Field Operational Tests of Aftermarket and Nomadic Devices in Vehicles

Large Scale Collaborative Project

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Final summary of achieved technical performance from National FOTs

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LIST OF ABBREVIATIONS

ABBREVIATION	DESCRIPTION
ACC	Adaptive Cruise Control
CAS	Collision Avoidance System
DFOT	Detailed Field Operational Test
DoW	Description of Work
FCW	Forward Collision Warning
FOT	Field Operational Test NB Specific National FOTs are prefaced by a Country Coding, e.g. UKFOT = United Kingdom FOT
GDS	Green Driving Support
LDW	Lane Departure Warning
LKA	Lane Keeping Assistance
LFOT	Large Scale Field Operational Test
ND	Nomadic Device
NSD	Navigation Support (Dynamic)
NSS	Navigation Support (Static)
SA	Speed Alert
SI	Speed Limit Information
TI	Traffic Information
UU	User Uptake
WP	Work Package

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EXECUTIVE SUMMARY

This deliverable reports on the activities undertaken in WP4.10 Technical Evaluations. This WP comprises two tasks; Task 4.10.1 System Performance Targets and Task 4.10.2 Actual System Performance. These tasks were planned to support the Sub-Project 4 of TeleFOT in Evaluation and Assessment of nomadic devices within the national Field Operational Tests (FOTs). The key objective of WP4.10 is to identify and define the target and actual technical performance metrics for the Nomadic Devices (NDs) used; it is not to assess the usability or quality of the data provided by the functions evaluated, but simply technical evaluations of the ND. However some clarifying comments received from individual test sites on subjective perceptions by FOT staff are included as a further interpretive reference. This was intended to assist cross community comparisons to be made, and assist with the answering of Research Questions (RQs; specifically the User Uptake RQs - UURQs) which form the basis for SP4. This deliverable was intended to be used in conjunction with the raw data collected by individual test sites to assist those partners in answering questions which may arise from their analysis. For example UURQ4 focuses on if driving behaviour is affected by the use of the NDs. Raw data from data loggers and questionnaires may suggest that driving behaviour was affected more in the UK than Sweden when using Green Driving Support - GDS (test sites used for illustrative purposes only), this deliverable will assist in answering *why* these differences may occur. For example factors such as screen size and quality, time to boot up, or method of information presentation may have affected perceived usefulness or amount that the ND was actually used, thus affecting actual driving performance differences.

WP 4.10 consists of three deliverables, the first (4.10.1) provided guidance to those involved in the FOTs in what aspects of the performance of the systems and applications under trial should be defined to enable a subsequent comparability to be performed. The framework described in D4.10.1 provided the information necessary for the test sites to develop a system performance definition for their own trial systems and applications that is both achievable and helpful to the later data analysis aspects of the project. Deliverable 4.10.2 presented the results which were collated from national FOT responses, and this deliverable (4.10.3) summarises the overall findings.

The deliverable report is structured in a manner that follows the ordering of the tasks undertaken to complete task WP4.10 in the Description of Work. A chapter is allocated to each of the tasks completed, followed by a chapter summarising the main findings from the collated results and finishing off with the conclusions from the WP as a whole.

Chapter 1, Introduction, sets the context of this WP within the general development of TeleFOT and the somewhat developmental nature of the progress from original project and FOT goals and the many practical issues that have had to be addressed in setting up multi-site trials. The implications of these factors on how system performance can and will be assessed is outlined, as is the implications to the scope of this WP.

Chapter 2, Objectives and Scope, examines in further detail the need to revisit the specific objectives and scope of an applicable and achievable system performance framework for TeleFOT specifically. This chapter also addresses the range of functionality deployed in the FOTs and the implications toward definition of a framework.

Chapter 3, Framework Rationale, expands upon the resulting approach taken which is based upon capturing from the FOT test sites their collective experience and expert assessment of the chosen systems deployed.

Chapter 4, Framework Definition, then describes the approach taken and the methodology to apply this for the test sites. An indication of the timing plan to be followed by the test sites to respond to the framework is given and the manner in which the feedback used is outlined. Framework templates to capture data are contained in supporting annexes. (This also includes a worked example of how the templates should be completed based upon a candidate system selected from within the FOTs in TeleFOT in Annex 1 and the collated national results given in Annex 2).

Chapter 5, Summary from Collated National FOT Technical Performance Data, provides an overview of the final system performance. This is a technical summary of the responses received concerning the technical performance of the systems deployed in the various FOTs, rather than of the users’ experience with the individual systems.

Chapter 6, Conclusions, summarises the earlier content and indicates the application of this information in interpretation of the data analysis conducted in other WPs of TELEFOT SP4.

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 (FOT) 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.

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

This deliverable reports on the activities undertaken in WP 4.10 Technical Evaluations. This WP comprises two tasks; Task 4.10.1 System Performance Targets and Task 4.10.2 Actual System Performance. The main objective of this WP was to identify and define the target and actual technical performance metrics for the various nomadic systems used in the national Field Operational Trials (FOTs) to enable cross FOT comparisons to be made.

In the original project Description of Work (DoW) it was suggested that this may perhaps include factors such as:

- Infrastructure Data gathering and handling
- Communications protocols utilised
- Nomadic device data handling
- Information Presentation
- User selected data presentation options
- Overall system reliability and redundancy

This was based on original assumptions about what types of technology and applications would be deployed within the TeleFOT FOTs. It was also based upon some assumptions about the level of access to specific products target or design performance specifications provided by the manufacturers. Finally it was also based upon assumptions about the abilities of the test sites to carry out performance tests to support such a list of aspects.

As the TeleFOT project developed over an initial stage of detailed investigation and planning as to the practicalities of setting up multiple FOTs with mainly commercially available equipment, several conclusions were eventually reached.

Firstly, the emerging nature of both the commercial market of Nomadic Device (ND) functions and the range of capabilities possible to be deployed caused some delays in eventual final definition of the functions and the manner in which they were to be deployed. A particularly disruptive influence was the sudden development of Smartphone applications in the initial years of TeleFOT detailed planning.

Secondly, this caused some changes in the way in which some functionality was eventually deployed and as a result some review on how data could be captured for behavioural trials, and how access to system performance data may be reduced. In cases where the underlying technology platform remained the same as the original plan, access to data on a commercial design from an external supplier/manufacturer also became problematic.

Finally, there was the assumption that test sites would have a broad capability for investigating technical system performance at a comparable level across the project. In discussion within the project it became clear that there were discrepancies in the levels of capability to investigate and carry out some of the originally conceived goals. The performance information reported by the test sites was therefore based on those aspects that could be achieved by all FOTs to ensure commonality and support the analysis of the various impact areas within SP4.

It was therefore necessary to carefully define the detailed scope and objectives of WP4.10 in order to yield useful complimentary analysis to that carried out in other areas of SP4. These factors have been addressed within this deliverable and a practical rationale for a system performance framework has been produced and a methodology for collecting information that is achievable within a project context has been defined.

2. OBJECTIVES AND SCOPE

2.1. Initial Objectives

The TeleFOT DoW describes the objectives of WP4.10 as follows.

- The main objective of this work package is to identify and define the target and actual technical performance metrics for the various systems used in the national FOTs to enable cross FOT comparisons to be made.

This objective was to be addressed in two sequential Tasks. These were described as:-

Task 4.10.1: System Performance Targets

At an initial stage in this WP, this task will define a system specification matrix that will identify key system specification and target performance criteria that will form a technical system definition for each system to be deployed in FOT. This activity will be timetabled to assist the work within TeleFOT SP2 in defining Framework requirements for the national FOTs. The co-ordinators of each national FOT will then be required to supply technical specifications to populate this framework to enable a holistic project definition of the technical capabilities of the proposed FOTs to be given and a comparison of the relative specifications and target performances of the systems to be carried out.

Task 4.10.2: Actual System Performance

As the various national FOTs in SP3 are established and carried out, this task will initially establish the reporting structure to be applied at the national level to assemble data on the actual “technical performance" of the systems in service to be collected. This information will then be collected by each national FOT for eventual supply to the task leader for collation, collective analysis and reporting. This will be detailed in the Final deliverable.

2.2. Initial Approach

Clearly different specific nomadic device functionality implemented in commercial products may have different methods and techniques, and potentially technologies, to deliver a specific function. As the TeleFOT project completed its initial stages of agreeing methodologies to be adopted in the first years of the project (2008-2010) it became apparent that there were still uncertainties in the actual functionalities and services to be deployed in the planned FOTs. Many of these uncertainties were related to the practical nature of defining achievable solutions and identifying, investigating, assessing and sourcing commercially available, or very near to market, viable ND applications that reflected state-of-the-art functionality.

Many of the practicalities in establishing viable trials were discussed in detail between consortia partners during plenary and SP meetings in the 2008-2010 periods. This included a great deal of informal feedback on how test sites were addressing the contractual issues with regard to establishing ND device supply, data interfacing and access to system specification details. In many cases this appeared to result in a basic consumer-supplier relationship only, where the only system specification definition of performance was that available to a normal consumer, e.g. instruction manuals and supplier web site public information. These discussions indicated that detailed target performance goals and design parameters for the ND applications from the system manufacturers/suppliers would not be accessible to the Test Sites. This had an impact in considering how the objectives of WP4.10 could be addressed.

The detailed definition phase of the project however is documented in a number of internal deliverables. An initial review of the planned functionality to be deployed in the various FOTs within TeleFOT was initially available in July 2009 (Functions Specification - D2.5.1 v1) which was subsequently amended based upon the inputs from the various Test Sites as initial plans became revised as systems were sourced and implemented. This was re-issued in July 2010 (Function Specification - D2.5.2 v2). This was supported by further definition of the way in which these functionalities were deployed and data recorded to support the behavioural analysis of the possible impacts of the use of the NDs. This was reported in further TeleFOT SP3 deliverables as these plans were firmed up.

Particular relevant references include definition of FOT status deliverables from SP3 in May 2010 (FOT Plans – D3.4.1 v4) and later revisions in August 2010 (FOT Plans – D3.4.1 v6). These defined positions of FOT intent and ND function deployment formed the major inputs to WP4.10 analysis.

These inputs are illustrated in the following diagram (Figure 2.1). This also indicates how the framework defined in this deliverable on ND system performance will be applied by the Test Sites and collated and analysed by WP4.10 to form context relevant feedback for the impact analysis work within SP4.

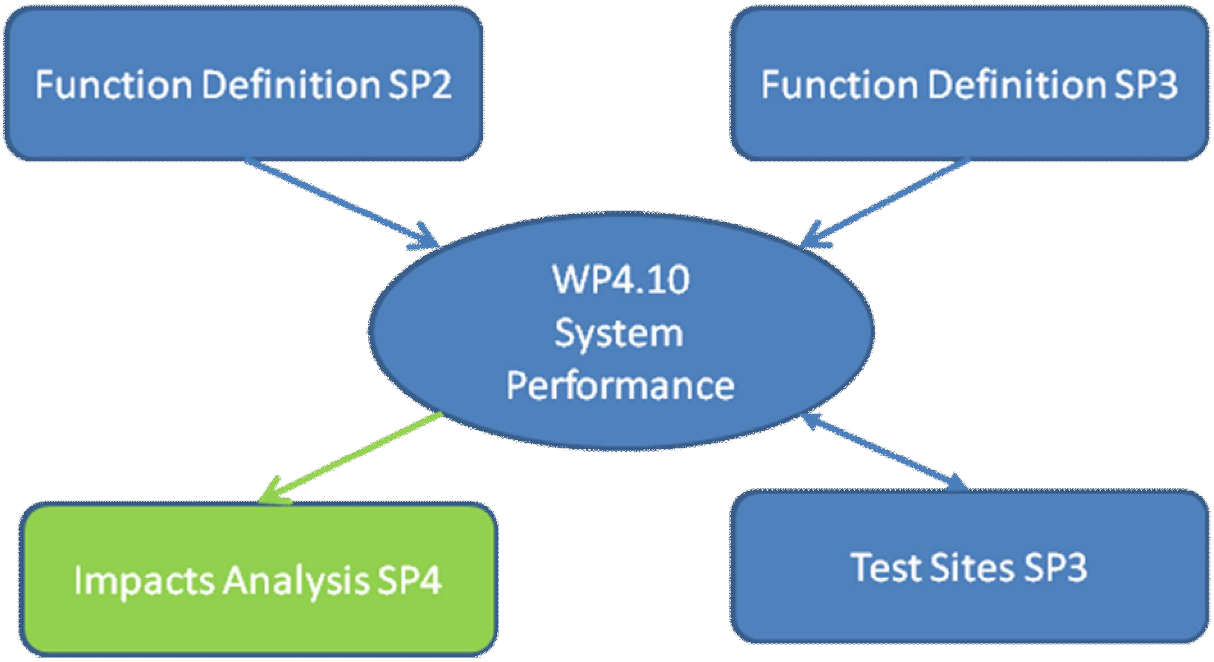

Figure 2.1 WP4.10 Inputs, Interactions and Outputs

2.3. Review of Detailed Objectives

Based upon the informal test site feedback noted above, and the agreed device and trial plans described in internal deliverables, an analysis of what was possible for a "system performance" analysis WP within the context of TeleFOT working arrangements and information access was performed. This specifically addressed the initial ambitions for areas of system performance assessment that was outlined in the original project DoW.

These initial ideas were defined as:

- Infrastructure data gathering and handling
- Communications protocols utilised
- Nomadic device data handling
- Information presentation
- User selected data presentation options
- Overall system reliability and redundancy

After a review it was identified that there were practical issues with regard to assessment of the first three items listed above. The topic of “Infrastructure Data gathering and handling” would only apply to a small sub-set of the ND functionality trialled within TeleFOT but would require a full understanding of how this aspect of service provision was implemented. It would also potentially require access, perhaps via the service provider, to meaningful indicators that would enable analysis of this aspect. As this was not available to Test Sites then this idea was disregarded.

Similar issues with practicalities of understanding and accessing any potential indicators relating to system performance for “Communications protocols utilised” and “Nomadic device data handling” which would also require ND/Service supplier support were also disregarded.

As a result a new definition of system performance target areas was established. This was defined as three areas from the original concept.

- Information Presentation
- User selected data presentation options
- Overall system reliability and redundancy

In addition as the rationale for defining a system performance framework was being developed a fourth area was added. This was:

- Use Cycle Performance

This is expanded upon in the next chapter , Chapter 3).

2.4. Nomadic Device functionality

It was clear that TeleFOT would carry out FOTs on a range of ND functionality. The definition of these “types” of ND functionality has been described in earlier TeleFOT internal deliverables, but a brief summary of the types is given here (from D2.5.1 v2 - D2.5.1 Functions specification, version 2.0) and subsequent documents. These definitions are given in the section below.

Traffic Information (TI)

This function can be found on both nomadic and aftermarket devices and can generically be described as follows:

> The system provides drivers with real-time information about the traffic situation (including congestions, weather conditions, road works, crashes, etc.). The system draws on external databases and connects to a traffic control centre.

It is designed to:

> Make the driver aware of the actual as well as potentially critical traffic conditions in the immediate road and street environment.

Speed Limit Information (SI)

This function is found on both nomadic and aftermarket devices. A generic description is the following:

> Display current vehicle speed and current speed limit of the road/street used.

It is designed to:

> Make the driver aware of actual speed limits on the road/street used.

Speed Alert (SA)

This function is found on both nomadic and aftermarket devices. A generic description is the following:

> Display current speed of the vehicle and the current speed limit of the road/street; a warning is issued when speed limit is exceeded.

It is designed to:

Make the driver aware of actual speed limits on the road/street used; Make the driver follow the current speed limit by providing a warning (visual and/or auditive) when the speed limit is exceeded.

Navigation Support (Static) (NSS)

The function is found on nomadic and aftermarket devices. Its generic description is as follows:

Guide the user to a destination set beforehand, through locating the vehicle (using a positioning system) and calculating "best path" (in terms of travel time, distance or other preferences) by the use of relevant algorithms.

It is designed to:

Provide navigation support to the driver to find the way towards a pre-defined destination.

Navigation Support (Dynamic) (NSD)

The function is available on nomadic and aftermarket devices. Its generic description is as follows:

Guide the driver to a destination set beforehand, through locating the vehicle (using a positioning system) and calculating "best path" (in terms of travel time, distance or other preferences) by the use of relevant algorithms. The algorithms also take into account the actual (and real time) status of the traffic system or other pre-selected topics.

It is designed to:

Provide navigation support to the driver to find the way towards a pre-defined destination, the current traffic situation and other pre-selected conditions influencing the traffic process are also taken into account.

Green Driving Support (GDS)

The function is found on both nomadic and aftermarket devices. Its generic description is the following:

A system which calculates what environmental impact one or several of the actual conditions of choice of route, driving style, operation of driveline, etc. will have. The algorithm also calculates what measure the driver can take in order to improve the situation at hand.

It is designed to:

Provide driving support (on all driving task levels) to the driver (often in real time) in order to, if possible, reduce the actual environmental impact of the driving.

eCall

The function is found on embedded systems. Its generic description is as follows.

A system that is intended to bring rapid assistance to motorists involved in a collision anywhere in the EC. It sends an emergency call message on being activated in an accident situation and can deliver information about location and severity of the accident.

Adaptive Cruise Control – (ACC)

The function is found on embedded automotive systems. Its generic description is as follows:

A function which supports the automatic maintenance of speed and safe headway of a vehicle within traffic. It utilises on-board distance sensors to detect vehicles ahead and adjust vehicle speed from a driver selected target speed to maintain headway.

Forward Collision Warning – (FCW)

The function is found on embedded automotive systems and installed nomadic devices. Its generic description is as follows:

The function employs a forward facing sensor to detect the presence and closing speed characteristics of a vehicle ahead. The system warns the driver when a “safe” threshold is exceeded and a forward collision is imminent.

Collision Avoidance System – (CAS)

The function is found on embedded automotive systems. Its generic description is as follows:

> The function employs a sensor to detect the presence and closing speed characteristics of another vehicle around that of the supported drivers. The system can warn the driver when a “safe” threshold is exceeded and a collision is imminent or can intervene with vehicle control if the driver does or cannot respond in time. While such systems can be for side and rear (blind spot warning) the most common is an intervening forward collision avoidance with automatic brake activation.

Lane Departure Warning – (LDW)

The function is found on embedded automotive systems and installed nomadic devices. Its generic description is as follows:

> The function employs sensors to detect the location and direction of the road lane and the relative location and trajectory of the vehicle in relation to the lane. It can provide the driver with a warning if the system detects a trajectory that will result in the vehicle leaving the lane.

Lane Keeping Assistance – (LKA)

The function is found on embedded automotive systems. Its generic description is as follows:

> The function employs sensors to detect the location and direction of the road lane and the relative location and trajectory of the vehicle in relation to the lane. It can provide the driver with a warning if the system detects a trajectory that will result in the vehicle leaving the lane and if the driver fails to respond the system can intervene and provide a corrective steering input.

2.5. Redefined Scope of the Workpackage in the context of TeleFOT

During the course of the detailed planning and modification of the form and context of the proposed FOTs, both LFOT and DFOT (as described in SP3) and an awareness of the type of data captured, and the emerging perceptions of the implications of the likely data to be collected from LFOTs and DFOTs, it was clear that there were implications to the task to be undertaken in data analysis. Parallel discussions in the analysis process to be undertaken in SP4 suggested the need for analysts in particular to have relevant and useful context information relating to the "performance" of the systems during the FOTs.

This knowledge also related to the importance of understanding the subjective questionnaire data collected from FOT participants and how that related to perceptions of user related factors.

It was clear that in order to assist this analysis the "system performance framework" had to be an effective and achievable way to collect relevant and applicable context information. This was particularly important in establishing an understanding of how similar generic functionality "performed" in different Test Site locations. The most relevant source of information of this aspect would obviously have to come from the Test Site personnel themselves who had gained the most experience of trialling a specific ND system or application.

For these reasons the Framework for collection of system performance information was shaped to have the most applicability to support the analysis work packages of SP4 within TeleFOT.

3. FRAMEWORK RATIONALE

The review of the objectives and scope of investigation described in the previous chapter led to a reconsideration of how meaningful and achievable data could be gathered on the comparative system performance of a wide range of ND applications and functions across a pan-European test sites.

Two approaches were followed, one focusing on a typical mass market end-user interaction with the ND and another one focusing on the specific TeleFOT participants/users…

3.1. Use Cycle - User

The concept of a use cycle was used as a basis for collecting system performance data. This considers the cycle of activity that a user carries out in interaction with a ND. This considers the following stages.

After initial system installation of the ND within the vehicle all NDs require an initial system activation stage to switch on or activate the device and/or function. This may take the form of pressing an "on" button or switch to supply power to the ND and activate the system. This may take some period of time until the system/function is ready for use. When the system has reached this activation stage it may then be possible to make system adjustments to ready the system for its use on that particular day/journey. A simple example here in the context of a Navigation Device would be to select a setting for the visual or auditory display. Subsequently the user may make data inputs to the system, again using the Navigation Device example this would be to select a destination for the journey and adjust, if necessary, the routing options required. The next stage in use would be for the user to receive data outputs from the system, again using the Navigation Device example this would be receiving turn-by-turn or distance-to-destination feedback. Finally at completion of the journey the user has to receive final system information, if provided, and de-activate the system. After this the system can be demounted and removed if required.

These highlighted areas form the focus of the system performance parameter that are proposed to be captured along with some other contextual information about system design, e.g. visual display screen sizes and resolution.

Collection of data on performance of NDs in this Use Cycle from Test Site Personnel having gained wide experience in the use of the device in FOTs in an objective manner, supported by any further clarifying subjective observations about system performance will provide a basis on comparing implemented ND functionality from Test Site to Test Site. It will also give necessary context to assessing cross Test Site comparison of behavioural results in SP4.

The following diagram indicates the Use Cycle and indicates that information gained on system performance related to timing/response and errors can be related to ease of use and impacts of system design on perceptions of "performance", "quality" and be related to User perceptions concerning acceptability.

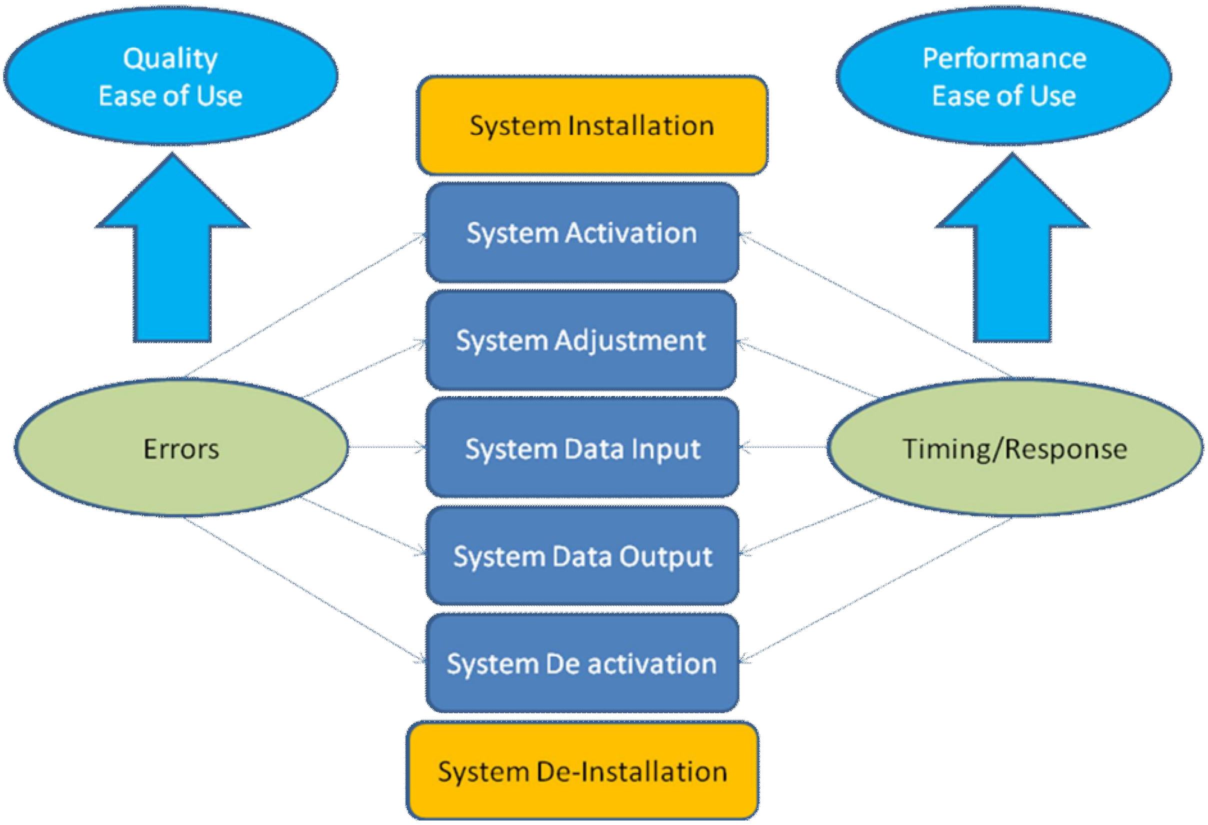

Figure 3.1 Use Cycle Elements and performance data use

3.2. Use Cycle - TeleFOT

It should be stressed that this individual user "use cycle" represents the way in which the FOT trialists experienced the ND systems and functionality deployed in trials. However this only represents a proportion of the experience generated within the project overall. Clearly the individual Test Site personnel also were "users" in a different way as they accumulated considerable experience directly in the performance of the system through initial selection of the technology, pilot trials and implementation in the FOTs. These personnel also were part of the data collection process from the trialists and received informal feedback over and above that documented in the various questionnaires that were completed during the FOTs.

It was therefore agreed that collection of the FOT experience on “system performance” over the course of the FOT period was a useful addition to the “user data” captured by questionnaires.

In particular the availability of this information would enable the impact analysis partners in SP4 to be as fully informed as possible as to the performance of the specific ND systems and applications when “in-service”.

This would particularly assist understanding of the context in which behavioural data on a function can be compared from different test sites where some comparable functions were trialled. A key issue here may be where similar “generic functionality” has been trialled by different test-sites but delivered by different specific products with potentially different design and performance parameter.

For this reason the system performance framework took particular emphasis on collecting data on three main aspects. Firstly, this included system specification (design) information on topics like display and control type and functionality, device size and functional design (including time and number of control activations to access functions). Secondly, subjective summary data on system performance perceptions from Test Site staff to enable a more holistic understanding of the features of the ND that related to Usability, Reliability, Trust, Perceptions of design optimisation, Usefulness and Value. Finally the framework should enable free text recording of any other observations or comments that the Test Site felt was appropriate to note in understanding how the ND system and application performed over the FOT period.

3.3. Summary

This section indicates that the original intent to capture engineering forms of “system performance” data was not only difficult to achieve, but would not assist the impact analyses WPs in SP4. As it became clear that this was an identified need within TeleFOT it was accepted that the “System Performance Framework” should instead be more appropriately focussed on generating definitions of the trialled device/application in such a way that would assist analysts in setting their analysis in context. This should necessarily include a standardised framework that enabled both objective data on each ND to be captured, and also, summarised subjective evaluation of overall system performance experienced by both managers and users within the individual FOT setting.

The data collection using this Framework was most appropriately carried out towards the end of FOTs in early 2012 when the test sites have gathered practical experience of the devices and applications deployed.

The overall definition of the Framework is described in the following section.

4. FRAMEWORK DEFINITION

4.1. Framework Introduction

The Framework for collection of system performance data and definition was therefore required to capture the specifications and aspects of performance of the ND devices and applications deployed by the individual test sites. This Framework would also be required to capture summaries of the Test Sites, and Users, overall perceptions of factors relating to actual performance of the systems over the FOT. This should also allow the capture of any other perceptions of the Test Sites related to general or specific aspects of how the system operated while on trial. By definition this latter part would be relatively unstructured to enable Test Sites to have an adaptable way of reporting any other information that would be useful to set the context under which the specific system performed that would aid independent analysts within the project in interpreting data.

The Framework was also required to be delivered in a form that could be easily completed by the individual test sites based upon their existing knowledge, rather than requiring considerable additional tasks. Therefore the final defined framework was developed on the basis of experience gathered in LFOTs and DFOTs and their relevant NDs employed by the authors.

The Framework developed takes the form of a series of template tables that could easily summarise the ND and the experience gathered during the FOTs. Finally it allowed the ability for the FOT personnel to add further additional performance or collective user perception feedback that would not be reported elsewhere in the project that may aid cross site and cross ND data analysis comparisons.

The application of the defined specific Framework within the project also had to enable subsequent collation and analysis in the latter aspects of WP4.10.

4.2. Framework Elements

For the reasons above a series of templates were designed to enable Test Sites to record data on each of the specific NDs and applications trialled.

The individual elements of the templates generated for the Framework are illustrated in Figure 4.1 below.

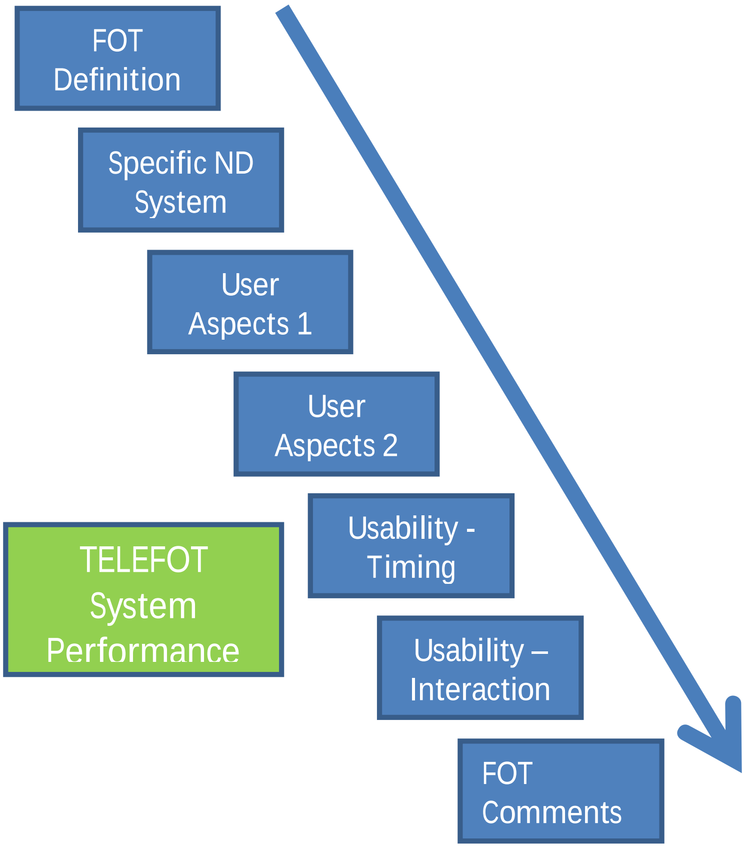

Figure 4.1 TeleFOT System Performance Elements.

The individual elements were intended to enable the collection of data as defined below

FOT Definition

This section defined which particular FOT and system functionality was being assessed including any specific product name or definition. It also defined who had carried out the reporting of system performance described within the completed templates and confirmed their role within the FOT and specific contact details in the case of any need to clarify aspects of the performance.

Specific ND System Definition

This section defined the specific characteristics of the system under evaluation. It clarifies whether the system was truly nomadic (i.e. capable of being removed after each journey). If it was not further clarification should be given in the comments section. It also defines whether the application was stand alone, or installed on a secondary device such as a Smartphone. It also identified what location the device was mounted or located in the vehicle during the FOT. A section then defined which modalities of HMI display and feedback were available from the ND; either visual, audio or haptic, as well as which of these was the principal mechanism.

As the majority of devices offered visual feedback the capabilities and format of the display screen were then defined. Next the physical and power characteristics of the ND were described (i.e. size, weight and battery performance). Finally the adjustability and user preference capabilities were assessed.

User Aspects 1

This section contained details of aspects related to user perceptions of aspects such as usability, perceived benefits, system trust, opinions on design and indications of future use potential for the ND, with results taken directly from the User Uptake Questionnaire.

User Aspects 2

This section contained details of aspects of system performance related to reported test site personnel perceptions of usability, reliability, system trust, usefulness and availability of user support for the ND.

Usability – Timing

This section defined the aspects of system performance related to the time taken to activate the ND system and application. This included the interval time to access the main system menu, the primary function, the primary application and provided a total time summary in seconds from start up to access the primary function. It also detailed time taken to adjust the function or HMI. Finally it detailed the de-activation and shut down timings. This was included as long time to activate and access functions could often result in dissatisfaction or failure to use ND systems.

Usability – Interaction

This section defined the aspects of system performance related to the number of system interactions necessary to activate the ND system and application. This included the interactions to access the main system menu, the primary function, the primary application and provided a total interaction summary from start up to access the primary function. It also detailed the number of interactions to adjust the function or HMI. Finally it detailed the de-activation and shut down interactions required. This was included as complex interactions to activate and access functions could often result in dissatisfaction or failure to use ND systems.

FOT Comments

Finally a section was provided to allow free text comments to be recorded by test site personnel on any other aspect of system performance, failure, usability or error experienced during the FOT that may have had an impact upon data captured and perceptions of usability.

Other information

Test Sites were also encouraged to supply other material to support this system performance summary such as copies of manufacturers manuals and target performance data sheets (if available) and photographs or images of HMI and ND devices to allow the third party analysts to have a more informed view of the system that generated test data.

4.3. Framework Deployment

This deliverable therefore defines the System Performance data capture framework that was deployed across the test sites in early 2012.

To enable full guidance to the test site personnel in the completion of the information requested in these framework a “worked example” of how data can be recorded and coded in these templates is given in Annex 1. This includes explanatory notes to explain the terminology used and form of reporting required.

The “worked example” is based upon a ND employed in the UK DFOT2 trial which utilised a Green Driving System (GDS) running as an application of a host Smartphone.

The completed framework elements as working documents are enclosed in this deliverable in Annex 2 as a blank Word Document. Partners were also able to access this necessary documentation from the project website.

Deliverable 4.10.1 and its annexes were distributed to the project partners in early February 2012 and an agreed response timetable was agreed with SP4 leaders and circulated to partners in parallel.

Responses were collated by the WP4.10 leader and made available to partners, and particularly analysts, shortly after completion and supply of those responses. These are reported in D4.10.2.

5. SUMMARY OF COLLATED NATIONAL FOT TECHNICAL PERFORMANCE DATA

The following chapter summarises the information supplied by the national FOTs. This information relates to the technical aspects of the various devices and applications deployed within the project. The summary comments provided below seek to describe the areas of commonality and differences observed between the NDs used in the various test sites. This summary has been prepared in order to inform the analysts within TeleFOT SP4 work-packages of the technical performance characteristics of the ND functions and host devices which may influence factors such as driving behaviour or user uptake during the FOTs.

The findings reported below are structured to reflect each section of the framework presented in Annexes 1 and 2. For example headings in bold below represents the title of the tables in the Annexes (e.g. Evaluation of trialled system in TeleFOT – FOT Definition below relates to tables A1.1 and A2.1), and sub-headings in italics represent the categories within each table (e.g. *FOT Info* relates to the section of questions and responses given in tables A1.1 and A2.1 under the sub-heading FOT Info). Text placed within quotations marks refer to possible options given within the framework to answer specific questions (e.g. ‘Satnav’).

Evaluation of trialled system in TeleFOT – FOT Definition

FOT Info

- Responses were received from a total of 22 FOTs from 10 different test sites across Europe. Of the 22 FOTs, 11 were LFOTs and 11 DFOTs.
- FILFOT2 evaluated two separate systems (DRIVECO and LATIS).
- The table below shows that the majority of FOTs (61%) evaluated the use of Navigation Support (NSS) as their primary function, with 8 LFOTs and 6 DFOTs assessing various aspects of NSS.
- Speed Limit Information (SI), Speed Alert (SA) and Traffic Information (TI) were typical secondary functions evaluated alongside NNS, mainly in LFOTs.
- Advanced Driver Assistance Systems (ADAS) – which included Forward Collision Warning (FCW) and Lane Departure Warning (LDW) – were the primary function evaluated in one DFOT and secondary functions in 4 other DFOTs. No LFOTs analysed ADAS functionality.
- Green Driving Support (GDS) was evaluated as the primary and secondary functions in 3 FOTs each, being assessed again by 3 LFOTs and 3 DFOTs.

Table 5.1: Functions evaluated in the different national FOTs

	Functions		FOT Type	
	Primary	Secondary	LFOT	DFOT
NSS	14	1	8	7
SI / SA	4	5	7	5
TI	1	4	4	1
ADAS	1	4	0	5
GDS	3	3	3	3

Specific ND System / Function Physical Definition

Host Device

- 83% (19/23) of the devices tested were truly nomadic, meaning they could be removed from the vehicle. Of these NDs 7 were hosted on and whose primary function was a 'Satnav' system and 11 on 'Smartphones'.
- The 4 remaining systems evaluated were 'Specific Systems' (e.g. data loggers or those developed specifically with a sole function in mind) and could not easily be removed from the vehicle or did not provide additional functionality for the user.

HMI Feedback

- Every system apart from one offered in-vehicle feedback to the driver, FILFOT4 gave feedback offline via a PC.
- The primary visual feedback from the NDs evaluated was 'Graphical' (in 14 cases), 'Both' graphical and text (7), only 'Text' in 1.
- The primary auditory feedback was 'Speech' (again in 14 cases), with 3 devices each either providing either 'Tones', 'Both' speech and tones, or 'No' audio.
- No systems offered 'Haptic' feedback to the driver.

Screen Specification

- The screen sizes of the Smartphone and Satnav host devices varied between 3.2" and 5.0" (8.1 and 12.7 cm; measured on the diagonal).
- All had 'Colour' screens, with all of the Smartphones principally being used in the 'Portrait' orientation, and Satnavs in 'Landscape'.
- 86% of the host devices utilised a 'Touchscreen', either with or without additional 'Hard' keys.

Unit Specification

- The battery life of the Satnavs and Smartphones ranged between 2 and 7 hours with usage. However, 5 (the ‘Specific Systems’) were powered directly from the vehicles 12v supply.

Adjustability

- Adjusting the volume of the host device for each evaluated systems was generally defined as ‘Simple’, but adjusting a more advanced screen feature such as the brightness of the screen was split 50-50 for complexity (‘Simple’ or ‘Complex’).

User Aspects 1 (User Uptake) Definition

Usability

- Of the 11 LFOTs for which responses were received and included in this evaluation, 4 LFOTs stated the ND was used by participants less than 25% of the time. The 4 Greek LFOTs reported systems being used greater than 75%. Two further LFOTs reported that the system was used for 100% of time, and one provided no data.
- In general participants taking part in the different FOTs were stated as being initially positive (80%) about the systems and functions being evaluated at the beginning of the FOT, the remaining 20% were neutral, with no test site reporting participants as being negative towards the functions being evaluated at the beginning of the FOT.
- Following the completion of the LFOTs participants were generally more negative towards the systems evaluated than when they started, this was mainly due to Usability and Reliability issues

Benefits

- Post FOT participants generally rated the benefit of having access to the system as Moderate (10/22), with 6 suggesting a large benefit and 4 a small benefit (2 no data).

Trust

- Trust that the system would provide the user with accurate information was generally rated by participants as being Moderate to Large for the NSS and GDS functions, but very varied for SI/SA with Greek participants rating trust in the information as large, with UK and Sweden rating as low.

Future Use

- The average amount that participants suggested that they would be prepared to pay to purchase the systems that they have been using throughout the duration of the FOT was approximately €20 as a one-off payment, with 5 test sites reporting that participants in general were not prepared to pay anything.

User Aspects 2 (Other Factors) Definition

Usability

- In general users' responses to the information being offered by the various systems was rated as being easy to interpret, with the exception of two FOTs using a specific NNS (GEDFOT1 and UKLFOT1).
- In general the ease to amend driving style based on the advice given was rated as moderate to high, as was the system responsiveness.

Reliability

- In general the truly NDs (Satnavs and Smartphones) were reported as being less reliable than 'Specific Systems' which were powered from the vehicle 12v supply.
- Considering if the system would rarely crash or freeze six of the systems were rated on the lower end of the scale for reliability, 4 towards the upper and 10 in the middle of the range. However the systems evaluated would usually start up first time, with half (10/20) always starting up first time and the other half generally starting up (2 no data).

Trust

- When responding to 'Users would followed the advice given' and 'Systems would generally give good advice' again this was generally positive with the exception of two FOTs using a specific NNS (GEDFOT1 and ESLFOT1).

Usefulness

- A contradictory view was generally expressed by participants who used systems with SI/SA. This was that the general concept of providing speed limit information for the current road was deemed the most useful aspect of such systems, but the least useful aspect was that these features were often out of date or inaccurate.

Usability – Timings and Interactions Definition

- Of the responses received the total time cited by the test sites for the system from off to fully functional varied according to if the ND application evaluated was hosted on a Satnav or Smartphone system, at a mean time of 82.5 versus 69.6 seconds respectively.
- However the time to boot up and gain access to the main menu was faster with the Satnavs, at 29.5 verses 53.7 seconds respectively. Conversely the time from main menu to fully functional was shorter with the Smartphone at 18.1 versus 53.0 seconds respectively.
- The time taken for a Smartphone to boot up, so the main menu could be accessed, equated to over three quarters of the total time taken, this would be similar to that of booting a PC, and reflects that once booted applications on the Smartphone can be accessed quickly and effectively.
- The number of button presses (or interactions) to access the primary use of the system was relatively consistent across platforms, with between 2 and 6 interactions needed. Again little difference was observed in the number of

interactions needed to change a function of the system or HMI, ranging between 3 and 9 interactions.

- The time taken to exit the system was again similar for both platforms (16.8 for Satnav and 13.3 secs for Smartphone). The number of interactions to exit for the Satnav was between 1 and 3, and for the Smartphone between 2 and 4 (this increase is accounted for by the exiting of the application to the main menu, then the turning off of the Smartphone).
- As might be expected those systems evaluated which powered by the vehicle's 12v supply (the 'Specific Systems') were far quicker to start up (at an average of 8.5 seconds) and shut down (instantaneous at ignition off) compared the Satnav and Smartphone host devices.

Further Comments concerning ND performance observed in the FOT

Included below are some observations on the technical performance of the ND applications deployed which were made by test site managers that summarised findings for the individual FOTs, for more detailed comments on specific systems or test sites please refer to Annex 1.

- The audio presentation of information for some systems was cited as being annoying; this was exacerbated if the information was wrong (as was often the case with SA). Audio was frequently stated as potentially being more intrusive than visual feedback.
- Delayed navigation information (specifically with Navigation Support) made systems difficult to understand.
- The Smartphone systems with a 3.2" screen were rated as being too small for navigation use; this was the smallest used in any FOT. No further comment was made regarding displays being too small, however a screen of 5.0" was cited by one FOT as being 'adequate for in-vehicle use'.
- Map databases and speed limit information that were not presenting the correct information were a particular annoyance, and cited as such by all test sites using mapping databases for various functions.
- However participants from the GELFOTs were generally satisfied with the NSS and SI/SA, this is despite them citing the issues mentioned above.
- Generally user uptake of NSS was low (used for less than 25% of journeys), particularly for the central European test sites.

6. CONCLUSIONS

This deliverable outlines the work conducted to complete WP4.10 – Technical Evaluations. The WP comprised two tasks, T4.10.1 focused on establishing the framework in accordance with the revised DoW set out by the TeleFOT project, and also the distribution of this framework to collect the necessary data in order to conduct the technical evaluations of the NDs used by different test sites. These tasks are outlined in this current deliverable from Chapters 2 through to 4 (as well as D4.10.1). Task 4.10.2 focused on collating and presenting the results returned by the FOT partners. These results are presented in Annex 2 (and D4.10.2), with a summary of the collated national FOT performance data presented in Chapter 5.

This deliverable has outlined the technical specifications of each host device for the specific NDs used by each national FOT (both L and DFOT), as well as providing a summary of which FOTs were evaluating which functions (NSS, GDS etc). HMI feedback mechanisms (visual, auditory or haptic) were also established, as well as parameters such as screen size and resolution, and battery life for example. In addition each test site was asked to supply usability information specifically related to the time taken and the number of user interactions (e.g. button presses) to access certain functions within their ND. These included time and interactions to access the main menu and primary function, or adjust the volume, as well as to start up and shut down.

Whilst this 'technical' data were being collated from test sites (which was the principal aim of the WP) other 'User Uptake' issues were also summarised in order to further assist those partners answering the SP4 research questions. These questions were derived from the Standard User Uptake TeleFOT questionnaire and related to opinions on the design of the device and user interface, initial reactions and benefits to the NDs to name a few. In addition 'Other Issues' which relate to participants' perceived usefulness, reliability and ease to interpret the information offered by the ND were also collected. Towards the end of the framework a section of free text was included for test site managers to comment on the practical use of the device during the FOT. This allowed more in-depth information to be captured surrounding issues which may have influenced the use of the ND during the FOT or common issues which arose. Finally test sites were asked to supply screenshots of the system interface, allowing for potential further assessment of ergonomic design and usability of each ND.

In summary the key objective of WP4.10 was to identify and define the target and actual technical performance metrics for the NDs used, thus allowing cross community comparisons to be made and to assist with the answering of RQs. This deliverable is intended to be used in conjunction with the raw data collected by individual test sites to assist those partners in answering questions which may arise from their analysis; this deliverable will assist in answering *why* differences may occur between test sites.

ANNEX 1: SYSTEM PERFORMANCE FRAMEWORK – WORKED EXAMPLE

This Annex contains the templates that will be utilised by the TeleFOT test sites to record the system performance elements relating to the ND functionality deployed in the FOTs.

In order that guidance can be provided on how these templates should be completed a worked example using one of the FOT ND functions is assessed and data entered into the template.

The principles and working methodology described should inform the Test Sites on how data should be recorded and eventually returned to WP4.10 for collation and analysis.

Summary Tables – Template completed as a worked example of Data Derived from a Green Driving System GDS

This is based upon an assessment of the UK FOT Green Driving System (GDS) that was an ND System which consisted as an application running on a HTC Smartphone.

This ND and application was assessed using the Framework outlined here in this Deliverable and data recorded into the template.

Further guidance notes are given on data entry and comments made on the worked example.

ND System Performance Framework

Worked Example

General Instructions to Complete this Document

A separate template should be completed by EACH test site for EACH nomadic device/application trialled in both DFOT and LFOT.

This template should be completed by the Test Site Manager, or someone who has significant experience both using the system and also detailed knowledge of participants' views on the system under evaluation.

Please include any further comments that you may have on the 'Comments' sheet, this more detailed information will greatly assist the people using this document to answer RQs and add context to specific questions.

The template consists of:

- Definition of the Specific FOT and Personnel responsible for the assessment
- Date of Assessment
- Definition of the design of the Device
- Definition of factors related to User Uptake
- Definition of Other Factors related to Test Site experience of deploying and trialling the Device
- Definition of system performance in relation to time to activate, access to functionality and shut down
- Definition of number of control inputs to activate, access to functionality and shut down
- Definition of any further comments that the test site has in relation to system performance experienced during the FOT

In addition any manufacturer derived product information, including instruction manuals and any target performance manuals should also be collated at each test site for each device/application.

The completed templates should be completed in MS WORD or EXCEL format by the Test Site.
Instruction manual and any other manufacturer supplied information should be produced in Acrobat format (.pdf).

Both of these items should be sent to the WP4.10 leaders at MIRA.

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Table A1.1: Evaluation of trialled system in TeleFOT – FOT Definition (Worked Example)

TeleFOT Country Code	UK
TeleFOT FOT Code	DFOT2
Primary Function of System Evaluated	Green Driving Support System (GDS)
Secondary Function(s) of System Evaluated	Lane Departure Warning (LDW), Forward Collision Warning (FCW)
System Name	Foot-LITE
Evaluation completed by	Stewart Birrell - MIRA
Role in Test Site	Test Site Manager
E-Mail Contact Details	stewart.birrell@mira.co.uk
Telephone Contact Details	+44 024 7635 8073
Date of Evaluation	06/02/2012

Table A1.2: Specific ND System / Function Physical Definition (Worked Example)

Host Device			Screen Specification					Preferences	
Nomadic Device (Y/N)	Secondary function	Vehicle Mounting	Screen Size (cm - HxW)	Screen Resolution	Colour (Y/N)	Orientation	User Interface (Touch/Hard/ Soft Key)	User Stored Favourites (Y/N)	Customisable Preferences (Y/N)
Y	Smartphone	Windscreen	5.7 x 9.4	480 x 800	Y	Portrait	Touchscreen	Y	N

HMI Feedback				Unit Specification				Adjustability	
Visual (Y/N) - (Text/ Graphic)	Audio (Y/N) - (Speech/ Tone)	Haptic (Y/N) - (Location)	Principle Feedback	Unit size (cm - HxWxD)	Weight (g)	Battery Life - Standby (h)	Battery Life - Usage (mins)	Volume - (Simple/ Complex/No)	Brightness - (Simple/ Complex/No)
Y - Graphic	Y – Speech	N	Visual	12.2 x 6.7 x 1.1	157	490	380	Simple	Complex

Notes to Complete A1.2

Host Device

- Is the host device 'Nomadic' i.e. can be removed from the car after use? Does the device have a secondary function, if so what is this? How is the device mounted in the vehicle: Windscreen holder, Specific vehicle mounting or No specific mounting etc?
- *In the worked example the Host Device is a Smartphone upon which the GDS is an application, device mounted on the windscreen*

Screen Specification

- These questions relate to the physical properties of the screen of the host device: Screen size, Resolution, Colour, Orientation, User Interface
- *In the worked example the characteristics of the visual display is described*

Preferences

- Does the system allow user defined preferences or favourites to be established?
- *In the worked example, these were judged as Yes and No respectively*

HMI Feedback

- How is the feedback presented to the driver in the vehicle by the host device: Visual (Text/Graphical), Audio (Speech/Tone) or Haptic (Location of the haptic feedback). In what form is the feedback principally offered to the driver: Visual, Audio or Haptic
- *In the worked example the Host Device has both an audio and visual interface, visual is primary*

Unit Specification

- Relates to physical properties of the host device: Size, Weight and Battery life
- *In the worked example these aspects are described and data on battery life quoted from manufacturers specifications*

Adjustability

- Can the volume and brightness be adjusted by a reasonably experienced user to enable use in all driving scenarios: Is this process Simple, Complex or Not possible
- *In the worked example, these were judged as Simple (Auditory Volume) and Complex (Visual Brightness)*

Table A1.3: User Aspects 1 (User Uptake) Definition – Test Site Perceptions (Worked Example)

Usability				Benefits	
To what extent was the system used	Initial reaction to the system	Impressions change during the test	Reasons given for this change	Benefit of having access to system	Main reason for benefit
100	Positive	N/A	N/A	Large benefit	Safety

Trust	Design		Future Usage
System would provide accurate information	Opinion on Design of Device	Opinion on Design of User Interface	Future use & paying to use system
Moderate	Attractive design	Learning	26-50

Notes to Complete A1.3

This section can only be completed if the User Uptake questionnaire has been completed for the FOT. If multiple questionnaires have been completed at different stages throughout the FOT, please use the ‘Post’ FOT User Uptake Questionnaire (UUQ) results.

Usability

- To what extent was the system used - Refers to Q1a of UUQ - Answers available: 0, <25, 50-75, >75, 100 (this will be 100% for systems only analysed during DFOTs)
- Initial reaction to the system - Q2 - Very negative, Negative, Neutral, Positive, Very positive (can be completed for L & DFOTs)
- Impressions change during the test - Q3a - Considerably negative, Somewhat negative, Unchanged, Somewhat positive, Considerably positive (N/A for DFOTs)
- Reasons given for this change - Q3b & d - Convenience, Efficiency, Safety, Reliability, Usability, Other
- *In the worked example, the system was used 100% of the time as it used during a DFOT, with the initial reaction to the system being stated as positive. As participants only used the system on the one occasion changes in impressions were not applicable*

Benefits

- Benefit of having access to system - Q4a - No benefit, Small benefit, Moderate benefit, Large benefit, Very large benefit
- Main reason for benefit - Q4b - Convenience, Efficiency, Safety, Reliability, Usability, Other
- *In the worked example, the system was judged as being a large benefit and the main reason given for this were safety features*

Trust

- System would provide accurate information - Q5 - Not at all, Small, Moderate, Large, Completely
- *In the worked example, participants rated their trust in the system according to the UUQ as moderate*

Design

- Opinion on Design of Device - Q8 - Easy to carry, Easy to transfer, Attractive design, Quality, Size of screen, Design match
- Opinion on Design of User Interface - Q9 - Installation, Manual, Learning, Text on screen, Symbol size, Symbol meaning, Control (stationary), Control (driving), System response, Understand info, Amount of info, Help function, Error messages
- *In the worked example, the most common answers given by participants related to the attractive design and learning*

Future Usage

- Future use & paying to use system - Q11, 12 & 13 - Not use, Not pay, 1-10, 11-25, 26-50, 51-100, >100
- *In the worked example, between £26-50 was the average amount being prepared to pay*

Table A1.4: User Aspects 2 (Other Factors) Definition – Test Site Perceptions (Worked Example)

Usability				Reliability	
Ease to interpret information given by user	System responds fast enough to user changes	Ease to amend driving based on advice given	Ease of set up & installation	Systems would rarely crash or freeze	System would always start up
4	3	5	NA	2	3

Trust		Usefulness		User Support	
User would follow the advice given	Systems would generally give good advice	Most useful aspect of the system	Least useful aspect of the system	User Manual Supplied (Y/N) - (Online/Paper)	After Sales Support (Y/N) - (Online/Phone)
4	3	Safety features	Audio	Y - Both	N

Notes to complete A1.4

NB: Questions not taken from a generic TeleFOT questionnaire.

Ratings on a general scale of, the higher the score the better it performed, i.e.:

1 = Poor, difficult, disagree, never;
5 = Good, easy, agree, always.

- Usability: Based on the general opinions of participants how would you summarise their experience using the system.
- *In the worked example, the system was rated as being easy to interpret the information given and amend driving based on this feedback, with the system generally responding fast enough, but ease of installation was not applicable during the DFOT*

- Reliability: How would you rate the reliability of the system evaluated, both in terms of starting up and then crashing when in use.
- *In the worked example, the test site manger rated the system as not always starting up when requested and that it would on occasion freeze or crash during operation*

- Trust: Would participants generally follow the advice given by the system or ignore it, and what was the interpretation of the participants regarding the accuracy and completeness of the advice given.
- *In the worked example, trust in the system by participants was generally high*

- Usefulness: Based on participant's feedback what were the most and least useful aspects of the system (please indicate as many as you feel appropriate).
- *In the worked example, the safety features were rated as the most useful aspect of the system with the audio given the least*

- User Support: Is a user manual supplied with system (either online, a physical paper copy or both), and is there any aftersales support offered with the system (whether or not participants use this support is not important, just if it is offered).
- *In the worked example, both an online and physical manual were available (however these were never offered or used by the participants), with no aftersales support offered as the system is not a current market ready product*

Table A1.5: Usability – Timings Definition (Worked Example)

System Activation				Total Time to System Activation	System Adjustments		Time to System De-Activation
Main Menu	Primary Function	Primary Application	Auto Start-up		Primary Function	HMI Function	
47	NA	24	NA	71	21	21	23

Notes to Complete A1.5

Note all time recorded in seconds. If there is variability in any of these timings based upon any system configuration aspects, then please give range of timings and record possible reasons for this in the later comments section.

- Time to access 'Main Menu' or homepage of the host device, or first screen where multiple user options are available (i.e. not the disclaimer screen, passcode input, or screen unlock etc).
- *In the worked example, it took 47 seconds for the Smartphone to turn on and load the main menu*

- Time to access 'Primary Function' of Satnav system from the main menu (i.e. navigation to destination mode with NS(S or D), relevant route or destination traffic information with TI, or ability to present speed limit of current location with SLI etc).
- *In the worked example, the host device is a Smartphone so the primary function is considered to be a phone so this is N/A*

- Time to access 'Primary Application' of Smartphone system from the homepage (i.e. navigation to destination mode with NSS, or feedback being given in GDS).
- *In the worked example, it took a further 24 seconds to access the GDS application from the Smartphones main menu*

- Time for 'Auto Start-up' from ignition on to system being fully functional.
- *In the worked example, the Smartphone requires turning on so there is no auto start up, hence N/A*

- 'Total Time to System Activation' (i.e. from system off to fully functional).
- *In the worked example, the total time is the time to access the main menu, plus primary application, so 71 seconds in total*

- Time to adjust 'Primary Function' parameter (i.e. something that is central to the primary function of the system, namely change a destination with NS(S or D), change threshold of SA, or sensitivity of GDS or ACC.
- *In the worked example, the time to adjust the sensitivity of certain information presented was 21 seconds*

- Time to adjust 'HMI Function' (i.e. this will normally be changing the volume of the system, if no audio present then changing a visual aspect of the display).
- *In the worked example, the time to adjust the volume was also 21 seconds as it was accessed from the same menu*

- 'Time to System De-activation' (i.e. from fully functional to system off).
- *In the worked example, from the GDS being active and feeding back information to the diver to fully off was 23 seconds*

Table A1.6: Usability – Interaction Definition (Worked Example)

System Activation			Total Number to System Activation	System Adjustments		Number to System De-Activation
Main Menu	Primary Function	Primary Application		Primary Function	HMI Function	
1	NA	5	6	5	5	4

Notes to Complete A1.6

Note interactions with the host device should be calculated, whether pressing physical buttons on the device or interacting with the touchscreen. Within this analysis inputting multiple values on the same screen (e.g. entering a four digit PIN code or a 6 digit post (aka zip) code only count as one interaction). However, entering a post code followed by a street number, then selecting to confirm the address will count as three different interactions on different screens not just one.

- Number of menu levels, pages which require user input, or screens which have to be negotiated to access ‘Main Menu’ or homepage screen.
- *In the worked example, the number of interactions with the host device was calculated based on the same parameters as described previously in ‘Notes to Complete A1.4’*

- Number of menu levels, pages which require user input, or screens which have to be negotiated to access ‘Primary Function’ of Satnav system from the main menu.

- Number of menu levels, pages which require user input, or screens which have to be negotiated to access ‘Primary Application’ of Smartphone system from the homepage.

- ‘Total Number to System Activation’ (i.e. from system off to fully functional).

- Number of menu levels, pages which require user input, or screens which have to be negotiated to adjust ‘Primary Function’ parameter.

- Number of menu levels, pages which require user input, or screens which have to be negotiated to adjust ‘HMI Function’.

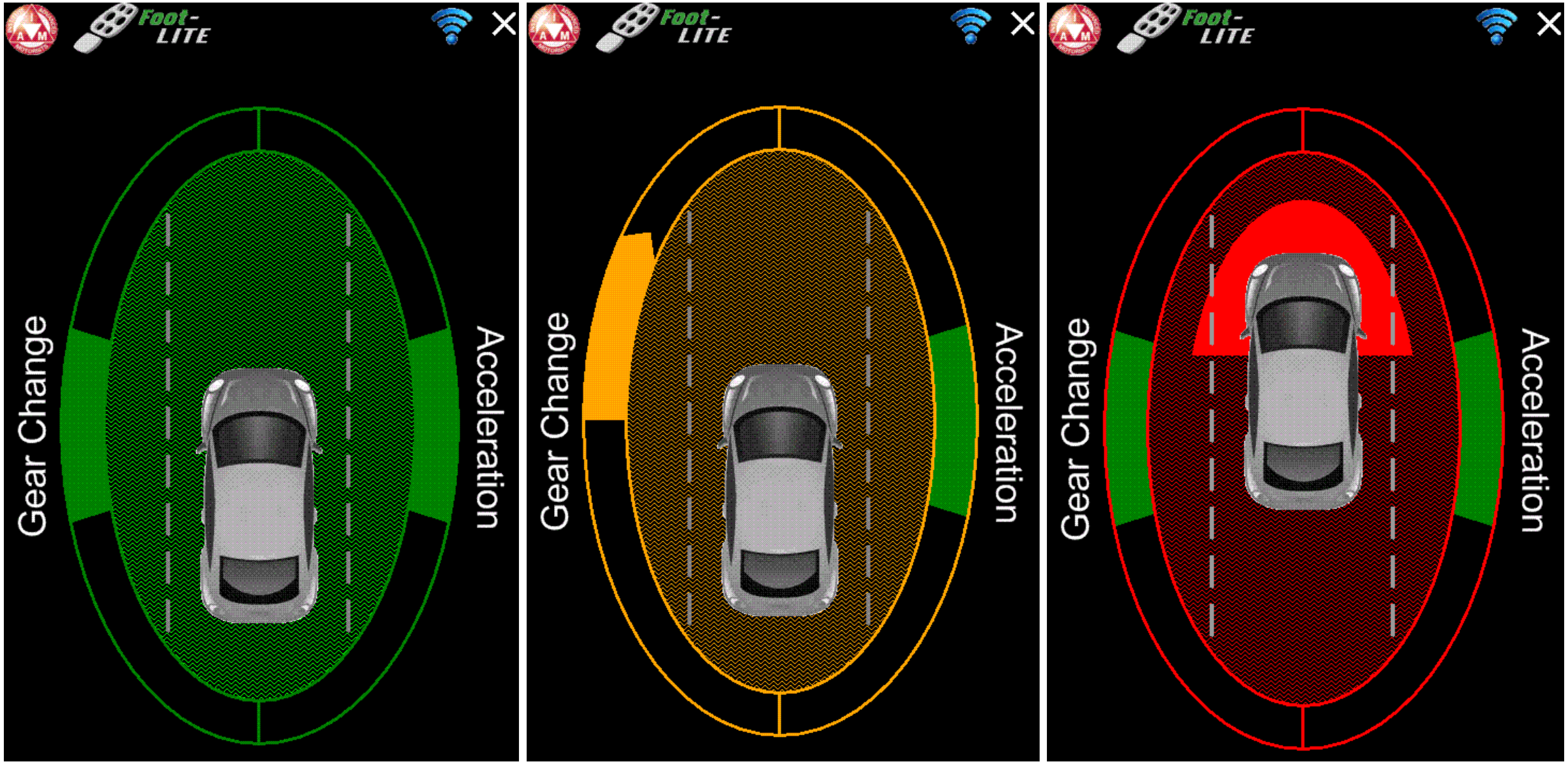
- ‘Number to System De-Activation’ (i.e. from fully functional to system off).

Table A1.7: Further Comments concerning ND performance observed in the FOT – (Worked Example)

Questions	Free Text Response
Please Indicate the TeleFOT FOT REFERENCE	UK DFOT2 – GDS: Foot-LITE
Please indicate here any comments you have regarding the Host Device	Participants liked the fact that the Foot-LITE system was hosted on a Smartphone as there was no need to carry another device into the car. As this was a DFOT no assumption can be made as to if participants would turn the system on for all journeys.
Please indicate here any comments you have regarding the User Uptake	Whilst participants were generally positive about the Foot-LITE system in the DFOTs some participants were irritated by the 'Lane positioning feedback' which was deemed too frequent and sensitive, this reduced user acceptance and future use.
Please indicate here any comments you have regarding Other issues - specifically reliability, usability and trust	As this was a DFOT the examiner controlled the system (start-up/shut down) and would reboot the system if it crashed or froze - which occurred to some extent on about 25% of journeys. This would not be tolerated by participants in an LFOT who would probably just not use the system in the future.
Please indicate here any comments you have regarding Timings and Number	Again as this was a DFOT the examiner controlled the system so there was no participant interaction.
Please indicate here any other comments you have	Foot-LITE was seen as a safety device first and foremost, with eco driving information an added value. Similar weather conditions were present through the trials.

Further Supporting Information – Please include Screenshots of HMI, Specific Issues etc (Worked Example)

UK DFOT2: The following images are screen shots of the ND display screen showing the GDS real-time feedback screen in operation.



ANNEX 2: COLLATED NATIONAL FOT SYSTEM TECHNICAL PERFORMANCE SPECIFICATIONS

See PDF for a tabular version of the results, or MS Excel Workbook ‘4.10.2_Collated Results’ for more detailed analysis.

Table A2.1: Evaluation of trialled system in TeleFOT – FOT Definition

FOT Code	FOT Info					ND Evaluation					
	TeleFOT Country Code	TeleFOT FOT Code	Primary Function	Secondary Function(s)	System Name	Evaluation completed by	Organisation	Role in Test Site	Email	Telephone	Date of Evaluation
GDFOT1	G	DFOT1	SI, SA	NSS	BLOM	Devid Will	IKA	Test Site Manager	will@ika.rwth-aachen.de	49 241 8025676	29.2.2012
ITLFOT1	IT	LFOT1	NSS	SI, SA	BLOM	Francesco Tesauri	Unimore	Test Site Manager	francesco.tesauri@unimore.it	39 (0)522 522663	23.2.2012
ITDFOT1	IT	DFOT1									
ITDFOT2	IT	DFOT2	NSS	TI, GDS	Easy-Road	Roberto Brignolo	CRF	Test Site Manager	roberto.brignolo@crf.it	39 011 9080534	28.3.2012
ESLFOT1	ES	LFOT1	NSS	SI, SA	BLOM	Henar Vega	Cidaut	Test Site Manager	marveg@cidaut.es	34 983 54 80 35	21.2.2012
ESLFOT2	ES	LFOT2									
ESDFOT1	ES	DFOT1	NSS	SI, SA	BLOM	Henar Vega	Cidaut	Test Site Manager	marveg@cidaut.es	34 983 54 80 35	21.2.2012
UKLFOT1	UK	LFOT1	NSS	SI, SA	BLOM	Steven Reed	Lboro	Test Site Manager	s.g.reed@lboro.ac.uk	44 1509 226955	5.3.2012
UKDFOT1	UK	DFOT1	NSS	SI, SA	BLOM	Steven Reed	Lboro	Test Site Manager	s.g.reed@lboro.ac.uk	44 1509 226955	5.3.2012
UKDFOT2	UK	DFOT2	GDS	FCW, LDW	Foot-LITE	Stewart Birrell	MIRA	Test Site Manager	stewart.birrell@mira.co.uk	44 024 7635 5073	6.2.2012
UKDFOT3	UK	DFOT3	FCW	LDW	Mobileye	Nadia Shehata	MIRA	Test Site Examiner	Nadia.shehata@mira.co.uk	44 024 7635 5318	16.2.2012
GRLFOT1	GR	LFOT1	NSS		TeleFOT App	Katia Pagle	ICCS	Test Site Manager	katia@iccs.gr	30 2107723865	30.3.2012
GRLFOT2	GR	LFOT2	NSS	SI	TeleFOT App	Katia Pagle	ICCS	Test Site Manager	katia@iccs.gr	30 2107723865	30.3.2012
GRLFOT3	GR	LFOT3	NSS	TI	TeleFOT App	Katia Pagle	ICCS	Test Site Manager	katia@iccs.gr	30 2107723865	30.3.2012
GRLFOT4	GR	LFOT4	NSS	SA	TeleFOT App	Katia Pagle	ICCS	Test Site Manager	katia@iccs.gr	30 2107723865	30.3.2012
GRDFOT1	GR	DFOT1	NSS	ADAS	TeleFOT App	Katerina Touliou	CERTH	Test Site Manager	touliouk@certh.gr	30 2310 498267	20.2.2012
GRDFOT2	GR	DFOT2	NSS, SI	ADAS	TeleFOT App	Katerina Touliou	CERTH	Test Site Manager	touliouk@certh.gr	30 2310 498267	20.2.2012
GRDFOT3	GR	DFOT3	NSS, SA	ADAS	TeleFOT App	Katerina Touliou	CERTH	Test Site Manager	touliouk@certh.gr	30 2310 498267	20.2.2012
FILFOT1	FI	LFOT1									
FILFOT2[1]	FI	LFOT2	GDS	TI, SI, SA	DRIVECO / LATIS	Johan Scholliers	VTT	Test Site Manager	johan.scholliers@vtt.fi	358 40 5370204	
FIDFOT1	FI	DFOT1									
FIDFOT2	FI	DFOT2									
FIDFOT3	FI	DFOT3									
FIDFOT4	FI	DFOT4	Driving Behaviour		Tele-ISA	Sami Koskinen	VTT	Technical Development	sami.koskinen@vtt.fi	358 40 516 2391	29.3.2012
FIDFOT5	FI	DFOT5	GDS		Tele-Bus	Johan Scholliers	VTT	Test Site Manager	johan.scholliers@vtt.fi	358 40 5370204	15.3.2012
SELFOT1	SE	LFOT1	SL, SA	GDS	Specific system	Pontus Engelbrektsson	Chalmers	Test Site Manager	Pontus.engelbrektsson@chalmers.se	46 31 7721397	2.3.2012
SELFOT2	SE	LFOT2	NNS	GDS, TI	Garmin Nuvi	Pontus Engelbrektsson	Chalmers	Test Site Manager	Pontus.engelbrektsson@chalmers.se	46 31 7721397	2.3.2012
SELFOT3	SE	LFOT3									
SELFOT4	SE	LFOT4	TI, Route Choice		Trelocity android app	Pontus Engelbrektsson	Chalmers	Test Site Manager	Pontus.engelbrektsson@chalmers.se	46 31 7721397	2.3.2012
FRLFOT1	FR	LFOT1									

Notes:

[1] FILFOT2 used two devices: the user's Smartphone and the DRIVECO module, which is attached to the vehicle's OBD-II interface. On the phone a DRIVECO application is installed. The DRIVECO module sends all data to the phone, only three LEDs show if the device is functioning. All DRIVECO alerts are generated by the phone application. Therefore FILFOT2 will have two lines of input FILFOT2(D) for DRIVECO and FILFOT2(L) for LATIS.

(yellow highlight) Missing information for FOT, either data not yet provided or specific FOT has been excluded from the TeleFOT project

Table A2.2: Specific ND System / Function Physical Definition

FOT Code	Host Device			HMI Feedback				Screen Specification					Unit Specification				Adjustability		Preferences	
	Nomadic (Y/N)	Main function	Vehicle Mounting	Visual (Y/N) - (Text/Graphic)	Audio (Y/N) - (Speech/Tone)	Haptic (Y/N) - Location	Principal Feedback	Screen Size (cm - HxW)	Screen Resolution	Colour (Y/N)	Orientation	User Interface (Touch/Hard/ Soft Key)	Unit size (cm - HxWxD)	Weight (g)	Battery Life - Standby (h)	Battery Life - Usage (mins)	Volume (Simple/ Complex/No)	Brightness (Simple/ Complex/No)	User Stored Favourites (Y/N)	Customisable Preferences (Y/N)
GDFOT1	Y	Satnav	Windscreen	Y - Graphic	Y - Speech	N	Visual	4.3" Diagonal	480 x 272	Y	Landscape	Touch	7.8 x 12.2 x 1.3	164		60-120	Simple	No	N	Y
ITLFOT1	Y	Smartphone	Windscreen	Y - Graphic	Y - Speech	N	Visual	3.2" Diagonal	400 x 240	Y	Portrait	Touch & Soft	11.3 x 5.6 x 1.3	118	400	300	Simple	Simple	Y	Y
ITDFOT2	Y	Satnav	Windscreen	Y - Graphic	Y - Speech	N	Visual	3.5" Diagonal	320 x 240	Y	Portrait	Touch	14.0 x 8.2 x 2.0	190	200	380	Simple	Simple	Y	Y
ESLFOT1	Y	Satnav	Windscreen	Y - Both	Y - Both	N	Visual	4.3" Diagonal	480 x 272	Y	Landscape	Touch & Hard	7.8 x 12.2 x 1.3	164			Simple	Simple	Y	Y
ESDFOT1	Y	Satnav	Windscreen	Y - Both	Y - Both	N	Visual	4.3" Diagonal	480 x 272	Y	Landscape	Touch & Hard	7.8 x 12.2 x 1.3	164			Simple	Simple	Y	Y
UKLFOT1	Y	Satnav	Windscreen	Y - Graphic	Y - Speech	N	Visual	5.3 x 9.5	640 x 480	Y	Landscape	Touch	7.5 x 12.2 x 1.4	164			Simple	Simple	Y	Y
UKDFOT1	Y	Satnav	Windscreen	Y - Graphic	Y - Speech	N	Visual	5.3 x 9.5	640 x 480	Y	Landscape	Touch	7.5 x 12.2 x 1.5	164			Simple	Simple	Y	Y
UKDFOT2	Y	Smartphone	Windscreen	Y - Graphic	Y - Speech	N	Visual	5.7 x 9.4	800 x 420	Y	Portrait	Touch & Hard	12.2 x 6.7 x 1.1	157	490	380	Simple	Complex	Y	N
UKDFOT3	N	ADAS	Specific - Fixed to dash	Y - Both	Y - Tone	N	Visual	3.6 x 3.6	Unknown	Y	NA (round)	Hard	5.0 x 5.0 x 5.0	NA	Powered by vehicle 12v		Simple	No	N	Y
GRLFOT1	Y	Smartphone	Windscreen	Y - Graphic	Y - Speech	N	Visual	11.2 x 5.7	800 x 480	Y	Portrait	Touch & Hard	11.2 x 5.7 x 1.1	157	490	380	Simple	Complex	Y	N
GRLFOT2	Y	Smartphone	Windscreen	Y - Graphic	Y - Speech	N	Visual	11.2 x 5.7	800 x 480	Y	Portrait	Touch & Hard	11.2 x 5.7 x 1.1	157	490	380	Simple	Complex	Y	N
GRLFOT3	Y	Smartphone	Windscreen	Y - Graphic	Y - Speech	N	Visual	11.2 x 5.7	800 x 480	Y	Portrait	Touch & Hard	11.2 x 5.7 x 1.1	157	490	380	Simple	Complex	Y	N
GRLFOT4	Y	Smartphone	Windscreen	Y - Graphic	Y - Speech	N	Visual	11.2 x 5.7	800 x 480	Y	Portrait	Touch & Hard	11.2 x 5.7 x 1.1	157	490	380	Simple	Complex	Y	N
GRDFOT1	Y	Smartphone	Windscreen	Y - Graphic	Y - Speech	N	Visual	3.7" Diagonal	800 x 480	Y	Portrait	Touch	11.8 x 6.0 x 1.2	129	430	720	Simple	Complex	Y	N
GRDFOT2	Y	Smartphone	Windscreen	Y - Graphic	Y - Speech	N	Visual	3.7" Diagonal	800 x 480	Y	Portrait	Touch	11.8 x 6.0 x 1.3	129	430	720	Simple	Complex	Y	N
GRDFOT3	Y	Smartphone	Windscreen	Y - Graphic	Y - Speech	N	Visual	3.7" Diagonal	800 x 480	Y	Portrait	Touch	11.8 x 6.0 x 1.4	129	430	720	Simple	Complex	Y	N
FILFOT2(D)	N	GDS	Specific	Y - Text	Y - Tone	N	Audio	NA - LEDs on DRIVECO Module					9.0 x 4.0 x 2.0	100	Powered by vehicle 12v		No	No	N	Y
FILFOT2(L)	Y	Smartphone	Specific	Y - Both	Y - Speech	N	Visual	NA - Driver's Smartphone		Y	Portrait	Hard	NA - Driver's own Smartphone				Simple	No	N	N
FIDFOT4	N	Specific system	Specific - Hidden	NA - Offline	NA	NA	NA	NA	NA	NA	NA	iButton	9.0 x 9.0 x 5.0		Powered by vehicle 12v		NA	NA	N	N
FIDFOT5	N	Specific system	Specific	Y - Both	N	N	Visual	21.0 x 17.0		Y	Landscape	Touch	NA	NA	Powered by vehicle 12v		NA	No	N	N
SELFOT1	Y	Specific system	Specific - Bolted to dash	Y - Graphic	Y - Tone	N	Visual	6.0 x 9.0		Y	Landscape	Touch	8.0 x 12.0	NA	Powered by vehicle 12v		NA	NA	N	Y
SELFOT2	Y	Satnav	Windscreen	Y - Both	Y - Both	N	Both		480 x 272	Y	Landscape	Touch	7.2 x 12.2 x 2.0	170		240	Complex	Complex	Y	Y
SELFOT4	Y	Smartphone		Y - Both	N	N	Visual	NA - Driver's own Smartphone?			Portrait	Touch	NA - Driver's own Smartphone				NA	NA	Y	Y

Notes:
Host Device - Is the host device 'Nomadic' i.e. can be removed from the car after use? Does the device have a secondary function, if so what is this? How is the device mounted in the vehicle: Windscreen holder, Specific vehicle mounting or No specific mounting etc?
HMI Feedback - How is the feedback presented to the driver in the vehicle by the host device: Visual (Text/Graphical), Audio (Speech/Tone) or Haptic (Location of the haptic feedback). What is the principle format of the feedback: Visual, Audio or Haptic
Screen Specification - These questions relate to the physical properties of the screen of the host device: Screen size, Resolution, Colour, Orientation, User Interface
Unit Specification - Relates to physical properties of the host device: Size, Weight and Battery life
Adjustability - Can the volume and brightness be adjusted by a reasonably experienced user to enable use in all driving scenarios: Is this process Simple, Complex or Not possible
Preferences - Does the system allow user defined preferences or favourites to be established?

Table A2.3: User Aspects 1 (User Uptake) Definition – Test Site Perceptions

FOT Code	Usability				Benefits		Trust	Design		Future Usage
	1. To what extent was the system used	2. Initial reaction to the system	3. Impressions change during the test	3a. Reasons given for this change	4. Benefit of having access to system	4a. Main reason for benefit	5. System would provide accurate information	6a. Opinion on Design of Device	6b. Opinion on Design of User Interface	7. Future use & paying to use system
GDFOT1	100	Neutral/Positive	Somewhat Negative	Usability	Moderate	NA	Moderate	Unattractive Design	Unattractive Design	1-10 (monthly)
ITLFOT1	<25	Positive	Unchanged	Usability, Reliability, Efficiency, Convenience	Moderate	Travel comfort, Convenience, Safety	Moderate	Easy to carry & transfer, Screen Size not appropriate	Symbols, Control (driving), Poor system response	1-10 (monthly)
ITDFOT2	100	Positive	Somewhat Negative	Other	Large	Safety	Moderate	Attractive design	Learning	26-50 (one off)
ESLFOT1	100	Positive	Somewhat Negative	Problems with positioning	Moderate	Speed compliance and nav to unknown destinations	Moderate	Easy to carry (light), Size of screen	Attractive, Easy to use	Not pay
ESDFOT1										
UKLFOT1	<25	Neutral	Considerably negative	Usability, Reliability	Small	Other	Small			26-50 (one off)
UKDFOT1										
UKDFOT2	100	Positive	NA	NA	Large	Safety	Moderate	Attractive design	Learning	26-50 (one off)
UKDFOT3	100	Neutral	NA	NA	Small	Safety	Large	NA	Understand info	Not pay
GRLFOT1	>75	Positive	NA	NA	Large	Convenience	Large	Easy to carry & transfer, Attractive design, Quality, Size of screen	Installation, Learning, Symbol meaning, Control (stationary), System response, Understand info,	11-25 (one off)
GRLFOT2	>75	Positive	NA	NA	Large	Convenience, Safety	Large	Easy to carry & transfer, Attractive design, Quality, Size of screen	Installation, Learning, Symbol meaning, Control (stationary), System response, Understand info,	11-25 (one off)
GRLFOT3	>75	Positive	NA	NA	Large	Convenience, Safety, Efficiency	Large	Easy to carry & transfer, Attractive design, Quality, Size of screen	Installation, Learning, Symbol meaning, Control (stationary), System response	11-25 (one off)
GRLFOT4	>75	Positive	NA	NA	Very Large	Convenience, Safety	Large	Easy to carry & transfer, Attractive design, Quality, Size of screen	Installation, Learning, Symbol meaning, Control (stationary), System response, Understand info, Amount of info	11-25 (one off)
GRDFOT1	100	Neutral	NA	NA	Moderate	Travel time minimised	Moderate	Attractive design	Error messages	11-25 (one off)
GRDFOT2	100	Positive	NA	NA	Moderate	Increased safety, More efficient traffic flow	Moderate	Attractive design	Error messages	11-25 (one off)
GRDFOT3	100	Positive	NA	NA	Moderate	Increased safety, More efficient traffic flow	Moderate	Attractive design	Error messages	11-25 (one off)
FILFOT2		GDS: Positive	TI, GDS, SA: Negative	TI: Reliability, Usability; GDS: Usability	TI, GDS, SA: Small/No	GDS: Lack of trust in info; SA: Service now free on many Smartphones	TI, GDS, SA: Moderate	NA	TI: Poor interface; GDS: Irritating sounds; SA: Learning	See UUQ
FIDFOT4	>75	Positive			Small/Moderate	Familiar schedules, no effect whether guiding device or not. Largest benefit for new drivers	Moderate/Large			Not pay
FIDFOT5	>75	Positive	Somewhat negative	Pressures to keep to timetables, indicates always overspeed	Moderate	Mostly beneficial for new drivers; according to experienced drivers the indication is according	Moderate	OK	OK	NA
SELFOT1	100	Negative			Moderate		Small	Usability - Lots of bugs	Positive	Not pay
SELFOT2	<10	Positive	Somewhat Negative but increased with time	Green driving and traffic info, not as good as imagined. With time learned the limitations of the devise and appraised it higher	Moderate	Convenience, less uncertainty regarding navigation, traffic and time of arrival	NNS: Large; GDS: Moderate	Positive	Positive	Not pay
SELFOT4	<25	Positive	Somewhat negative	No effect on travel times, bad user interface, poor access to information	Moderate	Easy access to information, being able to plan ahead	Mixed	NA	Not that good	0-10 (one off)

Notes:
1. To what extent was the system used - Refers to Q1a of UUQ - Answers available: 0, <25, 50-75, >75, 100 (this will be 100% for systems only analysed during DFOTs)
2. Initial reaction to the system - Q2 - Very negative, Negative, Neutral, Positive, Very positive (can be completed for L & DFOTs)
3. Impressions change during the test - Q3a - Considerably negative, Somewhat negative, Unchanged, Somewhat positive, Considerably positive (N/A for DFOTs)
3a. Reasons given for this change - Q3b & d - Convenience, Efficiency, Safety, Reliability, Usability, Other
4. Benefit of having access to system - Q4a - No benefit, Small benefit, Moderate benefit, Large benefit, Very large benefit
4a. Main reason for benefit - Q4b - Convenience, Efficiency, Safety, Reliability, Usability, Other
5. System would provide accurate information - Q5 - Not at all, Small, Moderate, Large, Completely
6a. Opinion on Design of Device - Q8 - Easy to carry, Easy to transfer, Attractive design, Quality, Size of screen, Design match
6b. Opinion on Design of User Interface - Q9 - Installation, Manual, Learning, Text on screen, Symbol size, Symbol meaning, Control (stationary), Control (driving), System response, Understand info, Amount of info, Help function, Error messages
7. Future use & paying to use system - Q11, 12 & 13 - Not use, Not pay, 1-10, 11-25, 26-50, 51-100, >100

Table A2.4: User Aspects 2 (Other Factors) Definition – Test Site Perceptions

FOT Code	Usability				Reliability		Trust		Usefulness		User Support	
	Ease to interpret information given by user	System responds fast enough to user changes	Ease to amend driving based on advice given	Ease of set up & installation	Systems would rarely crash or freeze	System would always start up	User would follow the advice given	Systems would generally give good advice	Most useful aspect of the system	Least useful aspect of the system	User Manual Supplied (Y/N) - (Online/Paper)	After Sales Support (Y/N) - (Online/Phone)
GDFOT1	2	3	1	4	2	3	2	2	SI	Nav	N	N
ITLFOT1	3	3	4	2	2	3	4	3	Convenience		Y - Both	Y - Both
ITDFOT2	4	3	4	3	2	5	4	3	Traffic efficiency		Y - Both	Y
ESLFOT1	4	3	4	4	3	3	2	2	Speed limit info	Nav errors (map updates, positioning problems)	Y - Paper	NA
ESDFOT1												
UKLFOT1	2	3	3	2	3	3	3	3	Speed alerts	Out of date	Y - Online	NA
UKDFOT1												
UKDFOT2	4	3	5	NA	2	2	4	3	Safety features	Audio	Y - Both	NA
UKDFOT3	3	4	5	5	4	5	3	3	Headway	Pedestrian Collision warning	Y - Both	Y - Both
GRLFOT1	4	4	5	5	3	4	3	4	Navigation instructions (audio & visual), History of destinations	Overview of a performed route (provides a function that allows you to see a video of the previous routes)	Y - Both	Y - Phone
GRLFOT2	4	4	5	5	3	4	3	4	Navigation instructions (audio & visual), History of destinations, Speed limit of the current road information (visual)	Overview of a performed route (provides a function that allows you to see a video of the previous routes), Not updated speed limits	Y - Both	Y - Phone
GRLFOT3	4	4	5	5	3	4	3	4	Navigation instructions (audio & visual), History of destinations, Speed limit of the current road information (visual)	Overview of a performed route (provides a function that allows you to see a video of the previous routes), Not updated speed limits	Y - Both	Y - Phone
GRLFOT4	4	4	5	5	3	4	3	4	Navigation instructions (audio & visual), History of destinations, Speed alert in case of exceeding the speed limit (visual and audio)	Overview of a performed route (provides a function that allows you to see a video of the previous routes), Not updated speed limits	Y - Both	Y - Phone
GRDFOT1	4	3	4	NA	3	3	3	4	Provided really the fastest routes	Audio	Y - Both	Y - Phone
GRDFOT2	4	3	3	NA	3	3	3	3	Increased awareness of speed limit	Inaccurate speed limit database	Y - Both	Y - Phone
GRDFOT3	3	3	3	NA	3	3	3	3	Increased awareness of speeding behaviour	Inaccurate speed limit database	Y - Both	Y - Phone
FILFOT2	TI, GDS, SA: 3	NA	TI:NA;GDS:4;SA:3	TI, SA: 5; GDS: 2	TI, GDS, SA: 2	TI:5;GDS:3;SA:NA	TI: 3; GDS, SA: NA	TI, GDS, SA: 3			Y - Paper	Y - Both
FIDFOT4	4		4	NA	4	5	3	4	Increased safety; Reduced stress; Driving style comparison to other family members		N	Y - Phone
FIDFOT5	3	NA	4	NA	3	3	3	3	Sticking to timetables	Driving comfort decreases		
SELFOT1				NA	2	5		3			Y	
SELFOT2			4	4	5	5		4	Navigation, time to destination, speed camera warning	Green driving	Y - Both	Y
SELFOT4					4	4		3		Did only work for some areas	Y - Online	Y - Mail

Notes:

Ratings on a general scale of: *1 = Poor, difficult, disagree, never; 5 = Good, easy, agree, always* . Questions not taken from a generic TeleFOT questionnaire.

Usability - Based on the general opinions of participants how would you summarise their experience using the system.
Reliability - How would you rate the reliability of the system evaluated, both in terms of starting up and then crashing when in use.
Trust - Would participants generally follow the advice given by the system or ignore it, and what was the interpretation of the participants regarding the accuracy and completeness of the advice given.
Usefulness - Based on participants feedback what were the most and least useful aspects of the system (please indicate as many as you feel appropriate).
User Support - Was the system supplied with a User Manual either online or physical paper version? Is there any After Sales Support offered either online help files, email or telephone support etc?

Table A2.5: Usability – Timings Definition

FOT Code	Time to Access				Total Time to Primary Use	Time to Adjust		Time to Exit and Shut Down
	Main Menu	Primary Function	Primary Application	Auto Start-up		Primary Function	HMI Function	
GDFOT1	25	100	NA	NA	125	20	10	25
ITLFOT1	38	NA	40	NA	78	45	1	7
ITDFOT2	60	NA	30	NA	90	10	10	20
ESLFOT1	23	70	NA	NA	93	16	8	8
ESDFOT1	23	70	NA	NA	93	16	8	8
UKLFOT1	23	24	NA	NA	47	5	5	20
UKDFOT1	23	24	NA	NA	47	5	5	20
UKDFOT2	47	NA	24	NA	71	21	21	23
UKDFOT3	NA	NA	NA	12	12	2	1	2,5
GRLFOT1	55	NA	13	NA	68	17	14	8
GRLFOT2	55	NA	13	NA	68	17	14	8
GRLFOT3	55	NA	13	NA	68	17	14	8
GRLFOT4	55	NA	13	NA	68	17	14	8
GRDFOT1	60	NA	15	NA	75	26	24	19
GRDFOT2	60	NA	15	NA	75	26	25	19
GRDFOT3	60	NA	15	NA	75	29	27	20
FILFOT2(D)	NA	NA	NA	16	16	NA	7	NA
FILFOT2(L)	30	NA	20	NA	50	NA	5	NA
FIDFOT4	NA	NA	NA	1	1	NA	NA	1
FIDFOT5	NA	NA	NA	1	1	NA	NA	1
SELFOT1					0			
SELFOT2	2	?	?	3	5			0
SELFOT4	NA - User's own Smartphone				NA	NA - User's own Smartphone		NA

Notes:

Time to access 'Main Menu' or homepage of the host device, or first screen where multiple user options are available (i.e. not the disclaimer screen, passcode input, or screen unlock etc).

Time to access 'Primary Function' of Satnav system from the main menu (i.e. navigation to destination mode with NS(S or D), relevant route or destination traffic information with TI, or ability to present speed limit of current location with SLI etc).

Time to access 'Primary Application' of Smartphone system from the homepage (i.e. navigation to destination mode with NSS, or feedback being given in GDS).

Time for 'Auto Start-up' from ignition on to system being fully functional.

Total Time to System Activation' (i.e. from system off to fully functional).

Time to adjust 'Primary Function' parameter (i.e. something that is central to the primary function of the system, namely change a destination with NS(S or D), change threshold of SA, or sensitivity of GDS or ACC.

Time to adjust 'HMI Function' (i.e. this will normally be changing the volume of the system, if no audio present then changing a visual aspect of the display).

Time to System De-Activation' (i.e. from fully functional to system off).

Table A2.6: Usability – Interaction Definition

FOT Code	Number to Access			Total Number to Primary Use	Number to Adjust		Number to Exit and Shut Down
	Main Menu	Primary Function	Primary Application		Primary Function	HMI Function	
GDFOT1	2	42	NA	44	8	6	1
ITLFOT1	1	NA	1	2	6	1	2
ITDFOT2	1	4	NA	5	3	3	3
ESLFOT1	1	1	NA	2	7	2	1
ESDFOT1	1	1	NA	2	7	2	1
UKLFOT1	1	2	NA	3	3	3	3
UKDFOT1	1	2	NA	3	3	3	3
UKDFOT2	1	NA	5	6	5	5	4
UKDFOT3	0	NA	0	0	3	1	0
GRLFOT1	1	NA	2	3	8	3	4
GRLFOT2	1	NA	2	3	8	3	4
GRLFOT3	1	NA	2	3	8	3	4
GRLFOT4	1	NA	2	3	8	3	4
GRDFOT1	1	NA	2	3	8	3	4
GRDFOT2	1	NA	2	3	9	3	4
GRDFOT3	1	NA	2	3	9	3	4
FILFOT2(D)	1	NA	NA	1	NA	4	1
FILFOT2(L)	2	NA	NA	2	NA	3	3
FIDFOT4	0	NA	0	0	NA	NA	0
FIDFOT5	0	NA	0	0	NA	NA	0
SELFOT1				0			
SELFOT2	1	1	NA	2	1	2	0
SELFOT4	NA - User's own Smartphone			0	NA - User's own Smartphone		

Notes:
Number of menu levels, pages which require user input, or screens which have to be negotiated to access ‘Main Menu’ or homepage screen.
Number of menu levels, pages which require user input, or screens which have to be negotiated to access 'Primary Function’ of Satnav system from the main menu.
Number of menu levels, pages which require user input, or screens which have to be negotiated to access 'Primary Application’ of Smartphone system from the homepage.
Total Number to System Activation' (i.e. from system off to fully functional).
Number of menu levels, pages which require user input, or screens which have to be negotiated to adjust ‘Primary Function’ parameter.
Number of menu levels, pages which require user input, or screens which have to be negotiated to adjust ‘HMI Function’.
Number to System De-Activation' (i.e. from fully functional to system off).

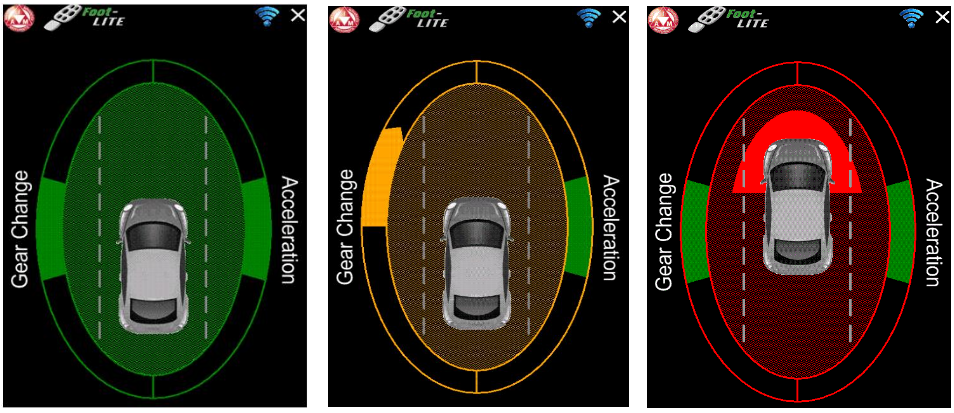
Table A2.7: Further Comments concerning ND performance observed in the FOT

FOT Code	Please indicate here any comments you have regarding the Host Device	Please indicate here any comments you have regarding the User Uptake	Please indicate here any comments you have regarding Other issues - specifically reliability, usability and trust	Please indicate here any comments you have regarding Timings and Number	Please indicate here any other comments you have
GDFOT1	Software not state of the art, bad graphical visualisation	Small display, bad resolution, slow, entering a destination quite complicated, unattractive design	Advices are very late (sometimes too late), navigation with coordinates not handy, speed limit database sometimes wrong	Very slow device, touch screen very slow, setting a destination by coordinates needs lots of button presses, difficult to shut down the device (sometimes no reaction)	
ITLFOT1	Some users found the device very convenient and handy, some that the screen was too small for navigation, some found the connection to external Bluetooth antenna tricky.				
ITDFOT2	The device was designed in 2008 while test were made end of 2011, beginning 2012. For this reason the device was necessarily not in line with most recent PNDs. As this was a DFOT no assumption can be made as to if participants would turn the system on for all journeys.	Participants were generally positive about the three functions proposed. The green driving support function was still at prototype stage and, in general, it was remarked that a link to contextual traffic situation would be greatly beneficial for the function itself. Moreover a number of participants remarked that the audio suggestion about gear selection or braking was irritating.	As this was a DFOT the examiner controlled the system (start-up/shut down). Some failures of the acquisition system late discovered (during the analysis) implied to repeat a second time the test. In order to avoid a pre-knowledge effect, new participants were selected. In general, this is rather surprising, the trust about information is not high and it slightly decreased after the test. This was due to some difficulty to interpret some indications and maps not totally updated in one point of the route.		On the Magneti Marelli PND the Navigation support and Traffic info were associated function, while green driving support was an alternative function. Similar weather conditions were present through the trials
SPLFOT1	Sometimes it was difficult to fix satellites and the process can take up too many minutes to make the first GPS fix.	In general, the menus are easy to learn and to use	In some cases, reliability has been questioned due to signal issues (positioning problems)		
UKLFOT1	The device was chosen so as to be unfamiliar to the trial participants – this precluded the use of Garmin or TomTom type devices. Unfortunately the device did not perform like a market leader and as such low use was recorded throughout the trial period	User uptake will be low – most participants used the device to record day to day behaviour (turning the device on) but few used it regularly to navigate – commonly 1 to 2 times per month.	Reliability was generally good with only ~3 devices failing completely (some due to being dropped etc)		
UKDFOT2	Participants liked the fact that the Foot-LITE system was hosted on a Smartphone as there was no need to carry another device into the car. As this was a DFOT no assumption can be made as to if participants would turn the system on for all journeys.	Whilst participants were generally positive about the Foot-LITE system in the DFOTs some participants were irritated by the 'Lane positioning feedback' which was deemed too frequent and sensitive, this reduced user acceptance and future use.	As this was a DFOT the examiner controlled the system (start up/shut down) and would reboot the system if it crashed or froze - which occurred to some extent on about 25% of journeys. This would not be tolerated by participants in an LFOT who would probably just not use the system in the future.	Again as this was a DFOT the examiner controlled the system so there was no participant interaction.	Foot-LITE was seen as a safety device first and foremost, with eco driving information an added value.
UKDFOT3	The device is fixed semi-permanently to the vehicle so it has not been possible to take weight measurements of Mobileye. It is also not possible to report a battery time since Mobileye runs off the vehicle and has no battery of its own. It should also be noted that whilst the user interface input has been described as 'hard key' the user during the trials has no need to touch the device.	The majority of participants who tested Mobileye would definitely change the sensitivity of different settings on the device, namely the headway warning threshold. A lot of people found Mobileye too intrusive and the sound to irritating; this might inhibit future user uptake.	The Lane Deviation Warning occasionally rang for the wrong side of the road when a participant was close to leaving lane. This rarely occurred but shook the drivers' trust in the device when it did. People also thought that the Lane Deviation Warning was not accurate enough and did not always alert them when they were close.	System is automatically activated and deactivated via the ignition, but should the user wish to do this manually e.g. turn it off whilst the engine is running, this takes approximately 1-2 seconds and one button press. To turn it on: 1-2 seconds, 1 button press. However it would only be used manually or manually adjusted by an examiner before or after a trial session.	
GRLFOT1	The size of the device was adequate for presenting navigation information even in larger vehicles that participated in the study (for which the cabin is bigger and therefore the distance between the driver and the device is larger comparing to normal cars).	Most participants would use the navigation system if it was for navigation support in unfamiliar places. However due to their participation in the TeleFOT study, some of the participants used it also for their common trips.	Sometimes the information presentation was delayed comparing to the actual situation. The users reported that they learned the way that the information was presented with time (learning by exposure).	In some cases participants reported delays in first GPS fix. For all of these cases the device was repaired. Participants also reported that after a loss of GPS the device was able to fix it again quite fast (e.g. when passing under a bridge or in heavily dense areas).	Participants were satisfied in general by the navigation functionality. They would like to have the opportunity to scroll over the map and see the remaining route (this option was not provided by the specific navigation s/w).
GRLFOT2	The size of the device was adequate for presenting navigation information and speed limit information even in larger vehicles that participated in the study (for which the cabin is bigger and therefore the distance between the driver and the device is larger comparing to normal cars).	Most participants would use the navigation and the speed limit information function if it was for navigation support in unfamiliar places or in larger trips. However due to their participation in the TeleFOT study, most of the participants used it also for their common trips.	Sometimes the information presentation was delayed comparing to the actual situation. The users reported that they learned the way that the information was presented with time (learning by exposure). Also in some cases the speed limits were not reliable; the users reported that they would like to have real time speed limits on their devices.	In some cases participants reported delays in first GPS fix. For all of these cases the device was repaired. Participants also reported that after a loss of GPS the device was able to fix it again quite fast (e.g. when passing under a bridge or in heavily dense areas).	Participants were satisfied in general by the navigation and the speed limit functionality. They would like to have the opportunity to scroll over the map and see the remaining route (this option was not provided by the specific navigation s/w) and they would like to receive real time speed limits.

GRLFOT3	The size of the device was adequate for presenting navigation information and the overview of the traffic information. However some of the participants reported that visuals of the en route traffic information could be larger.	Most participants would use the navigation and the traffic information function in unfamiliar places in the Attika region (the traffic information function was available only for the Attika region, meaning Athens and its suburbs). However due to their participation in the TeleFOT study, most of the participants used it also for most of their trips.	Sometimes the information presentation was delayed comparing to the actual situation. The users reported that they learned the way that the information was presented with time (learning by exposure). Also an improvement was proposed for the traffic information function, namely, to take into account the performed route and to provide only the relevant information to the driver and even alternative routes (dynamic navigation with traffic information).	In some cases participants reported delays in first GPS fix. For all of these cases the device was repaired. Participants also reported that after a loss of GPS the device was able to fix it again quite fast (e.g. when passing under a bridge or in heavily dense areas).	Participants were satisfied in general by the navigation and the traffic information functionality. They would like to have the opportunity to scroll over the map and see the remaining route (this option was not provided by the specific navigation s/w) and they would like to receive dynamic navigation.
GRLFOT4	The size of the device was adequate for presenting navigation information even in larger vehicles that participated in the study (for which the cabin is bigger and therefore the distance between the driver and the device is larger comparing to normal cars). Speed alerts were considered useful and most participants enjoyed having access to this functionality even if not all the speed limits were accurate.	Most participants would use the navigation and the speed alert function even in common trips and especially if it was for support in unfamiliar places or in larger trips.	Sometimes the information presentation was delayed comparing to the actual situation. The users reported that they learned the way that the information was presented with time (learning by exposure). Also in some cases the speed limits were not reliable; the users reported that they would like to have real time speed limits on their devices, but even so they considered the function of high value	In some cases participants reported delays in first GPS fix. For all of these cases the device was repaired. Participants also reported that after a loss of GPS the device was able to fix it again quite fast (e.g. when passing under a bridge or in heavily dense areas).	Participants were satisfied in general by the navigation and the speed alert functionality. They would like to have the opportunity to scroll over the map and see the remaining route (this option was not provided by the specific navigation s/w) and they would like to have access through their device in real time speed limits.
GRDFOT1	Participants followed the route suggested by the NAV as this was part of the testing procedure. Routes chosen by the NAV system were perceived as faster. Occasionally, participants had difficulty understanding what they were requested to do. For example, in some intersections they thought the advice to turn right or left was somewhat late (delayer) and others had difficulties to understand the suggested direction to follow in one roundabout was.	Audio should be further adapted in order to provide more precise info (for example, sometimes it advised users to stay on the right side when they had to go left in order to take a left turn). Provided really the fastest routes, sometimes it was surprisingly effective in this aspect. Most participants would use the navigation system if it was for navigation support in unfamiliar places. Collision Avoidance Warning was regarded as useful and they reported that it could be effective if used for longer period of time. However, the sound (not the haptic) for the lane departure warning (rubble strips sound) was a bit annoying and sometimes it was described as "off" (e.g. in curves with more than one lines).	Sometimes participants were annoyed by the sudden appearance of a window where they were asked if they wanted to close the application. They had to close the window in order to continue with the navigated journey. The TeleFOT application rarely crashed (2-3 times).	Sometimes timing of information (vocal) was a bit delayed for the participant to be able to change route or follow the suggested turn.	Participants were satisfied by certain HMI features and the navigation through certain streets that they thought would be not plausible to be included in the system (e.g. some service roads).
GRDFOT2	Participants did notice the speed limits per road segment but some of them did not comply with the limit. Probably the greatest advantage is the increased awareness for certain speed limit signs and, consequently, regional limits. However, compliance would be more appropriately evaluated in a large scale effort for behavioural change/adaptation to able to be investigated.	Speed limit was viewed as a positive addition. Users mentioned that an added value would be to add vocal notification for speed limit and speed limit change. Comments for ADAS are the same across DFOTs. Collision Avoidance Warning was regarded as useful and they reported that it could be effective if used for longer period of time. However, the sound (not the haptic) for the lane departure warning (rubble strips sound) was a bit annoying and sometimes it was described as "off" (e.g. in curves with more than one lines).	Participants noticed that there was wrong speed limit information for certain road segments and sometimes delays in speed info change were reported. For example, speed limit changed from 40 to 90 km/h and the speed limit provided was still 40 km/h. The fact that participants noticed every such deviation was a positive sign that they were paying attention to the messages provided by the TeleFOT application and this is an overall positive feedback.	Sometimes timing of information (vocal) was a bit delayed. Speed limit information changed later than the presented sign.	Speed limit information was an interesting addition but some participants mentioned that they felt "over-controlled" and overwhelmed with information about speed limit for each road segment, lateral and longitudinal control.
GRDFOT3	Speed alerts were effective in communicating speeding behaviour to participants. However, the small exclamation mark and the sound should be described beforehand in order participants to understand the meaning. In other words, all participants received the same information about the TeleFOT application but they had to be reminded about the way speed alert worked. It was not so intuitive and self-explainable.	Speed alert was an interesting and educative experience, as reported by participants. Users mentioned that an added value would be to add a more noticeable item (a red flashing circle, for example) for speed limit exceedances. Comments for ADAS are the same across DFOTs. Collision Avoidance Warning was regarded as useful and they reported that it could be effective if used for longer period of time. However, the sound (not the haptic) for the lane departure warning (rubble strips sound) was a bit annoying and sometimes it was described as "off" (e.g. in curves with more than one lines).	As some speed limits were wrong, speed alerts were wrong, as well. Sometimes, participants did not comply even if it was the right alert. This was not an effect of previous wrong messages but rather of idiosyncratic driving patterns.	Speed alert was a bit delayed for both onset and offset. In other words, sometimes the driver had exceeded the limit just for a while before it was shown on the screen and similarly the alert lasted a bit longer even if the driver had already decelerated.	Overall, most of the participants would such as device but some of them mentioned that ADAS could be incorporated into one unified system in order to be more effective (e.g. same voice messages).

FILFOT2	The applications (LATIS and DRIVECO) were installed on the test user's own Nokia Symbian S60 phone. In addition there is the DRIVECO module, which is attached to the vehicle's OBD-II interface. The LATIS is always in the background in the phone, and is activated when the phone detects through Bluetooth the DRIVECO module. Before the start of the pilot, the communication was optimised so that the energy consumption at the phone was as small as possible. However, due to the phone's logic, it was not possible to automatically activate the DRIVECO application, but the user had to confirm the connection. The FOT was characterised by a wide variety in phone and vehicle models, which made support difficult. Also, different telecom contracts or applications on the phone, could have an impact on the applications. Installation of the applications was – if the test user desired so – performed by VTT personnel	In general, test users were not very positive about the services. Regarding traffic information, the information (which is similar to information transmitted over TMC), which is related to the region and not directly to the route travelled, is seen as irrelevant or could be outdated (e.g. traffic jam is disappeared when the driver is at the location). Regarding green driving, the users did not always agree with the advices from the system, especially regarding hard braking. Other issues are related to motor braking (where system reports 0% motor braking, although user assures that he brakes on the motor). Regarding speed limit info, during the test period Nokia Maps came for free on newer models, and this application includes also a speed limit info/speed alert notification. Some users reported, especially during the start of the test, problems with the accuracy of winter speed limits.	See Previous		
FIDFOT4		Driver feedback reporting benefits from having a reliable data logger and rich data collection. It depends on the test design and participants, whether fixed installation is a good option. When such option is available, it provides reliable data logging			
FIDFOT5	The device (AC Panther) was installed in the public transport vehicle. The user interface is a touchscreen, but the only input needed by the driver is an identification code at the start of the trip				

Further Supporting Information – Please include Screenshots of HMI

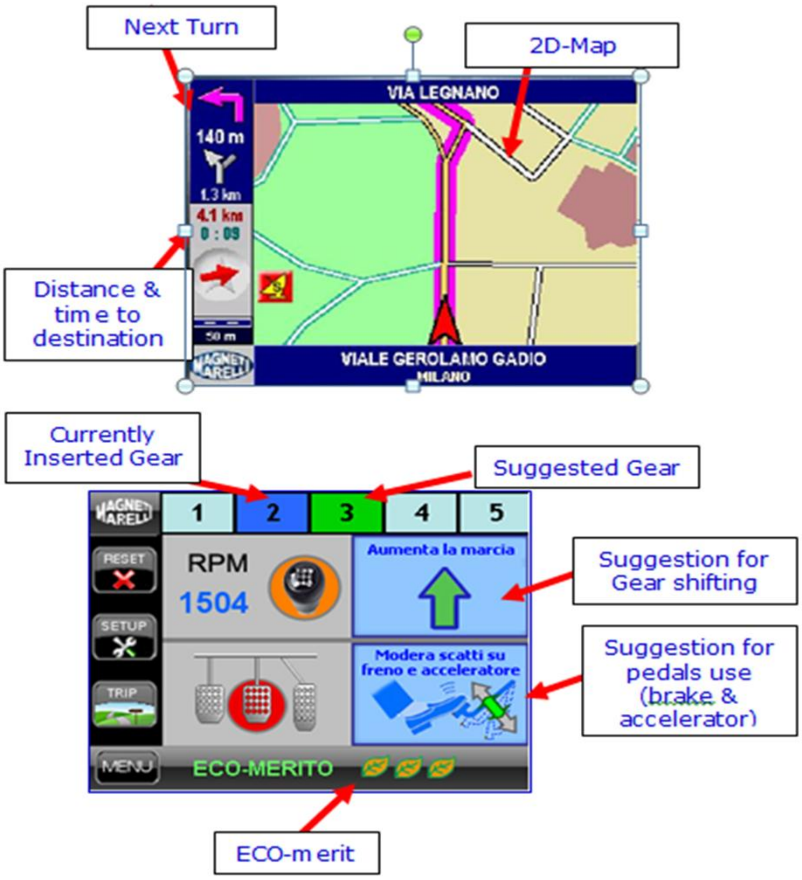


UKDFOT2

UKDFOT3

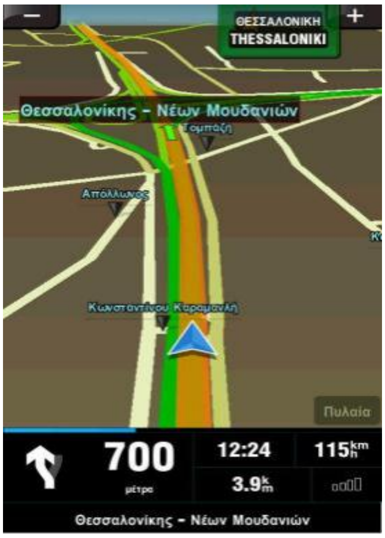
SPLFOT1

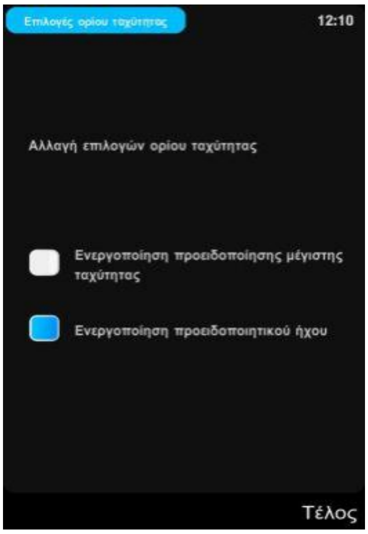
ITLFOT1

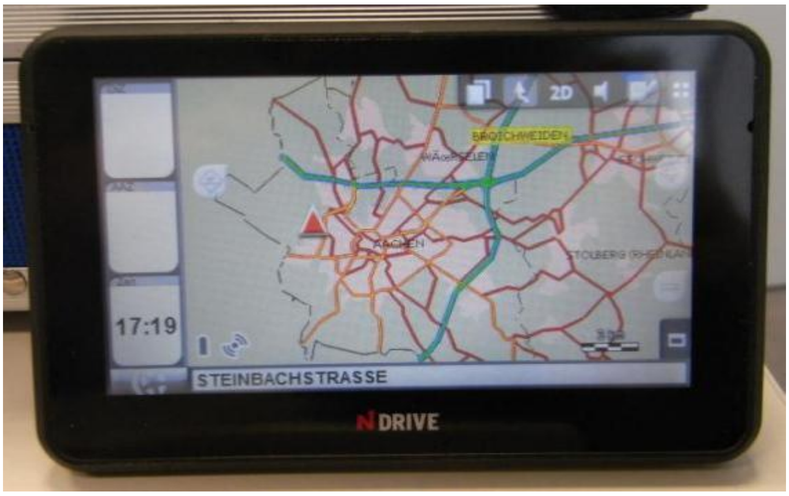


ITDFOT2

GRDFOT1, 2 & 3





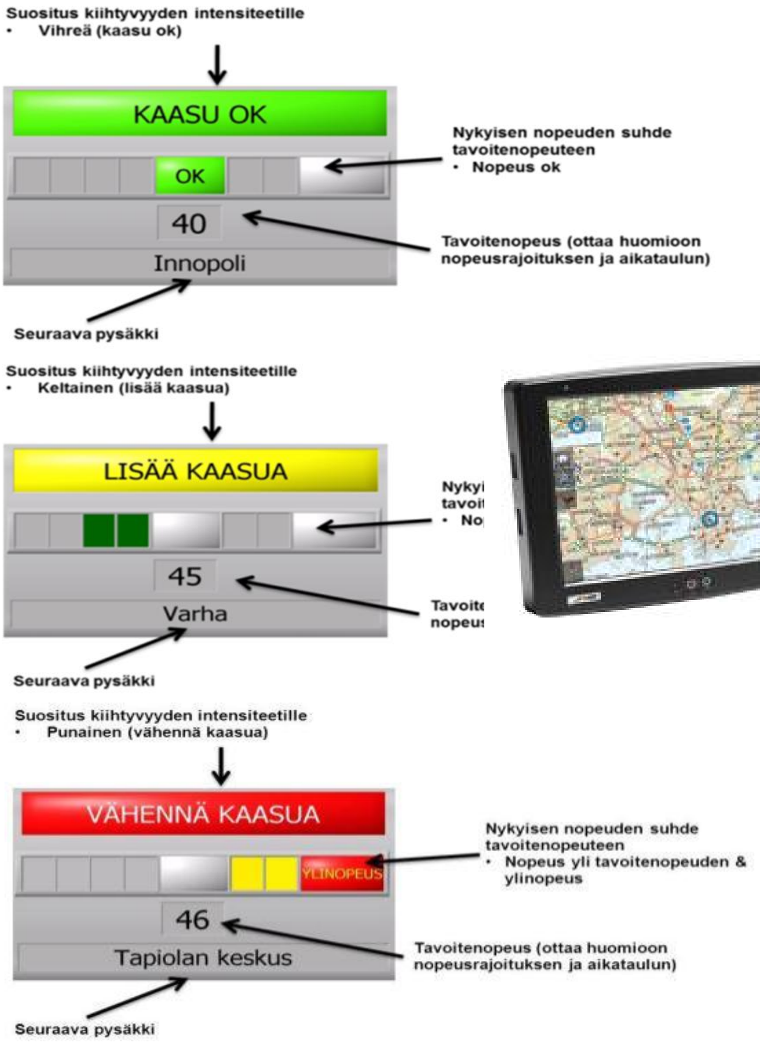


GERDFOT1

FILFOT2(D)

FILFOT2(L)

FIDFOT4



FIDFOT5

See www.zdnet.com/reviews/product/car-gps-navigation/garmin-nuvi-205w/32902071

SELFOT2

SEFLOT1