal effects

Exposure to time of day will be managed in the detailed FOT. It is likely that time of day effects will be controlled actively (i.e. day and night data collection if considered a significant factor in system usability).

6. CENTRAL TEST COMMUNITY – GERMAN TEST SITE

6.1. Detailed FOT1

6.1.1. Test Plan (applied)

Study design

The study will be run according to a within subject design. The participants will be introduced into the different features provided by the car (ACC, FCW,LKA) and the PND (speed limit/alert, static navigation support) during a short training on the ika test track. After this training the test subject will drive along the given test route in the different test setups (only ADAS, only PND and combination of ADAS and PND). During the test runs the data of the PND and the vehicle will be logged.

The test consists of one group of 8-10 subjects who are repeatedly driving in all three test configurations. Based upon the time span of the tests, seasonal and other effects, e.g. weather or traffic conditions, can be neglected.

Total duration of the test: 8 month. Baseline: only ADAS and only PND functions, Test case combination of ADAS and PND functions

Reference case

In the German test site two types of baselines are used. The first one is driving only with functions based upon the nomadic device (Static navigation support, Speed limit information and Speed limit alert). The second one is driving with ADAS functions only (Lane Keeping Assistant, Forward Collision Warning and Adaptive Cruise Control). With these two baselines the influence of the combination of both PND based and ADAS functions can be evaluated.

Data collection

- **Logging**

The vehicle data (CAN data) and the data of the CAA and ECA will be logged on an ordinary Laptop inside the vehicle. The PND data are logged inside the nomadic device. After the test runs both data sets will be synchronised and stored on a local server.

- **Survey tools used**

In the German DFOT only background and user uptake questionnaires will be used. Due to the setup of the DFOT travel diaries cannot be used during the test runs.

The background questionnaires will be filled in at the beginning of the test runs and the user uptake questionnaires will be filled in three times, at the beginning, in midterm and at the end of the test runs.

- **Other data collection means used**

No other data is collected beneath the CAA, ECA, PND and CAN data.

- **Data process path (architecture)**

The data will be collected inside the vehicle. After pre-processing (plausibility check and synchronisation of the different data sets) the data it will be stored on a local data base. From here a selection of data (e.g. core-data set) can be exported to the central TeleFOT database.

The evaluation of the whole data set is done on locally whereas parts of the data can be evaluated centrally via the central data base.

Pilot conduction

The pilot will take place after the needed tools (PND, ECA and CAA) have been delivered to ika. After having arrived at ika the tools will be tested in the office first. If the tools pass the first tests they will be implemented in the equipped vehicle and tested one by one and finally in combination.

The pilots will be conducted by personnel of ika. No special test subjects will be recruited for this purpose.

No special conditions have to be obeyed during the pilot testing.

Due to the fact that no test subjects will be participating in the pilot testing, no questionnaires will be filled in during this phase.

Technical evaluation

In case of the PND the technical fundamentals, like GPS reception, data logging etc. will be tested in the office and inside the vehicle.

The ECA will be tested outside the vehicle with recorded data and with online data inside the vehicle.

The CAA is tested in the same way. A first test is done inside the office to assure the correct functionality. After this the system is installed inside the vehicle and tested again.

Finally the combination of the system will be tested in test runs with the equipped vehicle.

FOT execution

The FOT will take place after the pilot tests have been finalised. The start of the test runs is depending on the delivering of the needed equipment (PND. CAA and ECA).

The test will be conducted with 8-10 participants, with different gender and age (between 25-55 years). The driver should have an experience of more than 3 years and more than 10,000 km per year, whereas the focus of the driver selection is on non professional drivers with at least slight experiences with ADAS functions.

6.1.2. Map of the area of the tests

The detailed field operational test in Germany will be conducted in the region between Cologne (Köln) and Aachen. The test area in which the DFOT will be conducted is shown as a satellite image and as a map section (see the following figures)

Figure 20: Satellite picture of the test area for the detailed FOT in Germany (between Aachen and Cologne)

Figure 21: Map of the test area for the detailed FOT in Germany (between Aachen and Cologne)

6.1.3. Functions tested

In the German DFOT several nomadic device functions are to be tested. These functions are static navigation and speed limit information/ speed limit alert. Furthermore the interaction between ADAS functions based on nomadic devices and ADAS functions integrated into the vehicle infrastructure will be assessed. Therefore the in-vehicle functions Forward Collision Warning (FCW), Adaptive Cruise Control (ACC) and Lane Keeping Assist (LKA) are tested additionally to the nomadic device functions named above.

6.1.4. Devices used

The German test site is using a Personal Navigation Device (PND) by Blom as nomadic device (shown in Figure 22), on which a customised navigation tool provided by a Blom subcontractor, is installed. The device offers the possibility to log the information provided by the PND (GPS position, notifications to the driver etc.) and the interaction between user (driver) and device by logging the operation of the device.

Figure 22: Bloom PND (NDrive G800)

In the German detailed Field Operational Tests an equipped vehicle is used for the test runs. This means that additional hardware is installed inside the serial vehicle, which is monitoring the environment, the vehicle and the driver during the test runs. This equipped vehicle is a modified Volkswagen Passat CC shown in Figure 23.

Figure 23: Equipped Vehicle DFOT Germany (Volkswagen Passat CC)

The vehicle contains a 3.6 l engine with 224 kW, an all-wheel drive and a double clutch automatic transmission. For the test of the interaction between in-vehicle ADAS functions and ADAS functions based upon nomadic devices, the vehicle is equipped with Adaptive Cruise Control (ACC), Lane Keeping ("Lane Assist"), Forward Collision Warning ("Front Assist") and Xenon Cornering Lights.

To get access to as many information as possible, the vehicle was modified by the Volkswagen research workshop. Inside the vehicle a gateway has been installed, providing access to most of the vehicle sensors, offering information like wheel speed, velocity, acceleration in longitudinal and lateral direction, yaw rate, steering angle and steering angle velocity. Additional to the vehicle data Object data of the ACC-sensor (e.g. preceding vehicles) and the "Lane Assist" (e.g. position of lane markings) are provided by the ADAS systems. Beneath these parameters other information like brake pedal and throttle status can be assessed as well as outer influences, e.g. by windscreen wiper status, ABS and ESP action are accessible. For surveillance of the area in front of the car an additional camera has been mounted to the A-pillar on the passenger side of the car, so that incidents in front of the car can be recorded throughout the test runs.

After the car has been modified by VW ika added the data logging hard- and software into the trunk. For the conduction of the test runs other modules like the Cockpit Activity Assessment module (CAA) provided by VTT and the Environmental Conditions Assessment module (ECA) provided by ICCS as well as the PND by Blom will be integrated into the vehicle.

For the conduction of the German DFOT a number of 10 participants have been determined. Due to the small group of participants it has been decided that it would be useful to concentrate on one user group, to get statistical relevant data. Therefore the test subjects have been limited to male between 20 and 30 years.

6.1.5. Conduction of the tests

At the beginning all test subjects have to fill in the Background questionnaires and the "before" questionnaires regarding e.g. user uptake.

In advance to the actual test runs the test vehicle and the installed test systems will be introduced to the test subjects. The introduction is based on driving scenarios in which the driver can experience the working system on the ika test track near to the Institut.

The actual test runs will be conducted as accompanied tests, in which the test subjects are driving along a given route. A surveillance, e.g. by using the "Wiener Fahrprobe", is not planned during the test runs.

Each test subject will be passing the test run several times with an offset of about 2 weeks. During and after these tests the subjects will fill in the questionnaires, so that the development e.g. of the user uptake can be evaluated.

6.1.6. Road type

Because of the focus on the interaction between internal ADAS functionalities and nomadic devices, a route on which as many ADAS functions as possible can be tested has to be chosen. Due to the fact that functions like ACC and Lane Keeping are designed to be used on well developed roads, like highways or main roads, the tests will be mainly conducted on these types of roads.

6.1.7. Traffic conditions and interaction with other road users

To ensure that systems, like ACC, become active during the comparatively short test runs, a route on which the traffic density allows to use the tested systems will be defined. The conditions in the chosen test area between Cologne and Aachen should be suitable for these tests.

6.1.8. Time of day and seasonal effects

The test period shall range over a time span of 3 month, so that the tests will be conducted under changing weather conditions and in different seasons. Due to the length of the test period and the number of conducted tests seasonal effect, like icy conditions, and other effects of weather conditions should be levelled over the period of testing. To avoid assessing short term effects all drivers are travelling the test routes several times in all of the three modes (with all systems, only with integrated systems, only with systems based upon the nomadic device).

In the following figures the sunrise, sunset, dawn and dusk times are shown (see Figure 24). The second figure shows the sun-path diagram for the city of Aachen (Figure 25).

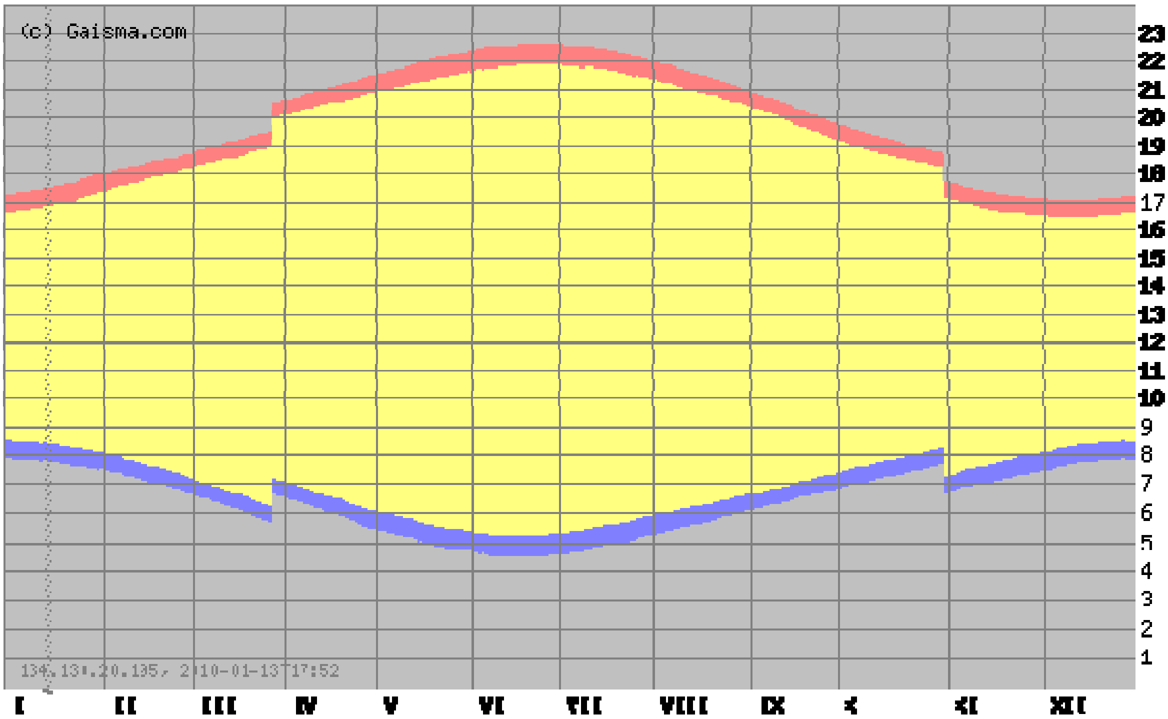


Figure 24: Sunrise, sunset, dawn and dusk times, graph [Gaisma.com]

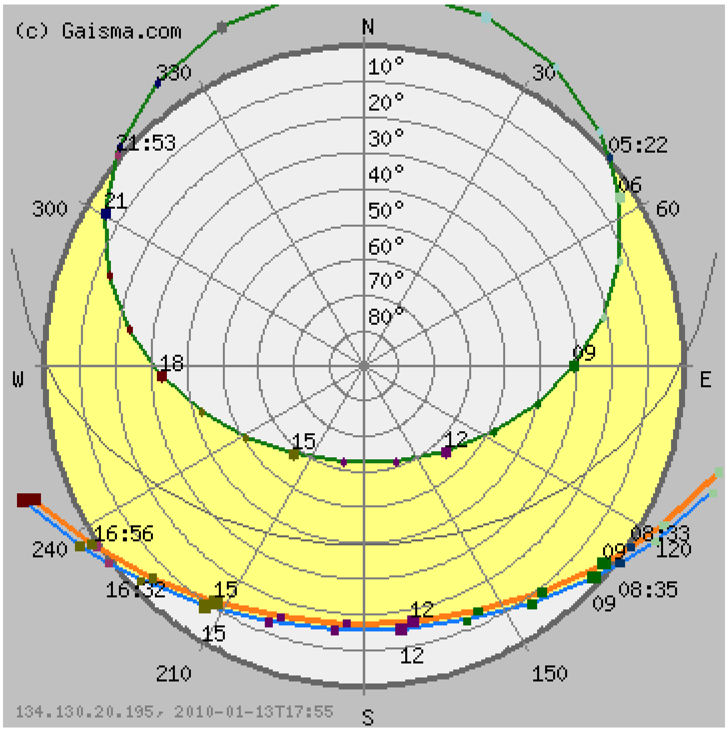
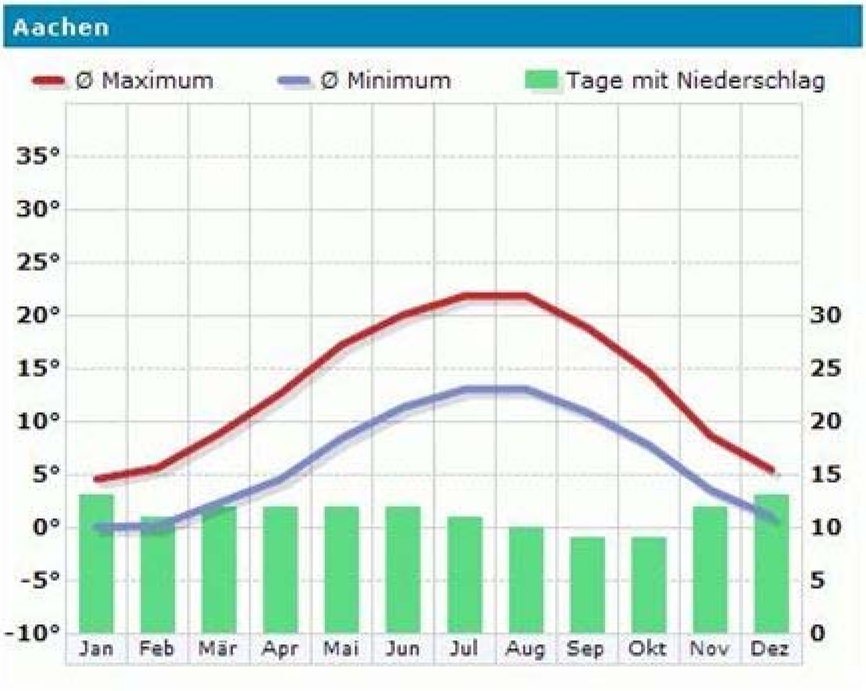


Figure 25: Sun path diagram [Gaisma.com]

6.1.9. Weather conditions

In the following diagrams the average temperature and precipitation is listed in a monthly overview (Figure 26) for the region of Aachen. Aachen is situated in the temperate zone with an oceanic climate. The weather is humid with mild winters and relatively balanced temperatures. Due to the location north of two low mountain ranges (Eifel and Hohes Venn) the precipitation in Aachen is slightly higher than in its surrounding area. Another effect of this location is the appearance of Föhn, a warm and dry down slope wind, with air flows from the south.



	Temperatur °C max. Ø	Temperatur °C min. Ø	Niederschlag mm	Niederschlag Tage	relative Feuchte	Sonne h/Tag	Wasser °C
Jan	4,6	0,1	62,2	13	82	-	-
Feb	5,7	0,2	56,6	11	79	-	-
Mär	8,9	2,4	66,4	12	76	-	-
Apr	12,7	4,6	63,2	12	72	-	-
Mai	17,3	8,5	74,9	12	70	-	-
Jun	20,1	11,4	82,2	12	72	-	-
Jul	21,9	13,1	79,8	11	72	-	-
Aug	21,9	13,1	75,8	10	74	-	-
Sep	18,9	10,9	59,2	9	77	-	-
Okt	14,7	7,8	63	9	80	-	-
Nov	8,7	3,6	71,9	12	82	-	-
Dez	5,5	1,1	73,1	13	83	-	-
Jahr	13,4	6,4	828,3	135	77	-	-

Figure 26: Climate diagram of Aachen, Germany [Wetterkontor.net]

7. CENTRAL TEST COMMUNITY – FRENCH TEST SITE

7.1. Large-scale FOT1: eCall

7.1.1. Test Plan (applied)

Study design

The LFOT to be conducted at French test site will emphasize on eCall function by using in-vehicle Nomadic Devices (NDs) in order to test its benefits, usability and impact on users' behavior. With the collaboration of the French Automobile Club and other public or private associated partners to conduct the experiments, around 300 drivers and vehicles from "Alsace and Franche-Comté Regions" each equipped with a ND (DANEW) will be used during the test.

Initially, we divided whole French LFOT setup and execution into three stages. In the first stage, we decided to study and analyze user needs and expectations such as HMI, type of information (audio, text, etc). In the second stage, we targeted to survey main technologies that have been utilized for current eCall systems such as communication channel, application development tools, and openness of the available NDs. We have developed software on DANEW platform that supports an e-Call system using GPRS communication. The third stage concerns tests' environment with eCall and a priori prevention scenarios. It is worth mentioning here that we have almost successfully completed the first two stages and have an output in the form of developed research questions, hypothesis, performance indicators, database, and installed eCall function on DANEW. We are soon going to deploy the TeleFOT French database server and expect to start piloting from the first week of November.

Reference case

The eCall function is the only one LFOT to be conducted in France. We have recruited 300 subjects to undertake the test spanning over the period of 7 months, including the period of results collection and analysis. Each driver, driving his/her own vehicle, will be given eCall enabled DANEW device which will provide a user friendly graphical interface. The '*what and how to use*' procedure is explained in the sub-section 'FOT execution'.

Data collection

- **Logging**

We are using ND (Danew) that supports Navigation and GPRS based connectivity. This device will first generate data (e.g., GPS position, event type and description etc) and then send this data instantly (using GPRS connection) to the French TeleFOT Server, where this will be stored for future data analysis purpose.

- **Survey tools used**

The web based questionnaires related to user background and acceptance will be used before and after the real test respectively.

- **Other data collection means used**

Users face to face verbal interviews can also be used to further verify the real time information.

- **Data process path (architecture)**

On the occurrence of particular event on the road that has to be reported to PSAP. The device (in parallel to setting up the e-Call to 112 PSAP operator) will generate data (e.g., GPS position, event type and description etc) and then send this data instantly (using GPRS connection) to the French TeleFOT Server, where this will be stored for future data analysis.

Pilot conduction

The pilot test consists of two phases: testing the technical functionalities, in order to ensure that the functions are stable and provide the expected output and modifying the function after comprehensive testing report.

We have planned to start pilot test in the first week of March, and will last for about two months. The pilot test will consist of 10 users, and take place in the region of Alsace Franche Comte.

We will use the web based questionnaires to collect the users' background information prior to start piloting and users up-take data after the pilot test is finished.

After finishing this pilot test, we will perform limited data analysis to anticipate new information and to further refine our research questions and hypothesis for the real test.

Technical evaluation

The technical verification of the e-Call function will be done during the pre-piloting phase. We have planned to verify e-Call functionality in the first week of December till the end of the year.

FOT execution

To test the eCall function we have recruited 300 test participants. We have planned, immediately after the test tools and local database server development, to start the pilot test during the first week of March that will remain active for two months. In the last week of April, we will take feedbacks of the pilot test and will refine our system and procedures until the end of Mai. After the successful piloting experiment, we are expecting to start the real test during the first week of June that will remain until the end of November 2011. Data analysis and assessment will be done during the month of December.

In order to execute the LFOT, each driver, using his/her own vehicle, will be given a DANEW with installed eCall application. The driver can use the following functionalities:

- Setup an eCall with the emergency response center: on touching the "Call to Emergency Center" button, the device will do the following,
  - First, send the position data (as a short text message) to the local TeleFOT server.

- Setup an eCall to the emergency response center. The position data gathered in the previous step will be directly accessible by the human operator receiving the eCall so that s/he can easily determine the geographical position of the event to be reported by an eCaller.

- Send an alert: The driver can also report an abnormal event on the road by sending a short text message to the local TeleFOT server. These events are then processed and analysed by the emergency response centre.

7.1.2. Map of the area of the tests

The test site will involve cars from different test participants of the region. The cars will mainly be used in the region Alsace-Franche Comté and the surrounding municipalities (See map below).

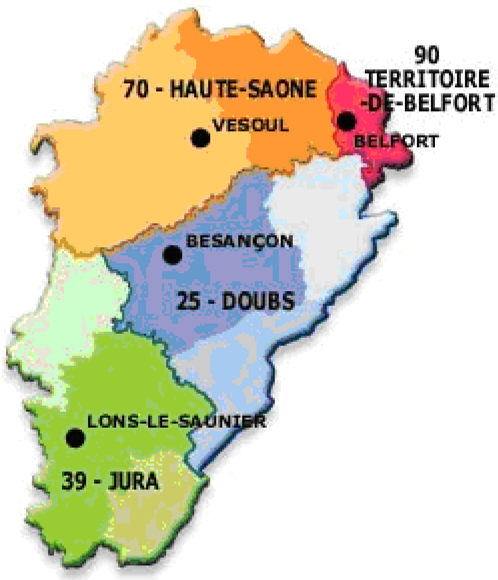


Figure 27: Map of the area of the French FOT1 test site.

7.1.3. Functions tested

The function tested at the French test site is the e-Call function.

7.1.4. Devices used

PND DANEW will be used to setup e-Call within vehicle [4]. It has the following main characteristics.

- Large 4,3" LCD touch screen
- GPRS connectivity for WEB services (internet) and FTP
- SIM card (data) and micro SD card slot
- SiRF Atlas III dual-core processor

- 64MB RAM and a 1GB flash memory
- Weights about 180 grams

Figure 28: DANEW device

7.1.5. Participants (No, characteristics, etc.)

It is expected that at around 300 vehicles (equipped with the DANEW device) will be used. Each vehicle will be registered to a particular participant of the test. A sophisticated classification method of drivers based on, for example profession, age, will be used to establish more diversified drivers' community.

7.1.6. Road type

All road types will be included. The road types selection are based on participants preferences.

7.1.7. Traffic conditions and interaction with other road users

All traffic conditions will be encountered by the participants.

7.1.8. Weather conditions

Data collection will take place over a 6 months (from June till November) period and all weather conditions experienced in that time will be a factor in the study. The trial is scheduled to take place during 2011.

7.1.9. Time of day and seasonal effects.

The test time will not be explicitly specified, there will be 24/24 hrs service during the testing period.

8. SOUTH TEST COMMUNITY – SPANISH TEST SITE (MADRID)

8.1. Large-scale FOT1: Valladolid

8.1.1. Test Plans (applied)

Study design

The objective of this FOT is to analyse the effects of the use of functions provided by nomadic devices in the vehicle (namely, a Personal Navigation Device – PND). Thus, a LFOT was defined using a before-after approach, in order to study the influence on behaviour (learning, short-term and long-term) of the use and learning of the functions provided by this kind of nomadic devices.

Reference case

Considering the study design defined in Valladolid test site (within subject design), a first stage of the tests (i.e. around 1-2 months) is established as baseline condition. During this phase, users don't receive any feedback from the nomadic device although they are asked to have the device on in the car (since the device is needed to make a data logging).

Research questions/Hypotheses/Indicators

Hypotheses, Research Questions and the corresponding indicators have been defined by SP4. Therefore, Valladolid test site will specially focus on the safety and mobility impact assessments (and thus, in their corresponding hypothesis) although, environment and user uptake will be also considered.

Regarding the particular research questions, special attention will be paid to the hypothesis directly related to speed and length of journeys, where CIDAUT (as Valladolid test site managers) has taken the leadership in the corresponding impact areas:

- **Safety**
  - RQ-S4: Is speed affected?
- **Mobility**
  - RQ-M4: Are the length of journeys in distance affected?
  - RQ-M5: Is the duration of journeys affected?
- **Environment**
  - RQ-EN2: Is speed homogeneity affected?
  - RQ-EN3: Is speed distribution affected?

Therefore, taking into account the hypothesis previously defined, the corresponding indicators associated to them are defined and afterwards analysed. Thus, as an example, indicators linked to the hypothesis leaded by CIDAUT will be mean speed and variance, start and stop of the journey, mean duration, mean length, etc.

Data collection

The nomadic device that will be used in the L-FOT Spanish Valladolid test site is a navigation device provided by BLOM, including a logging software especially developed for the TeleFOT project according to specific needs. Data logged include general purpose variables, route/journey data, functions information and user interaction with the device.

Moreover, LimeSurvey tool will be used as a support for filling in the questionnaires during the trials, although paper versions will be also provided to users. In this case, a later translation of the questionnaires will be done through LimeSurvey in order to upload the registered data into the central database.

Pilot conduction

The pilots of the LFOT in Valladolid have been executed (May 2010). They have included a sample of 6 subjects (2 females, 4 males) for 3 weeks, starting the 1st May. A briefing session was organised the 30th April in order to present the TeleFOT project, the Valladolid test site, the tests objectives and the material (questionnaires and nomadic device). During the session, users were asked to fill in the background and the user uptake (pre-test) questionnaires.

Moreover, during the test, users were asked to fill in once the user uptake (during test) and twice the travel diary (first and last weeks of the pilots).

Finally, a special session was organised at the end of the pilots in order to fill in the user uptake (post-test) questionnaire and to have a group discussion to obtain more feedback (opinions, experiences from using the device, etc.) from users.

Regarding baseline conditions, the first three days of the pilots, users were supposed to have the nomadic device in the vehicle but without receiving any feedback (no functions). Afterwards, users were able to use the device and its functions freely.

Technical evaluation

On one hand, verification tests have been done for the nomadic device and the specific logging software developed for TeleFOT. The results were positive although some improvement possibilities were detected. Therefore, considering this input together with the potential results/updates obtained during the pilot tests, a new version of the software will be generated.

On the other hand, experts´ evaluations have been carried out regarding technical performance (in order to check if they comply with TeleFOT and Valladolid test site requirements) together with usability aspects, in order to gain a deep knowledge of the device under study.

FOT execution

The pilots of the LFOT in Valladolid have been executed (May 2010) and the LFOT execution started after the summer (September 2010), after some minor adjustments as a result of the pilots. About the sample size, the initial target number of 120 subjects was reached.

The pilots consisted on 6 subjects using the device for 3 weeks. Firstly, subjects were received in a briefing session where the project and the trials were introduced, the user agreement was signed in, the first questionnaires were filled in (namely background questionnaire and User-Uptake pre-test) and the corresponding material was provided to them (navigation device and folder with different material such as questionnaires, diaries, dissemination information, user agreement, etc.). The first two days drivers could not use the device (before phase) and after that, drivers were allowed to use it freely (after phase). During the first and the last week, the travel diary was filled in. Finally, a group session was organised at the end of the pilots in order to receive more detailed feedback from users.

Therefore, taking into account the experience gained during the pilots´ execution, the LFOT was similarly planned: briefings were organised to inform the participants (divided into different groups) and group sessions will be arranged at the end to deepen in specific aspects detected during the FOTs. Regarding the questionnaires, subjects will be asked to fill in the travel diary 4 times during the whole execution of the tests and the user uptake at the beginning, the middle (2 different moments) and the end.

8.1.2. Map of the area of the tests

The west test site in Spain (WV) will be located in the area of Valladolid, a mid size city, located in Castilla y León region, in the North-West of Spain.

Figure 29: Map of the area of the Spanish LFOT (WV)

The province of Valladolid has a population of 495,000 distributed in an area of 8,202 km2. It is characterised by the uniformity of its orography, mainly plain areas with small hills. The capital is Valladolid (city) with more than 319,000 inhabitants and located at 691 m of altitude.

8.1.3. Functions tested

The Spanish-Valladolid test site is focused on the following functions: Navigation support (static), Speed limit information, Speed alert.

8.1.4. Devices to be used

The nomadic device that used in the L-FOT Spanish Valladolid test site is a navigation device from NDrive. This device is a personal navigation solution based on GPS technology. It provides navigation through visual and voice instructions, which includes names of roads and locations, door-to-door navigation and detailed information about points of interest in several languages.

Figure 30: The nomadic device to be used in the Spanish WV LFOT

8.1.5. The test vehicle (s) and type of instrumentation

The vehicle(s) used during the trials will be the users´ own vehicles.

Regarding the data acquisition, it will be done through the nomadic device itself thanks to a specific logging software that has been developed within TeleFOT project in order to register the needed information. Data logged will be:

- General purpose variable (Date, timestamp)
- Route/Journey data (GPS coordinates, number of satellites, speed, speed limit, road type, heading)
- Functions (on-off, warning messages, navigation mode)
- Assisted mode (route type, re-calculations)
- User interaction

8.1.6. Participants (No, characteristics, etc.)

Taking into account the most appropriate study design according to the project objectives and the test site research approach, a final set of 120 users was recruited.

Specifically, aspects such as age (25-65 years old), gender (male and female) and driving experience (>3 years driving experience and >10.000kms/year) were considered in order to achieve a suitable representation of the driving population.

8.1.7. Road type

Valladolid area is composed by different types of roads:

- Highway, motorway (speed limits: 100 and mainly 120 km/h)
- Single carriageway roads (speed limits: 70, 80 and mainly 100 km/h)
- Extra-urban roads (speed limits: 40, 60 and mainly 80 km/h)
- Urban roads (speed limits: 20, 30, 40, 70 and mainly 50 km/h)

8.1.8. Traffic conditions and interaction with other road users

Valladolid is a mid-size city and therefore, urban areas have a medium level of traffic except for some specific stretches and hours where isolated traffic jams can be encountered. Moreover, several extra-urban areas are located around the city with different speed limits and in some stretches regulated by traffic lights.

Additionally, several highways/motorways connect the city with other important locations /cities such as Madrid, Salamanca or Burgos.

8.1.9. Weather conditions

The climate can be considered as continental (attenuated) with a comfortable average temperature along the year. The average annual precipitations range between 400 and 600 mm, distributed along the year with an extreme decrease in summer.

8.1.10. Time of day and seasonal effects

Taking into account the duration of the test period for the large scale tests, seasonal effects can be avoided since drivers will use the systems under different weather conditions.

Regarding the time of the day, this could have an effect in the results due to the subjects´ habits and therefore, a varied sample should be considered in order to minimise these effects.

8.2. Large-scale FOT2: Madrid

8.2.1. Test Plans (applied)

Study design

The Madrid Test Site performs one Large scale FOT. In Madrid FOT three functionalities are analysed, namely Green driving, Speed limit information, and Real Time Traffic information.

The Madrid FOT is structured within three different phases:

- Baseline
- RT Traffic information
- Green driving + Speed limit information

Reference case

The Madrid Large Scale FOT study has been designed as a "within subjects design" that is, the same subjects are going to take part in the different phases of the tests

During the baseline phase the drivers should drive with a base line configuration of the device – that is, with none of the three functionalities to be tested (green driving, speed limit information and RT traffic information -. Due to the characteristics of the Madrid FOT drivers – they are already using Vexia device with green driving support and speed limit information- the data regarding the baseline situation will be acquired from historical data of the user's companies.

Data collection

The data collection in Madrid FOT is done outside the vehicle. The Vexia Econav device sends the information to the control centre via GPRS where it will be stored in a SQL server data base.

Regarding the collection of the subjective data, the Madrid FOT will use the following survey tools:

- User uptake questionnaires
- Data logged at the control centre – to fulfil the travel diary information
- Other data collection means – personal interviews to the drivers

Due to data protection issues related to Crambo clients and Vexia Econav users, the data collected in Madrid FOT will be pre-processed separately before sending it to the core consortium to be integrated with the rest of the data. This pre-process of the data will be done following the data processing procedures established by SP4 for the rest of the data coming from others FOTs, so that the results of the data pre-processing will be totally comparable and merged with the rest of the project data.

Technical evaluation

The technical evaluation of the new functionality developed by Crambo within TELEFOT framework and integrated in the Vexia device has been tested in a laboratory, the testing phase was successfully completed. The new functionality (real time traffic) was also tested outside the laboratory in a real environment during the piloting phase. This evaluation during the piloting phase was used to ensure that no problems were going to occur during the FOT development.

Pilot conduction

Lab testing and piloting: The new functionalities have already been implemented in the Vexia device and the lab testing phase has been successfully completed. The pilot phase was performed during early February 2011. These piloting tests will be performed in order to check the correct performance of the new functionalities implemented in the devices. 4 vehicles were equipped with the enhanced Vexia device in order to do the pilots.

FOT execution

Four different phases were foreseen to take place during the Madrid FOT execution

a) Subject recruitment: The subject recruitment phase finalised by the end of 2010. The drivers to participate in Madrid LFOT were recruited among the users of Vexia devices – mostly professional drivers-. These drivers were provided with the enhanced Vexia devices which were modified in order to be able to provide the functionalities required for this LFOT. The targeted number of participants for the Madrid Large FOT was around 100 drivers

b) Information to the test drivers: A session was organized by the Madrid FOT managers in order to inform the FOT participants about the new functionalities integrated in the Vexia devices and to introduce them to the LFOT in particular and to TeleFOT in general. The new functionality integrated in the Vexia device was, real time traffic information.

c) Validation and piloting phase: Several tests were performed in the laboratory in order to validate the new functionality and check the correct performance of the device with the integrated function. Besides a piloting phase also took place in order to validate the system in a real environment.

d) FOT execution: Three different FOT phases were defined for Madrid FOT:

- Baseline: During this phase the drivers should drive with a base line configuration of the device – that is, with none of the three functionalities to be tested (green driving, speed limit information and RT traffic information - Due to the characteristics of the Madrid FOT drivers – they are already using Vexia device with green driving support and speed limit information- the data regarding the baseline situation will be acquired from historical data of the user’s companies.
- Green driving + Speed limit information: During this phase the FOT participants will drive with these two functionalities.
- RT Traffic information: This functionality to be tested within Madrid FOT will be integrated in the Vexia Econav device and provided to the drivers.

8.2.2. Map of the area of the tests

The Spanish Large Scale FOT will be based in the city of Madrid. Madrid is the capital of Spain and the largest city of the country, with a population of more than 3.200.000 inhabitants, Madrid is one of the most populous municipalities in the European Union.

Madrid is located in the centre of Spain.

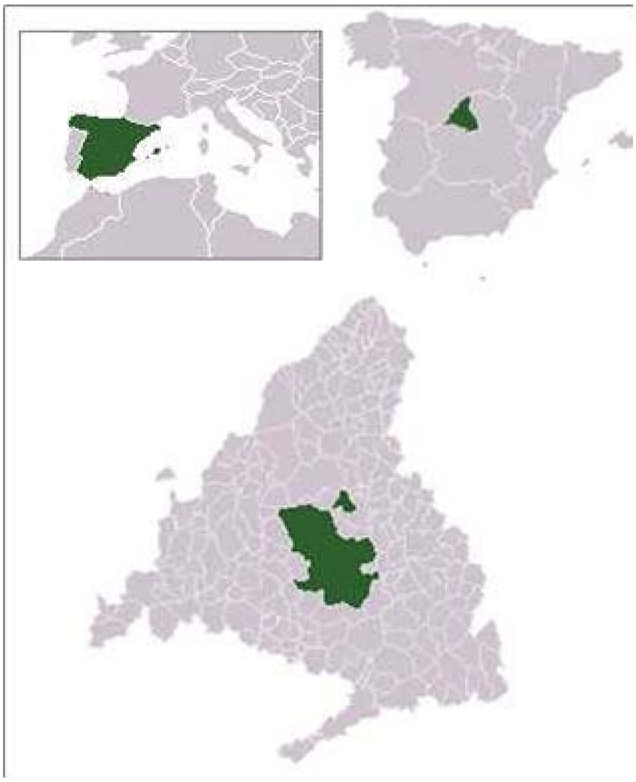


Figure 31: Location of Madrid

The Madrid large FOT will take place in the metropolitan area of the city which has an extension of approximately 5300km2. The FOT participants will be provided with real time traffic information of the main road arterials of the city, as well as information on maximum speed and incidences.

Figure 32: Madrid metropolitan area

8.2.3. Functions tested

The functions tested in Madrid FOT are Real time traffic information, Speed limit information and Green driving support

8.2.4. Devices used

The nomadic device used during the field tests in Madrid is an enhanced version of the new Vexia Econav, a navigation device which, apart from the normal navigation support, includes the green driving support functionalities that provides the user with information on which gear to use and when to change gears in order to reduce fuel consumptions. These devices will be properly modified in order to able to receive the real time traffic information provided by ETRA.

Figure 33: Vexia Econav

8.2.5. Participants (No, characteristics, etc.)

100 drivers were recruited among the users of Vexia devices. These drivers were provided with the enhanced Vexia devices modified in order to be able to provide the functionalities required for this LFOT.

8.2.6. The test vehicle (s) and type of instrumentation

The vehicles used in Madrid FOT were equipped with the above mentioned device properly modified in order to include the new functionalities to be tested in Madrid. The type of instrumentation needed inside the vehicle to perform the FOT is the Vexia Econav navigator device, no in-vehicle data logger is needed as the data are sent to a central data logger and are logged remotely.

8.2.7. Road type

Madrid FOT takes place within the most important road arterials and streets of the Madrid city centre and metropolitan area.

8.2.8. Traffic conditions and interaction with other road users

The Madrid FOT participants interact directly with other road users, as they will not run on segregated routes. Being a big city as it is, Madrid suffers from high density traffic, having regular peaks at rush hours (morning 7-9; evening 17-19, at working days) which cause usual congestions at the main city entrances and main roads of the city.

8.2.9. FOT execution

Madrid FOT started during the February of 2011 with the tests of the Real time traffic functionality. By this time the test drivers were provided with the enhanced Vexia devices properly modified to provide the new functionalities to be tested. Also green driving functionality and speed limit information started to be tested also in May 2011.

8.2.10. Weather conditions

Madrid is located about 600 metres above the sea level at 40º24N 3º41W and has a Continental Mediterranean climate with cool winters due to its altitude, including sporadic snowfalls and minimum temperatures often below 0 °C in Winter time. Summer tends to be hot with temperatures over 30 °C in July and August. Due to Madrid's altitude and dry climate, nightly temperatures tend to be cooler, leading to a lower average temperature in the summer months.

Precipitation levels are low, but rainfall (sometimes snowfall in wintertime) can be occurred all throughout the year. Summer and winter are the driest seasons, with most rainfall occurring in the autumn and spring.

8.2.11. Time of day and seasonal effects

In the following figures the Sunrise, sunset, dawn and dusk times graph and the Sun path diagram are depicted for Madrid.

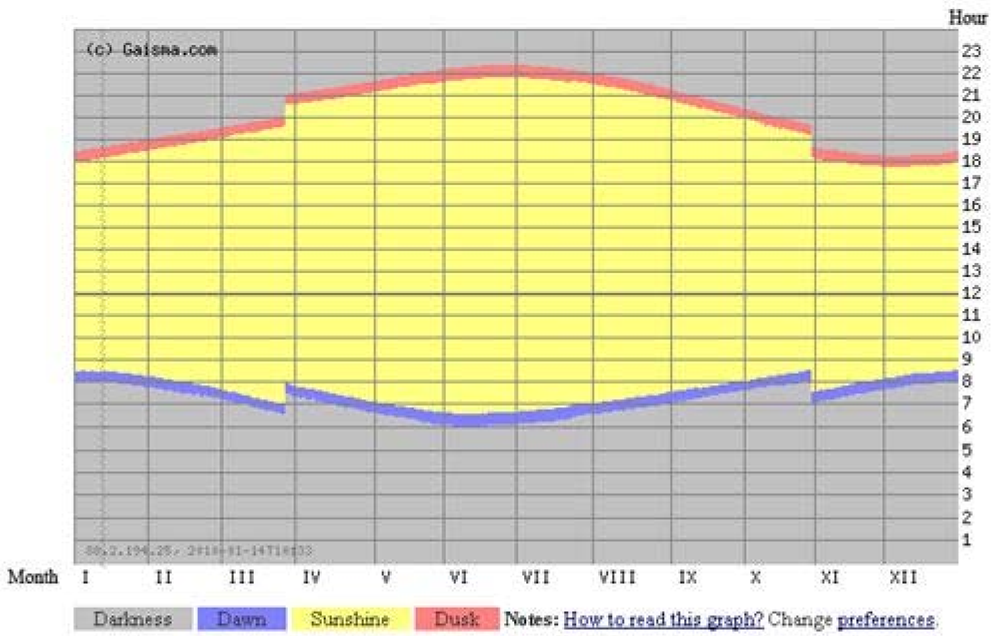


Figure 34: Madrid Sunrise, sunset, dawn and dusk times, graph

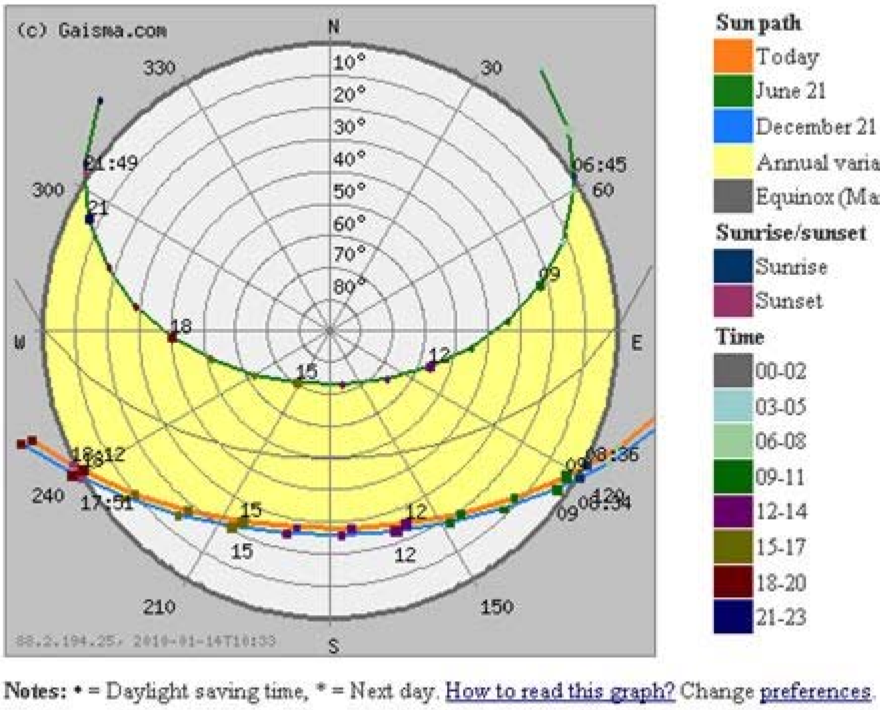


Figure 35: Sun path diagram

8.3. Detailed FOT1: Valladolid

8.3.1. Test Plans (applied)

Study design

Similarly to LFOT1, the objective of the DFOT1 is to analyse the effects of the use of functions provided by a navigation device. In this case, the DFOT is planned to complement the LFOT results, in order to allow in-depth investigate aspects that cannot be faced in LFOT. The DFOT in Valladolid test site is still under definition, since it will be specified considering the results obtained from the LFOT pilots and the definition of DFOTs in other locations with the final aim of covering the project objectives and trying to harmonise as much as possible. Nevertheless, a before-after study is planned.

Reference case

DFOTs in Valladolid test site are in early stage and thus, still under definition. Nevertheless, a baseline condition will be considered in order to compare different conditions and obtain statistically significant results.

Research questions/Hypotheses/Indicators

The specific hypothesis, research questions and the corresponding indicators will be defined once the requirements and the specifications of the DFOTs are described (of course, taking into account that these tests will support LFOT results as a complement).

Nevertheless, in this case the amount of data available for analysis will increase (higher number of variables and higher logging frequency) with regard to LFOT and therefore, the number of indicators and ultimately, the research questions and hypothesis.

Data collection

The vehicle to be used during the D-FOT trials will be a specifically equipped vehicle with a particular data acquisition system, including vehicle dynamics data, driver status variables, environment information and audio-video recordings. Furthermore, an additional logging will be done through the nomadic device using the same specific logging software as in L-FOT.

On the other hand, different questionnaires will be used (the same than in LFOT, together with others, specifically developed/considered for DFOT).

In the specific case of the DFOT, data will be stored locally.

Pilot conduction

The pilots of the DFOT in Valladolid are planned during the first months of 2011. The objective of the pilots will be to determine the feasibility of the DFOT and refine all aspects (design, tools, etc.) in order to comply with TeleFOT requirements and Valladolid test site specifications as a support of LFOTs.

Technical evaluation

Different technical evaluations are foreseen before the start of the pilots in order to verify the functionality of the data collection system.

FOT execution

DFOT execution is planned for the second quarter of 2011.

The overall number of participants will depend on the final decision about the study design to be considered. Nevertheless, the expected number of participants would be around 20 drivers.

Regarding the planning for the execution, a similar procedure will be used. A freely interaction with the device will be allowed, although subjects will have to perform some specific activities previously defined. In relation to the subjective information, the same questionnaires will be used during the tests although, specific extra questionnaires are foreseen as well in order to study other potential features of subjects, more detailed usability questionnaires, etc. Moreover, group sessions and interviews will be also considered.

8.3.2. Map of the area of the tests

The detailed FOT (WV test site) will be conducted in the province of Valladolid, located in the North-West of Spain (see L-FOT map).

8.3.3. Functions per site

Detailed tests are planned to be carried out as a complement to the large-scale tests performed in Valladolid (within the Spanish test site) with the aim of exploring in-depth drivers' behaviour when making use of particular driving functions. Thus, the same functions will be considered within the D-FOT, namely, Navigation support (static), Speed limit information and Speed alert.

8.3.4. Devices to be used

As said, the detailed test will be a complement of the L-FOT and therefore, the same nomadic device (navigator) will be used, namely NDrive.

8.3.5. The test vehicle and type of instrumentation

The vehicle to be used during the D-FOT trials will be a specific equipped vehicle with the corresponding data acquisition system. The system will include:

- Vehicle dynamics (speed, acceleration, GPS position, driven distance, use of pedals and controls, etc.)
- Driver status (CAA variables, micro-cameras including video and audio)
- Environment (weather conditions and lighting through video)

Furthermore, an additional logging will be done through the nomadic device using the same specific logging software as in L-FOT. As previously explained, data logged will be:

- General purpose variable (Date, timestamp)
- Route/Journey data (GPS coordinates, number of satellites, speed, speed limit, road type, heading)
- Functions (on-off, warning messages, navigation mode)
- Assisted mode (route type, re-calculations)
- User interaction

8.3.6. Participants (No, characteristics, etc.)

The overall number of participants will depend on the final decision about the experimental design to be considered within the detailed FOT. This test design will define the experimental conditions and as a consequence, the number of groups and the needed number of participants in each of them. Nevertheless, the expected number of participants would be around 20 drivers.

8.3.7. Road type

The detailed FOT will be conducted in Valladolid area and as far as possible, different types of roads will be covered within the trials (urban, extra-urban, rural and motorway) in order to consider several road features such as number of lanes, level of road curvature, speed limits, traffic densities, etc.

8.3.8. Traffic conditions and interaction with other road users

The area of the D-FOT trials will be selected according to different layouts and features (traffic conditions and environmental aspects such as signs, road markings, speed limits, etc.) in order to include different conditions in the subsequent analysis. For that, traffic information (previously mentioned in the L-FOT description) will be used in order to select the most suitable routes.

8.3.9. Weather conditions

As it was explained before (L-FOT description), Valladolid has a varying weather conditions along the year. According to the established timeplan, the D-FOT trials will be conducted in the first half of the year, thus involving winter and spring periods.

8.3.10. Time of day and seasonal effects

In this case, the duration of the test trials will be limited and therefore the seasonal effects will be taken into account: similar weather conditions will be ensured by selecting the appropriate days and modifying the calendar schedule. A similar procedure will be followed for the selection of the time of the day to carry out the D-FOT trials.

9. SOUTH TEST COMMUNITY – ITALIAN TEST SITE

9.1. Large-scale FOT1

9.1.1. Test Plans (applied)

Study design

The LFOT (IT-01) started in Italy in November 2010. Drivers are distributed within Italy, mainly in the Emilia Romagna region.

The study is running according to a between subject design with control group.

150 test subjects were recruited including users with more than 3 years of driving experience, age between 25 and 65, 10,000 km/year.

They have received an Acer beTouchE101 smart phone (supporting Navigation Static, Speed limit information, Speed alert functions, tested in combination) and a MetaSystem Data Logger has been installed onboard. Every subject has started with a 1 week baseline condition.

The drivers received also a Travel Diary, a Background questionnaire and User uptake questionnaires.

The first Travel Diary, the Background questionnaires and the User Uptake questionnaires (Before) have been compiled in paper version.

The Background questionnaires and the User Uptake questionnaires (Before) have been reported in the LimeSurvey version.

Travel diary transfer to digital version (excel file provided by VTT) is under completion.

In the next phases online versions will be compiled.

A control group (aiming at 50) is under recruitment, who will be driving with no device onboard, following the drivers' usual route. A Data Logger will be installed on their vehicles.

The drivers will receive also a Travel Diary (paper version) and a Background questionnaire.

Total duration of the test: 9 months. Baseline: 1 week

Reference case

A sample of 150 drivers was set as target for the Italian Large Scale FOT, to be possibly flanked by a control group of 50 drivers.

The control group will drive following the drivers' usual route. No navigation device will be used onboard.

Data collection

- **Logging –** The Italian Large Scale FOT will use MetaSystem's MetaSat TVM 5.0.
- **Survey tools used –**Travel Diaries, Background questionnaires and User Uptake Questionnaires (Before, During, After), provided by SP2, will be used in the Italian Large Scale FOT. An online version of the questionnaires, based on LimeSurvey, has been developed and test subjects will be invited to fill in questionnaires on line.

Test subjects will periodically receive a reminder to fill in the survey tools.

- **Other data collection means used**
- **A back up copy, stored by the memory card, will be kept.**
- **Data process path (architecture) –** here the architecture of the data collection system should be described (+ schema)

Data from the Control Group will be collected by the Data Loggers installed on the Vehicles (acceleration, gps position, timing, speed).

Data from the drivers will be collected both via the Data Logger and via the smart phone (acceleration, gps position, timing, speed). Syncronization of the data collected has to be made before sending data to the Central Database.

All the data from the test site will be sent firstly to a server to be installed at Unimore premises and then to the central database. Before being transferred to the central database, data are transformed into the official TeleFOT format by a transformation software developed by Unimore.

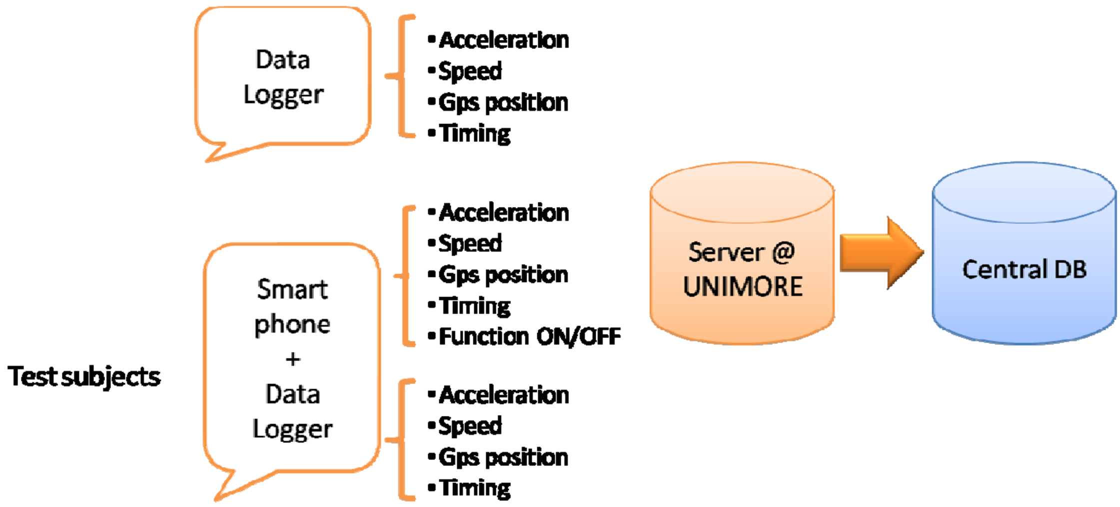


Figure 36 – ITA LSC FOT Data Architecture

Pilot conduction

The pilot have been conducted in the same area where the tests are taking place: in the Reggio Emilia area, province of the Emilia Romagna region, in Northern Italy.

The pilots have been designed so as to check the data flow, the logistics for data capture and transfer and the experimental methodology.

They included different road types, in order to assess the functions under different road conditions. Extra-urban, urban, residential and rural scenarios have been addressed, as well as access to the A1 Motorway (backbone of road transports).

During the pilot tests also questionnaires and travel diaries provided by SP2 have been tested, so to treat them as mini-FOTs, as decided at IP level.

Pilot testing is in fact conceived as a trial run of procedures and instruments that are to be used in the tests. The pilot testing will verify that the questionnaires/travel diary "work" in terms of questions, answer alternatives, terminology and translation, so that people understand them, and that they provide the data necessary in order to test the different hypotheses.

The pilot was conducted during October 2010. 5 persons were involved in the pilot testing, representing the participants in the test.

Vehicles for pilot tests were equipped with a smart phone and a MetaSystem ClearBox (MetaSystem's MetaSat TVM5.0). Relevant software, to be provided by Blom, have been installed on the smartphones in order to enable the test functions as well as data logging.

Travel diaries were delivered to users at the beginning of the test, together to instructions to fill them in.

The "before" questionnaires were filled in at the moment of the registration, together to background questionnaires. An Help Desk was arranged in order to support pilot testers (and, in the future, test subjects) with technical problems and to provide information.

Technical evaluation

The Nomadic device have been tested via test driving sessions, where it was tested the effective log collection following TeleFOT specifications, with respect to the functions planned to be tested and the data planned to be collected.

The data transmission from the device to the local database was tested as well.

Finally, it was tested if the data collection to be performed by the clearbox is correctly working.

FOT execution

The Italian Large Scale FOT tests started on November 2010 and end on September 2011.

The FOT started right after the pilot test was completed (early November 2010).

Four different phases were foreseen for the Italian LSC FOT execution:

a) **Subject recruitment**: The first subject recruitment phase was finalized by November 2010. The drivers to participate in the Italian LSC FOT have been recruited by the University of Modena and Reggio Emilia and MetaSystem, with the support of the main Stakeholders on the FOT (e.g. the Municipality of Reggio Emilia).

b) **Information to the test drivers:** Some sessions have been organized by UNIMORE and MetaSystem in order to inform the FOT participants about the general objectives of TeleFOT and how to participate to the tests**.**

c) **FOT execution:**

- **Baseline:** During this phase the drivers have driven with a base line configuration of the device – that is, with none of the three functions to be tested active. After one week of baseline conditions, the test subjects drove following their usual route.
- The **test subjects** drove their usual route using a smart phone as a driving support device. A MetaSystem Data Logger was installed onboard.

  The drivers have been required to fill in a Travel Diary, a Background questionnaire and User uptake questionnaires (paper version. The next questionnaires will be filled in online; if it is not possible, they will be provided in paper version).
- The **control group** will be driving with no device onboard, following the drivers' usual route. A Data Logger will be installed on their vehicles.

  The drivers will be asked to fill in a Travel Diary (paper version) and a Background questionnaire.

9.1.2. Map of the area of the tests

The large scale FOT is based in Reggio Emilia, province of the Emilia Romagna region, in Northern Italy.

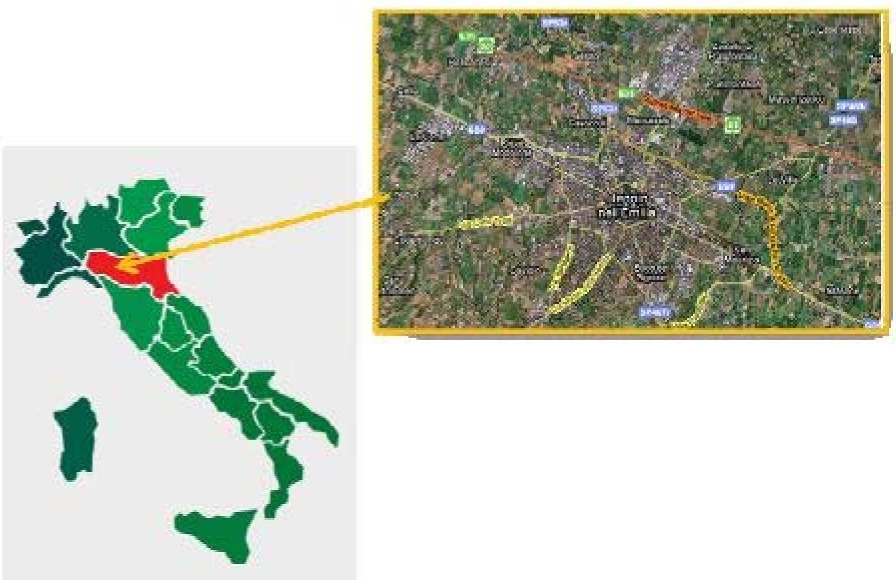


Figure 37: Reggio Emilia in Northern Italy

The region of Emilia-Romagna consists of nine provinces and covers an area of 22,124 km². Nearly half of the region (50%) consists of plains while 25% is hilly and 25% mountainous. The mountains stretch for more than 300 km from the north to the south-east, with only three peaks above 2,000 m.

About a half of the region is constituted by Padan Plain, an extremely fertile alluvial plain crossed by the river Po.

Via Aemilia divides the region into two almost equal parts: the Northern one (47,8 % of the total) consists of plains, while hills (27,1% of the total) and mountains (25,1% of the total) are in the Southern part of the region.

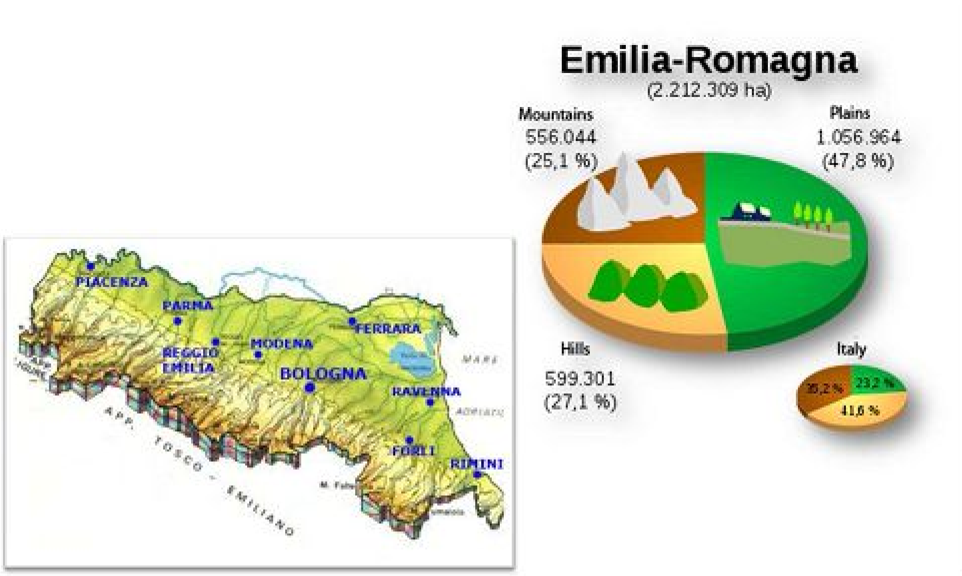


Figure 38: Emilia Romagna

9.1.3. Functions tested

The following functions are tested in the Italian Large Scale FOT: Speed limit information, Speed alert, and Navigation support (static).

9.1.4. Devices used

The Italian LFOT will use an Acer smart phone, model "beTouch E 101" [5], using a software to be provided by Blom.

Figure 39: Acer smart phone, model "beTouch E 101"

All the vehicles are equipped with MetaSystem's Clear Box, which is mainly used for data logging purposes.

9.1.5. Participants (No, characteristics, etc.)

A sample of 150 drivers was recruited for the LFOT, flanked by a control group of 30 drivers. Recruitment took into account driving experience (i.e. average Km. driven per year), age, gender, profession: participants will be recruited among drivers who comply with a minimum 10000 Km./year experience and who have received their driving license from at least three years; a pre-screening will also attempt to define which part of the yearly distance driven belongs to "usual roads" (criteria for "usual" are to be defined). Even though the sample is mainly composed by private car drivers, public or private fleet drivers are also included in the sample.

9.1.6. Road type

The plan is to include different road types, in order to assess the functions under different road conditions. Extra-urban, urban, residential and rural scenarios will be addressed, as well as access to the A1 Motorway (backbone of road transports).

Restricted Access Areas in downtown: in Reggio Emilia traffic restrictions are applied to Euro 0 and Euro 1 vehicles on specific periods; special access permissions for commercial vehicles (e.g.: goods delivery). Most of the urban and motorway road network relies on flat terrain; in the town's nearing, hills and mountains are present (up to 15% slopes) with tunnels (with possible lack of satellite connection).

Limitations for the test site can also be related to Telecom Network coverage for on line applications.

The urban morphology does not present particular problems, since the city is in prevalence in plain and buildings, in particular in the historical centre, are not very high (mainly three floors).

9.1.7. Traffic conditions and interaction with other road users

Traffic in Reggio Emilia presents regular peaks of density during working days (morning 7-9; evening 17-19), with possible congestions as a consequence of roadworks and accidents on the A1 Motorway: when it is closed or overcongestioned, the traffic is deviated onto Reggio Emilia road network.

In particular, the Reggio/Modena nord area is characterized by high levels of heavy transport and in case of accidents or overcongestion the interregional traffic impacts on the local road network, in particular on Via Aemilia.

A second road with a heavy goods and persons transport is the Brennero motorway, with a high impact on the urban mobility.

The vehicles circulation is not allowed in some areas of the cities (ZTL).

9.1.8. Weather conditions

Reggio Emilia's territory consists almost entirely of plains: it is placed in the southern part of the Emilia Romagna region.

Reggio Emilia's climate presents in prevalence severe winters, with frequent fog also during the day and sultry and hot summers. In winter time snow can fall from mountains to plains.

Autumn is very wet, cool and foggy until mid November, when climate starts to assume winter characteristics. Spring is quite mild.

Month	T min (°C)	T max (°C)	Precipit (mm)
Jan	-2	4	55
Feb	0	8	53
Mar	4	13	63
Apr	8	18	73
May	13	23	71
June	16	27	54
July	19	30	36
Aug	18	29	48
Sep	15	25	64
Oct	10	18	91
Nov	5	10	81
Dec	1	5	61

Figure 40: Temperature and precipitations

9.1.9. Time of day and seasonal effects

In the following figures the Sunrise, sunset, dawn and dusk times graph and the Sun path diagram are depicted for Reggio Emilia:

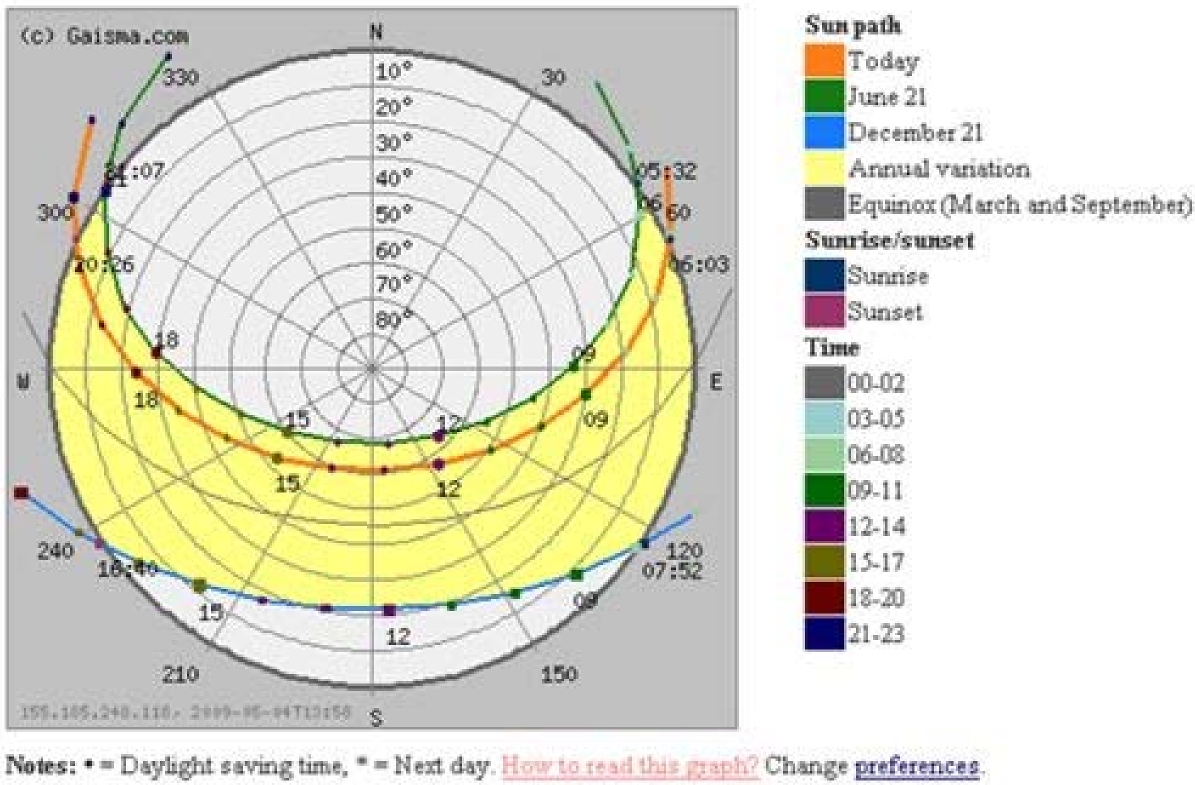


Figure 41: Reggio Emilia Sun path diagram (ref: May 2009)

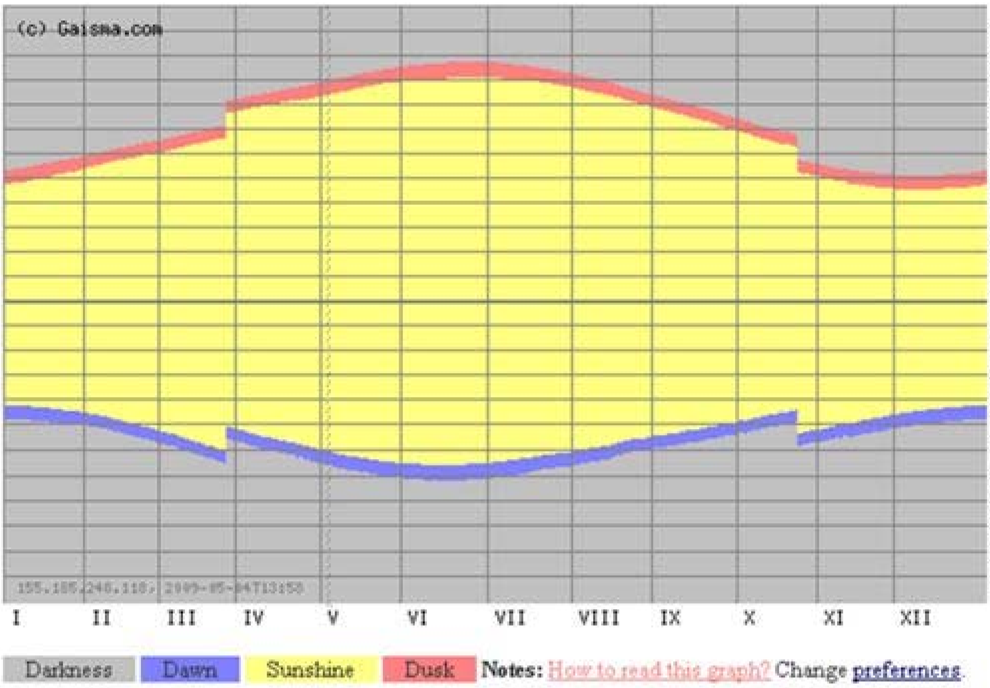


Figure 42: Reggio Emilia Sunrise, sunset, dawn and dusk times, graph

9.2. Detailed FOT1

9.2.1. Test Plans (applied)

The Italian Detailed FOT objectives are to test the user acceptance, safety and efficiency of the Magneti Marelli PND. It will complement the Italian LFOT and for this reason the functions tested are nearly identical to the functions tested in the Italian LFOT. The differences are due to the opportunity in the DFOT to test functionalities which are implemented in the Magneti Marelli device, and are not available in the LFOT device.

Tests will be based in Turin, in northwest Italy, capital of the Piedmont region. It involves Centro Ricerche Fiat and Magneti Marelli.

Study design

Two vehicles are used for tests, with around 50 drivers (within subject design). Participants were recruited among drivers who comply with a minimum 10000 Km/year experience; participants will be selected also taking into account their relationship towards technology, and in particular if they own/ use a similar device.

The study will be run according to a within subject design. After some time of testing the device, the system will be activated. The same drivers will perform two series of tests, to be able to evaluate the evolution over time, for example the user uptake.

Total duration of the test: 9 months.

Reference case

The reference case in the Italian DFOT will be the situation of drivers using the vehicle on the same trips as in the functions testing, but without the use of the functions

Data collection

- **Logging** – the logging will be performed using CANape (from **Vector** Technologies) and an on-board PC storing data. Observations. Furthermore in-vehicle video cameras will be used for road/traffic situation, driver behavior, monitoring of interaction driver-device (as no device logging is available).
- **Survey tools used –**Limesurvey tools will be used, questionnaires will be filled-in immediately before or after the test: the Background Questionnaire, the different User Uptake Questionnaires for each function tested: Pre-test, During-test, Post-test.
- **Data process path (architecture) –** the architecture of the data collection system is described in the following schema, where the onboard PC hosts the test tools (CAA), gathers data coming from the vehicle networks and from the test tools into a local database resident in the PC. Pre- and post-processing are performed at the level of the PC. Successive analysis is done locally (in the test site).

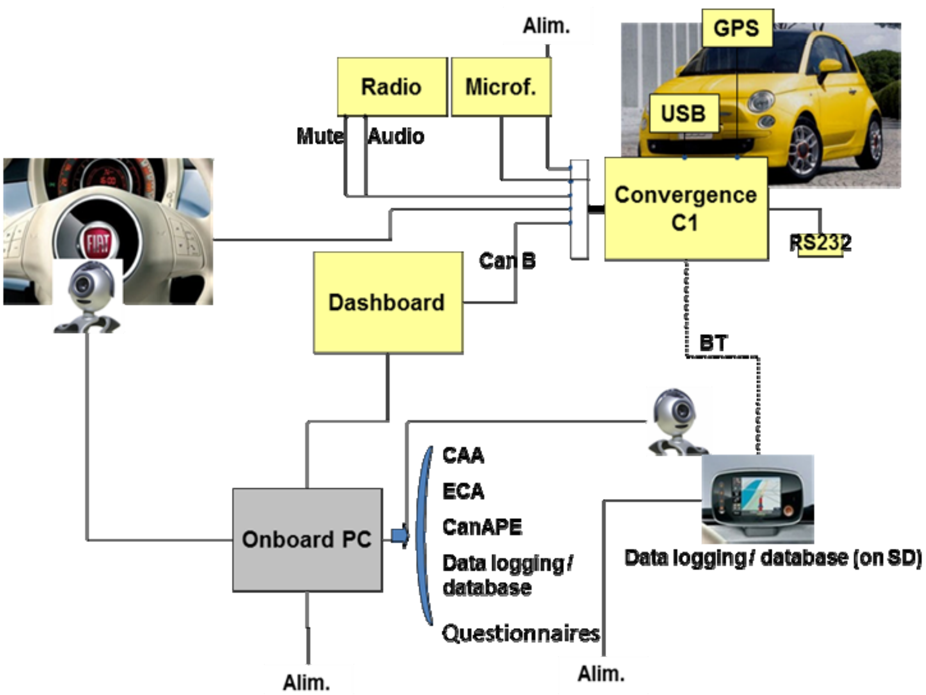


Figure 43. Architecture of the Italian D-FOT

Pilot conduction

A test bench has been set-up in November 2010. The pilot will take place in April 2011.

The pilot will involve 2-3 people, travelling from Venaria Reale/ Orbassano to the Southern Piedmont.

The questionnaires (travel diaries/user uptake, etc.) will be handled and filled-in immediately after the test.

Technical evaluation

The technical verification of the functions provided by the device has been performed during the early tests in 2010. The two test users reported some problems (interaction with the driver, visualization of messages..), which were resolved by Magneti Marelli during the same period.

Another aspect of technical evaluation regarded the test tools, the subjective data collection, in particular the survey tools.

The next step of technical evaluation will be to test the data flow, with test tools on-board the vehicle and database installed in the on-board PC. This will be performed in the context of the piloting activities (see above).

FOT execution

The actual FOT (excluding the pilot) started on April 2011 and is expected to end on December 2011. The sample is composed of 50 people, and is stratified according to age/gender/ mileage/ relationship with technology/ use of PNDs.
The following phases are undertaken:

1. **Test set-up**: the test tools are integrated within the vehicle. Verification of data flow is performed;
2. **Subject recruitment**: legal aspects are studied and all authorizations are sought from the companies (CRF, Magneti Marelli); the sample of drivers (50) is selected;
3. **Subject information**: the drivers receive information via email on the objectives and modalities of the tests. The drivers are briefed before each test session.
4. **Tests**: the sample of drivers during each test, the drivers go through these phases:
    a. baseline (no device activated)
    b. navigation (static/ dynamic), RTTI, speed camera alert
    c. Green driving support

The same drivers perform a second series of tests after a few weeks/ months to evaluate the user uptake. Finally it is expected to perform, if possible, a final validation tests in collaboration with the Italian Large scale FOT (see above).

Table 1: Timing of the Italian DFOT

Activity	Timing
Device functional test	May-December 2010
Test bench set-up	December 2010
Pilot	April 2011
Subject recruitment and	March-April 2011

information	
First series of tests	April 2011-December 2011

9.2.2. Map of the area of the tests

The Detailed FOT is based in Turin, in northwest Italy, capital of the Piedmont region.

Turin is a major city as well as a business and cultural centre in northern Italy, located mainly on the left bank of the Po River surrounded by the Alpine arch.

The Geography of Piedmont is that of a territory predominantly mountainous, 43.3%, but with extensive areas of hills which represent 30.3% of the territory, and of plains (26.4%). Turin is surrounded on the western and northern front by the Alps and on the eastern front by a high hill. The centre of the city is mainly in plain.

Figure 44: Turin

9.2.3. Functions tested

The following functions are tested in the Italian Large Scale FOT: Static and Dynamic Navigation, Traffic Information, Speed Camera Alert and Green Navigation.

9.2.4. Test vehicles and type of instrumentation

The Magneti Marelli PND is used on the vehicle planned to be used for tests. The logging is performed through dedicated PCs.

9.2.5. Participants (No, characteristics, etc.)

Two vehicles are used for tests, with around 50 drivers (within subject design).

Participants are recruited among drivers who comply with a minimum 10000 Km/year experience; a pre-screening will also attempt to define which part of the yearly distance driven belongs to "usual roads" (criteria for "usual" are to be defined). A differentiation will be made between professional and private drivers.

9.2.6. Road type

Scenario: mostly highway and urban roads.

Turin urban network is very thick and capillary. Roads are predominantly urban in the city centre, but Turin has a lot of high flow roads.

The Turin ring road connects different highways. It distributes the city accesses in all the cardinal points and allows getting to the most important cities of northern Italy. A21 to Piacenza, A4 to Milan and Trieste, A6 to Savona, A5 to Ivrea and Aosta and also A32 to French borders are the highways linking Turin to main cities and to the European and Italian road network.

A lot of high-level flow roads connect Turin outskirts to the city centre.

The urban morphology does not present particular problems, since the city is in prevalence in plain. So, most of the urban and highway road network lies on flat terrain. There are some hills and some rising roads are near the city, mainly on the right bank of the Po River.

There are restricted Access Areas in the city centre (named ZTL): in Turin traffic restrictions are applied to Euro 0, Euro 1 and Euro 2 vehicles on specific periods and within a specific "environmental zone". Special access permissions for commercial vehicles (e.g.: goods delivery), residents and disabled persons are available. Restricted access is also applied in the pedestrian only area, named "central zone ZTL", in which just public transport or allowed vehicles can pass through.

Extra-urban, urban, residential and rural scenarios will be addressed, as well as access to highway.

Since Turin is a big city, urban territory is characterized by high buildings forming a sort of "urban canyons" which may represent difficulties for signal detection.

The tests are carried on with trips beginning and ending in Orbassano (CRF) and Venaria Reale (Magneti Marelli).

9.2.7. Traffic conditions and interaction with other road users

As a city of over 900.000 citizens, traffic in Turin presents regular peaks of density during working days (morning 7-9; evening 17-19), with possible congestions as a consequence of road works and accidents on the high level of flow roads. Sometimes particular traffic congestions happen along the ring road highway due to the presence of a lot of factories in the city outskirts and to the movement of a lot of workers during the daytime.

In Turin critical points for traffic conditions are also some roads called Corso (C.so) Regina Margherita, C.so Giulio Cesare, C.so Francia, C.so Unione Sovietica, connecting the city centre to highways and outskirts.

9.2.8. Weather conditions

Turin has a continental climate. Winters are cold but dry, summers are mild in the hills and quite hot in the plains. Rain falls mostly during Spring and Autumn; during the hottest months, otherwise, rains are less usual but more strong (thunderstorms are usual). During Winter and Autumn banks of fog, which are sometimes very thick, form in the plains.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °C (°F)	6 (43)	8 (47)	12 (55)	16 (61)	20 (69)	24 (76)	27 (82)	26 (80)	23 (74)	17 (63)	10 (51)	7 (45)	16 (62)
Average low °C (°F)	-2 (28)	0 (31)	2 (37)	6 (43)	10 (51)	14 (58)	17 (63)	16 (62)	13 (56)	8 (47)	1 (35)	-1 (29)	7 (45)
Precipitation cm (inches)	4 (1.6)	4 (1.6)	6 (2.6)	9 (3.8)	11 (4.6)	9 (3.6)	5 (2.3)	6 (2.6)	7 (2.8)	8 (3.4)	7 (2.9)	4 (1.9)	85 (33.7)

Figure 45: Turin weather averages

9.2.9. Time of day and seasonal effects

In the following figures the Sunrise, sunset, dawn and dusk times graph and the Sun path diagram are depicted for Turin:

Figure 46: Turin Sunrise, sunset, dawn and dusk times, graph

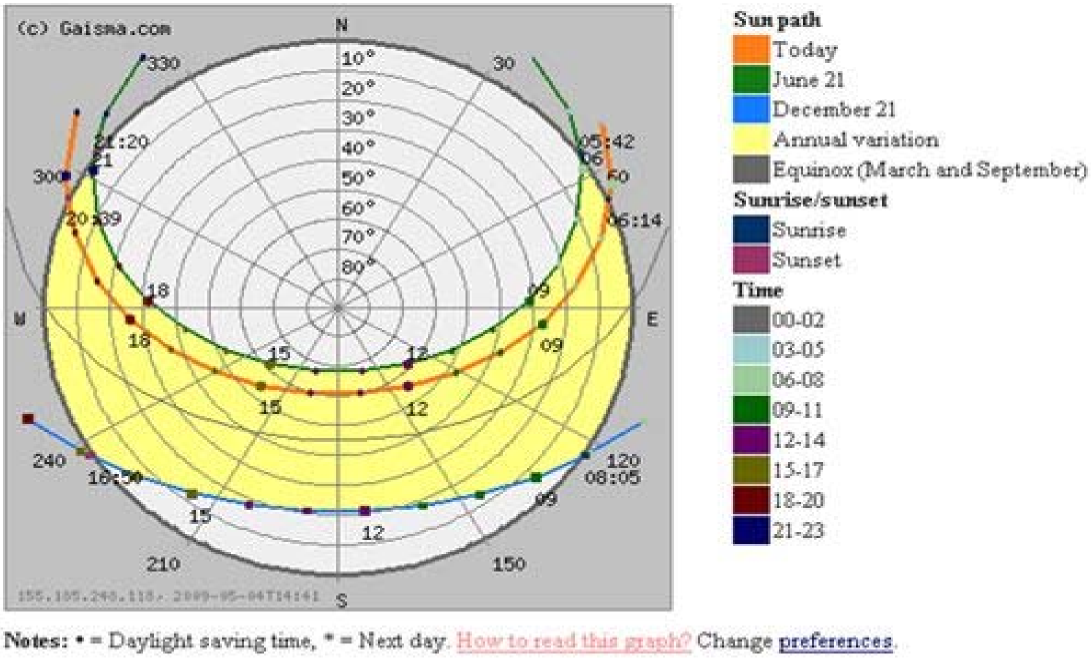


Figure 47: Turin Sun path diagram (ref. May 2009)

10. SOUTH TEST COMMUNITY – GREEK TEST SITE

10.1. Large-scale FOT1, FOT2, FOT3 and FOT4

10.1.1. Test Plans (applied)

Study design

In Greece 4 LFOTs were planned and executing, as follows:

- LFOT1: Navigation support (NAV)
- LFOT2: Navigation support + Speed Limit information (NAV+SL)
- LFOT3: Navigation support + Traffic information (NAV+TI)
- LFOT4: Navigation support + Speed Alert (NAV+SA)

Reference case

In order to guarantee comparability of results, a within subjects design was employed, in which the same subjects participate in all the above LFOTs, thus we have four experimental conditions plus a baseline (meaning the drivers will not have access to any of the functions under study), which is be the same for all the LFOTs. The order of the presentations of the various conditions to the subjects has been rotated, so as to counter-balance for learning effects among Baseline and LFOT 1 and between LFOTs 2, 3 and 4, as presented in **Table 2**.

In this way it will be possible to study the effects of the Navigation support compared to baseline, as well as the additional effects of Traffic Information, Speed Limit Information and Speed Alert plus Navigation Support, compared to Navigation only and compared to Baseline.

Data collection

- **Logging -** A software data logger is used for the Greek test site. The software, that is supplied by Telenavis, is incorporating into one main application both the core logging application and the navigation software. A GPS-enabled PDA based on Microsoft Windows Mobile 6.1 and equipped with GPS module, Accelerometer sensor, HSDPA 900 / 2100 3G network, Class 10 (4+1/3+2 slots), 32 - 48 kbps GPRS and a high resolution screen.

  The data logged fall into four main categories in terms of accessibility. The first category refers to the GPS raw data that are being collected directly by the logging software which has access to the GPS module of the PDA every one second. The second category is consisted of the 3-axis acceleration data accompanied with the corresponding UTC timestamp. The software gets the acceleration data at a frequency of about 4HZ directly from the acceleration sensor incorporated in the device. The third type of logged data refers to the different events that occur while driving. For that purpose the logging software is communicating with the Application Programming Interface of the Sygic application. Additionally, traffic volume and traffic requests are collected and logged as events by communicating over GPRS with the Athens Traffic Management Centre. For further details on the data logger you may refer to D3.2.2.b "Test tools" [6].

Objective data are collected via the sensors of the nomadic device, both in the baseline and in the experimental condition.

Summarising, messages with the position, speed, acceleration and event data will be generated approximately every 200 ms. Messages are locally stored in real time (after each trip) and are available to be uploaded to the central database every day.

Data checks are performed periodically, to ensure completeness of data and provide for corrective measures, in case of problems.

- **Survey tools used -** Subjective data is collected using the TeleFOT survey tools, which have been translated into the Greek language in order to be used in the Greek test site. The survey tools used in the Greek test site are the background questionnaire, the travel diaries and the user uptake questionnaires. For a detailed view of the survey tools used in the Greek test site you may refer to D3.2.2.b [6].

  The travel diary is completed after the end of month 1 of the baseline and experimental conditions. The during-test uptake questionnaire is completed after the end of month 1 of the experimental conditions. The background questionnaire is completed before the start of the experiments. The pre-test uptake questionnaire is completed before the start of the experimental condition. The post-test uptake questionnaire is completed at the end of the experimental condition.

  Participants are asked to hand in the questionnaires immediately after their completion. If these questionnaires are not handed-in in time, the participants are reminded to complete them.

Pilot conduction

A pilot test has been performed, before the beginning of the experimental condition (as described earlier). Each test involved 5 people from ICCS, driving for 3 days with the respective function off and for 3 days with the respective function on. These people have completed once the background questionnaire, the uptake questionnaires and the travel diary. The collected data have been made available for analysis and review. The pilot conduction helped to optimise the procedure and the questionnaires themselves.

Technical evaluation

Two series of technical evaluations have been performed. The first one was aiming at testing the test tool (isolated) capturing issues regarding the quality.

The second series of technical evaluation aimed at testing the data flow, i.e. testing the test tools in combination with the central user and data management centre. Several sessions of trial data loggings were performed in order to meet the interface specifications set by the central user and data management centre, resulting to the optimisation of the data logging process in the Greek test site.

FOT execution

The timing on which each of the Greek L-FOTs will be executed is described in the table below

Table 2: Greek L-FOTs execution timeplan.

	Feb- Apr 2011	Apr – Jun 2010	Jun – Aug 2011	Aug – Oct 2011	Oct-Dec 2011
Group A, 25 subjects	Baseline	LFOT 1	LFOT 2	LFOT 3	LFOT 4
Group B, 25 subjects	Baseline	LFOT 1	LFOT 2	LFOT 4	LFOT 3
Group C, 25 subjects	Baseline	LFOT 1	LFOT 3	LFOT 2	LFOT 4
Group D, 25 subjects	LFOT 1	Baseline	LFOT 3	LFOT 4	LFOT 2
Group E, 25 subjects	LFOT 1	Baseline	LFOT 4	LFOT 2	LFOT 3
Group F, 25 subjects	LFOT 1	Baseline	LFOT 4	LFOT 3	LFOT 2

For the Greek LFOTs, drivers who drive mainly in the Attiki region are participating (the Attiki region includes the Athens metropolitan area); this includes a network with urban, peri-urban roads, highways and rural roads. Of course the users are free to use the functionality offered by TeleFOT also when they travel outside the Attiki region.

The Baseline condition and LFOT1 started in Greece on February 2011. 150 drivers have been recruited; the selected participants are experienced drivers (hold a driving license more than 3 years) that drive more than 10000km per year, are not elderly (>65 years old) and they represent all levels of experience with driver’s support systems and of frequency of driving in various road environments.

The Sygic voice guided GPS navigation software is provided to the users (with maps for Greece and Cyprus), installed on the Samsung OMNIA II nomadic device. The users are also provided with the fixing device and a vehicle charger (which operates via the vehicle’s cigarette lighter slot). The software presents to the driver the navigation interface, namely route selection screen plus route guidance screen and vocal output (in LFOT1) plus one of the following: the speed limit information (in LFOT2), the speed alert warning (in LFOT4) and traffic information as received by the Traffic Management Centre of Athens (in LFOT3). Each LFOT condition lasts for approximately 4 months (2 months per group).

In LFOT 1 the navigation software is used. It presents to the driver the navigation interface, namely route selection screen plus route guidance screen and vocal output. In LFOT2 the navigation s/w will present (together with the navigation support) the speed limit information to the driver, through a visual speed limit traffic sign on the screen of the nomadic device. In LFOT3 the navigation s/w will present (together with the navigation support) the traffic information to the driver, through visual icons and text on the screen of the nomadic device. Some acoustic tones may be also used. In LFOT 4 the navigation s/w will provide (together with the navigation support) a warning to the driver, when he/she is driving with a speed greater than the speed limit in the current road segment. The warning will be visual on the screen of the nomadic device and acoustic.

The navigation system will be always on in the experimental conditions and always off in the baseline condition.

The data collected include GPS, acceleration and event message logs, which are measured via the sensors of the nomadic device approximately every 200 ms; the data are inline with the TeleFOT data structure format defined within the project. The logs are locally stored on the device in real time (after each trip) and are available to be uploaded to the central database every day. The users are instructed to firmly position the nomadic device on the fixing device (attached to the vehicle dashboard), at a location adequate for presentation of visual output to the driver and with such orientation that the three-axis measurements by the sensors of the nomadic device can easily be used to calculate the 3-axis acceleration of the vehicle. Objective data will be continuously collected via the sensors of the nomadic device, both in the baseline and in the experimental condition.

The general set of TeleFOT questionnaires has been used to collect subjective data. For each LFOT, the travel diary is completed after the end of month 1 of the baseline and experimental conditions. The during-test uptake questionnaire is completed after the end of month 1 of the experimental condition. The background questionnaire was completed before the start of the experiment. The pre-test uptake questionnaires are completed before the start of the experimental condition. The post-test uptake questionnaire will be completed at the end of the experimental condition.

10.1.2. Map of the area of the tests

The tests are performed in the city of Athens and the surrounding area (Attica prefecture).

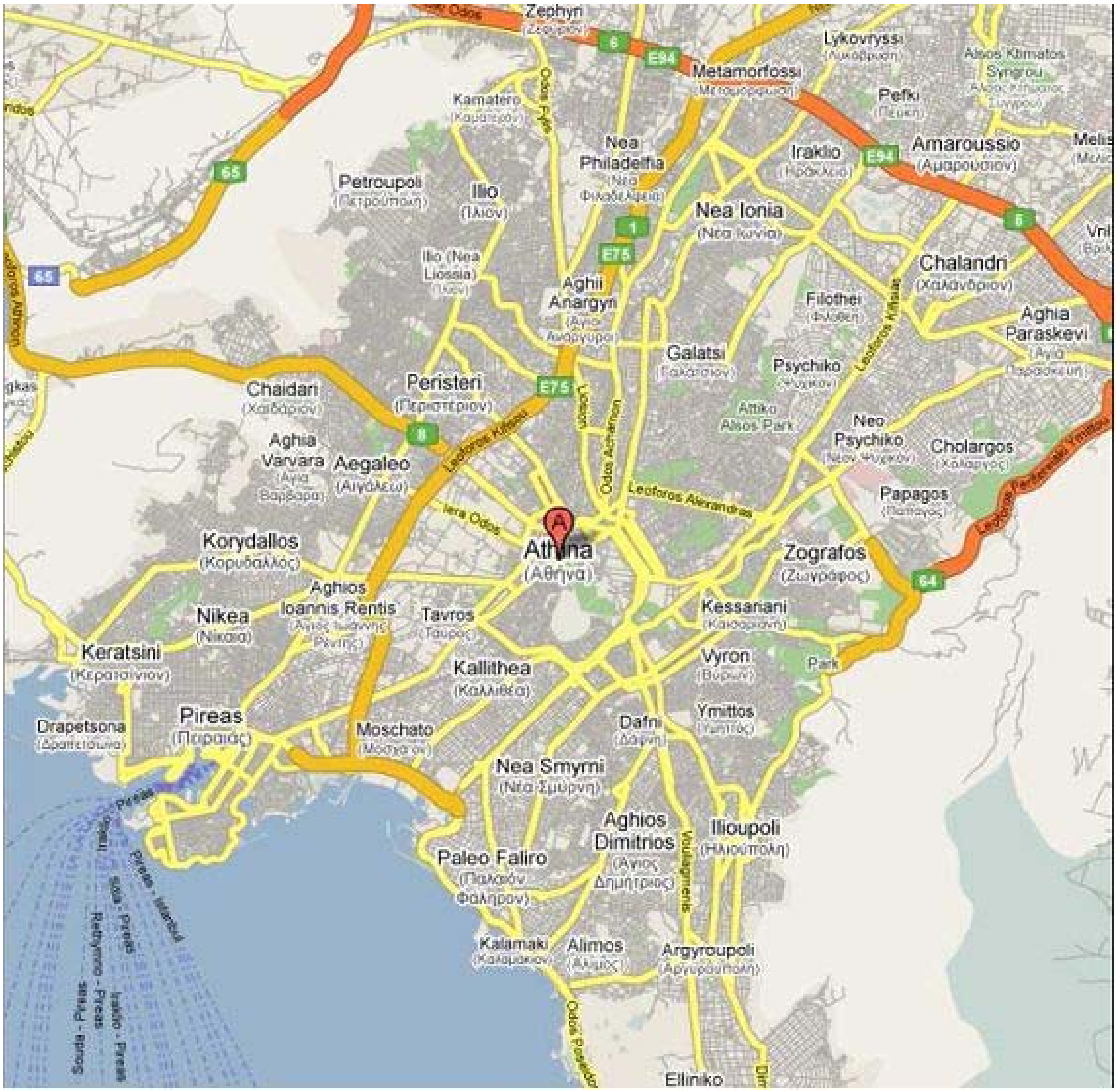


Figure 48: Athens and the surrounding area (Attica prefecture) where the Greek LFOTs will be conducted.

10.1.3. Functions tested

In Greece 4 functions are tested in the 4 FOTs: LFOT1: Navigation support (NAV), LFOT2: Navigation support + Speed Limit information (NAV+SL), LFOT3: Navigation support + Traffic information (NAV+TI), LFOT4: Navigation support + Speed Alert (NAV+SA).

10.1.4. Devices used

The Sygic voice guided GPS navigation software that is adequate for nomadic devices and for in-vehicle use was acquired through a call for tender. The navigation software presents to the driver the navigation interface, namely route selection screen plus route guidance screen and vocal output (in LFOT1) plus one of the following: the speed limit information (in LFOT2), the speed alert warning (in LFOT4) and traffic information as received by the Traffic Management Centre of Athens (in LFOT3).

More specifically, in LFOT 1 the Sygic navigation software is used. It presents to the driver the navigation interface, namely route selection screen plus route guidance screen and vocal output. In LFOT2 the navigation s/w will present (together with the navigation support) the speed limit information to the driver, through a visual speed limit traffic sign on the screen of the nomadic device. In LFOT3 the navigation s/w will present (together with the navigation support) the traffic information to the driver, through visual icons and text on the screen of the nomadic device. Some acoustic tones may be also used. In LFOT 4 the navigation s/w will provide (together with the navigation support) a warning to the driver, when he/she is driving with a speed greater than the speed limit in the current road segment. The warning will be visual on the screen of the nomadic device and acoustic.

The navigation system is always on in the experimental conditions and always off in the baseline condition.

The software runs on the Samsung OMNIA II nomadic device, purchased for the scope of TELEFOT. The device has the following characteristics: 528 MHz processor, 288 MB RAM, touch screen with 480x800 WVGA resolution, Windows Mobile 6.1 Professional, internal GPS antenna, G-sensor, Bluetooh and Wi-Fi connectivity, battery up to 6 hours, possibility to insert a memory card, software developer kit.

The speed and acceleration of the driven vehicle is measured with the sensors of the nomadic device. Therefore, the nomadic device is firmly positioned on a fixing device (attached to the vehicle dashboard), at a location adequate for presentation of visual output to the driver. The orientation of the device is such, that the three-axis measurements by the sensors of the mobile phone can easily be used to calculate the 3-axis acceleration of the vehicle, as indicated in Figure 53.

The following figures present the User interface of the navigation system on the nomadic device.

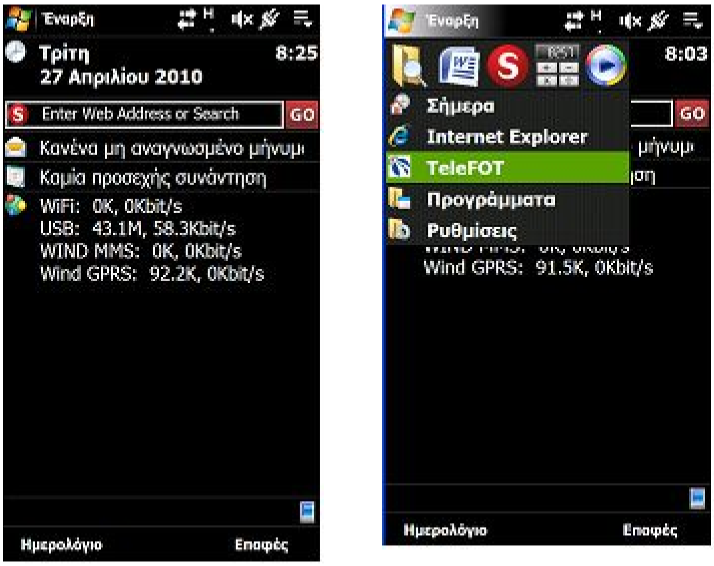


Figure 49: The nomadic device provides a typical Windows mobile HMI. The pictures reflect from left to right the sequence that needs to be followed in order to initiate the TeleFOT application menu.

The software data logger starts automatically upon initialization of the TeleFOT application.

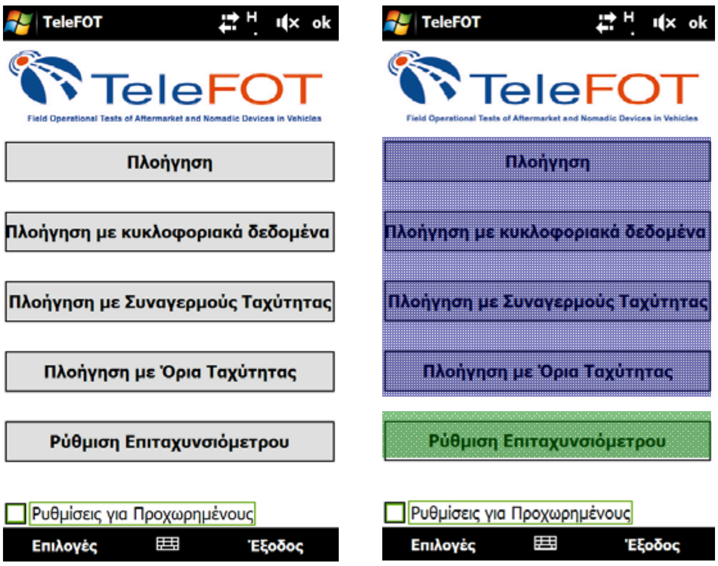


Figure 50: The interface of the TeleFOT application.

The user is provided with a set of possibilities (from top to bottom): (a) Navigation support (static) – for FOT1, (b) Navigation support with Speed limit information – for FOT 2, (c) Navigation support with Traffic Information – for FOT3, (d) Navigation support with Speed alert – for FOT 4, (e) Calibration of the accelerometer – for the baseline condition and all FOTs.

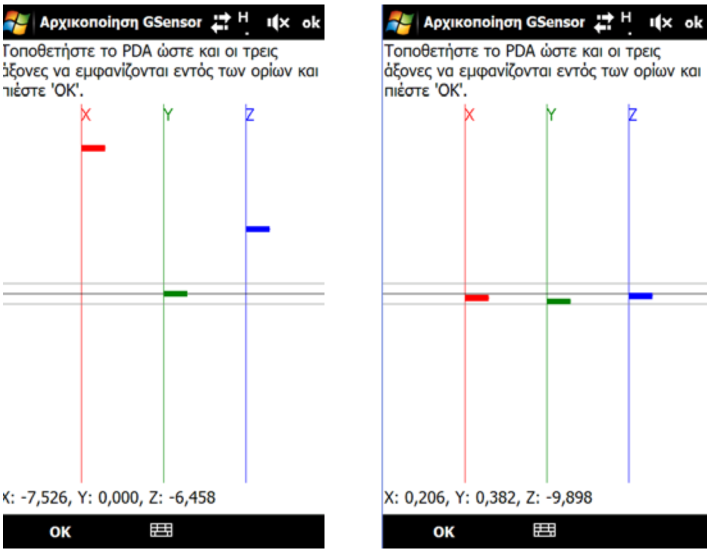


Figure 51: User interface of the TeleFOT accelerometer calibration.

The user is instructed to move the device in a way that the three lines are aligned (left side figure).

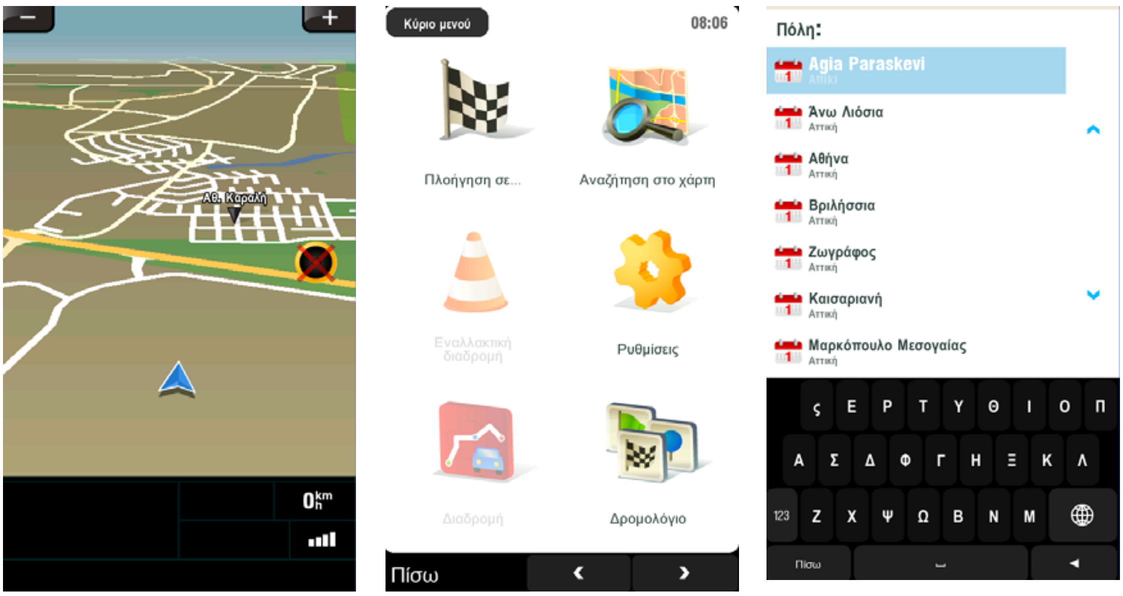


Figure 52: User interface of the TeleFOT navigation application.

The user is able to use a list of options provided by the application, as shown in **Figure 52**.

10.1.5. Data collection

- **Objective data**

Objective data are collected through the GPS and G sensor of the nomadic device, which is firmly positioned at the vehicle dashboard.

Objective data are continuously collected via the sensors of the nomadic device, both in the baseline and in the experimental condition.

Messages with the position, speed, acceleration and event data are also generated approximately every 200 ms. Messages are locally stored in the device in real time (after each trip) and are available to be uploaded to the central database every day.

Data checks are performed periodically, to ensure completeness of data and provide for corrective measures, in case of problems.

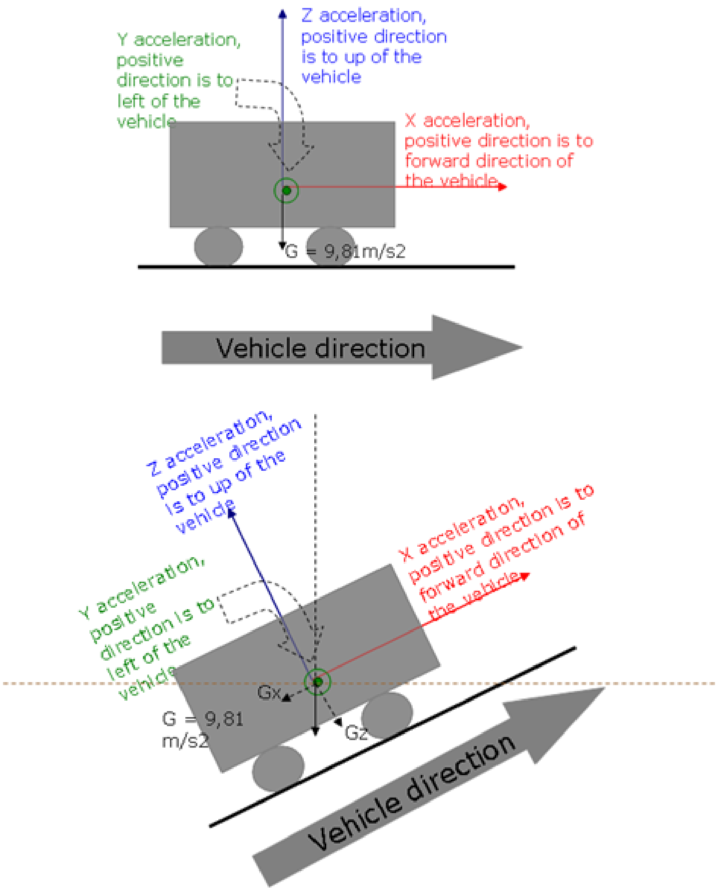


Figure 53: Acceleration measurements in the three axes (x, y, z).

- **Subjective data**

Subjective data are collected by the TeleFOT dedicated survey tools. The background questionnaire was completed once by each participant in the beginning and was also used to support the screening and selection of participants. Uptake questionnaires and travel diaries, as proposed by SP2 (D2.2.1 "Testing and evaluation strategy" [6]) were translated for the Greek LFOTs, and are completed at selected intervals during the experiment. The uptake questionnaire survey the driver's attitude towards the system, perceived influence on driving behaviour and driving style, user acceptance, and willingness to invest, as proposed by SP2 (in D2.2.1). Travel diaries collect data about all trips in one week, start-end time, origin-destination, use of support system and perceived impact of support system on the trip. Each LFOT condition lasts for approximately 3.5 months.

For each LFOT, the travel diary is completed after the end of month 1 of the baseline and experimental conditions. The during-test uptake questionnaire is completed after the end of month 1 of the experimental condition. The background questionnaire was completed before the start of the experiment. The pre-test uptake questionnaire is completed before the start of the experimental condition. The post-test uptake questionnaire is completed at the end of the experimental condition.

Participants are asked to hand in the questionnaires immediately after their completion. If these questionnaires are not handed-in in time, the participants are reminded to complete them.

10.1.6. Participants (No, characteristics, etc.)

A sample of 150 drivers participate in each FOT. They drive in two conditions, the baseline condition, where no support is provided, and the experimental condition, in which they receive support through the navigation system.

Male and female drivers are both represented in the sample. Participants are experienced drivers, i.e. having a driving license for more than 3 years and driving annually at least 10.000 km. Elderly drivers, over 65 years old, do not participate in the sample.

The navigation systems are currently being introduced in the Greek market. The sample is composed by both people with a previous experience in support systems and by people without such an experience.

The sample is composed by people who perform trips in all traffic environments.

A search for possible participants was initiated via the AUTOMOBILE AND TOURING CLUB OF GREECE (ELPA), via personal contacts of the personnel in ICCS and via advertisements in relevant web sites and magazines. Possible participants completed the background questionnaire. The selection of final participants was done so that all the above conditions are true, namely they are experienced drivers, not elderly, both male and female are participating the experiment, they represent all levels of experience with driver's support systems and of frequency of driving in various road environments.

10.1.7. Road type

The participants were instructed to behave and drive normally in a free way, as they would if they would not participate in the experiment. The drivers participating in the

LFOTs will drive mostly in the roads of the Attica prefecture. The Attica prefecture includes different road types, i.e. urban, peri-urban and highway environments, which means that it will be possible to assess the functions under study in the LFOTs in different road conditions.

10.1.8. Traffic conditions and interaction with other road users

As mentioned above, different road types will be addressed in the tests. Consequently, the traffic conditions will vary according to the environment and also according the time of day.

10.1.9. Weather conditions

The climate in Greece is typical of the Mediterranean climate: mild and rainy winters, relatively warm and dry summers and, generally, extended periods of sunshine throughout most of the year. A great variety of climate subtypes, always in the Mediterranean climate frame, are encountered in several regions of Greece. This is due to the influence of topography (great mountain chains along the central part and other mountainous bodies) on the air coming from the moisture sources of the central Mediterranean Sea.

In terms of climatology, the year can be broadly divided mainly into two seasons. The cold and rainy period, lasting from the mid of October until the end of March, and the warm and non -rain season lasting from April until September.

During the first period the coldest months are January and February, with, on average, mean minimum temperature ranging between 5 -10 degrees of Celsius near the coasts and 0 - 5 over mainland areas, with lower values (generally below freezing) over the northern part of the country.

Rainfall in Greece even in the winter, does not last a lot of days and the sky does not remain cloudy for several consecutive days, as it happens in other regions of the world. Winter bad weather days are often interrupted, during January and the first fortnight of February, with sunny days, well known as ‘Alkion days’ in ancient times.

During the warm and non-rain period the weather is almost stable, the sky is clear, the sun is bright and generally does not rain. However there are scarce intervals with rapid rain or thunderstorms of small duration mainly in mainland areas.

The warmest period is the last ten-day period of July and the first one of August, when the mean maximum temperature lies in the range of 29.0 and 35.0 degrees of Celsius. During the warm period the high temperatures are dampened from the fresh sea breezes in the coastal areas of the country and from the north winds blowing mainly in Aegean, well known as ‘Etesian’.

**The information presented in this chapter is acquired from the official website of the Hellenic National Meteorological service.*

10.1.10. Time of day and seasonal effects

Taking into account the duration of the test period for the large scale tests, seasonal effects can be avoided since drivers will use the systems under different weather conditions.

Regarding the time of the day, this could have an effect in the results due to the subjects´ habits and therefore, a varied sample is considered (e.g. different age groups, people with different working hours, etc.)

10.2. Detailed FOT1, FOT2, FOT3 and FOT4

10.2.1. Test Plans (applied)

Study design

In order to achieve a better understanding of the driver behavior and the effect of each of the tested nomadic devices, it is anticipated to have four different baseline cases (see above in Overview), following the LFOT design. During these baselines, the nomadic devices will run normally, while the ADAS functions will operate in the instrumented vehicle, registering all relevant parameters (headway, TTC, TLC, etc.) without however providing warnings to the driver.

In order to guarantee comparability of results, we will employ a within subjects design, in which the same subjects will participate in all the above DFOTs and baselines, thus we will have four experimental conditions plus a 4-stage baseline, as described above (in the Overview section).

In this way it will be possible to study the effects of the Navigation support combined with ADAS, as well as Traffic Information, Speed Limit Information and Speed Alert plus Navigation Support combined with ADAS, compared to each of the nomadic applications (baseline), while also in the baselines the parameters that are affected by the use of ADAS will be registered by the equipped vehicle. Comparisons may also be drawn between the Navigation support combined with ADAS and the Traffic Information, Speed Limit Information and Speed Alert information plus Navigation, combined with ADAS.

In Greece 4 DFOTs are planned, as follows:

- DFOT1: Navigation support + Collision Avoidance System + Lane Departure Warning (NAV+CAS+LDW)

- DFOT2: Navigation support + Speed Limit information+ Collision Avoidance System + Lane Departure Warning (NAV+SL+CAS+LDW)
- DFOT3[2]: Navigation support + Traffic information + Collision Avoidance System + Lane Departure Warning (NAV+TI)
- DFOT4: Navigation support + Speed Alert (NAV+SA)

Table 3: Functions to be tested in the Greek DFOTs

DFOT / Functions	DFOT1	DFOT2	DFOT3[3]	DFOT4
Traffic information			x	
Speed limit information		x		
Speed alert				x
Navigation support (static)	x	x	x	x
ADAS (CAS, LDW)	x	x	x	x

Due to the nature of the tests, aiming to assess the interaction of nomadic devices with ADAS in a small scale experiment, a feasibility compromisation led us to an a priori analysis for the computation of the required sample size, which resulted to 24 participants. These participants will all go through all the Baseline cases and DFOTs, according to the tests' schedule below.

Reference case

Four different baseline cases have been defined which can be seen in the table below:

Table 4: Baseline cases for the Greek DFOTs

Baseline	Functions	
Baseline 1	Navigation	
Baseline 2	Navigation	Speed limit info
Baseline 3	Navigation	Traffic info
Baseline 4	Navigation	Speed alert

Research questions/Indicators

The 'core' hypotheses that are reported in the data analysis plans (Dels 4.x.1) are those that will be addressed by all the test sites that have data (LFOT / DFOT and required function) to support the analysis methods proposed. They should be addressed across as many of the sites as possible in order to provide the European perspective required by the project.

[2] It is not yet definitely decided if the DFOT3 will be undertaken
[3] There is no final decision on whether the DFOT3 will actually be realized.

However, in the case of DFOTs, it is not yet definitely decided whether they will employ all the RQ/H they have the possibility to, or they will be limited to these RQ/H that either cannot be addressed by the LFOTs or there is the need for more detailed results in addition to the ones coming from the LFOTs.

In this perspective, and taking the D4.x.1 Deliverables as a guide, also baring in mind the information currently existing on the required variables and the DFOT test planning, the Greek DFOT will support the local LFOT by addressing as many of the generic research questions and hypotheses possible, as well as additional ones that refer to the functions tested in the Greek DFOT.

The data logged (and hence indicators) will be in agreement with the specification for the core data set as a minimum (D2.3.1). The pilot will further assess the logging capabilities.

Data collection

- **Objective data -** The data that will be collected through the nomadic device per DFOT is the same as for the LFOTs (see previous section).

  Additionally, through the CAN of the research vehicle, the following data is possible to be collected:

Table 5: Data possible to be logged in the Greek DFOT

Vehicle related parameters	Lane parameters	Obstacle parameters
Vehicle speed (VS) - km/h	Lane Distance from Left (LDL) -m	Obstacle Distance (OD) - m
Lateral Acceleration (Ax) - m/sec^2	Lane Distance from Right (LDR) -m	Obstacle Angle (OA)
Longitude Acceleration (Ay) - m/sec^2	Lane warning (LW) - an indicator	Obstacle Relative Speed (ORS)-km/h
YawRate (YR) - rad/sec	Lane Warning Side (LWS) - 1 left, 2 right ,3 both	Obstacle Lateral distance (OLD) - m
Curvature (cu) - 1/m	Right indicator (RI) - Possible values: 1(off),0(on)	
Curvature radius of vehicle (RC) - m	Left indicator (LI) - Possible values: 1(off),0(on)	
Gas pedal pos (GPP)		
Master Cylinder PRessure (MCP)		
Steering Angle (StA)		
Brake (Br)		
RPM (RPM) - rpm		
ExtErnal Temperature (ExTe) - Celsius		
Wiper Status (wi) - % - Possible values: 7(low),1		

Vehicle related parameters	Lane parameters	Obstacle parameters
(medium), 2(fastest)		

It should again be highlighted here that this list is subject to modification according to the variable requirements finalisation, as well as to the final decision on the overall role and planning for the DFOTs within TeleFOT.

- **Subjective data -** The subjective data will be collected by means of the different documents that have been created with SP2. More specifically, in the Greek DFOTs, no travel diaries will be used. Instead, the participants will have to fill in the Background Questionnaire (already translated in Greek) before the start of each test run, as well as the User Uptake Questionnaire (already translated in Greek) before and after each test run.

  The participants will be explained what is expected from them in terms of the questionnaires and the test site responsible will be available for any clarification needed.

Pilot conduction

Before the start of the DFOTs execution, some pilot tests will be taking place, with a limited number of people (3-5). The aim of the pilot tests will be first to check the good function of all the systems, in terms both of their technical features and their interaction with the driver. Secondly, it will be checked if the selected route is actually appropriate for the needs of the test. Finally, the questionnaires will also be filled in as foreseen in order to clarify any misleading questions or other inconsistencies.

Technical evaluation

Apart from the technical evaluations performed for the needs of the Greek LFOT, which are also in use in the DFOTs, additional technical controls have been performed in terms of the instrumented vehicle that will be used for the needs of the Greek DFOT. More specifically, the vehicle equipment (radar, sensors) has been checked to ensure its optimal performance and make any necessary adaptations. Moreover, two additional modules are going to be used especially for the needs of TeleFOT, i.e. the ECA and CAA. Regarding the first one, technical evaluations have been successfully performed in terms of libraries compatibility, while for the latter the evaluations are planned to take place in July 2010.

FOT execution

In order to guarantee comparability of results, we will employ a within subjects design, in which the same subjects will participate in all the above DFOTs and baselines, thus we will have four experimental conditions plus a 4-stage baseline, as described above.

Thus, the testing schedule is planned as follows:

Table 6: Timing of the Greek DFOTs

Timing	Tests	
November 2010	Baseline 1	DFOT1
January 2010	Baseline 2	DFOT2
April 2011	Baseline 3	DFOT3
June 2011	Baseline 4	DFOT4

NOTE: The timing of the DFOTs will follow the timing of the corresponding LFOTs, with each DFOT starting towards the end of the relevant LFOT. This was decided in order to take into account any relevant findings and/or shortcomings of the LFOTs and try to accommodate accordingly the DFOTs (to the possible extend). The timing stated here may be subject of changes depending on the availability of the instrumented vehicle and/or participants.

Due to the nature of the tests, aiming to assess the interaction of nomadic devices with ADAS in a small scale experiment, a feasibility compromisation led us to an a priori analysis for the computation of the required sample size, which resulted to 24 participants. These participants will all go through all the Baseline cases and DFOTs, according to the tests' schedule.

Briefing and training

The overall concept of the TeleFOT project and, in specific, the experiment objectives and procedure will be briefly explained to the participants in their first meeting with the research team. The participants will be instructed how to behave, namely that they are expected to drive normally, as they would if they would not participate in the experiment.

A short familiarisation session with the experimental vehicle and the nomadic device will follow, explaining to them what kind of functions are operating and how to use it in each DFOT. As the experiment will be controlled, in each case, either it is a baseline or an actual DFOT, it will be explicitly explained to the participants what is expected from their side.

The questionnaires will be also explained to the participants and instructions on how and when to complete them will be given. Of course the research team will be available to further clarify any question or misunderstanding.

Data collection

- **Objective data** - The objective data, i.e. the data that will be logged in the nomadic device and in research vehicle will be continuously collected throughout each test run. The log files, stored either in the device or in the vehicle, will be collected by the research team right after the end of each test run and stored in a local server. The collected data will be checked for consistency offline in the office.
- **Subjective data** - The subjective data will be collected through the background questionnaire and the user uptake questionnaire. The background questionnaire will be filled in by the participants before each test run, while the user uptake will

be filled in before and after each test run. All the questionnaires will be collected by the research team and stored locally.

10.2.2. Map of the area of the tests

The tests for the Greek Detailed FOT will be taking place in the area of Thessaloniki, the second biggest Greek city. This area can be seen in the map below.

Figure 54: Map of Thessaloniki and the surrounding area where the Greek DFOTs will be conducted

10.2.3. Functions to be tested

The Greek detailed tests are divided into four DFOTs, in each of which different functions are being tested, namely:

- DFOT1: Navigation support +ADAS (CAS, LDW)
- DFOT2: Navigation support + Speed Limit information +ADAS (CAS, LDW)
- DFOT4: Navigation support + Speed Alert +ADAS (CAS, LDW)

Table 7: Functions to be tested in the Greek DFOTs

DFOT / **Functions**	DFOT1	DFOT2	DFOT4
Traffic information			
Speed limit information		x	
Speed alert			x
Navigation support (static)	x	x	x
ADAS (CAS, LDW)	x	x	x

10.2.4. Devices to be used

In terms of nomadic devices the Greek DFOT will use the same device and software that will be used also for the Greek LFOT (see section 4.3.4.1).

Moreover, an instrumented vehicle will be used which is equipped with a series of systems. The vehicle is a Lancia Thesis Emblema.

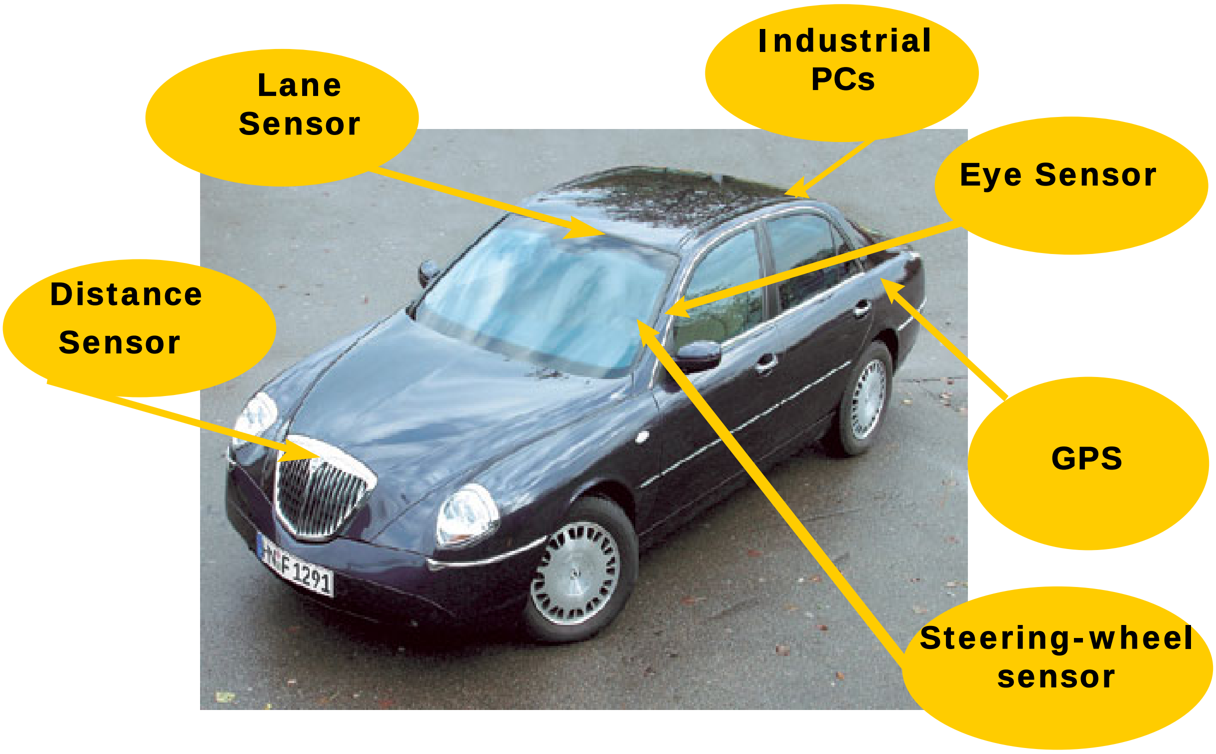


Figure 55: The experimental vehicle of the Greek DFOT

The research vehicle has been instrumented by many peripheral sensors. The signals of these sensors are transmitted via the CAN bus protocol.

Two peripheral sensors are used for the DFOT test pilot; the Frontal Radar and the Lane Departure Camera.

The Frontal Radar is located in the frontal bumper as it shown in the figure below.

Figure 56: The frontal radar

The Frontal radar acquires signals related to the leading obstacles such as vehicles, vans, pedestrians etc. The model of the radar is FUJITSU TEN and it includes two scan zones. The data of this sensor are transferred via the CAN bus protocol.

The Lane Departure Camera is located in the middle of the frontal window. The main components of the system are: a CCD camera and a processing unit.

Figure 57: The Lane Departure Camera

The CCD camera understands the driver's departures within the white lanes in highways.

Besides, many other CAN signals such as brake, cylinder pressure, steering wheel, OEM's OBD-II signals and many other are also stored(they will be mentioned analytically in section 3.5) .

Finally, all the above signals from the sensors are collected and stored in an industrial computer which resides at the trunk of the vehicle. This unit stores and uses all data with a specific applications developed by CERTH/HIT.

Figure 58: The industrial PC

Additionally, two more systems will be operating on the vehicle: the CAA module which will detect the driver distraction and the ECA module which assesses different types of traffic risk.

10.2.5. Participants (No, characteristics, etc.)

Due to the nature of the tests, aiming to assess the interaction of nomadic devices with ADAS in a small scale experiment, a feasibility compromisation led us to an a priori analysis for the computation of the required sample size, which resulted to 24 participants. These participants will all go through all the Baseline cases and DFOTs, according to the tests' schedule below.

In order to achieve a better understanding of the driver behaviour and the effect of each of the tested nomadic devices, it is anticipated to have four different baseline cases, following the LFOT design. During these baselines, the nomadic devices will run normally, while the ADAS functions will operate in the instrumented vehicle, registering all relevant parameters (headway, TTC, TLC, etc.) without however providing warnings to the driver.

Table 8: Baseline cases for the Greek DFOTs

Baseline	Functions	
Baseline 1	Navigation	
Baseline 2	Navigation	Speed limit info
Baseline 4	Navigation	Speed alert

In order to guarantee comparability of results, we will employ a within subjects design, in which the same subjects will participate in all the above DFOTs and baselines, thus we will have four experimental conditions plus a 4-stage baseline, as described above.

In this way it will be possible to study the effects of the Navigation support combined with ADAS, as well as Traffic Information, Speed Limit Information and Speed Alert plus Navigation Support combined with ADAS, compared to each of the nomadic applications (baseline), while also in the baselines the parameters that are affected by the use of ADAS will be registered by the equipped vehicle. Comparisons may also be drawn between the Navigation support combined with ADAS and the Traffic Information, Speed Limit Information and Speed Alert information plus Navigation, combined with ADAS.

Thus, the testing schedule is planned as follows:

Table 9: Timing of the Greek DFOTs

Timing	Tests	
June 2011	Baseline 1	DFOT1
June 2011	Baseline 2	DFOT2
July 2011	Baseline 4	DFOT4

NOTE: The timing of the DFOTs will follow the timing of the corresponding LFOTs, with each DFOT starting towards the end of the relevant LFOT. This was decided in order to take into account any relevant findings and/or shortcomings of the LFOTs and try to accommodate accordingly the DFOTs (to the possible extend). The timing stated here may be subject of changes depending on the availability of the instrumented vehicle and/or participants.

10.2.6. Road type

The DFOTs will be conducted mostly in highway and urban highway road environments, mainly due to the restriction of the lane departure system, for which the lane markings should be very clearly drawn in order to be recognised. Moreover, the Collision Avoidance System is operative for speeds over 30 Km/h, which is the case for extra-urban road environments.

10.2.7. Traffic conditions and interaction with other road users

In the Greek DFOTs all the participants will have to drive on a pre-defined route. This implies that the traffic conditions will at all instances be more or less the same. Moreover, the timing of the day when the route will be driven will be nearly the same at all cases so as to avoid the influence daily traffic variation. The interaction with other road users will be free, meaning that the test subjects will drive as usual and will not be separated from the rest of the existing traffic.

10.2.8. Weather conditions

For the weather conditions in Greece please refer to the Greek LFOT relevant section.

Especially for the Prefecture of Thessaloniki, the following figures illustrate the average annual weather features.

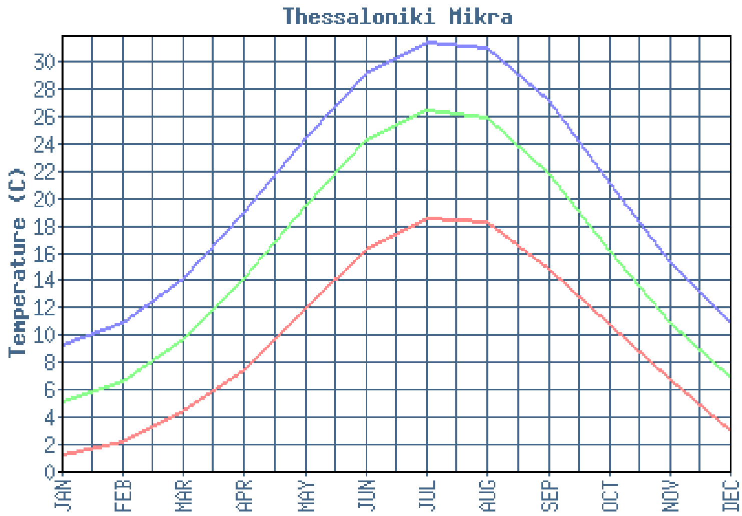


Figure 59: Monthly variation of absolute min (denoted with red line), max (denoted with blue line) and average (denoted with green line) temperatures in the prefecture of Thessaloniki.

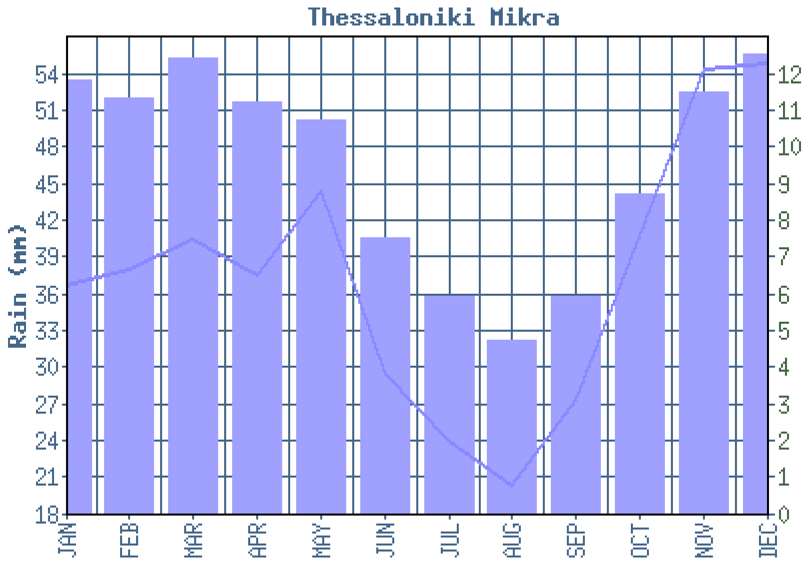


Figure 60: Monthly Average Rainfall (and total days of rain indicated in the right axis).

11. RISK ANALYSIS – CONTINGENCY PLAN

11.1. Introduction

In order to overcome and even avoid malfunctions or errors that are usually observed when operating a system, the possible errors must be identified at an early stage. Within the course of the TeleFOT project possible risks may be due to four reasons: system false, inappropriate use by the users, organisational difficulties especially when the FOT execution relies on third parties and finally, legal issues mainly with regards to the protection of the collected data. This section provides the risk analysis and contingency planning performed within TeleFOT (initiated during the previous period and reported in D3.4.1), which was revisited after the accumulation of the first results coming from the pilot tests and FOTs.

11.2. Risk analysis methodology

The Risk Priority Number calculation methodology followed within TeleFOT is presented below.

The results of the Risk analysis must be comparable and mainly must be presented in an understandable and comprehensive format. Such an analysis involves various factors of each safety-security issue: severity, occurrence probability, detectability and recoverability, not only for technical risk, but also for behavioural, legal and organizational related risks. Behavioural risks are related to the users' behaviour, regarding their interaction with the system, concentrating on the possible wrong moves or reactions or mal-adaptations they might perform. Legal risks include the risks that will arise if the system is not compliant with the legislation of the country. Finally, by the term organizational related risks, the risks involved within the organization structure of the service chain. The overall process is depicted below:

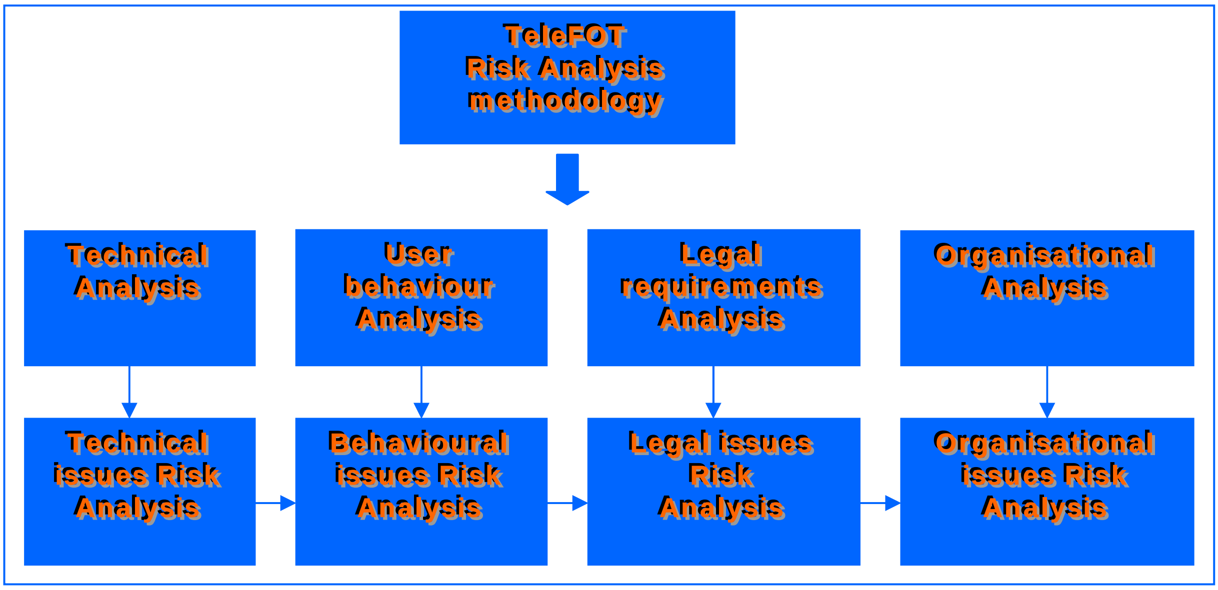


Figure 61: Risk analysis process.

The Risk priority number (for each risk category) is calculated by the following equation:

$$RPN = S \times O \times \frac{D+R}{2}$$, where

S=Severity

O=Occurence

D=Detectabilty

R=Recoverability

Of course, the independent Risk numbers of each category must be calculated for each TeleFOT identified risk: Technical Risk Number (RNT), Behavioural Risk Number (RNB), Legal Risk Number (RNL) and Organisational Risk Number (RNO) (see tables 1-4). The Overall Risk Number (ORN) for TeleFOT becomes:

$$ORN = \frac{RNT + RNB + \frac{RNL + RNO}{2}}{3}$$

Table 10: Severity level analysis.

Level of severity	Technical issue	Behavioural issue	Legal issues	Organisational issues
9-10 (extremely severe)	The failure could put user safety at risk	The user error in operating the system could lead to an incident worsening (i.e safety effects)	Are there laws in each country that do not allow the system to be implemented?	Wide and different organizational framework is needed, that is completely missing (i.e. new services)
7-8 (severe)	The failure implies the total loss of the system functions, resulting in user's dissatisfaction	User behavioural error may abort the system benefits (i.e. safety effects due to changes in ways of acquiring info)	New laws are required for system implementation and no relevant work has been performed yet	Organisational framework adaptation is needed (some initial actions have been taken on this domain)
5-6 (slightly severe)	The failure implies the partial loss of the system function, resulting in user's dissatisfaction	User's behavioural changes may significantly reduce the positive effects of the system	New laws are required for system implementation and work required has already been performed	Organizational framework adaptation is needed which has already started being realised
3-4 (significant)	The failure implies slight dissatisfaction to the user	User's behavioural changes may somehow influence the positive effects of the system	New laws are required for system implementation but consensus on them exist	There is a need for limited and easily realized organizational changes
1-2 (insignificant)	The failure does not imply perceptible effects to the system function and to the user's satisfaction	User's behaviour is not expected to reduce the system benefits significantly, or may even further enhance them	No new laws are required for implementation	There is no need at all for organizational changes

Table 11: Occurrence level analysis.

Occurrence level	Technical issue	Behavioural issue	Legal issues	Organisational issue
9-10 (high)	It is certain that some failures will sometimes occur	It is certain that some behavioural effects will occur (by the system users)	It is certain that some legal problems will occur	It is certain that there will be a need for organizational restructuring
6-8 (medium)	A failure could occasionally occur	Some behavioural effects could occasionally occur	Some legal problems could occasionally occur	A need for organizational restructuring could occasionally occur (depending on the needs of the service, that will arise after the operation of the system)
3-5 (slight)	There is only a slight probability that en error/failure will occur	There is only a slight probability that some behavioural effects will occur	There is only a slight probability that some legal problems will occur	There is only a slight probability that a need for organizational restructuring will occur
1-2 (improbable)	It is unlikely that a fault will occur	It is unlikely that some behavioural effects will occur	It is unlikely that some legal problems will occur	It is unlikely that a need for organizational restructuring will occur

Table 12: Detectability level analysis.

Detectability level	Technical issue	Behavioural issue	Legal issue	Organisational issue
9-10 (improbable)	It is impossible or improbable that a problematic area will be detected	It is impossible or improbable that a user's behavioural effect will be detected	It is impossible or improbable that a legal problem will be detected	It is impossible or improbable that an organizational problem will be detected
7-8 (slight)	The problematic area is detected only in particular cases	The user's behavioural effect is detected only in particular cases	The legal problem is detected only in particular cases	The organizational problem is detected only in particular cases
5-6 (moderate)	It is probable that the problem will be detected (depending on the situation)	It is probable that the user's behavioural effect will be detected	It is probable that the legal problem will be detected	It is probable that the organizational problem will be detected
3-4 (high)	It is very probable that a problem will be detected	It is very probable that the user's behavioural effect will be detected	It is very probable that the legal problem will be detected	It is very probable that the organizational problem will be detected
1-2 (very high)	It is certain that a problem will be detected	It is certain that the user's behavioural effect will be detected	It is certain that the legal problem will be detected	It is certain that the organizational problem will be detected

Table 13: Recoverabilty level analysis.

Recoverability level	Technical issue	Behavioural issue	Legal issues	Organisational issues
9-10 (null)	No recovery action is provided	System is inflexible to user's behavioural effects	System is either accepted or rejected by the legal framework	System requires a fixed organizational environment to operate
6-8 (low)	The user is only advised on the failure	Behavioural effects are taken into account by the system	System may be slightly adapted to meet legal restrictions	System requires a fixed organizational framework with limited adaptations
3-5 (high)	Effective recovery action is provided	System customization might compensate for user's behavioural effects	System encompasses different versions to meet particular legal demands	System may operate within various organizational frameworks
1-2 (full recoverability)	The failure effect is completely avoided by the recovery action	System does not allow user's behavioural effects	System is easily reconfigurable to meet legal demands	System does not require organizational changes

The Risk Analysis results may indicate problematic areas in which the system developers are called to put more effort on (i.e. to offer mitigation strategies). The next step is to attempt to assess the risk of each of those issues and to identify possible mitigating strategies. The possible success of these strategies should also be identified where possible.

Based on the analysis from the four contexts, the main issues are summarised according to the format below and assigned an overall risk rating. The possibility of a successful mitigating strategy (over a 10 year horizon) should also be assessed and rated. For consistency between the different contexts, the issue severity, and mitigation possibility, is assessed by common terminology.

The total risk that will be calculated has been matched to five levels of severity (with which should be filled in the 'Problem severity" column of the above table), as follows:

The total risk that will be calculated has been matched to five levels of severity (with which should be filled in the 'Problem severity" column of the above table), as follows:

Table 14: Correlation of Overall risk factor with overall risk severity level.

Overall risk factor	Overall severity
512-1000	I- Extremely severe
216-512	II- Severe
64-216	III - Moderate
8-64	IV - Slight
1-8	V - Insignificant

Please note that the above values are indicative. According to the severity level, the mitigation possibility can be defined:

Table 15: Severity and mitigation possibility scales.

Issue severity	Mitigation possibility
Extremely severe Severe Moderate Slight Insignificant	High Medium Low Improbable

Risk reduction is an iterative process involving dependencies between the different issues. In terms of mitigation strategies, risk can be reduced in a number of generic ways:

- reducing the magnitude (severity) of the consequences of the potential risk;
- reducing the probability of the risk occurring;
- increasing failure detection speed and probability;
- protecting against the risk - mitigating strategies to compensate for a failure (e.g. back-ups);
- transferring the risk to another Party.

The exact definitions of what is actually meant by the mitigation possibility are given below, according to the different levels of possibility.

Table 16: Failure mitigation possibility levels and their definition.

Possibility of mitigation (10 year horizon)	Definition
High	A solution is available at relatively little cost.
Medium	An achievable solution may be possible at reasonable cost, or a reasonable solution is available at modest cost.
Low	An expensive solution may be possible, but system benefits may not justify these, and/or a solution needs further investigation or is highly complicated.
Improbable	Solutions are too expensive (likely to remain so) in relation to the reduction of risk(s) and the benefits gained from the functionality of the system, and/or a solution is not available for the (extremely) severe risk that has been identified

A detailed Risk Assessment has been realised on the basis of the FMEA methodology Performing the FMEA started with defining the system to be analysed, constructing a block diagram and finally identifying all potential items and interface failure modes. A tabular format was used to document the FMEA which is based on various columns, including name or item, problem short description, severity, occurrence, detectability, recoverability and overall risk rates, effect of failure and possible actions to reduce failure rate or effects.

The following table was used to summarise the issues (actually three different tables were used, which were formatted in the same way; each table addressed different risk categories, i.e., one table has been used for the collection of technical risks, another table has been used for the collection of the behavioural risks, and a third table has been used for the collection of the legal and organisational risks). The table(s) together with the aforementioned material that explains the Risk analysis methodology (refer to chapter 3.2 of the document) was distributed to the TeleFOT Partners in order to collect their input. Each issue was assigned with a severity, according to the defined method (Table 17). Strategies for reducing (mitigating) the identified problems were considered by the TeleFOT consortium, whenever possible and the probability of their success were also assessed.

Table 17: Tabular format for the risk analysis.

Problem short description	S	O	D	R	Risk	Problem severity	Mitigation strategy	Mitigation possibility
							-	

The results of the aforementioned procedure are presented in the following tables.

Table 18: Technical Risks and Contingency Plans.

Problem short description	S	O	D	R	Risk	Problem severity	Mitigation strategy	Mitigation possibility
Damages to the devices.	5	4	3	7	100	Moderate	- Stipulate an insurance policy. - Bring device to the company for check and fix.	Medium
Loss of data / Poor quality data.	7	4	5	9	196	Moderate	- Preventive actions, such as periodically invite testers, via e-mail or telephone, to compile questionnaires. - Make spot-checks on testers. - Verify that the data is consistent before deleting. - Monitor the state of the data logger - Pilot tests on interfaces before starting the FOT.	Medium
The tools (e.g. ECA, CAA) do not enable to retrieve the proper data during the tests.	10	3	2	8	150	Moderate	- Verify specifications of tools with regards to the requirements	High

Problem short description	S	O	D	R	Risk	Problem severity	Mitigation strategy	Mitigation possibility
The system does not log the needed information	8	3	1	3			- System should be designed so that all needed information can be captured - Piloting interfaces between on-board devices (e.g. Bluetooth link between logger and navigation device)	Medium
Time to GPS first fix can be high depending on areas	5	3	3	1	30	Slight	- Wait to start tests until the GPS is fixed. If the GPS is turned on in the same area it was turned off, the first fix reduces in a great way	Medium
Loss of GPS data in urban canyons, large tunnels or dense wood areas	5	5	3	3	75	Moderate	- Signal is automatically recovered although some data may be lost in the meantime	Medium
Loss of connection with GPRS network for data transmission	3	5	5	6	82.5	Moderate	- Implement buffer on the data logging system to allow later data upload - Plan for an adequate device storage card	High
Unavailability of the functions under test (e.g. part of the service not supported anymore)	7	3	1	4	84	Moderate	- if the function is under test, not available anymore, the tests will be closed earlier than planned	Low

Problem short description	S	O	D	R	Risk	Problem severity	Mitigation strategy	Mitigation possibility
Loss of connection with GPRS network for data transmission	3	5	5	6	82.5	Moderate	- If GPRS connection is lost, data transmission is not possible. This is not problematic as data can be downloaded later and there is enough space in the device storage card	High
System start-up. Test users cannot install the devices/services	3	2	7	1	24	Slight	- The system is complex and starting it up must be as simple as possible to avoid failures - Provide support for the installation	Low
Synchronisation of different data sources	8	8	5	5	320	Severe	Data logged with different loggers can be synchronised by GPS-time	High
Integration of hardware (CAA, ECA etc.) can be difficult	8	8	5	7	384	Severe	If the missing functionality is not critical for the overall TeleFOT objectives, replace with simpler solution or abandon in case it jeoperdases the overall test plan. If the function is really critical, re-allocate resources from other tasks to finish the development.	Medium

Problem short description	S	O	D	R	Risk	Problem severity	Mitigation strategy	Mitigation possibility
High temperatures in Greece, require time “off” in between test sessions (for DFOTs)	4	5	4	3	70	Moderate	- Enable reasonable time for data collection to avoid shut downs due to overheating	Medium to High
Application run only in certain phone models. Test participants are early-adopters of technology and change to newest phone models with such operating systems on which the applications cannot run (causes drop out)	8	6	7	9	7	Slight	- New participants were recruited to substitute the drop outs in early phases of FOT	Medium
Technical failures in applications not detected by service provider but test user feedback	6	7	7	4	6	Slight	- Active reactions to feedback of test participants - FOT personnel should also use the systems	Medium

Table 19: Behavioural Risks and Contingency Plans.

Problem short description	S	O	D	R	Risk	Problem severity	Mitigation strategy	Mitigation possibility
Problems with the user-interface (e.g. selecting the desired address on the navigation device)	5	3	3	3	45	Slight	- The software manual guides the user in the selection of the desired address thus minimizing the risk of mistakes. Use of official Navteq data also minimizes this probability. - Plan for a local help desk (via telephone and email) to support the drivers when needed.	Medium
User does not use services/logging equipment	8	5	3	5	160	Moderate	- Dependent on the test site: check at server on user's activity, contact driver and check for possible problems. Stimulate driver to use the service	Medium

Problem short description	S	O	D	R	Risk	Problem severity	Mitigation strategy	Mitigation possibility
User might be distracted by ADAS functions or/and nomadic device	5	9	4	5	202,5	Moderate	- Ensure that the ADAS and nomadic devices functions presented to the drivers are in- or close to- the market and therefore have an adequate HMI design. Instruct the drivers to follow the manuals and place the nomadic devices in a position that does not obstruct their field of view	Medium
Service malfunction/ low quality of service	7	4	2	3	168	Moderate	- If the services do not perform well, test drivers may stop tests in advance,	
Changes in driver's driving style during the test due to change of job, illness, home…	6	4	6	4		Moderate	- Evaluation on case-by-case.	High
Familarisation to ICT solutions differ and carry inherent limitations	3	4	6	4	60	Moderate	- ICT knowledge familiarisation to be harmonised; training required (included in briefing session)	High

Table 20: Legal Risks and Contingency Plans.

Problem short description	S	O	D	R	Risk	Problem severity	Mitigation strategy	Mitigation possibility
Accidental events such as thievery or crash and TeleFOT being blamed.	5	1	1	7	20	Slight	- Alert the drivers to protect the TeleFOT equipment. Before starting the tests, in the recruitment phase, make sure that test participants sign an agreement.	High
All potential implications in case of incident are not properly addressed on beforehand.	10	1	5	3	40	Slight	- Ensure that all D and L-FOTs follow the legal guidelines - Ensure that the test participants sign an agreement before the initiation of the tests.	High
Legal issues regarding accidents and certification have been taken into consideration	3	3	3	3	27	Slight	- Clarify consent issues	Medium to high
Data privacy issues (e.g. possibility of tracking persons; discussions in media)	4	5	3	4	70	Moderate	- The data privacy can be assured by a privacy act Statement. An adequate consent form will be signed by all drivers participating in the tests.	High
Police or other governmental instance requires	3	1	1	1		Slight	- The consortium will have to comply with the legal requirements	Low

Problem short description	S	O	D	R	Risk	Problem severity	Mitigation strategy	Mitigation possibility
consortium to provide logged information on test user, suspected of major offence/crime								

Table 21: Organisational Risks and Contingency Plans.

Problem short description	S	O	D	R	Risk	Problem severity	Mitigation strategy	Mitigation possibility
High transmission costs.	8	6	1	1	48	Slight	- Negotiations with the telecommunication providers will stabilize the costs.	Low
The target number of test participants cannot be reached	7	6	2	4	126	Moderate	- Initiate the test if the deviation is not high and extent the recruitment phase: every 10 subjects missing, an up to 2 months delay is considered, in order to allow training, pre-testing and material provision. - Find a minimum threshold to maintain the sample validity - Apply benefit policy for test participants	Medium
Could not apply benefits/honoraria for participants	4	4	3	5	64	Slight to Moderate	- Recruit process for longer period of time and recruit less people	Medium to high

Problem short description	S	O	D	R	Risk	Problem severity	Mitigation strategy	Mitigation possibility
Drop out: Part of the test drivers decide to be not involved in the test any long.	7	7	3	3	147	Moderate	- Initiate the test if the drop outs are not high and extent the recruitment phase: every 10 subjects missing, an up to 2 months delay is considered, in order to allow training, pre-testing and material provision. - Find a minimum threshold to maintain the sample validity - Predict drop outs (percentage) and have back up test participants that can enrol at short notice	Medium
No service data for the locations to test	5	9	4	4	180	Moderate	- It is unlikely that there are zones without service data (e.g. speed limits, traffic info, maps). FOT Test plans must be provided in advance to make sure that data is provided on a sufficient level - Map matching afterwards in the central database	Medium
No service data for the locations to test	1	1	5	1	3	Insignificant	- It is unlikely that there are zones without service data (e.g. speed limits, traffic	High

Problem short description	S	O	D	R	Risk	Problem severity	Mitigation strategy	Mitigation possibility
							info, maps). FOT Test plans must be provided in advance to make sure that data is provided on a sufficient level	
There might be uncertainty in determining the correct composition of the test subjects	4	5	5	8	130	Moderate	- The test subjects should be recruited in accordance to the guidelines provided by SP2	Medium
Test plan requires modifications of the service software (e.g. service activation, logging of required information)	4	3	1	8		Slight	- The test site will negotiate with the service providers on the needed modifications to the software	
Special agreements need to be arranged with the third parties participating in the test site (e.g. protected data processing)	7	6	3	8	231	Severe	- Reach an agreement with the third parties in order to be able to analyse the user's data.	Medium

11.3. Conclusions On Risks Analysis /Contigency Plans

TeleFOT, due to the fact that it aims to test the impacts of driver support functions on the driving task with large fleets of test drivers in real-life driving conditions and thus it comprises of multidisciplinary activities, has a list of technical challenges and risks, as detailed in the above section. Despite this fact, as seen in **Error! Reference source not found.**, Table 19, Table 20, and Table 21, TeleFOT consortium has already identified compensating measures and fallback plans for each individual risk.

The majority of the risks can be compensated at a relatively small cost or in some other cases, an achievable solution may be possible at reasonable cost, or a reasonable solution is available at modest cost. In those cases that the technical, behavioural, organisational or even legal risk, can potentially create a severe problem to the TeleFOT project, one can see that the mitigation possibility is high, which means that the TeleFOT consortium can address the specific problem at a relatively small cost. Moreover, the majority of the moderate problems can also be faced at a relatively small cost, while for some of them an achievable solution may be possible at reasonable cost, or a reasonable solution is available at modest cost.

The analysis shows that as TeleFOT has ambitious goals, matching new technological developments with a complex problem has inherently high risk. This is compensated within TeleFOT by the high previous expertise in this area of several of its partners, their multidisciplinary and the consortium’s width.

12. CONCLUSIONS

The scope of this deliverable is to provide the descriptions of the TeleFOT test communities, which were built in order to facilitate the execution of the project FOTs. For Large and Detailed FOTs, it has presented the objectives of the testing, the functions tested and the overall set up of each test site. In addition, the differences and synergies between Detailed FOTs and Large-scale FOTs is also presented in this deliverable, as an important element of the TeleFOT concept.

REFERENCES

[1] Franzén, S., Engelbrektsson, P., Gaitanidou, E., Solar, A., Tesauri, F., Richardson, J., Schröder, U., TeleFOT Deliverable 2.5.1 "Functions sepcification", 2009

[2] "Final Report from an FOT on usage and acceptance of a Speed Alert system", MOTION project, Sweden 2009.

[3] MobilEye official website: http://www.mobileye.com/ (accessed on 28/07/2010)

[4] Danew official website: http://www.danew.com/ (accessed on 28/07/2010)

[5] Acer beTouch E101 official website: http://mobile.acer.com/en/phones/betouch-e100/ (accessed on 28/07/2010)

[6] Karlsson, I.C.M., Rämä, P., Alonso, M., Engelbrektsson, P., Franzén, S., Henar Vega, M., Kulmala, R., May, A., Morris, A., Mascolo, Juliene E., Schröder, U., Welsh, R., TeleFOT Deliverable 2.2.1 "Testing and Evaluation Strategy", 2009

[7] Tiehallinto 2009, Tiefakta 2009, http://www.tiehallinto.fi/pls/wwwedit/docs/22643.PDF

[8] Website of the Hellenic National Meteorological service: http://www.hnms.gr/hnms/english/index_html.

[9] Meteorological world website: http://www.gaisma.com/en/

[10] Vexia device website: http://www.vexia.co.uk/

[11] Blom device website: http://www.blom.no/geoespaciales/en

[12] Garmin devices: http://www.garmin.com/garmin/cms/site/us

ANNEX I: SUMMARY LFOTS

The following table provides a summary of the TeleFOT Large-Scale FOTs.

Table 22: Summary LFOTs

TS	L-FOT	Function(s)	Users (#)	Control Users (#)	of which # of professional drivers	Pilot start	Pilot end	Baseline (aka "before") period	FOT start	FOT end	Rely upon 3rd parties? How can TeleFOT be affected?
Sweden	LFOT1	Speed limit info, Speed alert, Green driving support	100	0	100	May 2010	September 2010	October 2010	October 2010	November 2011	Stockholm Ciy , Innova
Sweden	LFOT2	Navigation support (static) Green driving support Traffic informatio	100	0	0	August 2010	September 2010	October 2010	November 2010	May 2011	TeleFOT has full control

TS	L-FOT	Function(s)	Users (#)	Control Users (#)	of which # of professional drivers	Pilot start	Pilot end	Baseline (aka "before") period	FOT start	FOT end	Rely upon 3rd parties? How can TeleFOT be affected?
		n									
Sweden	LFOT3	Traffic information Speed Alert Speed limit Navigation support (static)	800	0	0	April 2009	May 2009	No baseline	May 2009	November 2009	Yes. Apello (MOTION project) - data logs are not fully inline with the TeleFOT spec.
Sweden	LFOT4	Traffic info	500	0	0	August 2010	September 2010	Sep-Nov 2010	September 2010	May 2011	Swedish Transport Administration, Trelocity

TS	L-FOT	Function(s)	Users (#)	Control Users (#)	of which # of professional drivers	Pilot start	Pilot end	Baseline (aka "before") period	FOT start	FOT end	Rely upon 3rd parties? How can TeleFOT be affected?
Finland	LFOT1	Traffic information Speed limit information Green driving Navigation support (static) Navigation support (dynamic)	200	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Negotiations with 3rd parties were unsuccessful. LFOT1 will not take place.
Finland	LFOT2	Green driving support	150		0	Jun 2010	Aug 2010	1,5 months	Sep 2010	Oct 2011	TeleFOT has control DRIVECO

TS	L-FOT	Function(s)	Users (#)	Control Users (#)	of which # of professional drivers	Pilot start	Pilot end	Baseline (aka "before") period	FOT start	FOT end	Rely upon 3rd parties? How can TeleFOT be affected?
UK	LFOT1	Navigation support (dynamic) Speed limit information Speed alert	80	Same group	0	June 2010	September 2010	1month	Jan 2011	Sep 2011	TeleFOT has total control. BLOM, LOUGH
UK	LFOT2	Forward Collision Warning	30	Same group	TBD	October 2011	October 2011	1month	November 2011	March 2011	TeleFOT has control
Germany	-	-	-			-			-	-	-
France	LFOT1	eCall Alerts system	300	TBD	TBD	March 2011	Apr 2011	-	July 2011	Nov 2011	TeleFOT has control

TS	L-FOT	Function(s)	Users (#)	Control Users (#)	of which # of professional drivers	Pilot start	Pilot end	Baseline (aka "before") period	FOT start	FOT end	Rely upon 3rd parties? How can TeleFOT be affected?
											French Automobile Club, PSAP, DANEW, UTBM
Spain (Valladolid)	LFOT1	Speed limit information Speed alert Navigation support (static) Speed cameras alert	120	Same group	0	May 2010	May 2010	Sep-Nov 2010	Nov 2011	Sep 2011	TeleFOT has total control. BLOM, CIDAUT

TS	L-FOT	Function(s)	Users (#)	Control Users (#)	of which # of professional drivers	Pilot start	Pilot end	Baseline (aka "before") period	FOT start	FOT end	Rely upon 3rd parties? How can TeleFOT be affected?
Spain (Madrid)	LFOT2	Traffic information Speed limit information Green driving support	100	Historical data	Most of them	February 2011	Mar 2011	Historical data	Mar 2011	6-9 months after (under discussion with users)	TeleFOT has partial control. ETRA has agreement with CRAMBO that provides the Vexia devices
Italy	LFOT1	Speed limit information Speed alert Navigation support (static)	150	30	0	October 2010	October 2010	November 2010 - 1 month	November 2010	September 2011	TeleFOT has total control. UNIMORE, METASYSTEM, BLOM

TS	L-FOT	Function(s)	Users (#)	Control Users (#)	of which # of professional drivers	Pilot start	Pilot end	Baseline (aka "before") period	FOT start	FOT end	Rely upon 3rd parties? How can TeleFOT be affected?
Greece	LFOT1	Navigation support (static)	150	Same group	Up to 50	Sept 2010	Nov 2010	Yes Feb-June 2011	Feb 2011	Jun 2011	TeleFOT has total control. Third parties involved: Telenavis, ELPA
Greece	LFOT2	Navigation support (static) Speed limit information				Sept 2010	Nov 2010		Jun 2011	Dec 2011	
Greece	LFOT3	Traffic information				Sept 2010	Nov 2010		Jun 2011	Dec 2011	
Greece	LFOT4	Navigation support (static) Speed alert				Sept 2010	Nov 2010		Jun 2011	Dec 2011	

ANNEX I: SUMMARY DFOTS

The following table provides a summary of the TeleFOT Detailed FOTs.

Table 23: Summary DFOTs

TS	D-FOT	Function(s)	Users (#)	of which # of professional drivers	Control Users (#)	Pilot start	Pilot end	FOT start	FOT end	Rely upon 3rd parties? How?
Sweden	-	-	-			-		-	-	-
Finland	DFOT1	Traffic information Speed limit information Speed alert Navigation support (static) Navigation support (dynamic) Green Driving Support	26	TBD	TBD	Beginning of 2011	depends on the LFOT plan	depends on the LFOT plan	depends on the LFOT plan	No relevant research questions have been identified. Does not take place

TS	D-FOT	Function(s)	Users (#)	of which # of professional drivers	Control Users (#)	Pilot start	Pilot end	FOT start	FOT end	Rely upon 3rd parties? How?
Finland	DFOT2	eCall	2-3	0	same group	May 2011	May 2011	May 2011	May 2011	VTT in cooperation with Ministry of the Interior, Emergency Response Centre Administration and The Police College of Finland TeleFOT has good control on the project..

TS	D-FOT	Function(s)	Users (#)	of which # of professional drivers	Control Users (#)	Pilot start	Pilot end	FOT start	FOT end	Rely upon 3rd parties? How?
Finland	DFOT3 (Benchmarking)	Traffic information Speed limit information Navigation support (static) Navigation support (dynamic)	10	0	0	None	None	June 2009	October 2009	TeleFOT had total control VTT
Finland	DFOT4 (TeleISA partner project)	Driving behaviour feedback (Speed limit information)	30	0	0-n (under □egotiation)	May 2010	June 2010	June 2010	December 2011	PPCT Finland as service provider

TS	D-FOT	Function(s)	Users (#)	of which # of professional drivers	Control Users (#)	Pilot start	Pilot end	FOT start	FOT end	Rely upon 3rd parties? How?
Finland	DFOT5 (TeleBUS)	Green driving support	60	All (professional bus drivers)	60			Project started 1/2011 (data can be obtained also from earlier period)	Project will end 12/2011	TeleFOT has total control; (VTT)
UK	DFOT1	Navigation support (static) Speed limi information Speed limit alert	30	0	Same group	March 2011	March 2011	April 2011	2011	TeleFOT has total control. BLOM, LOUGH
UK	DFOT2	Green Driving support	Unknown	TBD	Same group	Sept 2011	Sept 2011	Oct 2011	Feb 2011	TeleFOT has control

TS	D-FOT	Function(s)	Users (#)	of which # of professional drivers	Control Users (#)	Pilot start	Pilot end	FOT start	FOT end	Rely upon 3rd parties? How?
UK	DFOT3	Forward collision warning Lane deopature support	Plans not finalised yet	0		November 2011	November 2011	November 2011	December 2011	TeleFOT has control
Germany	DFOT1	Speed limit information Speed alert Navigation support (static) Forward Collision Warning Adaptive Cruise Control Lane Keeping	12	0	Same group (2 reference cases)	Spring 2010/11	Summer 2011	Summer 2011	Fall2011	TeleFOT has total control IKA, VTT, ICCS, BLOM
Spain (Valladolid)	DFOT1	Speed limit information Speed alert Navigation	20	TBD	Same group	2nd Quarter 2011	TBD	After the pilot test conductio		TeleFOT has total control

TS	D-FOT	Function(s)	User s (#)	of which # of professi onal drivers	Control Users (#)	Pilot start	Pilot end	FOT start	FOT end	Rely upon 3rd parties? How?
		support (static)						n		CIDAUT, RUEKER, BLOM
Spain (Madrid)	-	-	-	-	-	-	-	-	-	-
Italy	DFOT1	Traffic information Navigation support (static) Navigation support (dynamic) Green driving support Speed cameras alert	50	N/A	N/A	April 2011	April 2011	April 2011	December 2011	TeleFOT has total control CRF, MM, VTT, ICCS
Greece	DFOT1	Navigation support (static) Forward	24 (5 for the	-	Same group	March 2011	March 2011	July 2011	Septembe r 2011	No; TeleFOT has total

TS	D-FOT	Function(s)	Users (#)	of which # of professional drivers	Control Users (#)	Pilot start	Pilot end	FOT start	FOT end	Rely upon 3rd parties? How?
		Collision Warning Lane Departure Warning	pilot)							control CERTH/HIT, ICCS, VTT
Greece	DFOT2	Navigation support (static) Speed limit information Forward Collision Warning Lane Departure Warning		-		April 2011	April 2011	October 2011	November 2011	No; TeleFOT has total control
Greece	DFOT4	Navigation support (static) Speed alert Forward Collision Warning		-		May 2011	May 2011	November 2011	December 2011	No; TeleFOT has total control

TS	D-FOT	Function(s)	Users (#)	of which # of professional drivers	Control Users (#)	Pilot start	Pilot end	FOT start	FOT end	Rely upon 3rd parties? How?
		Lane Departure Warning								