Cooperative Mobility Systems and Services for Energy Efficiency

D320.31(D3.1)	ecoSmartDriving Use Cases & System Requirements

SubProject No.	**SP3**	**SubProject Title**	**ecoSmartDriving**
Workpackage No.	**WP3.2**	**Workpackage Title**	**Use cases & requirements**
Task No.	**3.2**	**Task Title**	**Use cases & requirements**
Authors		**N. Eikelenberg, J. Subbian (FFA), R. Blanco, D.Sanchez (CTAG), L. Andreone, S. Damiani, E. Balocco (CRF), E.-P. Neukirchner, Lutz Bersiner (BOSCH)**	
Dissemination level PU/PP/RE/CO		**PU**	
File Name		**D320.31(D3.1) ecoSmartDriving Use Cases & System Requirements-v10- CLEAN**	
Due date		**31.10.2010**	
Delivery date		**19.03.2014**	

Abstract	ecoSmartDriving is focused on helping the driver of a passenger car to plan a trip in the most energy efficient way and while being

Information Society Technologies	Project supported by European Union DG INFSO ICT-2009-6.1, ICT for Clean and Efficient mobility
Project reference	FP7-ICT-2009-4 IP Proposal - 247908

IP Manager	Jean Charles Pandazis, ERTICO – ITS Europe Tel: +32 2 400 0714, E-mail: jc.pandazis@mail.ertico.com

	on trip drive that route that requires the least amount of fuel and drive on that route in the most fuel efficient way. Information from road side units, traffic management center, ecoMaps and also from other vehicles are used to determine the best route and the most efficient driving strategy. Once the driver has arrived at his / her destination, ecoSmartDriving helps the driver to analyse and understand how the driving behaviour has influenced fuel consumption of the vehicle. This document is the first deliverable of the ecoSmartDriving sub project (SP3) and describes the results of the work package 2 activities in SP3 on use cases, requirements and subsystem concept definition. Similar deliverables exist for SP4 and SP5 and on the overall project level for SP2. As a starting point stakeholders and users for ecoSmartDriving applications have been identified and their main needs have been collected. Based on this, the development of the use cases started. In parallel, the inefficiencies that occur in the current situation have been analysed. The inefficiencies that are relevant for passenger car applications can be divided into pre-trip and on-trip related inefficiencies. The on-trip inefficiencies can be sorted into primary driving task related inefficiencies (related to acceleration, deceleration, gear choice, idling, etc.) and non-primary driving task related like route choice, use of auxiliaries that consume electrical energy etc. The applications that are described in the use cases, system concept and requirements are ecoTripPlanning, dynamic ecoNavigation, ecoDrivingSupport, ecoInformation, ecoPostTrip and ecoMonitoring. To realise these applications some high level innovative components have been defined that are shared by many of these applications: ecoCooperativeHorizon (which ensures the cooperativeness of the applications), ecoHMI (which ensures the best possible communication of the driving strategies to the driver) and TripDataSet (which stores the fuel consumption related trip data for use by several of the applications). On a overall eCoMove project level also the eCoMove communication platform, ecoMaps and ecoSituationalModel are important elements that are part of the system concept.

Control sheet

Version history			
Version	**Date**	**Main author**	**Summary of changes**
01	27.09.2010	N. Eikelenberg (FFA)	First draft
02	01.10.2010	N. Eikelenberg (FFA)	Included tasklist
03	05.10.2010	N. Eikelenberg (FFA)	Tasklist updated & use cases overview included
04	06.10.2010	N. Eikelenberg (FFA)	Included content for chapter 3 & 4
05	11.10.2010	N. Eikelenberg (FFA)	Merged all input received until 11/10/10
06	13.10.2010	N. Eikelenberg (FFA)	Merged all input received until 13/10/2010
07	15.10.2010	N. Eikelenberg (FFA)	Final draft for peer reviewers
08/Final	29.10.2010	N. Eikelenberg (FFA)	Final version for delivery
09	18.10.2010	D. Kuck (FFA)	Consider comments from annual review
10	19.02.2014	D. Kuck (FFA)	Consider comments from final review
	Name		**Date**
Prepared	N. Eikelenberg, J. Subbian (FFA), R. Blanco, D.Sanchez (CTAG), L. Andreone, S. Damiani, E. Balocco (CRF), E.-P. Neukirchner, Lutz Bersiner (BOSCH)		15.10.2010
Reviewed	J. Stille (NAVTEQ), M. Mortara, M. De Gennaro, F. Tosetto		25.10.2010
Authorized	Jean-Charles Pandazis		19.03.2014
Verified	Manuela Flachi		19.03.2014

Circulation	
Recipient	**Date of submission**
Project partners	19.02.2014
European Commission	19.03.2014

Table of Contents

FIGURES

TABLES

TERMS AND ABBREVIATIONS
(*See also D2.1*)

Abbreviation	Definition
FVD	Floating Vehicle Data
HMI	Human Machine Interface
MPP	Most Probable Path (extracted from the ecoCooperativeHorizon)
V2X (V2V/V2I)	Refers to Vehicle to Vehicle or Vehicle to Infrastructure communication

Term	Definition
ecoCooperativeHorizon	The electronic horizon is an entity containing information relevant for driving within a specific range of the route driven in the near future. The range can be defined by time or by distance of the future route. The route is assessed using several data such as target in navigation software or commonly chosen targets. The adjective “cooperative” emphasizes that all necessary information are provided or improved by car to infrastructure or car to car communication. The adjective “eco” indicates that fuel consumption relevant map data are included.
ecoDriving	The driving style of a vehicle or truck can be described by the adjective “eco”, if it is beneficial for the environment, the nature. This is mainly accomplished by low emissions and low consumption of (fossil) energy.
ecoDynamicMap	ecoStaticMap enriched with dynamic attributes relevant for Dynamic ecoRouting and ecoDriving; dynamic attributes includes Real-Time Traffic information, Weather information et
ecoFVD message	eco Floating Vehicle Data message is a set of information sent by a vehicle to other vehicles and/or to the infrastructure in order to describe a vehicle’s progress (e.g. last geographical positions and related time stamps, average speed in the last minutes…), its fuel consumption (e.g. kind of fuel, consumption indicators during the last time interval…) and its destination (in terms of geographical coordinates).
ecoHMI	This component provides all human machine interaction services necessary for eCoMove applications. In turn, ecoHMI makes use of HMI control to enable appropriate input/output modes and surface

ecoInformation	This is the application that provides information on how to tune other vehicle functions at best to minimize fuel consumption;
ecoMonitoring	This is a new use of the concept of floating vehicle data as relevant information (derived from the TripDataSet) will be distributed to the traffic control centre and to the vehicle network (in an anonymous way) so that the whole network can benefit from eco information gathered locally
ecoPostTrip	Process that records in vehicle data (like speed, acceleration, gear,…) and navigation data for the analysis of how much the driver has been driving in respect to an optimal eco driving and gives related feedbacks to the driver
ecoRoute	Calculated route with lowest fuel consumption for specific driver and specific vehicle
ecoRouteAdvice	Advice from Traffic Management centre on which route is assumed to be the least fuel consuming route with a certain destination within the network
ecoRouting	This is the algorithm that determines the least fuel consuming route given a specified origin and destination. This algorithm is used within the ecoTripPlanning application as well as in the ecoNavigation application.
ecoNavigation	This is the application that provides the driver the least fuel consuming route (ecoRoute) and guides him / her along this route. This application takes into account the routing advice given by the Traffic Management & Control (SP5), the ecoRouteAdvice. In the DoW this application was named as Dynamic Green Navigation.
ecoSituationalModel	The situational model predicts the future driving situation for the near future within the e-Horizon and provides information about the estimated velocity profile with the corresponding probability. It is based on the behaviour of average drivers in standard situations. The purpose of the situational model is to optimize the driving strategy of the host vehicle
ecoStatic Map	Standard Digital Map used for On-board and Off-Board Navigation enriched with attributes relevant for ecoTrip Planning and ecoRouting; attributes such as Traffic Patterns, Slopes, Legal Speed Limits, Curvatures etc. are not used by classical Navigation System but are necessary for Eco features
ecoTripPlanning	Process that for given Start and Destination point and for defined time window for departure or arrival calculates optimal start time and optimal route; optimization goal is to minimize impact of journey to the environment. Eco Trip Planning is based on Eco Static Map, Car and Driver characteristics

TripDataSet	Database in which all trip data that is relevant for fuel consumption is stored, e.g. road parameters, traffic state, vehicle state, driver operation, etc.

Introduction

1.1. Purpose of this deliverable and relation to other SPs

This deliverable describes the results of the activities in WP2 of the SP3 ecoSmartDriving.
The activities of all WP2 in the eCoMove project are coordinated from SP2 Core Technology Integration. The common goal of the WP2 activities is to outline an integrated and shared view on the eCoMove systems and functionalities that is agreed with all partners and subprojects. At the basis of this common view are the use cases and requirements. These are the main basis for the development of the eCoMove applications.

Each of the SPs should have a clear view of its contribution to the total eCoMove system and should be aware of its interfaces to the other SPs.
The scheme below shows the relation among User Needs, Use Cases, Functionalities and Requirements (Figure 1).

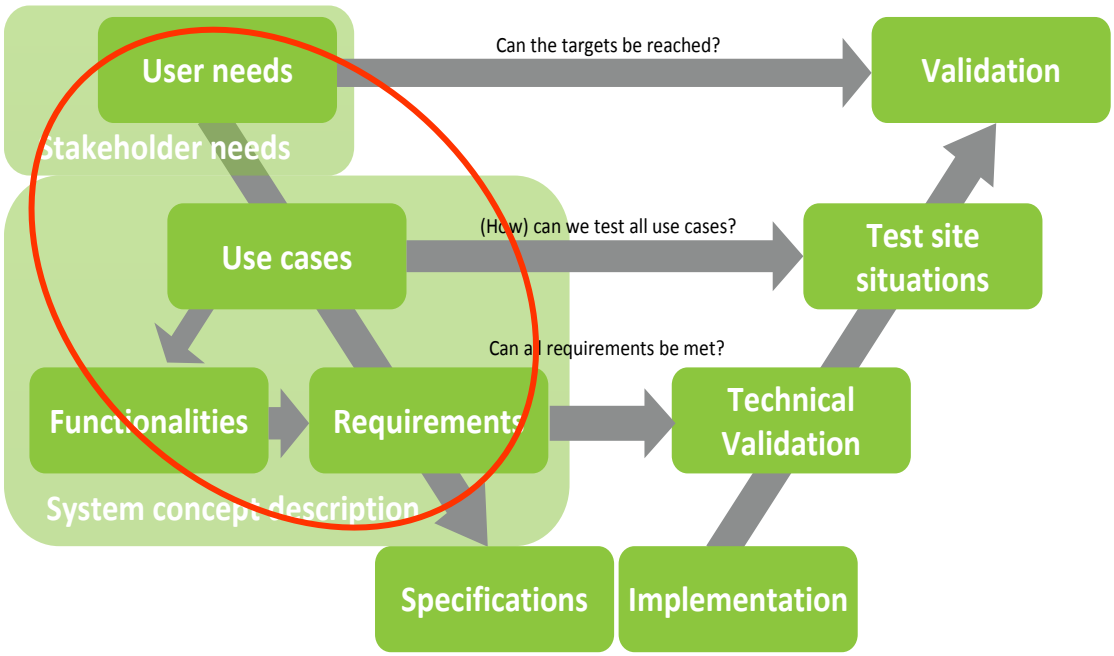


Figure 1: Relation between User Needs, Use Cases and Requirements (V-model)

The picture well depicts in the red circled area the contribution to the overall project inside the V model. The results of this deliverable will be the basis for the Architecture and Specification phase followed by the Implementation phase where the subsystem will be implemented in a demonstration vehicle. For the Design phase a detailed V-diagram can be used.
An intermediate step that has been implemented in the V-model is the identification of the inefficiencies, as a basis for the use cases.

Scope of this document, starting from the current situation, is to take picture of the inefficiencies and different use cases in order to produce an organized collection of user requirements. The user requirements, with the functionalities partially identified in an early stage, will be the basis for the specification activities (see also Figure 2).

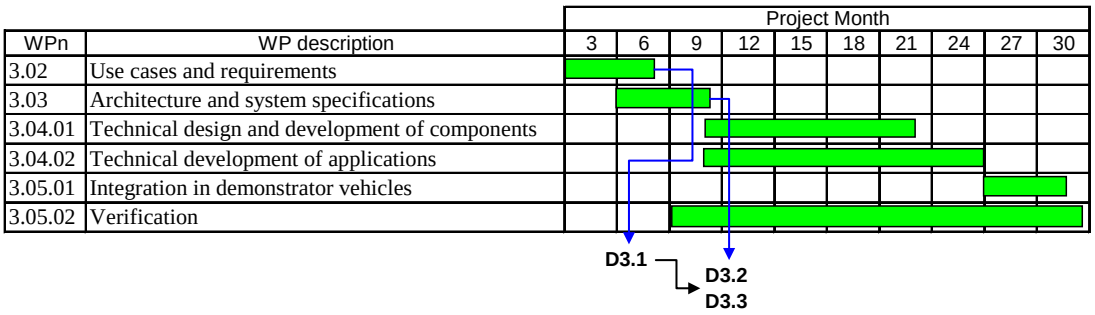


Figure 2: Deliverable dependencies within SP3

1.2. Reading guide

This document describes in Chapter 2 the current situation for ecoSmartDriving: here a state of the art is presented, together with the general objectives of SP3 and the scope of the research, starting from the situation today, the performance of existing systems, and taking into account the progress to be developed beyond the state of the art.

In Chapter 3 the users and stakeholders for ecoSmartDriving are considered, analysing both the possible SP3 results' users and the most important stakeholder needs.

Chapter 4 describes the inefficiencies targeted by the specific subproject and the reasons why these inefficiencies cannot be completely solved in the current situation; what is needed to answer to the inefficiencies previously described, is the difficult problem tackled in Chapter 5, dedicated to the ecoSmartDriving innovations.

The use scenarios of SP3 are described in Chapter 6.

Chapter 7 deals with the specific ecoSmartDriving subsystem, describing its operational environment, the applications of the subsystem and the interfaces with the other subsystems.

Finally Chapter 8 deals with the requirements based on the use cases, applications and subsystem concept description.

The structure of this document is based on the OCD/SSS and IRS documents of the MIL498-standard and also checked with ISO/IEC 15288.

Current situation for ecoSmartDriving

2.1. Background

Reduction of CO_2-emissions of passenger cars is a very important topic within Europe. Automotive OEMs and suppliers put a lot of effort in the development of more fuel efficient powertrains. However, one of the biggest factors of impact on fuel consumption is the driver: the way he/she drives, the route he/she chooses, the way he/she maintains the vehicle, etc.

2.2. Objectives

The eCoMove Project and specifically the ecoSmartDriving subproject (SP3) aim at reducing the fuel consumption and therewith CO_2-emissions of passenger cars as part of the total eCoMove system.
The reduction of CO_2-emissions will be pursued by:

- Sustainably changing the driving behaviour of individual drivers to a more fuel-efficient driving style, both during the trip as well as by learning from previous trips.
- Supporting drivers in choosing the route with the lowest fuel consumption.

2.3. Scope

Within the ecoSmartDriving subproject the focus is on passenger cars and particularly to influence the behaviour of their drivers.
The trip as such and the choice for a specific vehicle is a given and there is no intention to automatically control the vehicle, but only to influence by means of informative advices the way the drivers drives the car.
Both nomadic devices as well as in-vehicle integrated systems are considered (Figure 3).

Figure 3: Examples of nomadic devices that can be used in the car

2.4. Limitations and constraints in the current situation

In the current situation no cooperative systems (V2V or V2I) exist yet that enable intelligent information exchange that can help to improve the driving style. Also no systems are known that can give a detailed outlook to the driver on the situation ahead that is relevant for fuel efficient driving, so he / she can adjust the driving behaviour

accordingly. The only system available nowadays is the VMS (Variable Message Sign) that informs on the traffic jam or speed limits.

2.5. Description of the situation today

For the description of the situation today it is important to identify the trip phasing eCoMove is looking at. Three phases are relevant: pre-, on- and post-trip. They are defined based on the driver action state (see Figure 4):

- ***Pre-trip phase - Planning state***: in this phase the driver creates travel plans (in case of a fleet operators it could also be the fleet planner). Planning as such does not directly impact fuel consumption or CO_2-emissions. However, decisions made in this phase can influence the actual execution of the trip. This phase starts when the driver plans his / her trip and checks the vehicle. The driver can do this either in the vehicle or at home / office / etc.. It ends with the driver starting his / her vehicle to drive to the planned destination;
- ***On-trip phase - Acting state:*** in this phase the driver drives the vehicle within a network that is controlled by the traffic management centre. Here the driver's choices and actions directly affect energy consumption (such as driving behavior, destination changes, etc). This phase starts with the moment the driver starts the vehicle to drive to the planned destination. The phase ends with driver switching the engine and ignition off and trip-destination had been reached.
- ***Post-trip phase - Analysing state:*** in this phase the driver receives feedback and learns how his / her driving behaviour and route choices have impacted the fuel consumption and what possibilities he / she has to improve this in the future. Therefore this phase indirectly affects energy consumption.

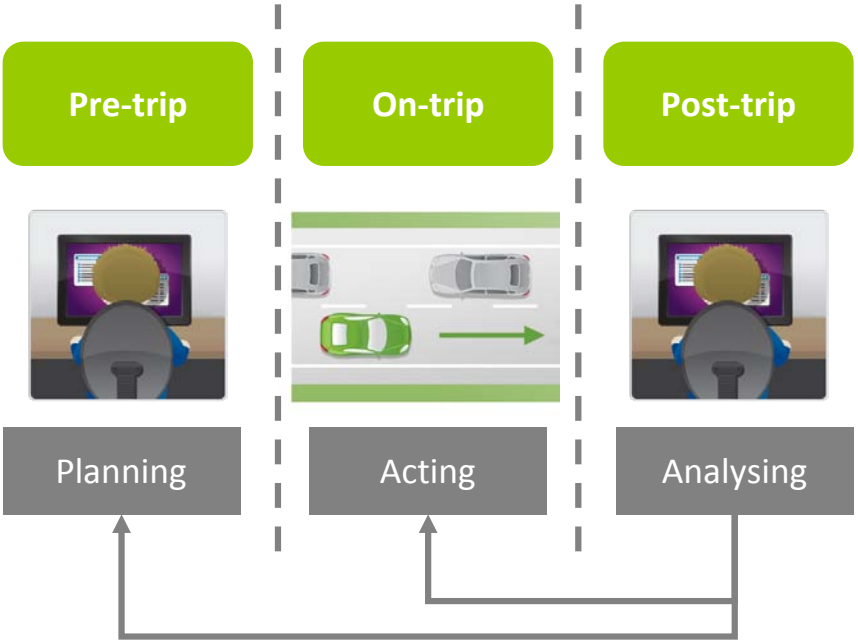


Figure 4: Trip phasing

For each of the trip phases described above there are already some systems available on the market, the most of which are represented in Figure 5.

- ***Pre-trip***: Gradually several ecoRouting systems are entering the market that support drivers in choosing the route with the lower fuel consumption.
- ***On-trip***: Dynamic adjustment of routes takes place based on traffic information that is broadcasted (e.g. Traffic Message Channel-data) or transmitted via mobile phone connections. Already at present, commercial Transport Planning Offices manage their vehicle fleets in an economical optimum based on consumption per kilometre. Traffic lights in cities are managed by Traffic Management Centres with the intention to optimise traffic flow. Currently there are only few and limited systems that support the driver to drive the vehicle in a fuel efficient way. These available systems are both very basic (e.g. gear shift indicator) and not predictive. This type of systems are either integrated in the vehicle (e.g. Ford ECOmode) or available on nomadic devices that can – in the best case – be connected to the OBD (On Board Diagnostic)-port of the vehicle (e.g. Garmin EcoRoute HD).
- ***Post-trip***: Several OEMs already offer a post trip analysis to their customers, either directly in the vehicle (e.g. Ford ECOmode) or off-board (e.g. FIAT EcoDriving / Blue&Me or Ford Econocheck).

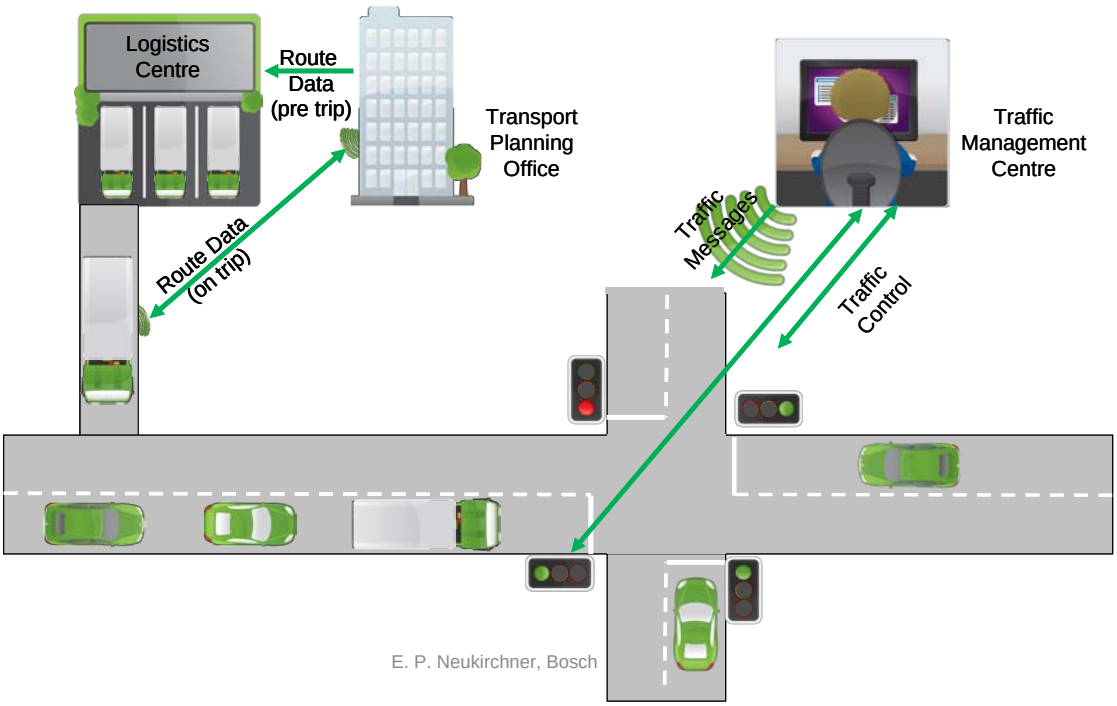


Figure 5: The situation today

2.5.1. Performance of existing systems

There are no validated data available that demonstrate the saving potential of current systems. Estimates show a big range from 5 to 25%, depending on what is chosen as a reference.
For ecoDriving trainings similar figures exist, but here it is also proven that improvements do not last, since drivers fall back into their old habits very soon.

2.5.2. Provisions for safety, security & privacy

For the current systems safety, security & privacy are not an issue, since they do not interfere with other systems within the vehicle and do not send out any information outside the vehicle.

Users and Stakeholders for ecoSmartDriving

3.1. Users vs. Stakeholders

In the eCoMove users are defined as those parties who directly interact with the applications and therefore are within the eCoMove system boundaries. Stakeholders are those actors that are affected by the eCoMove system(s) and do not necessarily reside within the eCoMove system boundaries.

In the figure below (Figure 6) the stakeholder diagram shows the different stakeholders that are relevant for the ecoSmartDriving subproject and how they are related to each other and to the ecoSmartDriving system. In this diagram users are shown in grey and stakeholders in green.

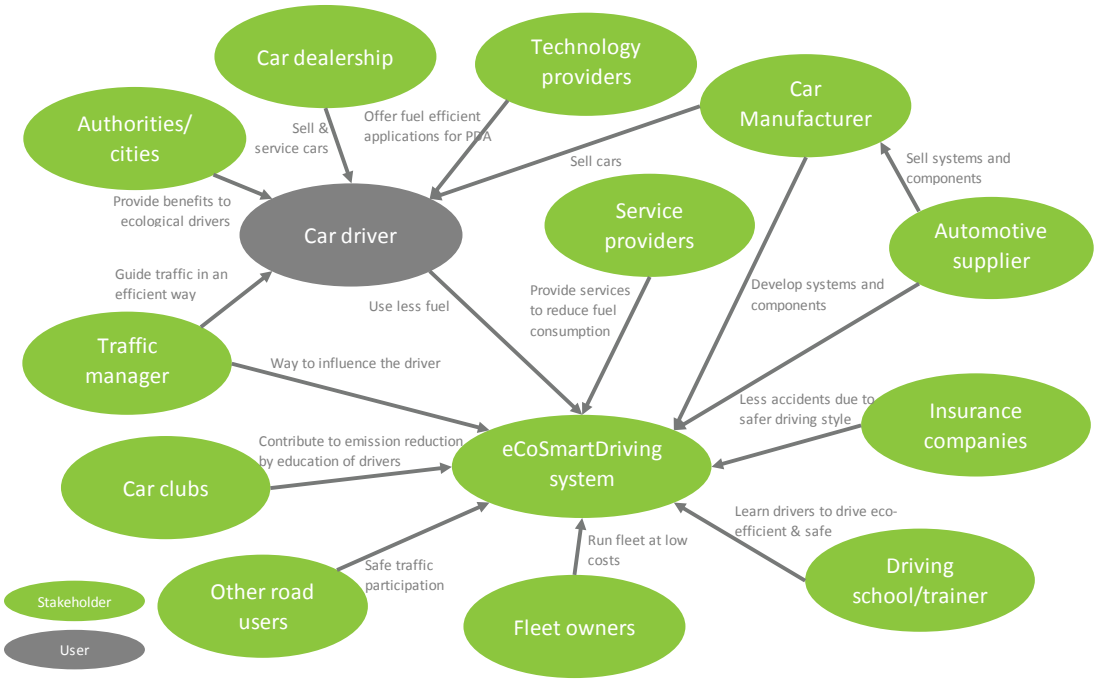


Figure 6: Stakeholder diagram for ecoSmartDriving

3.2. Users for ecoSmartDriving

For the ecoSmartDriving subproject only one type of user has been identified: car drivers. Although there is only one type of user of the system there are many different types of car drivers that also have different needs for an ecoSmartDriving system.
The target for the eCoMove project is to reach as many drivers as possible, which means that the system should be accepted by e.g. both drivers with high mileage as well as drivers that only use the vehicle e.g. once per week or experienced drivers vs. young drivers.
In the SP6 of the eCoMove project a study is done to identify which different typologies of drivers are relevant for the eCoMove project, either due to different

motivators or due to other characteristics. For a detailed description of the different types of users and their needs, please check eCoMove Deliverable D6.1 [2].

3.3. Stakeholders

The stakeholders that are important for the ecoSmartDriving subproject can be divided into stakeholders that are also in the eCoMove consortium or linked to it and external stakeholders that are not directly involved in the project.

The stakeholders that are also involved in the project are (between brackets the names of the eCoMove partners that represent this stakeholder are mentioned):

- Car manufacturers / OEMs: these stakeholders want to sell cars that meet customer needs; fuel efficiency is gaining importance as buy criterion for cars. (BMW, FIAT, FORD).
- Automotive suppliers: these stakeholders want to sell systems and components to OEMs and also meet driver needs with new / better products. (Bosch, Continental, Magneti Marelli).
- Service providers: these stakeholders offer services that can help the driver to drive more fuel efficiently. Services can vary from providing a traffic prediction to reservation of parking places at destination. (Telecom Italia).
- Technology providers: these stakeholders also want to provide applications on e.g. a PND (personal navigation device) or smart phone equipment that help the driver to drive more fuel efficiently or choose the least fuel consuming route (TomTom-TeleAtlas, NavTeq).
- Car clubs: organisations that offer break down support and education / information for drivers, also regarding fuel efficiency (RACC).

Indirectly involved stakeholders (e.g. advisory board members) are:

- Driving schools/trainers: teach drivers a fuel efficient AND safe driving behaviour (GoGreen, DVR – advisory board member).
- Insurance companies: reduce the number of accidents by promoting less aggressive driving styles, i.e. eco driving (Allianz – advisory board member).
- Authorities / cities: reduce the level of CO_2-emissions in the road network (Test Sites – Düsseldorf, Munich, Helmond, Berlin, ASFA).

Stakeholders that are not directly involved in the project, but are as well important:

- Other road users: vehicles without the eCoMove system, public transports, emergency vehicles, pedestrians, cyclists, motorists, etc., their main need is to be able to safely use the road network.
- Fleet owners: fleet owners operate large fleets of vehicles; for these stakeholders it is important that the vehicles are well maintained and costs are kept low by fuel efficient driving behaviour.
- Traffic managers: traffic managers control the traffic within a city by all available means (e.g. traffic light control); from ecoSmartDriving perspective these stakeholders want to ensure that the driver follows recommendations given by the traffic centre.

- Car dealerships: these stakeholders sell cars produced by the OEMs to the drivers; for these stakeholders it is important that the features in the car can be easily explained and give an added value for the vehicle in order to sell better.

3.4. Important user & stakeholder needs

In the previous paragraphs already the most important needs of the different stakeholders have already been described. During two stakeholder workshops these needs have been discussed in more detail.
In addition to these workshops several questionnaires have been used to collect specific driver (user) needs. For a detailed overview, please check eCoMove deliverable D6.1 [2].
This paragraph will therefore focus on the needs that have been expressed by the other stakeholders, although several also refer to driver's needs.

The user and stakeholder needs are per definition entirely user/stakeholder oriented and are not necessarily consistent.

The outcomes of the stakeholder workshops and inputs can be summarised in the following needs:

1. The ecoSmartDriving system should create awareness in drivers about EcoDriving
2. The benefits of using the system should be clear:
    a. Cost saving
    b. Fuel saving
    c. Impact on travel time
3. The system should be adaptive / self-learning
4. It should be possible to personalise the system according to individual needs
5. The system should not tell the driver that he/she's a bad driver, but provide positive reinforcement:
    a. Incentives
    b. Quantify benefits
6. Personal freedom should not be limited by the system: it should leave choices to the driver
7. To improve acceptance of the system the system should:
    a. Be reliable
    b. Use reliable information
    c. Be transparent (which information is used to do what)
8. The benefits of the system should be higher than the costs.
9. The system should also contribute to increase traffic safety and may for sure not endanger traffic safety.
10. Privacy issues need to be included in the system design:
    a. It should be clear what is done and why with the information that is exchanged with other vehicles / traffic management / other systems
11. A balance needs to be found between the needs of the network and of the individual driver: for an individual driver it is not acceptable that he/she follows a recommendation given by the system and find out – after the trip – that this wasn't a good alternative for him/her.

These needs are taken into account for the requirements of the eCoMove project and in this document more specifically for the ecoSmartDriving subsystem.

Targeted Inefficiencies

At the basis of the eCoMove project are the inefficiencies that cause unnecessary fuel consumption and CO_2-emissions. In the eCoMove deliverable D2.1 the complete overview of inefficiencies that is targeted by the eCoMove project is given [1].
This chapter will describe the inefficiencies that are important for the ecoSmartDriving subproject – inefficiencies that are relevant for passenger cars.

4.1. SP3 specific inefficiencies

For the ecoSmartDriving subproject those inefficiencies that are caused by individual passenger cars are targeted. The inefficiencies can be sorted into pre-trip inefficiencies and on-trip inefficiencies. Although during the pre-trip phase no fuel consumption is caused, the decisions made in this phase can influence the fuel consumption in a positive or negative way.
The numbers and letters in the lists below refer to the complete overview of the inefficiencies that is included in D2.1 [1] and therefore their might be some gaps in the numbering.

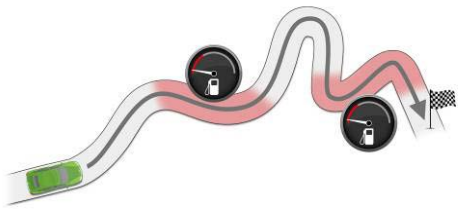
4.1.1. Pre-trip inefficiencies

The pre-trip inefficiencies that are targeted by ecoSmartDriving are:

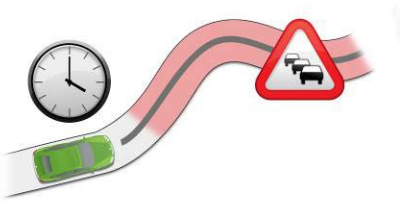
- ***INEF01: Inefficient vehicle condition***; this inefficiency can be split into:
  - Conditions that can be measured/recognised by systems in the vehicle, like tire pressure and maintenance status;

  - Conditions that cannot be measured / recognised by the vehicle like unnecessary weight in the vehicle, carriers that influence aerodynamics, tire condition.

- ***INEF02: Inefficient route choice***; when planning a trip the driver can already select a certain route which is not necessarily the best one from fuel consumption perspective. Reasons for an inefficient route choice could be lack of knowledge on traffic state on selected route, insufficient knowledge about route-alternatives, or insufficient knowledge about factors influencing fuel consumption on the route.



- ***INEF03: Inefficient travel timing***; not only the route as such but also the time a trip should take place (or the chosen start / targeted arrival time) can impact the fuel consumption due to e.g. heavy traffic that causes congestions and therefore inefficient driving. Travel timing is chosen before the trip and if it is possible to adjust the timing to e.g. traffic conditions the trip could be covered with less fuel.



INEF04 (Inefficient payload) is not relevant for passenger car applications.

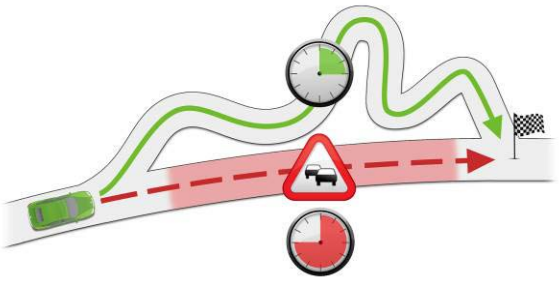
4.2. On-trip inefficiencies

The on-trip inefficiencies that are targeted by the ecoSmartDriving subproject can be split into three main categories:

- Non-driving task related inefficiencies:
    - ***INEF05: inefficient use of (electrical) energy consumers***: many drivers are not aware of the additional fuel that is consumed when many auxiliaries are used when driving a vehicle. Electrical energy consumption has a direct effect on fuel consumption of a vehicle.

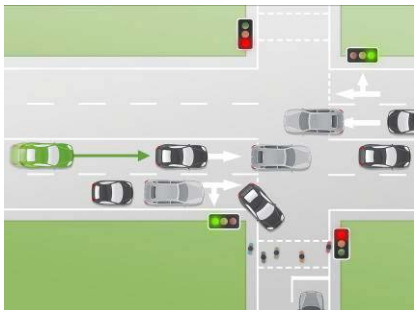
    - ***INEF06: inefficient on-trip vehicle condition***: this inefficiency is similar to INEF01, but in the case the driver is already driving. Examples of relevant inefficiencies are driving with open windows or reduced tire pressure during the drive.

- Secondary driving tasks related inefficiencies:
  - ***INEF07: inefficient routing***. During the trip the driver has to find his/her way to the destination, with or without using a navigation system. In addition to the route choice itself several other routing inefficiencies can occur that are relevant for ecoSmartDriving:
    - a. Caused by traffic situation: if there is a sudden congestion (e.g. due to an accident) the selected route does not necessarily still be the best route from fuel consumption perspective;

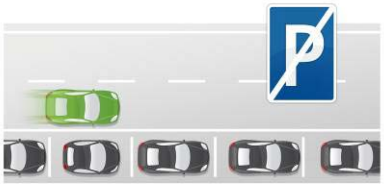


    - b. Caused by road design/traffic: lane changing behaviour, knowing which lane to choose for the next turn, etc.;

    - c. Caused by traffic signals: currently it is not possible to adjust the route to traffic light green status;



- e. Caused by the situation at the chosen destination: e.g. when arriving at the destination a parking place is not available which then causes additional distance to be driven.



- Primary driving task related inefficiencies: the inefficiencies that are included in this category relate to the longitudinal control of the vehicle by the driver – everything he/she does to achieve, maintain or reduce speed, including gear shift. For each of the inefficiencies, reasons that cause these inefficiencies are listed: they can be traffic induced, road induced, weather/environment induced, driver induced, traffic signal induced or vehicle induced. The inefficiencies targeted by ecoSmartDriving are the categories a to the for the following inefficiencies:

  - ***INEF08: inefficient acceleration***
  - ***INEF09: inefficient deceleration***
  - ***INEF10: inefficient (unnecessary) idling***
  - ***INEF11: inefficient speed***
  - ***INEF12: inefficient gear/rpm***

  In Figure 7 the complete matrix is shown that describes the inefficiencies and their possible causes. In the pictures below several examples of scenarios in which these inefficiencies occur are shown (Figure 8, Figure 9, Figure 10, Figure 11, Figure 12, Figure 13).

INEF13 (Unnecessary stops) is only relevant for SP5 Traffic Management & Control since the inefficiencies included here are caused by and can only by solved by this subproject. For more details please look into D5.1.

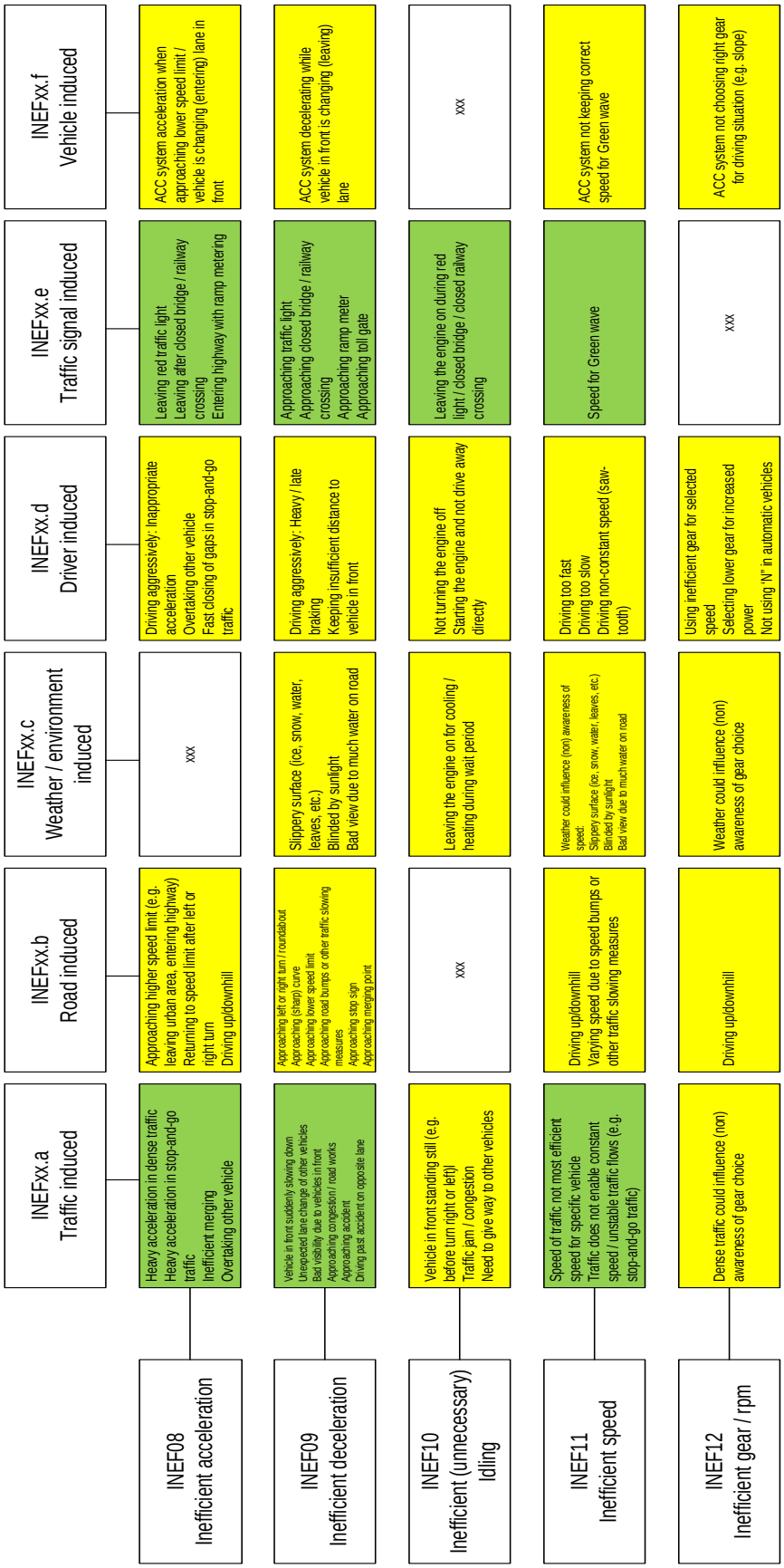

INEFxx.a
Traffic induced
INEFxx.b
Road induced
INEFxx.c
Weather / environment induced
INEFxx.d
Driver induced
INEFxx.e
Traffic signal induced
INEFxx.f
Vehicle induced
INEF08
Inefficient acceleration
Heavy acceleration in dense traffic
Heavy acceleration in stop-and-go traffic
Inefficient merging
Overtaking other vehicle
Approaching higher speed limit (e.g. leaving urban area, entering highway)
Returning to speed limit after left or right turn
Driving up/downhill
xxx
Driving aggressively: Inappropriate acceleration
Overtaking other vehicle
Fast closing of gaps in stop-and-go traffic
Leaving red traffic light
Leaving after closed bridge / railway crossing
Entering highway with ramp metering
ACC system acceleration when approaching lower speed limit / vehicle is changing (entering) lane in front
INEF09
Inefficient deceleration
Vehicle in front suddenly slowing down
Unexpected lane change of other vehicles
Bad visibility due to vehicles in front
Approaching congestion / road works
Approaching accident
Driving past accident on opposite lane
Approaching left or right turn / roundabout
Approaching (sharp) curve
Approaching lower speed limit
Approaching road bumps or other traffic slowing measures
Approaching stop sign
Approaching merging point
Slippery surface (ice, snow, water, leaves, etc.)
Blinded by sunlight
Bad view due to much water on road
Driving aggressively: Heavy / late braking
Keeping insufficient distance to vehicle in front
Approaching traffic light
Approaching closed bridge / railway crossing
Approaching ramp meter
Approaching toll gate
ACC system decelerating while vehicle in front is changing (leaving) lane
INEF10
Inefficient (unnecessary) Idling
Vehicle in front standing still (e.g. before turn right or left)
Traffic jam / congestion
Need to give way to other vehicles
xxx
Leaving the engine on for cooling / heating during wait period
Not turning the engine off
Starting the engine and not drive away directly
Leaving the engine on during red light / closed bridge / closed railway crossing
xxx
INEF11
Inefficient speed
Speed of traffic not most efficient speed for specific vehicle
Traffic does not enable constant speed / unstable traffic flows (e.g. stop-and-go traffic)
Driving up/downhill
Varying speed due to speed bumps or other traffic slowing measures
Weather could influence (non) awareness of speed:
Slippery surface (ice, snow, water, leaves, etc.)
Blinded by sunlight
Bad view due to much water on road
Driving too fast
Driving too slow
Driving non-constant speed (saw-tooth)
Speed for Green wave
ACC system not keeping correct speed for Green wave
INEF12
Inefficient gear / rpm
Dense traffic could influence (non) awareness of gear choice
Driving up/downhill
Weather could influence (non) awareness of gear choice
Using inefficient gear for selected speed
Selecting lower gear for increased power
Not using 'N" in automatic vehicles
xxx
ACC system not choosing right gear for driving situation (e.g. slope)

Figure 7: On-trip Primary driving task related inefficiencies

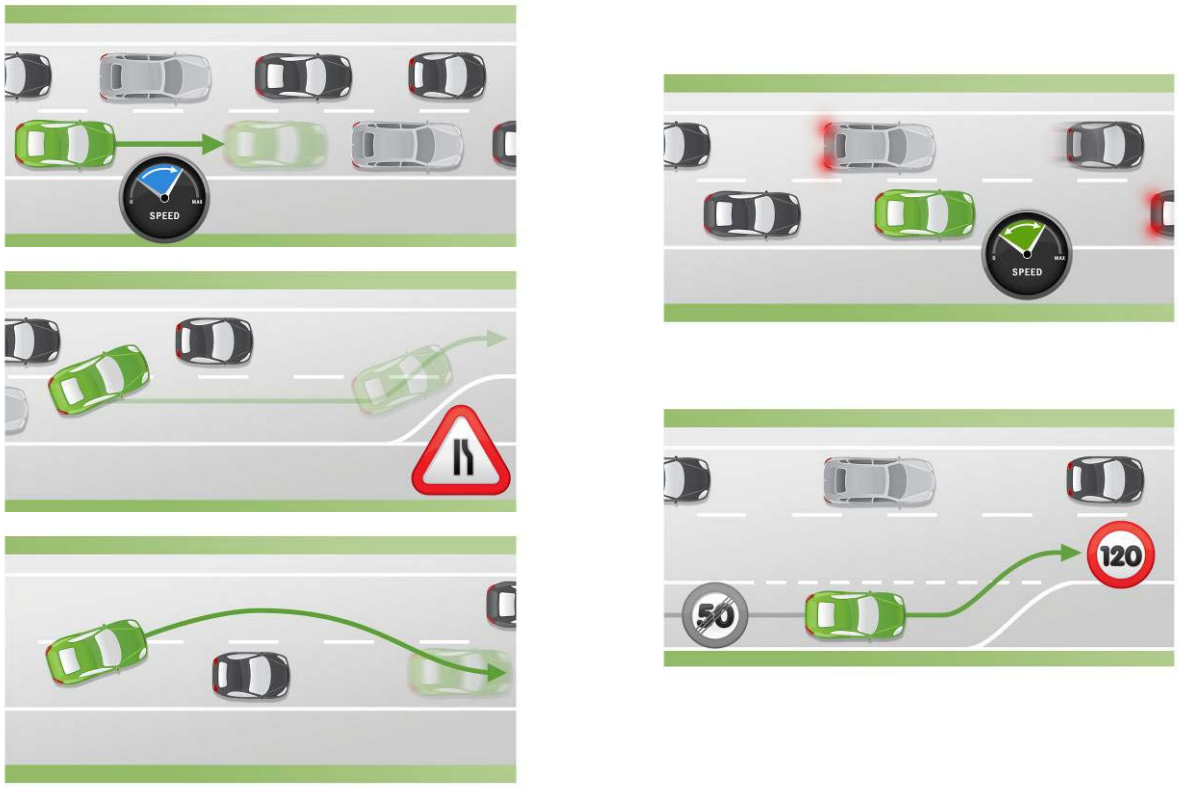


Figure 8: INEF08 - Inefficient acceleration scenarios

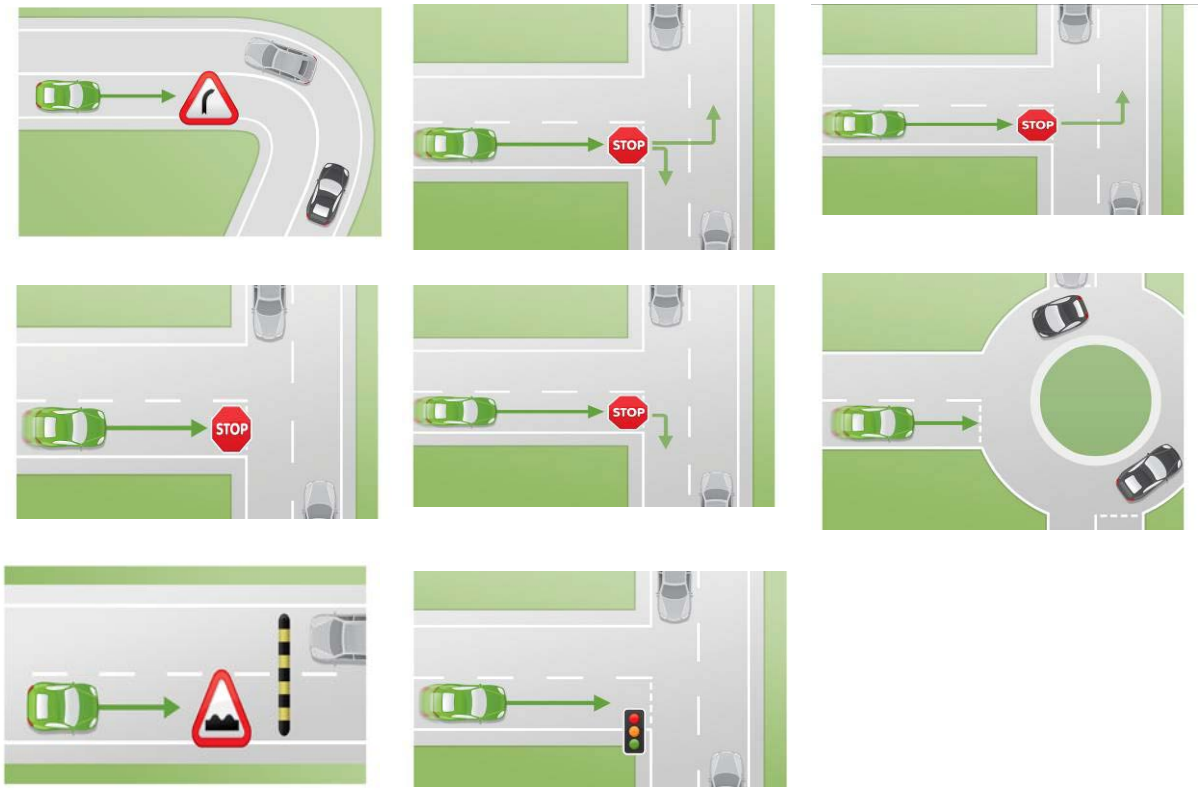


Figure 9: INEF09 - Inefficient deceleration scenarios (1/2)

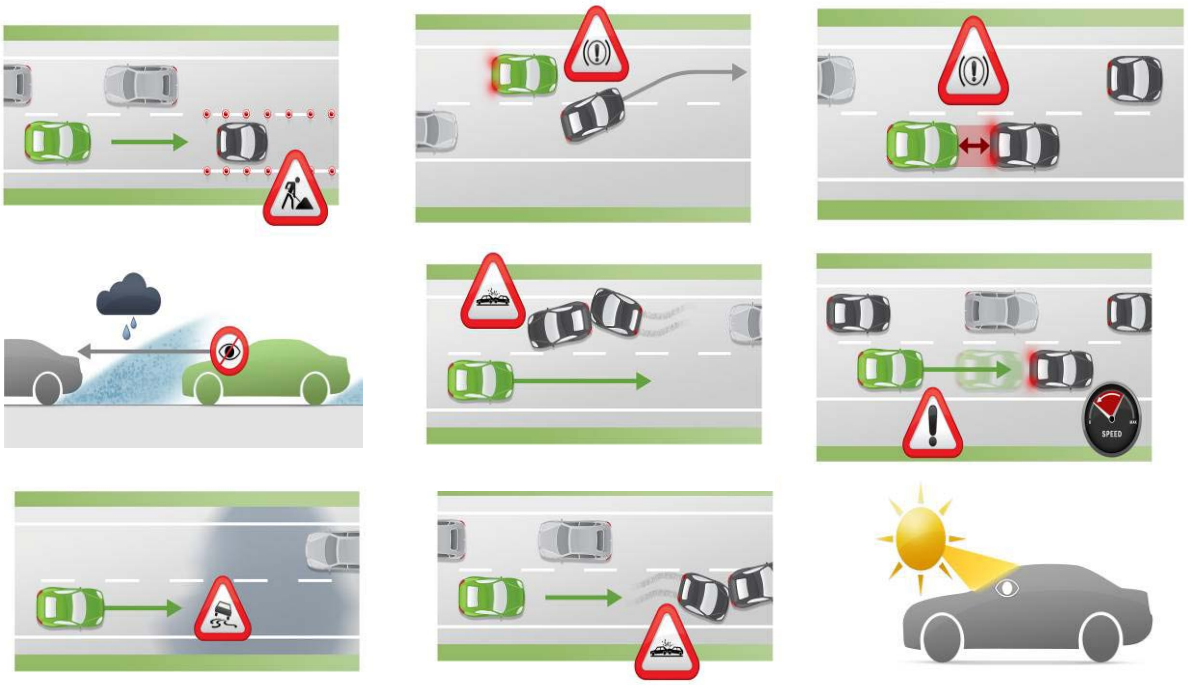


Figure 10: INEF09 - Inefficient deceleration scenarios (2/2)

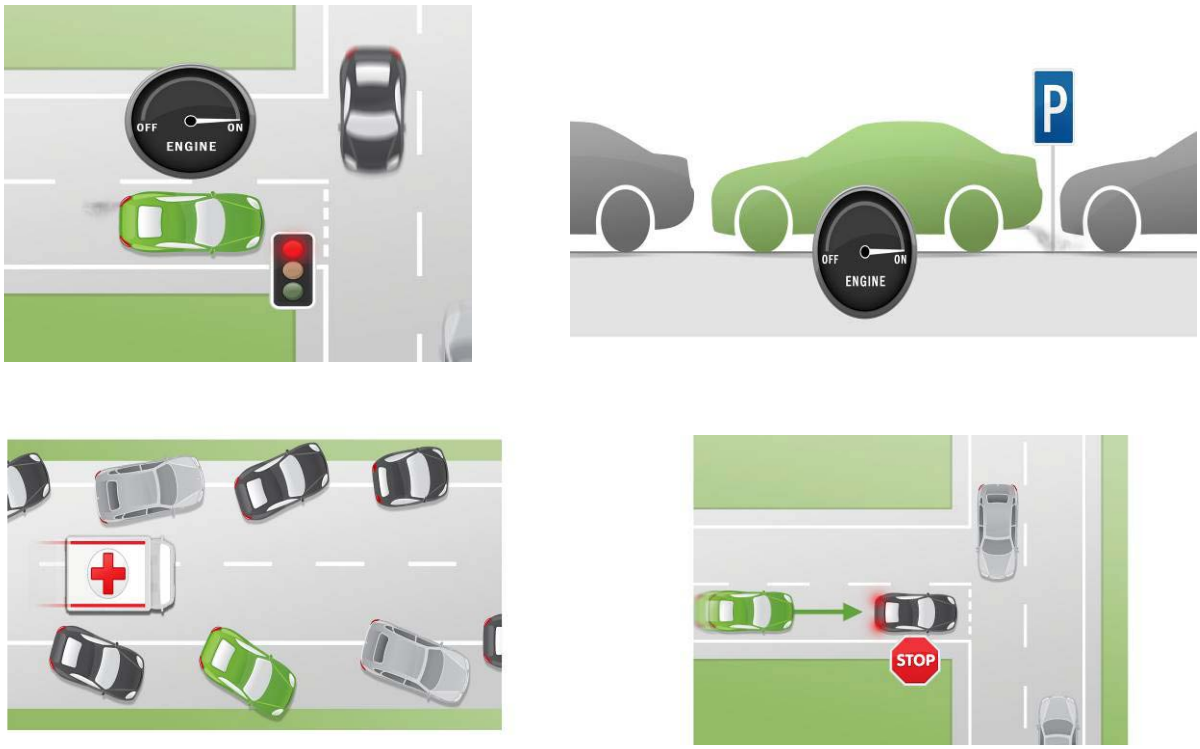


Figure 11: INEF10 - Unnecessary idling scenarios (vehicle stopped, engine not turned off)

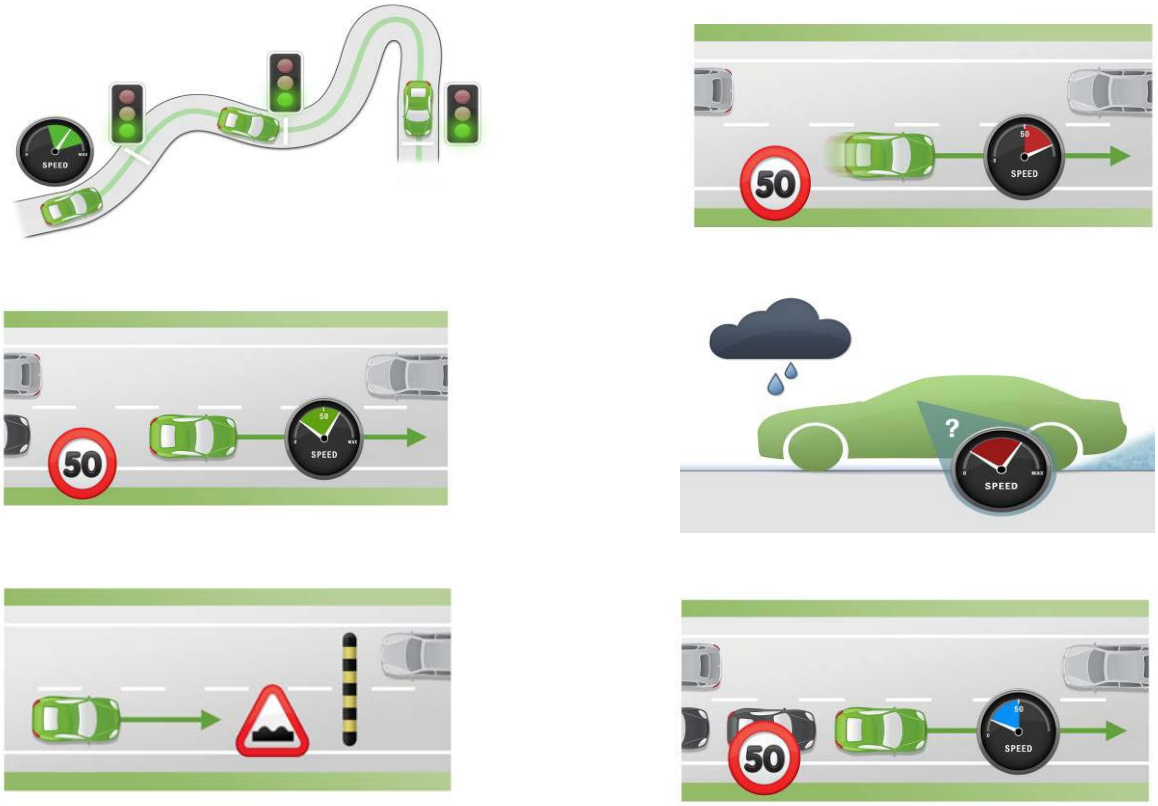


Figure 12: INEF11 - Inefficient speed

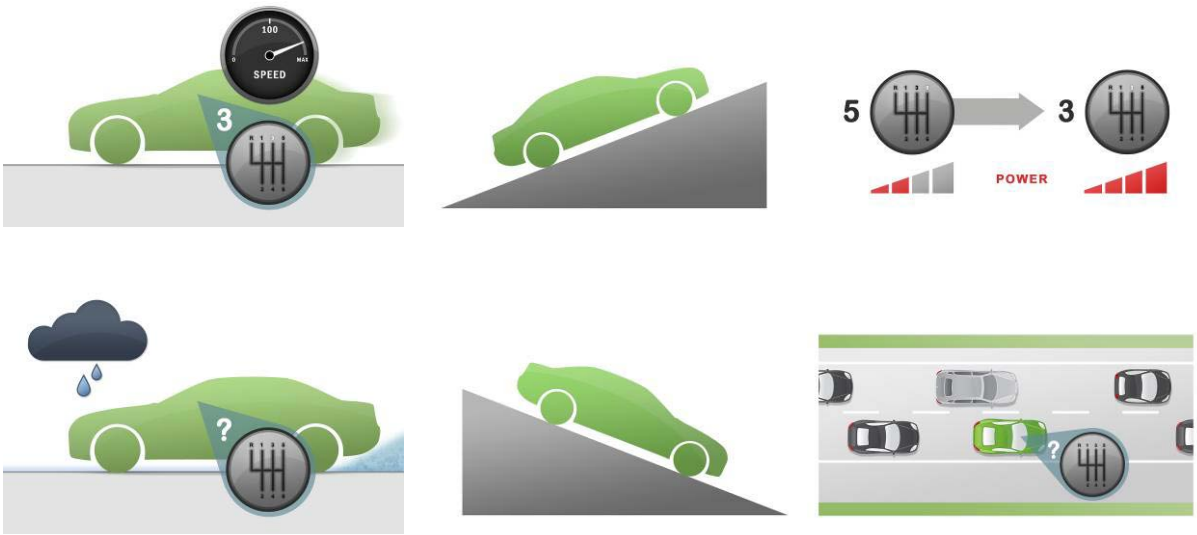


Figure 13: INEF12 - Inefficient gear

4.3. Prioritisation of inefficiencies

For the prioritisation of the inefficiencies for the ecoSmartDriving subproject the following criteria are most important in terms of CO_2 reduction:

- Impact (small-medium-large unnecessary use of fuel consumption): How big is the inefficiency?
- Occurrence (rarely-sometimes-often-always): How often does the inefficiency occur?
- Influence (small-medium-large): How well can be the inefficiency influenced?
- Effort (small-medium-large): How much development effort is required to realise a solution that can solve/reduce the inefficiency significantly?

The ratings are all relative to each other, since their main use is a comparison of the different inefficiencies. For example: the rating 'small' in the category Influence means that the level of fuel consumption reduction that can be influenced is much smaller than if the rating 'large' is given.

The evaluation of the inefficiencies is done based on expert best guess (Occurrence, Influence, and Effort) and company internal background knowledge of fuel consumption effects of the different inefficiencies (Impact).

Table 1: Prioritisation of inefficiencies for ecoSmartDriving

Inefficiency	**Impact**	**Occurrence**	**Influence**	**Effort**
INEF01: Inefficient Vehicle Condition (pre-trip)	Small	Sometimes	Large	Small
INEF02: Inefficient Route Choice	Medium	Sometimes	Large	Medium/Large
INEF03: Inefficient Travel Timing	Small	Rarely	Medium	Small (but requires INEF02 solution)
INEF05: Inefficient Usage of (Electrical) Energy Consumers	Small	Often	Medium	Small
INEF06: Inefficient Vehicle Condition (on-trip)	Small	Sometimes	Small	Small
INEF07: Inefficient Routing (on-trip)	Medium/Large	Often	Large	Medium/Large
INEF08: Inefficient Acceleration	Large	Often	Large	Large
INEF09: Inefficient Deceleration	Large	Often	Large	Large
INEF10: Inefficient (Unnecessary) Idling	Large	Often	Large	Large
INEF11: Inefficient Speed	Large	Often	Large	Large
INEF12: Inefficient Gear (RPM)	Large	Often	Large	Large

From the table above (Table 1) it becomes clear that, based on the criteria listed above, the targeted inefficiencies either can have a large impact and require a large implementation effort or the impact is rather small, but also the implementation effort is small.

For the ecoSmartDriving project that means that all of the listed inefficiencies will be targeted in the use cases and applications, but it also indicates where the biggest efforts will be put to.

4.4. Inefficiencies and ideas that will not be addressed by ecoSmartDriving

For the ecoSmartDriving the scope has been limited to influencing the driver and not to take over the control of the vehicle from the driver. Therefore the inefficiencies that are 'Vehicle induced' will not be targeted (i.e. INEF08f-12f). However, that does not mean that the systems that are developed within the ecoSmartDriving subproject cannot be used as input for such systems.
Also the inefficiencies that are only relevant for Freight and Logistics (INEF04) as well as Traffic Management and Control (INEF13) will not be targeted in this subproject.

ecoSmartDriving innovations

Today the rate of improvement of the energy efficiency of new vehicles and of the latest traffic management systems due to technological progress alone is not able to keep up with the growth in demand for mobility – more and more people want to travel further and further in their personal car, while society's demand for an every-expanding range of goods keeps road freight traffic growing.
A radically new paradigm for mobility of people and goods must be found, and one promising direction lies in the application of mobile communication between vehicles (V2V) and between vehicles and the infrastructure (V2I) to enable what are called "cooperative mobility systems" or cooperative systems for short. eCoMove will create the various innovative elements needed for this new ecosystem to work effectively and deliver the targeted 20% reduction in avoidable energy use and CO_2-emissions.

The essence of the innovation of the eCoMove project is that all foreseen applications will be working within a cooperative system that aims at minimising the total fuel excess and achieving the maximum energy efficiency. This has not been demonstrated anywhere else up to now.

5.1. Innovations in eCoMove ecoSmartDriving SP3

In this paragraph the specific innovations related to SP3 ecoSmartDriving are analysed.

The SP3 Subproject consists of three main research applications, related to Pre-Trip, On-Trip and Post-Trip phases.
Additionally, a last application – regarding eco floating vehicle data – is addressed to distribute the most relevant information from the trip to the traffic control centre, both when being on trip as well as when the trip is finished.

In the following, the specific innovative items for each ecoSmartDriving applications are described.

1) ecoTripPlanning (**pre-trip**) application will enable ecoRouting complemented with relevant information that can support even further reduction of fuel consumption like: suggested time slot, parking availability. This new function will be designed to be available on nomadic devices and will be downloadable in the vehicle as the selected nomadic device can be integrated fully into vehicles. The ecoInformation application like described under the next point will partly also be active in the pre-trip phase, just before the driver starts the trip.

2) the on-trip ecoSmartDriving applications contain three applications:

- *A. dynamic ecoNavigation:* dynamic green navigation that integrates the information from the traffic centre, from the other vehicles, from the ecoMaps and the ecoCooperativeHorizon.

- *B. ecoDriving Support:* dynamic suggestion to drivers how to drive depending on driving context – traffic – location – road - environment, on driving tasks and strategies, on driver' driving style, on driver's motivations, on vehicle typology and fuel usage. The ecoDrivingSupport application also relies heavily on the innovative ecoCooperativeHorizon and the ecoMaps.

- *C. ecoInformation:* information on how to tune other vehicle functions at best to minimise fuel consumption; this application will not only be active on-trip, but also support the driver to check the vehicle before he / she starts the trip.

3) ecoPostTrip application (**post-trip**) is based on the TripDataSet (where all trip data is stored that is relevant for the fuel consumption) that is an essential component of the whole chain of eco applications as it will be the key to understand how the driver is driving. The information derived will be used to optimise the eco driving strategies and the provision of dedicated information to the driver, both inside the car as well as off-board.

4) The last application of the ecoSmartDriving subproject is the **ecoMonitoring application** (incl. eco floating vehicle data (ecoFVD)): relevant information derived from the TripDataSet will be distributed to the traffic control centre in a fully anonymous way to protect drivers' privacy, both on-trip as well as post-trip.

Table 2 shows in a schematic way the really innovative aspects of the ecoSmartDriving applications already described.

Table 2: ecoSmartDriving Innovations

ecoSmartDriving Application	**Innovations of the research**
ecoTripPlanning (pre-trip)	The novelty lies in the possibility to plan in advance an ecological trip and in the fact that this planning can be performed either on nomadic device or on board. The integrated use of ecoMaps and the access to historical traffic data and predictions of traffic loads enables to provide routes with the lowest fuel consumption and preferred time slot for maximum saving.
ecoInformation (pre- and on-trip)	The novelty of this application lies in the fact that the vehicle state is not only checked, but that the driver is also informed about the consequences of this state for the fuel consumption of the vehicle and recommendations are given how the settings can be best tuned for optimal fuel consumption.
ecoDrivingSupport (on-trip)	The main innovation in this application is the pre-view of the driving situation (type of road, speed limits, other traffic, status of traffic lights, etc.) given by the ecoCooperativeHorizon that is used to determine the

	optimal driving strategy for the upcoming situation. This driving strategy is then translated through the ecoHMI into driving recommendations for the driver. Additionally the information is provided to the driver in an innovative way: i.e. via dynamic suggestion to drivers not only on the route to follow but also on how to drive depending on driving context accompanied by driver's motivations to show and demonstrate to the drivers "the advantage of driving eco" and to sustain their willingness to follow these eco suggestions.
Dynamic ecoNavigation (on-trip)	In addition to the determination of the least fuel consuming route, that is also included in the ecoTripPlanning application, the Dynamic ecoNavigation uses the dynamic mode of ecoMaps integrated with information (relevant to save fuel) coming from traffic control centre and from other vehicles and guides the driver even to take the best lane for reducing fuel consumption and find the least fuel consuming way to a parking spot.
ecoPostTrip application (post trip)	The novelty of the ecoPostTrip application lies mainly in the fact that fuel consumption related trip data (stored in the TripDataSet) is not only used to provide direct feedback (either on-board or off-board) to the driver, but also for optimising the route planning for future trips on the driver specifics (not all drivers drive the same way, so also optimal routes could be different for different drivers) and also to personalise and adjust the driving recommendations in the other on-trip applications to the specific driver and his motivations.
ecoMonitoring application (eco floating vehicle data)	This is a new use of the concept of floating vehicle data as relevant information (derived from the TripDataSet) will be distributed to the traffic control centre and to the vehicle network (in an anonymous way) so that the whole network can benefit from eco information gathered locally.

Essential for the novelty of all the ecoSmartDriving applications is that they are **cooperating with other vehicles and infrastructure to improve the pre-view of the situation ahead and of the traffic state ahead** in order to have the best possible dataset to determine the least fuel consuming route or way of driving.
Also the integration of all these applications in an integrated system, working together (i.e. using the data from the TripDataSet for different applications), has not been shown before.
Although not a real innovation, the way these applications will come together into an integrated ecoHMI is an essential part of the project and has not been shown as such before.

5.2. Limitations foreseen

The limitations foreseen for the future implementation of research results are both of technological origin and related to users behavior.

From the **technological point of view**, the most critical point is related to the real time exchange of information among drivers and among drivers and infrastructure. Essential factors are the connectivity, the availability of infrastructures and the amount of vehicles equipped with devices communicating real time information. In addition the ecoMaps should be updated in real time independently from environment constraints and changes.

From the point of view of the **drivers**, it could be difficult to convince the user about the absolute privacy preservation on the information distribution among vehicle, infrastructure and traffic control centre.
Another difficulty is due to the 'change of mind' necessary to convince drivers that in some situations the personal driving style might be changed. People must become conscious of the importance of changing some driving habit both to obtain personal advantage (for example in fuel consumption) and to have a real improvement of the quality of life for the whole society. To obtain this result a determinant role will be played by the HMI. The way the information and suggestions are provided to the drivers as well as the ability to provide incentive them with bonus or fulfilment are key factors to motivate them to follow the eCoMove suggestions and learn the proper driving and trip planning behaviour.

It could be useful to introduce the possibility of incentives for those drivers available to adopt the ecoSmartDriving behavior.

Use scenarios

The use scenarios, or use cases, are defined based on the inefficiencies as listed in Chapter 4 (see also D2.1 [1] for a detailed overview of the inefficiencies) using a common template that is also applied in the other eCoMove sub projects.
Following the structure of the identified inefficiencies, the use cases are also classified according to the trip-phasing, meaning pre-trip, on-trip and post-trip.

This has resulted in the following use cases:

- Pre-trip phase:
  - UC_SP3_01: Checking Vehicle Condition (pre-trip)
  - UC_SP3_02: Planning ecoTrip
- On-trip phase:
  - UC_SP3_03: EcoUse of Vehicle Systems
  - UC_SP3_04: Dynamic ecoNavigation
  - UC_SP3_05: Dynamic ecoGuidance
  - UC_SP3_06: Support ecoDriving
- Post-trip phase:
  - UC_SP3_07: In-vehicle ecoTripFeedback
  - UC_SP3_08: Off board ecoTripFeedback

In the following paragraphs these use cases are described in more detail.

Table 3: Relation between Use Cases and Inefficiencies

	UC_SP3_01: Checking Vehicle Condition (pre-trip)	UC_SP3_02: Planning ecoTrip	UC_SP3_03: EcoUse of Vehicle Systems	UC_SP3_04: Dynamic ecoNavigation	UC_SP3_05: Dynamic ecoGuidance	UC_SP3_06: Support ecoDriving	UC_SP3_07: In-vehicle ecoTripFeedback	UC_SP3_08: Off board ecoTripFeedback
INEF01: Inefficient Vehicle Condition (pre-trip)	x							
INEF02: Inefficient Route Choice		x						x
INEF03: Inefficient Travel Timing		x					x	x
INEF05: Inefficient Usage of (Electrical) Energy Consumers			x				x	x
INEF06: Inefficient Vehicle Condition (on-trip)			x				x	x
INEF07: Inefficient Routing (on-trip)		x		x	x		x	x
INEF08: Inefficient Acceleration						x	x	x
INEF09: Inefficient Deceleration						x	x	x
INEF10: Inefficient (Unnecessary) Idling						x	x	x
INEF11: Inefficient Speed						x	x	x
INEF12: Inefficient Gear (RPM)						x	x	x

Table 3 shows the relation between the inefficiencies and the use cases and shows that all inefficiencies that are selected as relevant are covered by the use cases.
It's relevant to indicate that in the case of post-trip applications the use cases have no direct impact on reducing the inefficiencies. However, the post-trip use cases are aimed at teaching the driver about the inefficiencies and in this way contribute to reducing them, therefore there is an indirect impact on the indicated inefficiencies.

6.1. Use Cases

This chapter includes all the use cases identified following the main classification of the in-vehicle applications: Pre-Trip, On-Trip and Post-Trip.

6.1.1. Pre-Trip

In this sub-chapter the use cases related to the Pre-Trip situations are included. Two main use cases were identified:

- UC_SP3_01: Checking Vehicle Condition (pre-trip)
- UC_SP3_02: Planning ecoTrip

Next paragraphs, the description of these use cases is included.

6.1.1.1. Checking Vehicle Condition

Use Case ID	UC_SP3_01
Version	V02
Author	F. Tosetto, M. De Gennaro, P. Mortara / SP3 / MM David Sánchez, Rosa Blanco / SP3 / CTAG
Contributing partners	Continental
Responsible SPs	SP3
Short Description	This system helps the driver to be aware of vehicle conditions that influence fuel consumption before starting the trip. Some inefficiencies can be detected by systems in the vehicle (if available), such as low tire pressure and maintenance interval. In this case the driver can be automatically notified that e.g. tire pressure is too low. Other inefficiencies cannot automatically be detected by systems in the vehicle, like wrong vehicle maintenance (old air filters, obstruction of air outtakes, change of oil, etc…), bad tire condition, vehicle loading (unnecessary weight), unnecessary or inefficient accessories or equipment that might affect aerodynamics, etc… In case it is not possible to detect an inefficient condition automatically (e.g. equipment that might affect aerodynamics, bad tire condition, etc…) the system asks the driver to check these conditions.
Goal	Fuel efficiency improvement on vehicle level - eliminate inefficient vehicles conditions: low tire pressure, wrong vehicle maintenance (old air filters,

	obstruction of air outtakes, change of oil, etc…), bad tire condition, vehicle loading (unnecessary weight), unnecessary or inefficient accessories or equipment that might affect aerodynamics, etc…
Constraints	Data availability in the network / Possible annoyance of the driver (e.g., the driver is alerted about an additional weight on the vehicle → he might know the fact and he really need to carry this weight)
Actors	Driver, Vehicle system
Driving situation	Pre-trip situation (Before starting the trip)
Vehicle type&state	All types of vehicles.
Inefficiency addressed	INEF01 Inefficient vehicle condition
Pre-condition	The sensors installed in the vehicle (or the driver by checking/looking) can detect an inefficient condition of the vehicle.
Post-condition	The driver follows the recommendations.
Main flow	1- The vehicle checks the conditions that can be detected automatically (the information is in the vehicle network): o Tire pressure o Vehicle maintenance 2- In case an inefficient condition was detected, a recommendation is presented to the driver. 3- The driver is asked to check some conditions (difficult to check automatically): o Tire condition o Vehicle loading (unnecessary weight) o Adjustments / equipment influencing aerodynamics
Exceptions	N.A.
Dependency with other Use Cases	UC_SP3_03

6.1.1.2. Planning ecoTrip

Use Case ID	UC_SP3_02
Version	V02
Author	F. Tosetto, M. De Gennaro, P. Mortara / SP3 / MM
Contributing partners	CRF, MM, CTAG
Responsible SPs	SP3, SP4
Short Description	Before starting the trip, the driver sets his / her route using the following parameters: • Destination → an appropriate ecoRoute can be selected. Historic and predictive traffic and speed profiles are taken into account for the ecoRoute calculation (interaction with network needed). • Trip timing → departure time / arrival time: o Departure time is fixed (no earlier than…..h) o Arrival time is fixed (no later than …h) o Both arrival and departure time are not fixed • *Requirement for parking → Reservation of parking spaces will be possible taking into account final destination, so unnecessary driving will be avoided – this part is only possible when already quite close to the destination and therefore only available on-trip, not pre-trip.*
Goal	Reduction of fuel consumption choosing the most efficient route, avoiding searching for parking place, taking into account the timing for the route (e.g. avoiding congestions that could influence the arrival time).
Constraints	Data availability (network level): historic traffic profiles and the predictive traffic information is available from the Traffic Management Centre. Historic traffic profiles can also be available locally (in maps). Availability of parking guidance system application (planned in SP5 to be available when already quite close to destination). The application is available off-board and on-board and is able to connect to traffic prediction database.
Actors	Driver, Vehicle system, Traffic Management Centre
Driving situation	Pre-Trip when planning the trip
Vehicle type&state	All type of vehicles
Inefficiency addressed	INEF02 Inefficient route choice INEF03 Inefficient travel timing – pre-trip INEF07.e Destination induced inefficient routing

	(looking for parking place)
Pre-condition	The driver wants to plan his/her trip to use as less as possible fuel
Post-condition	The driver follows the ecoRoute (incl. trip timing) planned with the tool and saves fuel
Main flow	1- The driver introduces desired parameters in the system: destination, departure and arrival time and need of parking space (in case it's needed). 2- System checks the information about the historic traffic profiles and the predictive traffic information provided by the Traffic Management Centre. 3- System calculates the ecoRoute based on driver preferences and offers choices to driver 4- Driver chooses ecoRoute 5- Once the ecoRoute has been chosen pre-trip (e.g. a day before), the actual and predicted traffic situation is monitored and checked if the settings of the original trip (departure time / arrival time) can be kept. Three scenarios can occur: a. No change in the network, arrival and departure time stay the same, driver can start the trip at the planned time b. Departure time is fixed (no earlier than…..h): in case of heavy traffic it might be more efficient to leave later, the system sends a message to the user that he can better depart e.g. half an hour later. c. Arrival time is fixed: in case there is heavy traffic the driver gets a signal that he should leave earlier to be able to arrive at the requested time. Automatically the route is adjusted to the eco-route taking into account the traffic information. 6- If traffic prediction changes before the trip has started, the route/timing is automatically adjusted and the driver is informed about this.
Exceptions	The driver priority could not be the fuel efficiency (e.g. more important to reach the destination in short time).
Dependency with other Use Cases	UC_SP3_04 UC_SP3_05

6.1.2. On-Trip

In this sub-chapter the use cases related to the On-Trip situations are included. Four general use cases were identified:

- UC_SP3_03: EcoUse of Vehicle Systems
- UC_SP3_04: Dynamic ecoNavigation
- UC_SP3_05: Dynamic ecoGuidance
- UC_SP3_06: Support ecoDriving

Next paragraphs, the description of these use cases is included.

6.1.2.1. EcoUse of Vehicle Systems

Use Case ID	UC_SP3_0003
Version	V02
Author	F. Tosetto, M. De Gennaro, P. Mortara / SP3 / MM
Contributing partners	CONTI, FFA, CTAG
Responsible SPs	SP3
Short Description	Efficient use of energy consumers can reduce fuel consumption, since it is directly generated by the engine or indirectly if the energy is drawn from the battery. Some of the main electrical energy consumers are: • Air conditioning / climate system • Windshield heating • Seat heating • External/internal lighting • Multimedia system • Charging of mobile phone batteries or other mobile equipment • Etc. Also the vehicle condition during the driving is considered: • Reduced tire pressure during the trip. • Driving with open windows/tailgate. After checking vehicle condition/efficient use of energy consumers, a recommendation is given to the driver, taking into account also de combination of both conditions (e.g. at low speeds driving with open windows is in general more fuel efficient than using the air conditioning system to cool down the vehicle); therefore the system needs to check what currently the best option is given the driving situation and weather situation).
Goal	Reduction of fuel consumption by the reduction of usage of the alternator or energy stored in the battery. The alternator provides electric energy (taken from the motor) to the battery. The less the alternator works, the

	less energy is taken from the engine to the electrical consumers (all engine energy is used to propel the car). This is valid in most cars with auto-switch-off alternators. In addition the battery can be charged at times the energy is relatively cheap (e.g. when driving downhill).
Constraints	Availability of data regarding environment and driving situation.
Actors	Driver, vehicle, energy consumers
Driving situation	On-trip
Vehicle type&state	Passenger vehicle, engine on. UC might differ in its final output depending on vehicle configuration (intelligent alternator, hybrid vehicle)
Inefficiency addressed	INEF05 Inefficient usage of (electrical) energy consumers INEF06 Inefficient vehicle condition
Pre-condition	Energy use of electrical consumer and/or inefficient vehicle condition detected.
Post-condition	Driver follows the recommendation of the system.
Main flow	1- The system detects an energy consumer and/or inefficient vehicle condition. 2- The system analyses the situation taking into account the driving situation/weather situation. 3- A recommendation is presented to the driver: a. Operation recommendation b. Information about additional fuel consumption caused by usage of vehicle systems.
Exceptions	In specific situations electrical consumers bring benefits in terms of safety (e.g., lighting, driving at 35ºC equals at driving with 0,8 g of alcohol in the blood per liter). In this type of situations the system should be overruled, safety comes on the first place.
Dependency with other Use Cases	UC_SP3_01

6.1.2.2. Dynamic ecoNavigation

Use Case ID	UC_SP3_04
Version	V02
Author	
Contributing partners	BOSCH, NAVTEQ, TELEATLAS
Responsible SPs	SP3, 4, 5
Short Description	The ecoRoute determined by the navigation system will be adjusted dynamically during the trip based on real time and predicted traffic status information and information received from broadcast transmitters,

	mobile internet services, other vehicles, and roadside units (e.g. ecoRouteAdvice). When arriving at the destination, in order to prevent driving around searching for parking place, the route can be adjusted to lead driver to the parking spot via the most economical route.
Goal	To drive the least fuel consuming route (ecoRoute) and avoiding driving around looking for parking place.
Constraints	To have enough information from the other vehicles (high number of equipped vehicles), the traffic management centre and the infrastructure.
Actors	Passenger vehicle, traffic management centre, other vehicles and infrastructure (RSUs).
Driving situation	On-trip following an ecoRoute calculated previously (see use case UC_SP3_02).
Vehicle type&state	Passenger vehicle while driving an a selected ecoRoute
Inefficiency addressed	INEF07 Inefficient routing
Pre-condition	A route is entered in the navigation system and the driver is following the route.
Post-condition	The driver has reached the destination through the least fuel consuming route.
Main flow	1- The driver selects the ecoRoute that has been calculated in the navigation system (see UC_SP3_02) taking into account the parameters introduced and the trip starts. 2- During the trip and taking into account the information received (real time & predicted traffic, ecoRouteAdvice, information from other vehicles, infrastructure) the route is adjusted dynamically. 3- The directions are given to the driver during the trip to enable him/her to follow the ecoRoute 4- When the driver is close to the destination he / she is asked if he / she needs guidance to a parking place. 5- The driver arrives at destination (or parking place).
Exceptions	The driver priority could not be the fuel efficiency (e.g. more important to reach the destination in short time → see UC_SP3_02)
Dependency with other Use Cases	UC_SP3_02 / UC_SP5_3 (ecoRouteAdvice)/traffic prediction

6.1.2.3. Dynamic ecoGuidance

Use Case ID	UC_SP3_0005
Version	V02
Author	N. Eikelenberg / SP3 / FFA
Contributing partners	CTAG
Responsible SPs	SP3, 4, 5

Short Description	When a route has been entered in the navigation system or if no route has been entered and an ecoCooperativeHorizon prediction is made (most probable path prediction), the route is adjusted based on traffic light settings and actual traffic density within a city network (neighbourhood scale). Also the lane choice in case of more lanes is included (e.g. choosing the correct lane for the direction in which you are going to prevent unnecessary late merging actions that often cause congestions/stop-and-go traffic).
Goal	Increasing efficiency avoiding unnecessary maneuvers, improving speed smoothness and adapting the route in specific urban situations.
Constraints	Available real time data from the network (V2V and V2I)
Actors	Driver, Vehicle, Traffic Management, roadside units, traffic lights, drivers and other road users.
Driving situation	On-trip in situations where a better lane choice or guidance can reduce the need for decelerations/accelerations.
Vehicle type&state	Passenger vehicle while driving
Inefficiency addressed	INEF07 Inefficient routing
Pre-condition	Availability of Most Probably Path or Route from navigation system and lane choice situation and/or variability of traffic congestion.
Post-condition	Driver has passed the 'obstacle' / road situation without many decelerations and accelerations / as smooth as possible speed.
Main flow	1- The vehicle knows the next (part of the) route where the driver wants to go (either a route has been introduced in the navigation system / the most probable path is determined with ecoCooperativeHorizon). 2- Taking into account the traffic lights information, the actual traffic density and/or the lane choice (in case more lanes) the system analyses what is the most efficient route/lane for the driver. 3- The driver is guided on this lane/route (received from UC_SP5_9).
Exceptions	Roadworks (not noticed), safety issues, driver deviates from route
Dependency with other Use Cases	UC_SP3_02 UC_SP3_05 UC_SP5_09

6.1.2.4. Support EcoDriving

Use Case ID	UC_SP3_06
Version	V02
Author	N.Eikelenberg (FFA)
Contributing partners	All SP3 partners.
Responsible SPs	SP3, SP4
Short Description	During the driving and taking into account the vehicle status, the route and the driving situation (traffic, infrastructure, weather, etc…), the ecoDrivingSupport system gives to the driver the most adequate indication about: • Acceleration in the most economical way. • Deceleration in the most economical way. • Recommendations to shut down the engine (vehicle without stop-start system). • Avoid idling. • Most adequate speed (adjust speed to driving situation). • Gear shifting. Important is that the system is based on a prediction of the road ahead and therefore can support the driver to better anticipate.
Goal	Improvement of fuel efficiency for primary driving tasks giving recommendations to the driver about acceleration, deceleration, speed, gear shifting, shut down the engine and avoid idling,
Constraints	Availability of information (e.g. details on road ahead, weather conditions, traffic information…). The HMI should be adequate in order to get the acceptation from the driver. For safety reasons, it could be possible not to have the optimal behaviour in all situations (e.g.,sudden acceleration when overtaking a slower vehicle in one-lane roads, etc.)
Actors	Driver, Vehicle, Traffic Management, Road side units (incl. traffic lights)
Driving situation	During driving various inefficient situations can occur in which the system should be active. Inefficient situations can be caused by traffic, road layout, traffic signals, weather / environmental conditions or by the driver him / herself. - All situations where an acceleration is required: o Traffic induced: Overtaking, changing lanes o Traffic signal induced: Leaving a red traffic light, closed bridge, railway crossing, toll gate, ramp meter, lane closure

	o Road induced: after a turn left or right, after a sharp curve, when entering the highway, when leaving urban area, lane block - All situations where a deceleration is required: o Traffic induced: Overtaking, changing lanes o Traffic signal induced: Arriving at a yellow or red traffic light, closed bridge, railway crossing, toll gate, ramp meter, lane closure o Road induced: approaching a turn left or right, roundabout, sharp curve, when leaving the highway, when entering urban area or when approaching a road with lower speed limit, lane block (construction site) When driving on a slope these situations as such are not influenced, only the recommended acceleration or deceleration rate, speed and gear could be different. - Stopping the vehicle can be induced by several causes: o Traffic induced: accident in front, heavy congestion, having to give way at a crossing. o Road induced: lane closures, lane blocks (construction site) o Weather induced: leaving the engine on while de-icing the vehicle, on a hot day to keep the air conditioning running, on a cold day to keep the heating running, before leaving to warm up the engine o Traffic signal induced: stop sign, at a red traffic light, closed bridge, railway crossing, ramp meter, etc. Main difference between these situations is the way the expected stop-time is predicted. - A non-constant speed can be induced by several causes: o Traffic induced: stop-and-go traffic / dense traffic o Road induced: varying speed due to traffic calming measures o Driver induced: the driver is simply not

	able to maintain a constant speed for whatever cause ("hectic style"; poor anticipation behaviour; poor distance control / space management…) o Traffic signal induced: in case there is a 'green wave' there is an optimum speed for the vehicles to 'catch' all green lights and avoiding to stop or decelerate and accelerate each time; in case of cooperative traffic lights, the vehicle can receive a recommended speed to approach the traffic light. - In certain situations the driver chooses a speed that is not the most efficient speed for that situation. o Road induced: ▪ When driving up- or downhill it can sometimes be more efficient if the driver decreases the speed a bit or increases the speed a bit ▪ Depending on the vehicle and taking into account other traffic the most efficient speed for the vehicle that suits the driving / traffic situation can be chosen (e.g. limit speed sensible on the highway as higher speed increases fuel consumption drastically) o Weather conditions can require a certain speed. - The driver does not drive with the most efficient gear for the current speed, taking into account the expected upcoming situation: o Driving at constant speed in wrong (= too low) gear o Standing still on an uphill slope keeping the vehicle in position by using gear / gas or D and brake proportional to how steep the position is. Exceptions: a) during acceleration it is sometimes necessary to use a lower gear to enable the required acceleration; b) skipping gears is sometime required and/or fuel efficient to quickly achieve a constant speed at low rpm.
Vehicle type&state	Passenger vehicle. System might work differently on:

	• ICE (Internal Combustion Engine) vehicles / Hybrid vehicles / Electric Vehicles. • Vehicles with manual gearbox / automatic gearbox • Vehicles with Start & Stop / without start & stop system
Inefficiency addressed	INEF08: inefficient acceleration INEF09: inefficient deceleration INEF10: inefficient (unnecessary) idling INEF11: inefficient speed INEF12: inefficient gear (RPM)
Pre-condition	Support ecoDriving should detect above mentioned inefficiency situations through specific algorithms, using CAN-data and possible external data (headway sensors, V2X information…)
Post-condition	Driver following the recommendation shown by the system, resulting in better fuel efficiency.
Main flow	1- The current and predicted driving situation is analysed and optimal driving strategy is determined based on: a. Current position and status of the vehicle b. Predicted path of the vehicle c. Road, traffic, traffic signal and environment parameters on predicted path d. Direct environment of vehicle (through vehicle sensors and V2V/V2I information exchange) 2- The system gives a recommendation for the optimal driving strategy (e.g. acceleration, deceleration, speed, gear, engine on/off). 3- The driver follows the recommendation of the system.
Exceptions	Safety critical situations (e.g. it should not be allowed that the system gives a recommendation to accelerate when there is a vehicle driving in front of the eCoMove vehicle at a distance less than xx meters).
Dependency with other Use Cases	UC_SP5_10

6.1.3. Post-Trip

In this sub-chapter the use cases related to the Post-Trip situations are included. Two general use cases have been identified:

- UC_SP3_07: In-vehicle ecoTripFeedback
- UC_SP3_08: Off board ecoTripFeedback

Next paragraphs, the description of these use cases is included.

6.1.3.1. In-Vehicle ecoTrip Feedback

Use Case ID	UC_SP3_07
Version	V02
Author	N. Eikelenberg / SP3 / FFA
Contributing partners	FFA
Responsible SPs	SP3
Short Description	During the trip, relevant data (speed, accelerations, fuel consumption, …) is stored in the vehicle. Directly after the driver ends his / her trip the in-vehicle eCoMove system gives the driver some advices or compliments on the main fuel consumption related issues in his / her last drive. The data of each trip is stored inside the vehicle and analysed on drive style aspects. The results of these analyses can be fed back into the ecoDrivingSupport system to adjust the recommendations to the driver specifics and the stored data can be used to personalise the settings of the ecoRouting.
Goal	Inform the driver how fuel efficient he / she has driven and which aspects in the drive contributed to this. Long-term improvement of the driver behavior in terms of eco-driving.
Constraints	Data need to be related to a specific driver to be useful for comparison.
Actors	Driver, vehicle system
Driving situation	Post-Trip
Vehicle type&state	Passenger vehicle, engine shut down, ignition off, driver inside the vehicle
Inefficiency addressed	General inefficiencies of the complete trip relating to primary driving tasks and the way the driver has followed the recommendations
Pre-condition	Performance data is recorded during the trip.
Post-condition	Driver receives information about the past trip.
Main flow	1- After the trip the data is analysed. 2- Results are presented to the driver. 3- The information is stored in the vehicle and fed back to the ecoDrivingSupport system.
Exceptions	N.A.
Dependency with other Use Cases	UC_SP3_06 UC_SP3_08

6.1.3.2. Off-Board ecoTrip Feedback

Use Case ID	UC_SP3_08
Version	V02
Author	N. Eikelenberg / SP3 / FFA

Contributing partners	
Responsible SPs	**SP3**
Short Description	The data of the past trips can be extracted from the vehicle for analysis on a PDA or PC. Details of various fuel consumption related trip aspects (speed, gear-shift, smoothness of drive, acceleration/deceleration behavior, idle time, etc.) can be analysed in detail, also related to route details and compared with previous trips. Data can be analysed on trip basis for an individual driver, but also drivers can compare their behaviour with each other. This can be done on a family basis, but also through an internet community.
Goal	Inform the driver how fuel efficient he / she has driven and which aspects in the drive contributed to this and how he / she can improve fuel economy further
Constraints	Fuel consumption details should be available in relation to route details and driving profiles
Actors	Driver, vehicle system, PC/PDA
Driving situation	N.A., use case takes place OUTSIDE of the vehicle
Vehicle type&state	Passenger vehicle, engine shut down, ignition off, driver has left the vehicle
Inefficiency addressed	All inefficiencies of the complete trip, related to route details, relating both to primary driving tasks as well as non-primary driving tasks.
Pre-condition	Trip data is extracted from vehicle either via wireless communication or via USB or other wired communication options
Post-condition	Driver has learned how his / her behaviour on a specific trip contributed to his / her fuel economy
Main flow	1- The data is extracted from the vehicle on a mobile device/data carrier. 2- Detailed analyses are performed. 3- Comparison of data is performed.
Exceptions	N.A.
Dependency with other Use Cases	UC_SP3_07

6.1.4. Cooperativeness of use cases

In the table below the use cases from sub project ecoSmartDriving are categorised based on the level of cooperativeness (Table 4). Several Use Cases have non-cooperative parts which may be realised without their cooperative parts. This is indicated by the occurrence of more than one X within one row.

Table 4: Categorisation of Use Cases on Cooperativeness

UC short name	UC Identifier	Non - cooperative (Independent)	Independent but cooperative approach beneficial	Cooperative (V2V)	Cooperative (V2I, incl. traffic management)
Checking Vehicle Condition	UC_SP3_01	X			
Planning ecoTrip	UC_SP3_02		X		
EcoUse of Vehicle Systems	UC_SP3_03		X		
Dynamic ecoNavigation	UC_SP3_04			X	X
Dynamic ecoGuidance	UC_SP3_05			X	X
Support ecoDriving	UC_SP3_06		X		
In-Vehicle ecoTripFeedback	UC_SP3_07	X			
Off-Board ecoTripFeedback	UC_SP3_08	X			

6.2. Assumptions and constraints

The specific constrains related to each use case are indicated in the correspondent field for each one. In this sub-chapter, main assumptions and constrains are highlighted:

One of the most relevant constrain in most of the use cases is the availability of the information needed by the systems:

- Information from the vehicle network.
- Information from the sensors in the vehicle.
- Information about the environment: traffic information (from the Traffic Management Centre), other vehicles information (enough number of vehicles with V2V), infrastructure information (V2I), weather conditions, etc…

During the preparation of these use cases it is assumed that all this information will be available from the vehicle network, from the sensors and from the environment. In case, this information will not be available some little variations in the implementation of the use cases should be considered.

Finally, during the definition of the use cases, constrains or conditions regarding the interaction with the driver (HMI) are not included. In this case, it is assumed that an adequate ecoHMI will be developed for the integration of applications.

The ecoSmartDriving subsystem

In this chapter the SP3 portion of the eCoMove system concept is described in detail. For the overall eCoMove system concept see D2.1.

7.1. Operation environment

In SP3 ecoSmartDriving operation closely related to a single vehicle is addressed. The applications apply for any type of vehicle, independent of realisation of power train (combustion engine, hybrid or electrical drive). Primary operation environment is the passenger car, but use in commercial vehicles is generally not excluded. (For commercial-specific applications see SP4.)

Prevalently, operation of ecoSmartDriving is during driving (on-trip) and within the car. Considerable parts referring to preparation (pre-trip) and evaluation (post-trip) may (not must) be applied outside the car, e.g. in the office or at home.

On-trip ecoSmartDriving applications address the routing as well as assisting single maneuvers during driving and are thus active throughout the entire trip, be it in urban or rural environments and on any type of road. At least partial availability of Vehicle to Infrastructure and Vehicle to Vehicle communications is assumed.

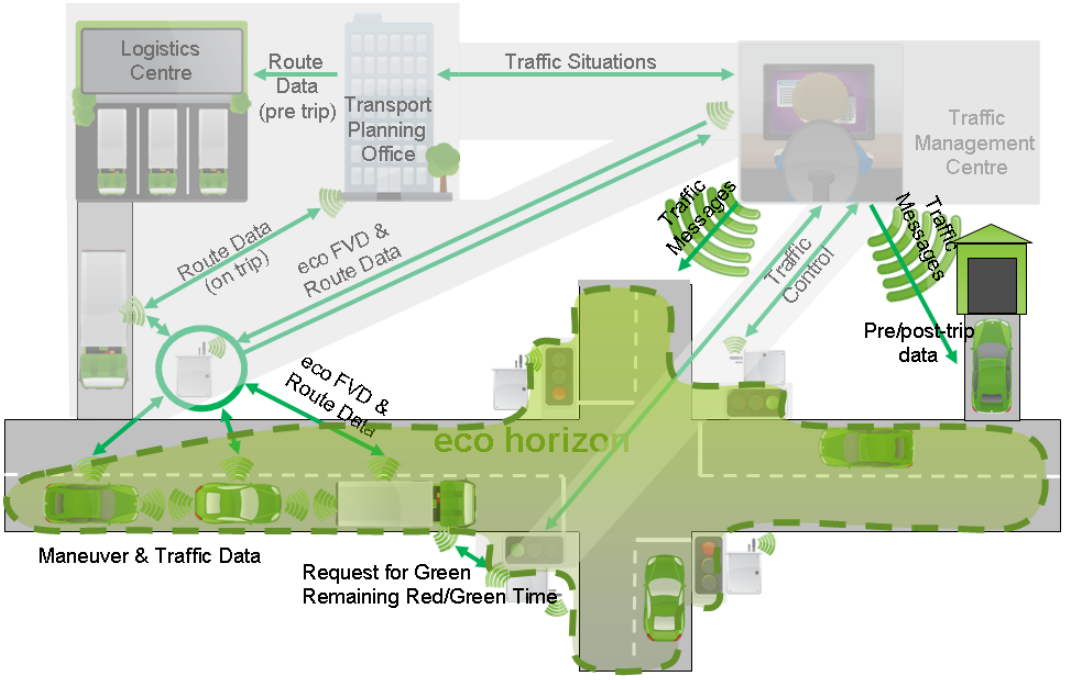


Figure 14: System Concept Overview for ecoSmartDriving

For pre-trip and post-trip applications if not applied within the car, a private or professional office environment is assumed which enables trip planning and trip evaluation using digital data from the ecoSmartDriving subsystem. Also portable / nomadic devices are considered for this type of applications. The SP3 operation

environment is illustrated in Figure 14. It is the non-shaded part of the overall system concept overview.

Applications and components located e.g. in the Traffic Management Centers or in Road Side Units are not treated within SP3.

7.2. Overview of the applications and components

7.2.1. Description of applications

Within the ecoSmartDriving subproject the inefficiencies are targeted by applications and components that are active in the pre-trip phase (before the driver enters in the vehicle and starts his/her trip), on-trip while the driver is driving his/her vehicle on the road and post-trip when the driver has arrived at his/her destination and leaves the car. The table below (Table 5) provides an overview of what applications are available under the different trip phases and whether these applications would be available within the vehicle or off the vehicle.

Table 5: Application available In-Vehicle and Off-Vehicle

	Pre-Trip	**On-Trip**	**Post-Trip**
In - Vehicle	➢ ecoTripPlanning ➢ ecoInformation	➢ ecoInformation ➢ dynamic ecoNavigation ➢ ecoDriving Support ➢ ecoMonitoring	➢ ecoPostTrip ➢ ecoMonitoring
Off - Vehicle	➢ ecoTripPlanning		➢ ecoPostTrip

7.2.1.1. Pre-trip applications

Pre-trip addresses check and (if indicated) readjustment of vehicle conditions that might influence the eco behaviour of the vehicle. Further, before starting and given a destination, an optimised route is calculated taking all available information into account for minimizing energy consumption.

The applications foreseen are:

- **ecoTripPlanning**: this application will enable ecoRouting complemented with relevant information that can support the reduction of fuel consumption like: suggested time slot, parking availability. Results of the routing must be transferable to an in-car system. This application will be designed to be operational on nomadic device too, so that instead of transferring route data to an in-car system the nomadic device can be put into the car.
  In more detail: for given start and destination points and for defined time window for departure or arrival the ecoTripPlanning calculates optimal start time and optimal route; the optimisation goal is to minimise impact of the journey to the environment in terms of CO_2-emissions and fuel consumption. The ecoTripPlanning is based on ecoMap, car and driver characteristics (based on how

the driver has been previously driving) as well as traffic predictions. Thus the ecoTripPlanning will offer:

- an off-line ecoRouting, that calculates the optimal route to minimise fuel consumption based on eco map data and traffic state prediction information.
- an off line information to the driver of expected journey and arrival time integrated with info from traffic predictions.

- **ecoInformation**: this application supports the driver to identify inefficient vehicle conditions before the trip in order to enable him/her to solve the inefficiencies. Although this application can be used pre-trip it's only available inside the vehicle, as can be seen from Table 5.

7.2.1.2. On-trip applications

On-trip addresses check while driving and possibly readjustment of vehicle conditions that might influence the eco behaviour of the vehicle. Further, while driving and given a destination, the remaining route is recalculated taking all available information into account for minimising energy consumption, which may lead to an actualised route recommendation. Also if no destination is given, but the expected route can be based on the most probable path of the ecoCooperativeHorizon, actual information about traffic state in the vicinity of the vehicle may lead to (micro-level) route alternatives. Finally, local information on the driving situation is used to influence primary driving tasks.

The ecoSmartDriving applications will be made available to drivers as soon as the ignition is switched on / engine is started and it will assist the driver for the whole journey with real time information on the best route to choose for saving fuel and with advices on how to drive presented either in a continuous mode (like a training course) or in highlight mode. Advices are presented only at special moments when the driver is using fuel heavily and the system can tell how to avoid excess consumption. The connectivity to other vehicles and to the infrastructure will be included. The information provided will be related to cooperative stop-start assistance at traffic light (recommended speed profile to pass on green) and to “smooth clustering” (recommended manoeuvring to stay in cluster with nearby vehicles and avoid unnecessary acceleration/braking).

The on-trip ecoSmartDriving system is composed of three applications:

- **dynamic ecoNavigation**: it integrates the information from the traffic centre, from other vehicles, from ecoMaps and the ecoCooperativeHorizon in routing and guidance functionalities. This application not only helps the driver to find the least fuel consuming route and guide him / her to drive on this route, but also dynamically adjust the route to changes in the road network and traffic load, as well as guides the driver on the best lane for as low as possible fuel consumption.

- **ecoDriving Support**: it dynamically provides suggestion to drivers how to drive eco-friendly depending on driving traffic situation – location – road - environment, on driving tasks and strategies, on driver’ driving style, on driver’s motivations, on vehicle typology and fuel usage. The essence of the system is that it is a forward looking eco driving assist function that provides dynamic advice in

a medium-to-long time perspectives on how to drive (e.g. suggested advance speed, gear, acceleration, deceleration consumption prediction). The actual position and the heading of the vehicle are determined by the ecoCooperativeHorizon and therefore does not necessarily need a destination to be entered in the navigation system. Information and feedbacks will be provided via multimodal (visual, acoustical or haptic) interfaces that will be applied both to primary driving commands (e.g. gas pedal) or to secondary visual, acoustic, haptic display. The ecoCooperativeHorizon is an important information source for this application.

- **ecoInformation**: this application supports the driver to identify and solve inefficiencies due to inefficient vehicle conditions when on being on trip (e.g. use of air conditioning, changes in tyre pressure, driving with windows open...). This application is the same application as listed in the pre-trip overview.

7.2.1.3. Post-trip applications

Post-trip addresses subsequent evaluation for giving feedback to the user and to the system itself in order to give support for future trips.

The **ecoPostTrip application** that is foreseen in the ecoSmartDriving sub is based on the drivers TripDataSet that is an essential component of the whole chain of eco applications as it will be the key to understand how the driver is driving. The information derived will be used to optimise the eco driving parameters and the provision of dedicated information to the driver; this application is foreseen to be available on-board of the vehicle, but in a more extensive version also off-board. The ecoPostTrip application will be made available either immediately after driving (providing feedbacks on how ecologically the driver has been driving) or/and be made available for subsequent downloading for a detailed analysis of driving behaviour.

Within the ecoSmartDriving applications the data recorded in the ecoPostTrip application can be used in the following ways:

- Provide feedback to the driver directly after engine shut down on e.g. his/her top 3 priority improvement opportunities (or reward him/her if he/she has done well).
- Downloading and analysing of the driving data and driver profile at home.
- Use the data within the ecoSmartDriving applications to develop a driver behaviour profile which can be used:
- As input for the green routing to personalise the route based on individual driver behaviour and preferences;
- Adjust the green driving support advices based on how the driver has reacted to them (e.g. if he always changes gear a certain time later than the advice is given, the advice could be given earlier)

7.2.1.4. ecoMonitoring application

In addition to the applications listed above the **ecoMonitoring application** is active in the on-trip and post-trip phase. The ecoMonitoring application is the basis for the eco floating vehicle data - ecoFVD, and derives relevant information from the TripDataSet that is also used for the ecoPostTrip application and distributes it to the

traffic control centre in a fully anonymous way to protect drivers' privacy. The ecoFVD information will also be available while the vehicle is driving on the road.
The specification of the ecoMonitoring application is done in cooperation with SP2 where the communication platform is specified and the needs for information exchange are specified.

7.2.2. Description of components

The components necessary for the above applications are represented in Figure 15, together with the SP3 application layer. Components have been subdivided in a service layer (immediately accessed by the applications) and a support functions layer. The latter makes use of peripherals/sensors gathered in the lowest layer.

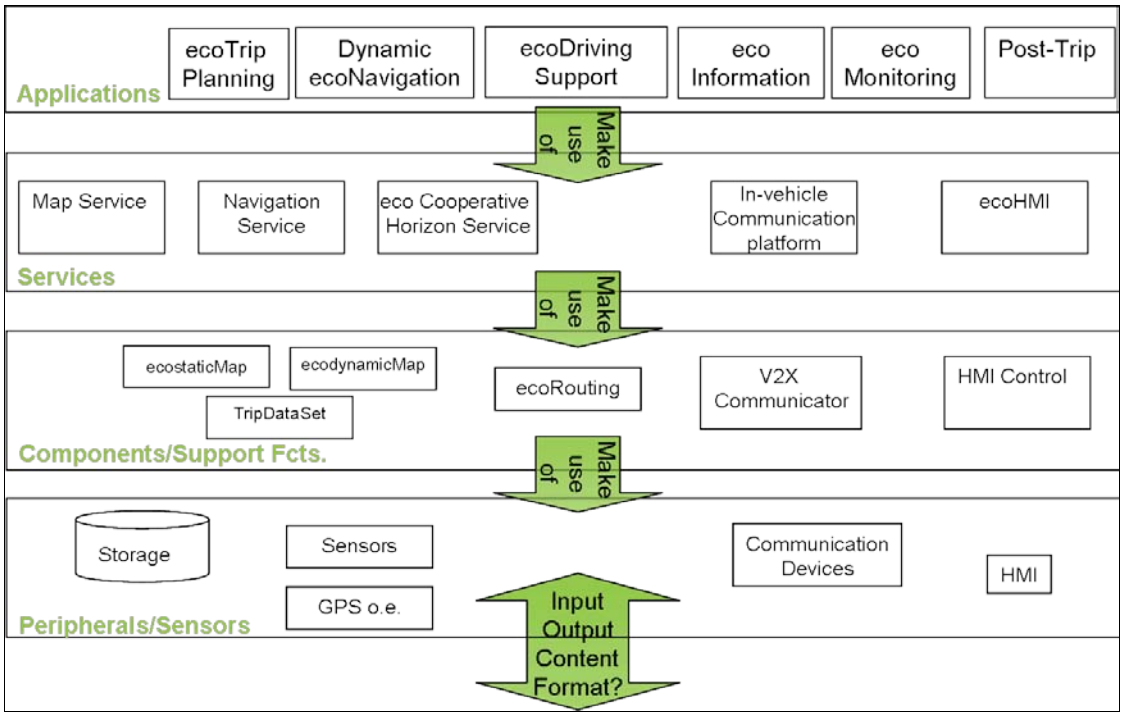


Figure 15: ecoSmartDriving applications and components

In the following, the essential components (on the service and components layer of Figure 15) are described with respect to their roles:

The **ecoHMI** provides all human machine interaction services necessary for ecoSmartDriving applications. In turn, ecoHMI makes use of **HMI control** to enable appropriate input/output modes and surfaces. The ecoHMI is an **interface concept** that provides the interface between the ecoDriving Support, the ecoInformation, the on-board ecoPostTrip applications and the driver. If possible also the interface with the ecoNavigation and ecoTripPlanning will be integrated into this ecoHMI.

The ecoHMI should be capable of handling all information related to the following items that are required by the applications (content is provided by the applications, the ecoHMI 'only' provides the interface with the user):

- different driver typologies that are evaluated via the on board real time analysis of how the driver is driving (a specific function in the vehicles will also be made available to indicate who is driving in case the car is used by different drivers), as also stored in the TripDataSet.

- different driving tasks and contexts obtained from the information derived from the on board ecoDrivingSupport and ecoNavigation system, from the other vehicles and from the traffic centres

- specific vehicle typology fuel consumption model that indicates which is the optimal driving profile to obtain the lowest fuel consumption

The ecoHMI will be designed to convince the drivers to follow the system suggestions and to teach them a better driving behavior. This will be pursued by designing motivating contents and look & feel, able to provide the better user experience in term of usability, efficiency and above all satisfaction.
The ecoHMI will be the key factor to influence positively the driving behaviour and this should be better obtained by means of motivation, giving the driver a true understanding of efficient drive and mobility both in term of economic savings and of environmental advantages. Drivers should thus be stimulated to compete with themselves and with the other drivers through a sort of playful contest for the best eco driving performance.

In-vehicle Communication platform provides all communication services necessary for ecoSmartDriving applications. In turn, the In-vehicle Communication platform makes use of **V2X communicator** to establish appropriate communication paths from the vehicle to other vehicles and to the infrastructure.

ecoCooperativeHorizon Service provides on-trip ecoSmartDriving applications with an electronic horizon where needed shown in Figure 14. Where the traditional electronic horizon (provides the vehicle with a preview of the road network ahead) is based on map data, the ecoCooperativeHorizon contains additional fuel consumption related map data (from ecoMaps) and other relevant information obtained via V2V and V2I-communication. The ecoCooperativeHorizon makes use of:

- In-vehicle Communication platform
- Map Service
- **TripDataSet** (consumption related info gained by stored driving data)
- Navigation Service

Navigation Service provides all ecoSmartDriving applications (ecoTripPlanning and ecoNavigation) with navigation services. In turn, navigation makes use of:

- In-vehicle Communication platform
- Map Service
- **TripDataSet** (consumption related info gained by stored driving data)
- ecoRouting

Map Service provides all information related to the road network necessary for ecoSmartDriving applications. In turn, Map service makes use of map information stored in:

- **ecoStatic Map** (basic road network info and consumption related info such as slopes, curvatures)
- **ecoDynamic Map** (consumption related info such as traffic light status information)
- **TripDataSet** (consumption related info gained by stored driving data).

7.2.3. Relation between applications and inefficiencies

The nature of the different types of inefficiencies has been analysed in Chapter 4. Relation of applications to inefficiencies is given in Table 6 and the relation between the applications and use cases in Table 7.

The ecoMonitoring application has no direct link to inefficiencies, but supports the other applications.

Table 6: Relation between applications and inefficiencies

Application	Inefficiency addressed
pre-trip: ecoInformation ecoTripPlanning	 INEF01 Inefficient vehicle condition INEF02 Inefficient route INEF03 Inefficient travel timing – pre-trip
on-trip: ecoInformation dynamic ecoNavigation ecoDriving Support	 INEF05 Inefficient usage of (electrical) energy consumers INEF06 Inefficient vehicle condition INEF07 Inefficient routing INEF08: inefficient acceleration INEF09: inefficient deceleration INEF10: inefficient (unnecessary) idling INEF11: inefficient speed INEF12: inefficient gear (RPM)
post-trip: ecoPostTrip	 General inefficiencies of the complete trip

Table 7: Relation between applications and use cases

Application	Use case addressed
pre-trip: ecoInformation ecoTripPlanning	 UC_SP3_01: Checking Vehicle Condition (pre-trip) UC_SP3_02: Planning ecoTrip
on-trip: ecoInformation dynamic ecoNavigation ecoDriving Support	 UC_SP3_03: EcoUse of Vehicle Systems UC_SP3_04: Dynamic ecoNavigation UC_SP3_05: Dynamic ecoGuidance UC_SP3_06: Support ecoDriving
post-trip: ecoPostTrip	 UC_SP3_07: In-vehicle ecoTripFeedback UC_SP3_08: Off board ecoTripFeedback

7.3. Description of the ecoSmartDriving subsystem

7.3.1. Function analysis for applications

For a common view of ecoSmartDriving functions, corresponding functional requirements have been specified, see Chapter 8, and graphical descriptions have been generated per SP3 application:

Figure 16 shows the functional description of **ecoNavigation**. For the ecoRouting it holds for both the ecoTripPlanning as well as the dynamic ecoNavigation and ecoGuidance. The aim is to improve the eco balance by planning a route with lowest fuel consumption and guiding the user on that route while travelling. Dynamic changes of eco relevant parameters are taken into account by continuous check for updated information from the traffic centre, from other vehicles, and from the ecoCooperativeHorizon.

Figure 17 shows the functional description of the **ecoInformation** application. The main steps in this application are the data acquisition, the optimisation and the communication to the driver (through the ecoHMI).

Figure 18 shows the functional description of **ecoDrivingSupport**. It provides dynamic suggestions to drivers about how to drive, depending on the context (traffic, location, road, environment), on driving tasks and strategies, on the driving style, on driver's motivations, on vehicle typology and fuel usage. Dynamic changes of eco relevant parameters are taken into account by continuous check for updated information from the traffic centre, from other vehicles, and from ecoCooperativeHorizon.

Figure 19 shows the functional description of **ecoMonitoring**. It provides the eco floating vehicle data (ecoFVD) to the Traffic Management Centre and to the other vehicles through V2X communication.

Figure 20 shows the functional description of the **ecoPostTrip** application. It provides facilities for trip evaluation from locally stored trip data in order to give feedback to the user and to improve driving and routing strategies for future trips.

Figure 21 shows the functional description of the **ecoCooperativeHorizon**. This service component provides dynamic information about relevant objects (roads, crossings, vehicles) in the proximity of the vehicle and acts as a service for the on-trip application.

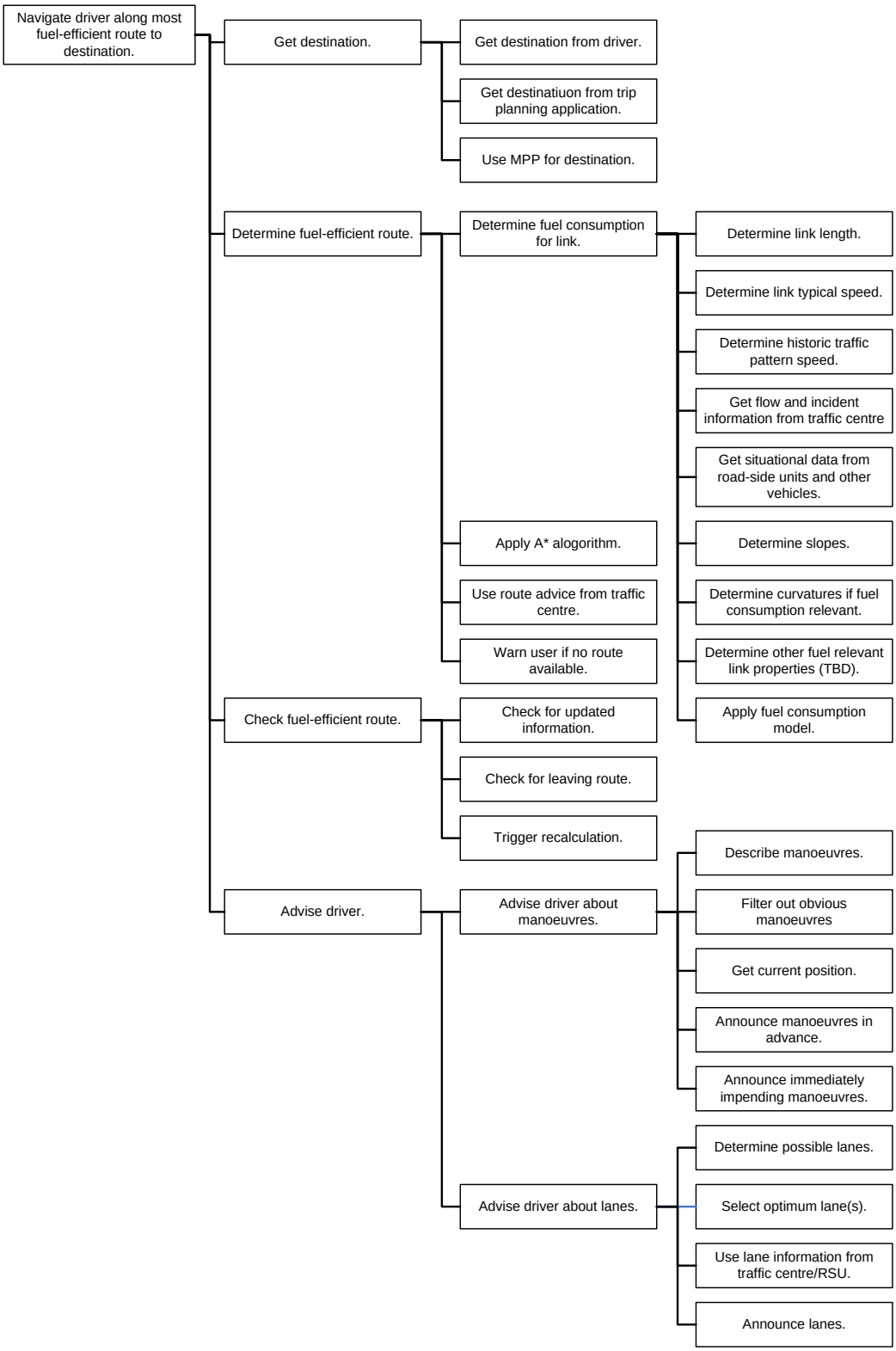


Figure 16: Functional description of ecoNavigation (the tree 'Determine fuel efficient route describes the ecoRouting that is also used in the ecoPreTrip application)

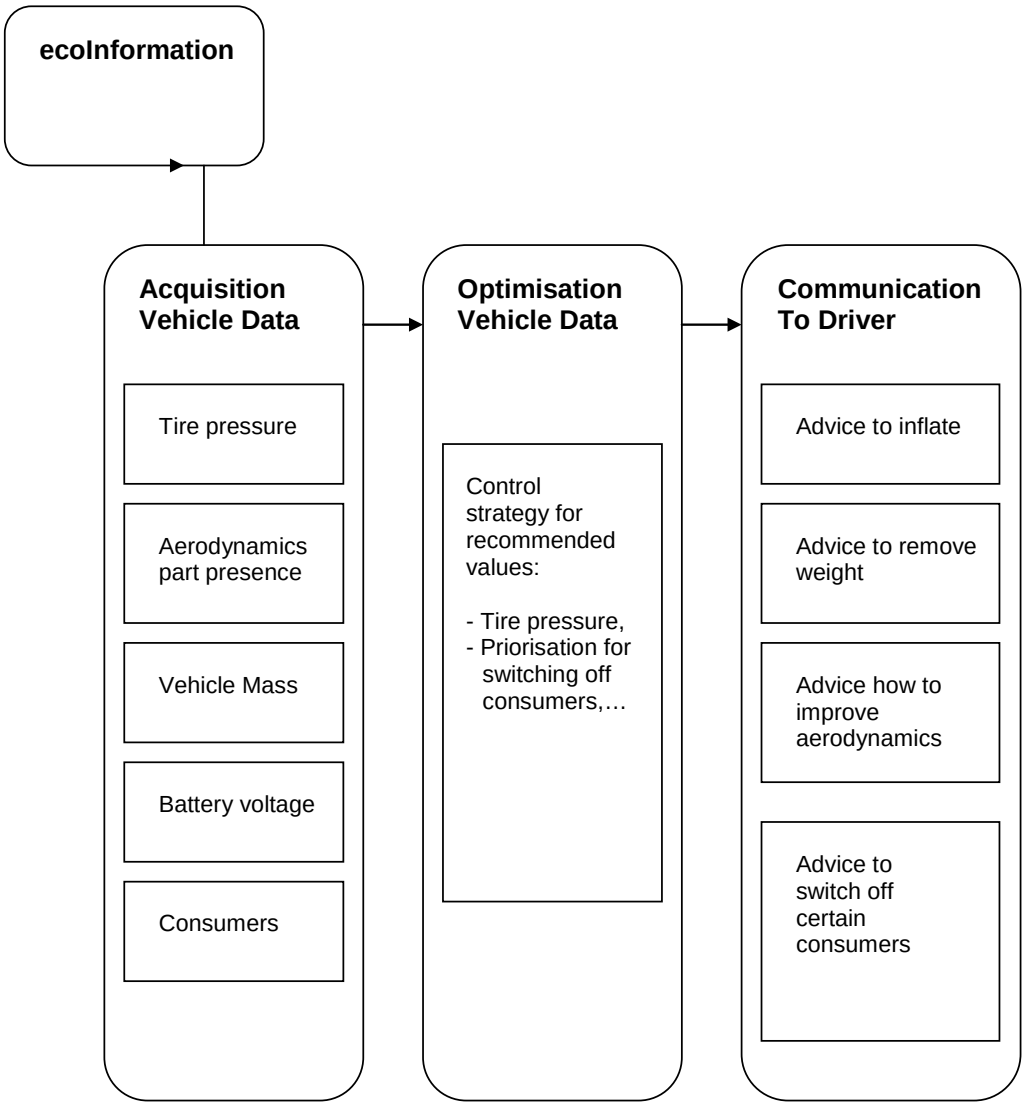


Figure 17: Functional description of ecoInformation

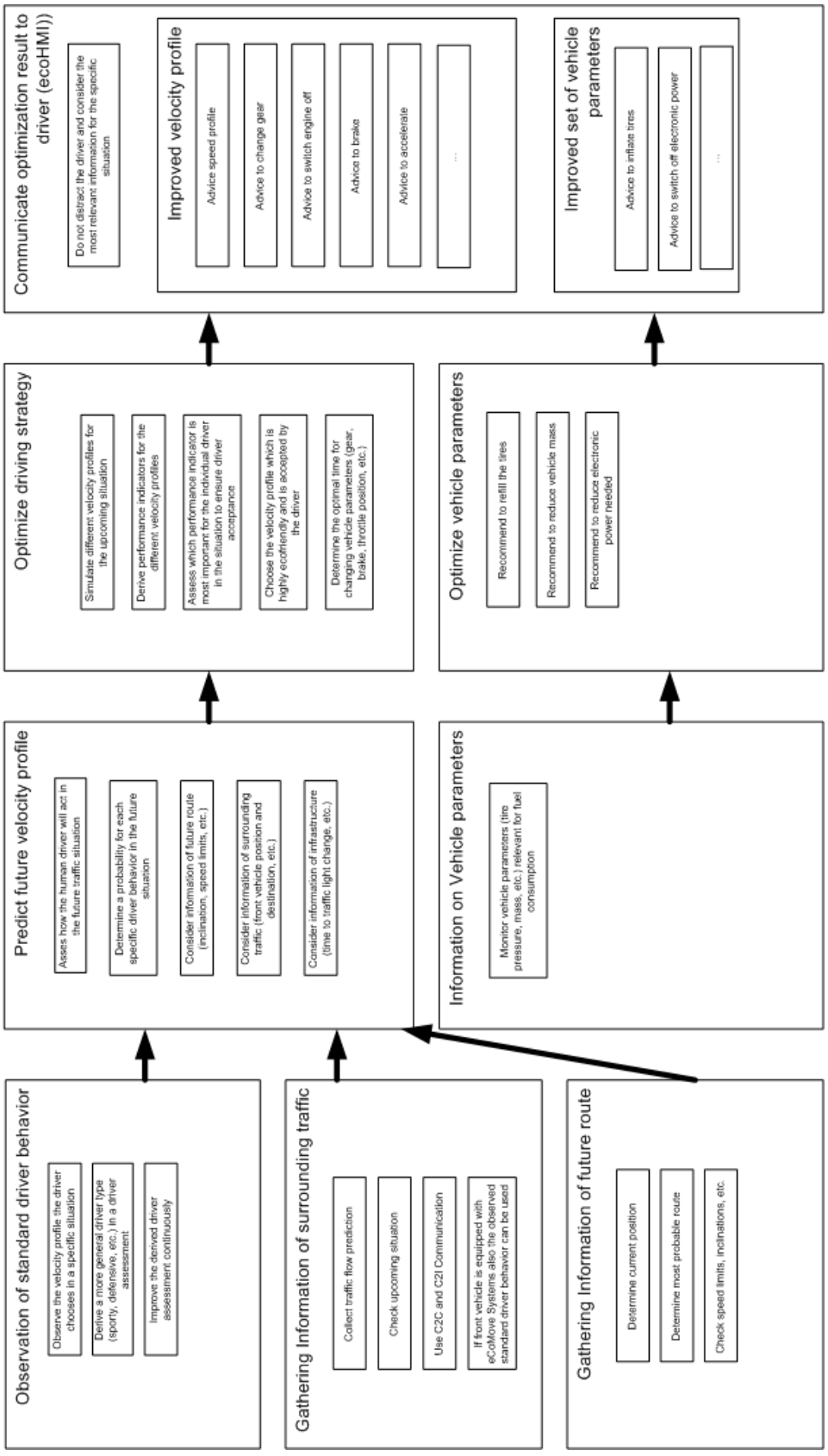


Figure 18: Functional description of ecoDrivingSupport

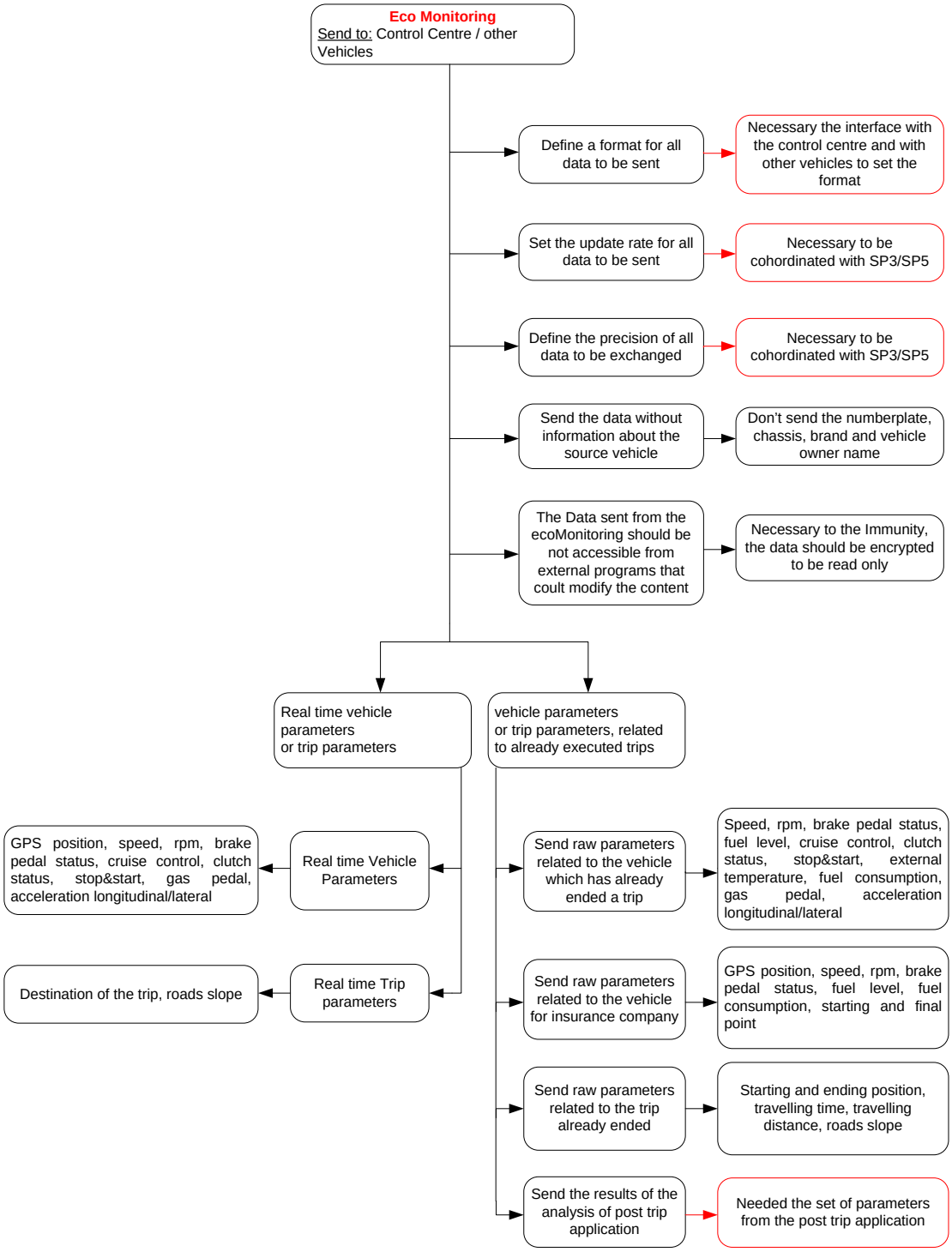


Figure 19: Functional description of ecoMonitoring

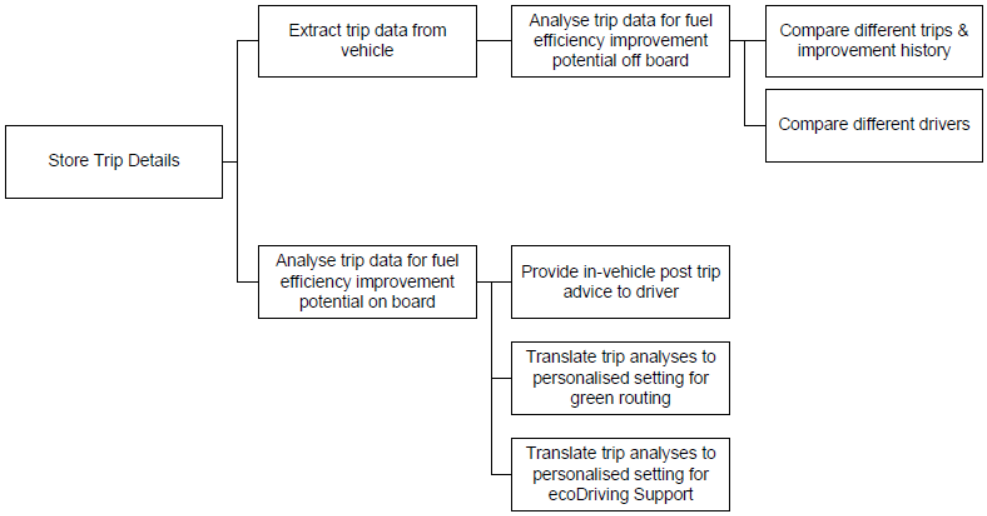


Figure 20: Functional description of ecoPostTrip application

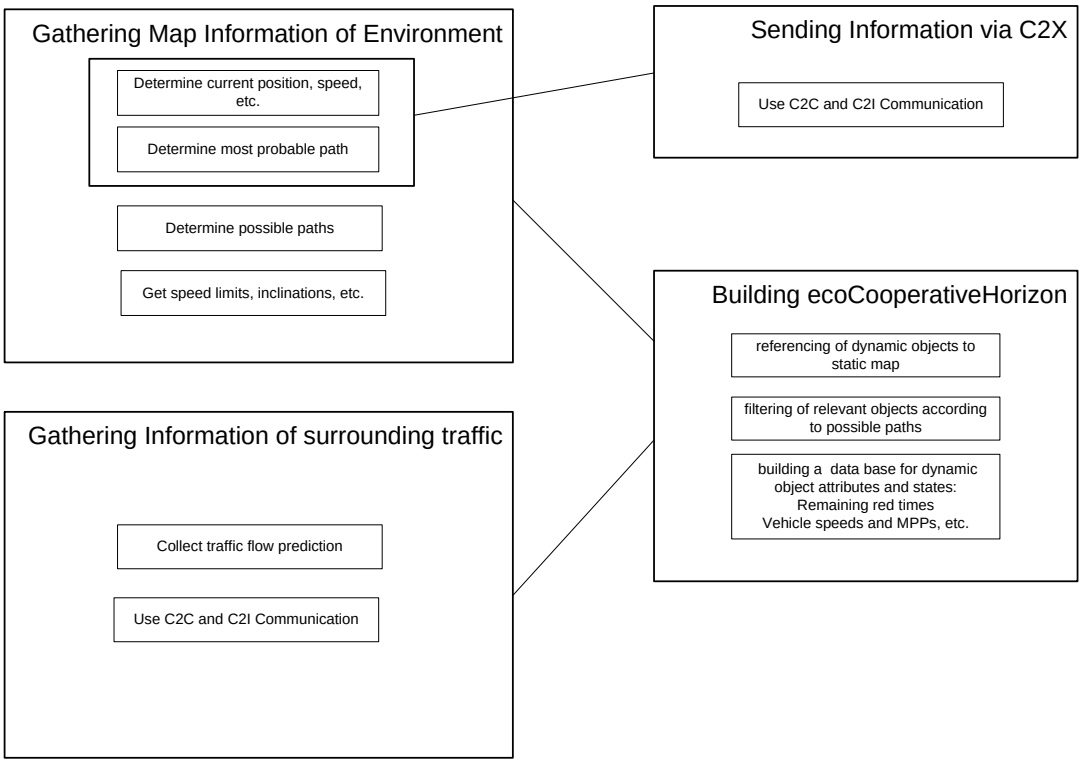


Figure 21: Functional description of ecoCooperativeHorizon

7.3.2. Interfaces with other subsystems

In this Chapter, interfaces to other eCoMove subsystems, as indicated in Figure 14, are described.

Manoeuvre (ecoFVD) & Traffic Data is a bidirectional V2V interface among vehicles. It provides the vehicle with information about states of other vehicles in the

vicinity and thus is covered by the ETSI CAM standard [3] with the exceptions indicated below:

- current position
- speed
- heading
- most probable path (not covered by CAM)
- traffic state in the proximity (not covered by CAM)

In order to extend the range of V2V communication, a multihop protocol is needed for transport of info over many instances without overcharging the communication channel.

Request for Green/Remaining Red/Green Time is a bidirectional V2I interface among vehicle and traffic lights (acting as a Road Side Unit). It informs the ecoSmartDriving subsystem about traffic lights phase and it enables request for green from approaching vehicles.

ecoFVD & Route Data is a bidirectional V2I interface. It is either established between vehicle and Road Side Unit or between vehicle and Traffic Management Centre. From the vehicle, ecoFVD is transmitted. Into the vehicle, route data such as

- temporal and local speed limits
- temporal and local speed recommendations
- temporal construction areas
- temporal and local traffic states
- local bypass recommendations
- is transmitted.

Traffic Messages is a basically unidirectional interface between Traffic Management Centre and vehicle. It is either established via a broadcast radio channel or via mobile communication channel where the uplink direction is used for request for traffic messages only.

Pre/post-trip data is an interface connecting the vehicle with the home or office computer. Into the vehicle, route data available in the office such as destination and available eco data is transmitted. From the vehicle, recorded drive data are transmitted.

7.4. Performance characteristics of the ecoSmartDriving subsystem

Performance requirements such as update frequencies, update times, accuracy, etc. are still to be discussed as addressed in the functional requirements.

In general, the amount of data to be treated by the ecoSmartDriving subsystem is (apart from the static map content) estimated to be at most a few (one digit) MB per ride, which should be able to be exchanged within a few seconds via WLAN or 3G/4G connections. Specific details need to be checked in the next phases of the project and will be subject for the sub project 2 on Core Technologies.

In the next phases of the project performance requirements on eco messages transmitted are imposed on

- actuality
- spatial resolution
- accuracy
- reliability
- availability
- coverage (area)
- consistency

The same is also the case for ecoMap data regarding:

- actuality
- spatial resolution
- accuracy
- reliability

7.5. Provisions for safety and security

Safety aspects are touched by ecoSmartDriving with respect to

- attention distraction caused by HMI
- changing behaviour of the user and/or vehicle in traffic environment

The first item is not explicitely addressed within SP3, but HMI related research findings e.g. in the AIDE project provide appropriate means to build a safe HMI also for future applications.
The second item is to be considered in every single on-trip use case since reduced safety is in the overall scale always equivalent to a loss of power efficiency.

Privacy issues are touched if relevant information leaves the vehicle. Measures are provided in the ecoMonitoring application where all data export matters are bundled. This includes prevention of transmitting individual vehicle data (such as number plate) and data encryption.

Safety and privacy are also tangible by intrusion of unauthorized messages into the ecoSmartDriving subsystem. This issue is left for further treatment.

Requirements

The core objective of the eCoMove Project and its sub-project, ecoSmartDriving (SP3), is achieved by developing a co-operative system that addresses the user and stakeholder needs.

However in order to successfully realize this co-operative system, defining use cases (*see chapter 6*), identifying the desired functionality (*see chapter 7.3.1*) and documenting the requirements (*this chapter*) of what the system is expected to do becomes an inevitable process.

The overall requirements for the eCoMove system are listed in the deliverable D2.1 [1]. But in this chapter we will summarize the requirement specification for the ecoSmartDriving applications and its components (*as listed in chapter 7.2*).

The requirement specification is basically a complete description of the behavior of a system to be developed and it describes what the system is to accomplish rather than how it is to be accomplished. The requirement specification for an application or component basically consist of the following types

- a **Functional requirement**: this requirement describes the core functionality of the application/ component
- an **Interface Requirement**: this specifies the interaction of the application/ component with other application/component, users, hardware, software, and communications
- a **Non-Functional Requirement**: these are requirements which impose constraints on the design or implementation of the system (such as performance requirements, security, usability & humanity, legal requirements etc).

The identified requirement specification provides a basis for architecture development and defining the system specification in the next phase of this project.

In the following *Chapter 8.1* a brief description is provided on how to read the requirements table. *Chapter 8.2 to 8.10* provides the collected requirements specification for each application/ component.

8.1. How to read the requirements table

The requirements for ecoSmartDriving subproject are collected in a requirements template as shown below.

«Requirement_No»	*«Req_Type»*	*«Description»*
		«Rationale»

Table 8: Requirements Template

In the above table, the first column consist of a requirement number of the format

SP3 - X - XXXXx

SP3 – stands for ecoSmartDriving subproject

X – the number for the application/ component as listed in chapter

(here the following numbers are used for the applications and components

Applications: *1 – ecoTripPlanning, 2 – ecoInformation, 3 - dynamic ecoNavigation, 4 - ecoDriving Support, 5 – ecoPostTrip application, 6 – ecoMonitoring*

Components: *7 – ecoHMI, 8 – ecoCooperativeHorizon, 9 - TripDataSet)*

XXXX– is the actual number of the requirement (e.g. 0001)

In case several requirements are closely related then they have the same sequential number indexed by a trailing alphabet (e.g. XXXXx - 0001a)

The second column in the *Table 8* consists of the type of the requirement. It could be a functional requirement or a non-functional requirement (all the other types except the functional ones listed in the *Table 9* below are identified as non-functional requirement). A more detailed description of the requirement type is described in the *Annex I ecoSmartDriving requirements*.

Type	Abbreviation
Cultural & Political	CP
Functional	F
Legal	L
Maintainability & Support	MS
Performance	P
Usability & Humanity	UH
Look & Feel	LF
Operational & Environmental	OE
Security	S

Table 9: Requirements type

Third column, first row *(Table 8)* consists of the actual description containing the intention of the requirement and third column, second row *(Table 8)* consists of rationale for that requirement. This explains the fundamental reason of why such a requirement is needed.

8.2. ecoTripPlanning requirements

This application helps in planning the trip for the user and will enable ecoRouting complemented with relevant information that can support the reduction of fuel consumption like suggested time slot.

8.2.1. Functional Requirements

SP3-1-0001	F	**Description**: The system needs to collect from the user and/or from the vehicle the necessary information in order to determine an optimal route.

		The necessary data are the following: • Vehicle type (in case it is a vehicle that is not enabled to drive through certain areas) • From (start location) • To (location destination) • When (date and time of the trip)
		Rationale: Building block for ecoTripPlanning
SP3-1-0002	F	**Description**: The system needs enhanced maps data to determine the ecoRoute. To determine the ecoRoute the system needs additional data from digital maps (e.g. road slope)
		Rationale: Building block for ecoTripPlanning
SP3-1-0003	F	**Description**: Availability of additional information to increase the function performance. The preTrip function will be able to perform better route computing if historical traffic data will be available for each road segment. These data potentially are provided by external service / function.
		Rationale: Building block for ecoTripPlanning
SP3-1-0004	F	**Description**: The functions should be able to take care of local traffic restrictions. Municipality frequently proposes temporary traffic restriction. The ability to consider them makes the result more useful. These data potentially are provided by external service / function.
		Rationale: Building block for ecoTripPlanning
SP3-1-0005	F	**Description**: A link to external services is necessary to provide the system with data which are not locally available. Data as historical data, traffic limitation etc. are available from external services.
		Rationale:

		Building block for ecoTripPlanning
SP3-1-0006	F	**Description**: In case the departure / arrival time entry of the user is not specified, the ccoTripPlanning application should enable trip timing optimisation (departure/arrival time) based on TrafficStatePrediction if fuel consumption can be reduced with an alternative timing.
		Rationale: Building block for ecoTripPlanning
SP3-1-0007	F	**Description**: In case the arrival time is fixed the ecoTripPlanning application should be able to warn the driver if the travel time changes before the trip has started.
		Rationale: Building block for ecoTripPlanning
SP3-1-0008	F	**Description**: The route planner ought to know the basic vehicle fuel efficiency characteristics, particularly the consumption curves, the presence of regenerative braking or start/stop technology, and the load carried. In addition, the ability to travel through certain areas may not just be a function of the vehicle type, but also its load and toll passes held.
		Rationale: Building block for ecoTripPlanning

8.2.2. Interface Requirements

SP3-1-0008	OE	**Description**: The ecoTripPlanning application should use the ecoRouting component to determine the least fuel consuming route based on one or more of the following entries from the user: a. Origin b. Destination c. Intermediate destination d. Arrival time e. Departure time f. Vehicle ID
		Rationale: In order to calculate the optimal route.
SP3-1-	OE	**Description**:

0009		The ecoTripPlanning application should be available off board and on-board of the vehicle a. Off-board availability should be enabled via a mobile device or via PC b. On-board access via TBD device
		Rationale: In order to help the user plan ahead of the trip and indpendent of the car
SP3-1-0010	OE	**Description**: The ecoTripPlanning application should be able to access TrafficStatePredictions (SP5) to enable the user to perform the following check: a. One day or more before the trip: based on historic traffic profiles – check should be done daily b. Day of the trip: prediction of traffic state based on actual traffic situation – at least once per hour; more often if feasible
		Rationale: For providing optimal suggestions

8.2.3. Non-Functional Requirements

SP3-1-0011	UH	**Description**: Acceptance for ecoTripPlanning application: the function should represent an opportunity for the user
		Rationale:
SP3-1-0012	UH	**Description**: Usability of data input: the interface should be easy to use
		Rationale:
SP3-1-0013	UH	**Description**: Usability of data output: the result should be easy to be used
		Rationale:
SP3-1-0014	UH	**Description**: Usability the ecoTripPlanning application: the system should be easy, effective and safe to interact with
		Rationale:

8.3. ecoInformation Requirements

This application helps the user with information on how to tune vehicle functions at best to minimise fuel consumption and inform the driver about fuel savings.

8.3.1. Functional Requirements

SP3-2-	F	**Description**:

0001		The driver is informed on the tires pressure status, and receives a recommendation when necessary, encouraging to inflat tires to an optimized pressure value to reduce the rolling resistance, and thus reduce the fuel consumption.
		Rationale: Reducing the rolling resistance by over-flatted tires (+10%)
SP3-2-0002	F	**Description**: The driver is informed on the best practices related to aerodynamics influence: encouraging to dismount unused luggage racks in order to reduce the aerodynamic resistance.
		Rationale: Reducing the aerodynamic resistance by mounting (spoiler for truck) or dismounting accessory (luggage rack,..) .
SP3-2-0003	F	**Description**: The driver is informed on the best practices related to weight influence, encouraging to remove unused weights on passenger car or unused trailers on trucks in order to reduce significantly weight.
		Rationale: Reducing the extra-weight on trip
SP3-2-0004	F	**Description**: The driver is informed and encouraged when necessary to deactivated (manually) some electrical consumers (AC, electrical heater systems, radio/video, auxiliaries plugged on "car cigar-jack",...) in order to reduce the torque resistance from alternator, and thus reducing fuel consumption and/or saving battery energy during trip.
		Rationale: Reducing the torque resistance and saving battery energy.

8.3.2. Interface Requirements

SP3-2-0005	OE	**Description**: Outputs to: SP4 : ecoHMI interface - PreTrip ecoInformation encouraging to mount a spoiler for cockpit roof on trucks in order to reduce the aerodynamic resistance.
		Rationale: Interface required
SP3-2-0006	OE	**Description**: Outputs to : SP4 : ecoHMI interface - OnTrip ecoInformation displaying in real time the current lost of fuel in

		order to induce the mounting of the spoiler..
		Rationale: Interface required
SP3-2-0007	OE	**Description**: Outputs to : SP4 : ecoHMI interface - PostTrip ecoInformation displaying in real time the total lost of fuel in order to induce the mounting of the spoiler..
		Rationale: Interface required
SP3-2-0008	OE	**Description**: Outputs to: SP3 : ecoHMI interface - PreTrip ecoInformation encouraging to dismount luggeage track from the roof in order to reduce the aerodynamic resistance.
		Rationale: Interface required
SP3-2-0009	OE	**Description**: Outputs to : SP3 : ecoHMI interface - ON Trip ecoInformation :displaying in real time the current over-consumption of fuel due to aerodynamic lost.
		Rationale: Interface required
SP3-2-0010	OE	**Description**: Outputs to : SP3 : ecoHMI interface - PostTrip ecoInformation displaying in real time the total over-consumption of fuel
		Rationale: Interface required
SP3-2-0011	OE	**Description**: Inputs from : SP3 : ecoDriving - PreTrip/ OnTrip/ PostTrip Engine variables (torque, consumption, engine speed, AC switch, State of charge, engine temp...), TireGuard system variables, Vehicle sensor variables (contacts)
		Rationale:

		Interface required

8.3.3. Non-Functional Requirements

SP3-2-0012	P	**Description**: The ecoInformation related to the tire guard function must have 3 levels of pressure. ecoLevel = Comfort Level + 10 % Comfort Level= Pressure advised by manufacturer. Safety Level = Comfort. The precision of the pressure acquisition must have an appropriate tolerance. The recurrency of the acquisition is at least every 10 secondes.
		Rationale: Precision and Measurement recurrency
SP3-2-0013	P	**Description**: The ecoInformation system related to the optimizing electrical consumers should able to measure electrical data from power net (power, current, voltage) with the precision (10% power of the smallest consumption). The measure is done before any regulation by the alternator or other regulator.
		Rationale: Precision and Measurement recurrency
SP3-2-0014	UH	**Description**: ecoInformation can display the tires pressure status, encouraging to inflat tires to an optimized pressure value to reduce the rolling resistance, and thus reduce the fuel consumption. ecoInformation can include information on potential consumption loss, money or range gain if tires are not correctly inflated. ecoInformation can inform on the nearest station for inflating tires.
		Rationale: Reducing the rolling resistance by over-flatted tires (+10% standart pressure)
SP3-2-0015	UH	**Description**: ecoInformation can inform on the best practices related to aerodynamics influence, encouraging to dismount unused luggage racks and/or to mount a spoiler for cockpit roof on trucks in order to reduce the aerodynamic resistance. ecoInformation can include information on potential consumption loss, money or range gain during pre-trip, trip and post-trip..
		Rationale:

		Reducing the aerodynamic resistance by mounting (spoiler for truck) or dismounting accessory (luggage rack,..) .
SP3-2-0016	UH	**Description**: ecoInformation can inform on the best practices related to weight influence, encouraging to remove unused weights on passenger car or unused trailers on trucks in order to reduce significantly weight. ecoInformation can include information on potential consumption loss, money or range gain during pre-trip, trip and post-trip.
		Rationale: Reducing the extra-weight on trip Informing the fuel saving / CO2-emission reduction estimated up to xx%.
SP3-2-0017	UH	**Description**: ecoInformation can inform and encourage when necessary to deactivated (manually) some electrical consumers (AC, electrical heater systems, radio/video, auxiliaries plugged on "car cigar-jack",...) in order to reduce the torque resistance from alternator, and thus reducing fuel consumption and/or saving battery energy during trip. ecoInformation can include information on potential consumption (money and range) loss, if non necessary loads are activated. ecoInformation can provide information in Pre-trip phase, during Trip, and on Post-trip phases as well, with different priorities and contents depending on driving conditions
		Rationale: Reducing the torque resistance and saving battery energy. Best fuel saving reduction in extreme conditions (AC on traffic jam in summer…) for passenger car (incl. hybrid) and trucks.

8.4. Dynamic ecoNavigation Requirements

This application provides the user with dynamic ecoNavigation support by integrating the information from the traffic centre, from the other vehicles, from the ecoMaps and the ecoCooperativeHorizon.

8.4.1. Functional Requirements

SP3-3-0001	F	**Description**: User must be able to select destination.
		Rationale: Routing requires a destination to route to.
SP3-3-0002	F	**Description**: dynamic ecoNavigation must generate a route to the destination.
		Rationale:

		This is the very purpose of routing.
SP3-3-0003	F	**Description**: dynamic ecoNavigation must check alternatives to MPP when no destination is known.
		Rationale: Even without a final destination, it's possible to find more fuel-efficient alternatives to the road ahead of the vehicle.
SP3-3-0004	F	**Description**: dynamic ecoNavigation should warn of impossible routes.
		Rationale: The system shouldn't guide the driver through illegal maneuvers without at least informing the driver.
SP3-3-0005	F	**Description**: Green route must be fuel-efficient.
		Rationale: This is what makes the route a green route. Unfortunately, there is no way to set a requirement on the actual fuel savings (compared to what?) in advance; and since routing needs some heuristics for performance reasons, it's not feasible to require the route to be the very optimum route – one at most can require a good enough route.
SP3-3-0006	F	**Description**: dynamic ecoNavigation should make use of vehicle parameters.
		Rationale: The least fuel consuming route might depend in some cases on vehicle data like mass, cw (aerodynamic drag coefficient), cross section, or motor properties.
SP3-3-0007	F	**Description**: dynamic ecoNavigation should make use of historic traffic patterns.
		Rationale: The least fuel consuming route depends on the possible speeds along the route which can be estimated from collected data.
SP3-3-0008	F	**Description**: dynamic ecoNavigation should make use of dynamic traffic information and situational data.
		Rationale: The least fuel consuming route depends on the possible speeds along the route; this information can be collected and distributed centrally. Also incidents need to be taken into account.

		Roadside units can distribute situational information about local traffic and near-future events like traffic light phases.
SP3-3-0009	F	**Description**: dynamic ecoNavigation should make use of floating vehicle data from other vehicles.
		Rationale: Information from other vehicles might allow conclusions on where it's currently possible to drive in a fuel efficient way.
SP3-3-0010	F	**Description**: dynamic ecoNavigation should make use of route advice from a traffic centre.
		Rationale: A traffic centre might have route advice that takes into account on the one hand planned measured like future traffic light control settings, on the other hand the effects of one vehicle on the total fuel consumption of the vehicles in the area.
SP3-3-0011	F	**Description**: When new floating vehicle data or dynamic traffic information is available, the route is recalculated. If the newly calculated route shows a significant fuel saving compared to the previous one, it replaces the previous route for further guidance.
		Rationale: New dynamic traffic information orV2V information (or even the ego vehicle moving with a different speed than assumed, for the time dependency of traffic pattern data) might outdate a route.
SP3-3-0012	F	**Description**: When the vehicle leaves the route, the route is recalculated.
		Rationale: When the driver misses some manoeuvre, new guidance is needed within a short time.
SP3-3-0013	F	**Description**: dynamic ecoNavigation guides the driver along the route and informs about impending manoeuvres.
		Rationale: Just having a route is not enough; it needs to be used to guide the driver.
SP3-3-0014	F	**Description**: dynamic ecoNavigation gives lane information to the driver.
		Rationale: Lane information enables early lane choice which improves traffic flow and thus reduces fuel consumption.
SP3-3-	F	**Description**:

0015		Optionally, the route can be optimized for a configurable combination of fuel consumption and travel time.
		Rationale: In real life, drivers wouldn't use a green route if that means unreasonably high travel times, so there's a trade-off between the two that should be reflected in the application.

8.4.2. Interface Requirements

SP3-3-0016	OE	**Description**: dynamic ecoNavigation must access the static ecoMap, the interface is TBD.
		Rationale: The map is the very base for routing. Details of the interface will be defined in task 2.4.3.1.
SP3-3-0017	OE	**Description**: dynamic ecoNavigation should access dynamic traffic information.
		Rationale: Dynamic traffic information helps avoiding traffic incidents and delivers information on possible speeds which are important for fuel consumption estimation.
SP3-3-0018	OE	**Description**: dynamic ecoNavigation should access situational data from Road-Side Units and floating car data from other vehicles via the dynamic ecoMap.
		Rationale: Situational data helps locally optimizing the route.
SP3-3-0019	OE	**Description**: dynamic ecoNavigation should access MPP from ecoHorizon.
		Rationale: Without a planned route, dynamic ecoNavigation still can propose better alternatives to the MPP.
SP3-3-0020	OE	**Description**: dynamic ecoNavigation should receive route advice from traffic centre.
		Rationale: This is the counterpart to SP5 route advice.
SP3-3-0021	OE	**Description**: dynamic ecoNavigation should use driver profiles created by TripDataSet.
		Rationale: Driver behaviour has a large influence on fuel consumption, and

		this influence can vary much depending on the road properties, so the most fuel-efficient route may be different for different drivers.
SP3-3-0022	OE	**Description**: ecoNavigation should be available as a component to applications; interfaces are yet TBD.
		Rationale: dynamic ecoNavigation will be used by both pre-trip planning and on-board navigation; as a modular component, it shouldn't need knowledge about the applications that use it.

8.4.3. Non-Functional Requirements

SP3-3-0023	P	**Description**: A route calculation should take at most one minute for a route up to 500 km.
		Rationale: We cannot keep the user waiting too long for a route. On the other hand, dynamic ecoNavigation algorithms may be considerably more complex than the fastest/shortest route calculation in commercial navigation systems (which usually are highly optimized), so we have to allow (at least in this research project) considerably longer computing times.
SP3-3-0024	P	**Description**: A route recalculation due to new/updated information should take at most one minute for a route up to 500 km.
		Rationale: Dynamic traffic information and V2V information needs to be processed in a timely fashion to be useful.
SP3-3-0025	P	**Description**: A route recalculation after leaving the route should take at most 10 seconds.
		Rationale: When the driver has left the route, new guidance is required almost immediately; in this case, time is more important than route quality. Usually, just a way back to the previous route is calculated.

8.5. ecoDriving Support requirements

This application provide dynamic suggestion to drivers on how to drive depending on driving context – traffic –location – road - environment, on driving tasks and strategies, on driver' driving style, on driver's motivations, on vehicle typology and fuel usage.

8.5.1. Functional Requirements

SP3-4-0001	F	**Description**: The system has to consider the driving safety in the determination of the driving strategies
		Rationale: The system has to determine a driving strategy that considers driving safety. Although hard braking maneuvers are inefficient these should be recommended when the vehicles is driven above the legal speed maximum. Also too close distances to front vehicles have to be avoided in any situation.
SP3-4-0002	F	**Description**: The system optimizes the velocity profile of the vehicle for the trip (driving strategy) dynamically. Therefore the following variables are affected: travel time, fuel consumption, driver acceptance, (electrical) power supply for different energy consumers
		Rationale: To determine an optimal driving strategy the system should consider the following information: • Velocity (current and future maximum velocity limitations) • Inclination (current and future) • Constant vehicle parameters such as engine and transmission map • Estimated inconstant vehicle parameters such as mass, rolling or aerodynamic resistance
SP3-4-0003	F	**Description**: The recommended green driving strategy considers the type of driver to reach a maximum driver acceptance.
		Rationale: The system has to assess the standard driving style of a specific driver (e.g. sporty or highly efficient driving style). Depending on this driving style recommendations for a more fuel efficient driving style have to be proceeded.
SP3-4-0004	F	**Description**: The system shold consider a holistic use function of the driver including travel time as well as fuel consumption.
		Rationale: The green driving strategies should be tunable to consider the benefits of a driver to move as well as the cost arising from fuel consumption. A faster arriving at the target destination and a lower usage of fuel is beneficial for the driver. A higher velocitiy is nearly in all situations accompanied by higher fuel consumption. Thus the driver decides on his driving behaviour in a trade off between driving time and fuel consumption. This trade off is

		driver specific and has to be estimated by the system to ensure optimal results.
SP3-4-0005	F	**Description**: The driving strategies consider information about the driving style of front vehicle to improve the prediction of future driving situations and thereby improve the calculation of green driving strategies.
		Rationale: The front vehicle affects the driving strategy of the following vehicle. A probable behavior of the front vehicle can be assessed taking a standard driver into account. The system should also be able to assess the driving style of the front driver using several sensor informations. If the front vehicle is equipped with a eCoMove system it should determine and predict the driving style of its driver. This information should be transmitted to the following vehicle to increase the predicion accuracy and thus the effectiveness of driving strategies.
SP3-4-0006	F	**Description**: Determination and prediction of the effectiveness of different driving strategies
		Rationale: The system has to assess the effectiveness of different driving strategies (e.g. coasting, deceleration with engine in trailing throttle mode or braking) and communicate their probable effectiveness (this is the energy consumption) to the driver. This comparison enables the driver to see the benefits of a predictive driving style.
SP4-4-0007	F	**Description**: The system considers both fuel economy and the potential trade-off with travel time while optimizing the trip and the driving strategies for a specific traffic stituation.
		Rationale: driver acceptance can only be ensured, if besides fuel consumption als other relevant parameters such as travel time and acceleration profile are considered. The holistic use function has to be adjustable by the driver
SP4-4-0008	F	**Description**: The system dynamically determines the optimal driving strategy and communicates it to the driver.
		Rationale: The ecoDriver Coaching system is aware about the vehicle status (e.g. load) and the route to be driven. Furthermore it considers the environmental conditions of the vehicle (e.g. other vehicles, infrastructure, weather, legal restrictions) to adjust driving

		behavior to the current driving situation. Based on all this information it supports the driver in using the vehicle in the most fuel efficient way.
SP4-4-0009	F	**Description**: System does not recommend something which is against any legal restriction (such as maximum speed)
		Rationale: The driving strategy must come up with optimization results that do not exceed the legal maximum speed.
SP4-4-0010	F	**Description**: The performance of the chosen driving strategy is analyzed and stored for further evaluation.
		Rationale: To educate the driver to a more eco friendly driving style feedback of how he performed on the trip has to be provided.

8.5.2. Interface Requirements

SP3-4-0011	OE	**Description**: The system estimates the travel time for the journey based on calculations considering different driving strategies. The driving strategies system thus should be equipped with an interface to support this.
		Rationale: To inform the driver about the estimated travel time this value has to be calculated dynamically. The estimated travel time of the journey also affects the behavior of the driver. For example he is willed to drive more eco friendly if he knows that he will arrive in time.
SP3-4-0012	OE	**Description**: The system stores relevant data during the trip and analyses the driving behavior/ the driving strategy of the driver to allow a post trip feedback to the driver. Therefore an interface of the driving strategies should be implemented if necessary.
		Rationale: The post trip analysis and feedback to the driver requires stored data derived from the evaluation of driving strategies. Therefore relevant data has to be stored depending on the specific hardware specificaions. For example the total amount of fuel that could have been saved driving optimally can be derived and stored.
SP4-4-0013	OE	**Description**: The on-board navigation guides the driver along the planned ecoTrip containing the application of green driving strategies.
		Rationale:

		The system is guiding the driver how to drive energy efficiently following the planned ecoTrip.

8.5.3. Non-Functional Requirements

Currently no Non-functional requirements have been identified.

8.6. ecoPostTrip Requirements

This application provides the user with a feedback after the trip on how eco-friendly he has driven and the recommendations on how to improve the same.

8.6.1. Functional Requirements

SP3-5-0001	F	**Description**: At the end of the trip - the application must be able to store the trip details based on the defined parameters (TBD) for a defined period of time(TBD)
		Rationale: The trip data should be stored for future analysis and reporting
SP3-5-0002	F	**Description**: At the end of the trip - the application must be able to provide a detailed analysis report of the trip (onboard) with TBD parameters such as a. Gear change behaviour b. Acceleration behaviour c. Deceleration behaviour d. Constant speed e. Anticipative driving f. Distance keeping (if possible based on vehicle sensors) g. Engine idling h. Drive style related to road geometry
		Rationale: Inform the driver how fuel efficient he / she has driven and which aspects of the drive contributed to this
SP3-5-0003	F	**Description**: The application must be able to analyze certain parameters (TBD) of the trip details and provide an advice on improving the fuel efficiency
		Rationale: To make the driver aware of the ways to save fuel
SP3-5-0004	F	**Description**: The stored trip data should be exportable to PDAs and PCs
		Rationale:

		For offline analysis of the data
SP3-5-0005	F	**Description**: The application should be able to compare the current trip data with the previous trip data of the same driver and provide a comparison report
		Rationale: To motivate the driver to improve from his current best
SP3-5-0006	F	**Description**: The application should be able to share the specific parameters (TBD) of the trip data to TBD-application in order to improve the green routing
		Rationale: To improve the accuracy of the fuel consumption prediction on a particular route
SP3-5-0007		**Description**: The application should enable identification of single trips
		Rationale: To compare each single trip with other trips made
SP3-5-0008		**Description**: The application should be able to identify the driver- when there is more than one driver using the same vehicle. Otherwise it has to used a guest account.
		Rationale: to avoid ambiguities
SP3-5-0009		**Description**: the application should be able to determine the remaining saving potential of trip
		Rationale: as an awareness for the user
SP3-5-0010		**Description**: The ecoPostTrip application that is available off-board should enable a detailed analysis of a trip on fuel consumption related behaviour like for example: a. Gear change behaviour b. Acceleration behaviour c. Deceleration behaviour d. Constant speed e. Anticipative driving f. Distance keeping (if possible based on vehicle sensors)

		g. Engine idling h. Drive style related to road geometry
		Rationale: For offline analysis of the data

8.6.2. Interface Requirements

SP3-5-0011	OE	**Description**: The application should enable downlaod of trip data onto a USB-stick or other devices such as PDAs and PCs
		Rationale: For offline analysis of the data
SP3-5-0012	OE	**Description**: The ecoPostTrip application should be able to provide input to the ecoHMI on the trip evaluation including a selection of the following parameters: a. fuel saved by following system recommendations b. evaluation of selected drive style parameters (e.g. gear shift, anticipative driving or a driver preference) c. tips for better driving
		Rationale:
SP3-5-0013	OE	**Description**: The ecoPostTrip application should be able to store and retrieve trip data from the TripDataSet component
		Rationale: As a storage database

8.6.3. Non-Functional Requirements

SP3-5-0014	UH	**Description**: the readability of the report should be more clear also when it is exported to an external devices
		Rationale: to be able to analyze offboard
SP3-5-0015	S	**Description**: the report should be secure enough and should not be editable by unauthorized persons and/or deletable by the user
		Rationale: to maintain privacy and secure the data
SP3-5-0016	L	**Description**: Sharing of the report to others should be authorized by the user
		Rationale:

		to identify the willingness of the user to share his data

8.7. ecoMonitoring Requirements

The ecoMonitoring application provides the ecoFVD to the Traffic management center and to the other vehicles. It derives relevant trip information from the TripDataSet of the ecoPostTrip application. It distributes it to the traffic control centre and other vehicles in a fully anonymous way to protect drivers' privacy.

8.7.1. Functional Requirements

SP3-6-0001	F	**Description**: The ecoMonitoring system sends to the control centre (and to external vehicles if required from them to refine their pre – trip algorithms) some TBD parameters related to the last executed trip, after the post trip application. [The parameters could be: - vehicle parameters: speed, rpm, brake pedal status, fuel level, cruise control if available, clutch status, stop&start if available, external temperature, fuel consumption, gas pedal, acceleration longitudinal/lateral. - trip parameters: starting and ending position, travelling time, travelling distance, roads slope.]
		Rationale: Send to other vehicles and to the control centre the data related to the last executed trip.
SP3-6-0002	F	**Description**: The ecoMonitoring system sends to the control centre (and to external vehicles if required from their pre-trip applications) the results of the post trip application.
		Rationale: Inform the control centre and the other cars of eventual results of the post trip application.
SP3-6-0003	F	**Description**: The data sent from the ecoMonitoring to the control centre must be standardized. All OEM must make available to the ecoMonitoring the same data with the same TBD format. The ecoMonitoring can work on all the OEM vehicles in the same way.
		Rationale: The control centre must receive the data required from all the vehicles with the same standard format, independently of the OEM.
SP3-6-0004	F	**Description**: The ecoMonitoring system sends to the control centre and to external vehicles as floating car data, some TBD parameters

		related to the vehicle itself and to the current trip: [The parameters could be: vehicle parameters: GPS position, speed, rpm, brake pedal status, cruise control if available, clutch status, stop&start if available, gas pedal, acceleration longitudinal/lateral. - trip parameters: destination of the trip, road slope.]
		Rationale: Send to other vehicles and to the control centre the real time data related to the current trip of the vehicle.
SP3-6-0005	F	**Description**: The ecoMonitoring system sends to the insurance company the raw paratemers related to the vehicle and to the trip. [The parameters could be: vehicle parameters: distance, speed, rpm, brake pedal status, fuel level, fuel consumption - trip parameters: initial position and destination of the trip.]
		Rationale: Send to insurance company data related to the trip in order to receive benefits for ecoDriving

8.7.2. Interface Requirements

SP3-6-0006	OE	**Description**: The ecoMonitoring application should be able to retrieve trip data from the TripDataSet.
		Rationale: Retreive the information about the vehicle (also the trip?) from the TripDataSet.
SP3-6-0007	OE	**Description**: The ecoMonitoring application should be able to provide the ecoFVD message (incl. destination information) to the communication platform
		Rationale: The ecoMonitoring should send to the communication platform the set of data to be sent out to vehicles and traffic management centre.
SP3-6-0008	OE	**Description**: The control centre defines some specific TBD parameters to be received by the ecoMonitoring system for any trip of the vehicle. [The parameters could be: vehicle parameters: speed, rpm, brake pedal status, fuel level, cruise control if available, clutch status, stop&start if available, external temperature, fuel consumption, gas pedal, acceleration longitudinal/lateral.

		trip parameters: starting and ending position, travelling time, travelling distance, roads slope.]
		Rationale: The control centre discriminates among all data related to a generic trip, and selects a limited set of parameters to be sent from the ecoMonitoring system.

8.7.3. Non-Functional Requirements

SP3-6-0009	P	**Description**: Define an update rate for each post trip parameter to be sent to the control centre.
		Rationale: The ecoMonitoring system has to send to the control centre some data related to the post trip, but any parameter has its own update rate (ex. speed, acceleration, fuel consumption), and not all updates can be sent to the control centre, otherwise there is too much traffic over the network
SP3-6-0010	P	**Description**: The ecoMonitoring system has to collect data with a TBD precision, which is dependent from the particular parameter to be collected (as an example, the precision on speed could be at level of 0.01 m/sec, while for acceleration it could be at level of 0.01 m/sec2).
		Rationale: Set the precision of each parameter to be monitored.
SP3-6-0011	S	**Description**: Privacy requirement. The data saved by the ecoMonitoring system should contain information about the last trip performed, without any information about the car and the driver sending the data.
		Rationale: Transmit data without information about the source vehicle. Yes: speed, acceleration, fuel type, displacement, type of vehicle (hybrid/not), windows open/closed, driving style, and similar data. No: numberplate, chassis, brand, vehi
SP3-6-0012	S	**Description**: Immunity requirement: the data sent from the ecoMonitoring should be not accessible from external programs that could modify the contents. The data format should be encrypted to be read only from an eCoMove system.
		Rationale: Immunity requirement from external illegal access.

8.8. ecoHMI Requirements

This component provides all human machine interaction services necessary for ecoSmartDriving applications.

8.8.1. Functional Requirements

SP3-7-0001	F	**Description**: The ecoSmartDriving HMI should provide on-board training sessions. These should be complimentary to post-trip information.
		Rationale: To ensure that the driver will use the system in the intended way, the system HMI should support the driver by offering introduction and learning sessions inside the car in standstill (e.g. "How to use“, "Learn more about your system“).
SP3-7-0002	F	**Description**: ecoSmartDriving HMI should provide a help function
		Rationale: A context specific help function will give the driver the opportunity to get more information about the indicated elements of the current ecoSmartDriving HMI view and driver’s options to operate the system, e.g. how to navigate in the menu or to change modes.
SP3-7-0003	F	**Description**: The ecoSmartDriving HMI should indicate a possible Availability or non-availability of the system. Also the indication should be given if the system is switched to on or off.
		Rationale: If the system function is not available for a certain reason, it should be indicated to the driver. In case of a system failure the driver should be informed by issuing an appropriate message.
SP3-7-0004	F	**Description**: System switches silent if there are no driver reactions
		Rationale: If the driver does not want to use the system or is in a specific situation (e.g. emergency) the system should not produce too many warnings and recommendations. This would just distract the driver.
SP3-7-0005	F	**Description**: It should be possible to configure or even to shut down the ecoHMI by the user
		Rationale: It must be taken into account, that every user has his personal preferences and wants to decide whether he wants to use a system or in which cases he wants to use it.

SP3-7-0006	F	**Description**: The ecoHMI should motivate the user to change the behaviour to a more efficient driving
		Rationale: guiding the driver how to drive energy efficiently
SP3-7-0007	F	**Description**: The ecoHMI should assist at obstacles by recommending an energy efficient driving.
		Rationale: The HMI has to inform the driver about obstacles (e.g. road works, congestion, speed limits, roundabouts etc.) and how fast he should drive and when he should start to coast.
SP3-7-0008	F	**Description**: The ecoHMI should help the driver to approach a slower vehicle in an energy efficient way
		Rationale: The driver is approaching a slower vehicle. He has to adopt the speed of the slower front vehicle
SP3-7-0009	F	**Description**: The ecoHMI should tell the driver to turn off the car if it is stopped for traffic reasons
		Rationale: The vehicle is stopped for traffic reasons. If the motor is running then it consumes fuel

8.8.2. Interface Requirements

SP3-7-0010	OE	**Description**: The ecoHMI should provide an interface to the information identified in the ecoDrivingSupport that has to be indicated to the driver
		Rationale: the interface is required
SP3-7-0011	OE	**Description**: The ecoHMI should provide an interface to the information identified in the ecoInformation application that has to be indicated to the driver
		Rationale: the interface is required
SP3-7-0012	OE	**Description**: The ecoHMI should provide an interface to the information identified in the Dynamic ecoNavigation application that has to be

		indicated to the driver
		Rationale: the interface is required
SP3-7-0013	OE	**Description**: The ecoHMI should provide an interface to the ecoPostTrip application. To indicate the analysis report
		Rationale: the interface is required

8.8.3. Non-Functional Requirements

SP3-7-0014	UH	**Description**: The ecoSmartDriving HMI should indicate the driver with feedback about short term and long term efficiency performance (e.g. the indication of fuel consumption rate etc)
		Rationale: The driver's motivation and excitement to use the system regularly will work on the basis of comparing efficiency performance values. Long term efficiency performance should also be the basis for rewarding the driver, e.g. with incentives.
SP3-7-0015	UH	**Description**: The ecoSmartDriving HMI should provide consistent system reactions
		Rationale: As a basis for intuitiveness and comprehensibility of the ecoSmartDriving system the HMI should provide consistent system reactions to driver inputs, road conditions, traffic conditions and environmental conditions.
SP3-7-0016	UH	**Description**: The ecoSmartDriving HMI should provide information and warnings which are easy to understand by the user
		Rationale: Beside an easy-to-use menu navigation it is important to provide all information and warnings in the way that they are easy to recognize, to differentiate and easy to remember
SP3-7-0017	UH	**Description**: To support efficient deceleration the ecoSmartDriving HMI should communicate to the driver HOW to decelerate (Applying the brake pedal, Engine in trailing throttle mode or Coasting) and also WHEN to start decelerating. If applicable, the reason for deceleration (e.g. curve, traffic light, speed limit) should also be provided.
		Rationale:

SP3-7-0018	UH	**Description**: To support efficient acceleration the ecoSmartDriving HMI should communicate to the driver how to accelerate more energy efficient. If applicable, the reason for acceleration (e.g. to cross the traffic light, change in speed limit) should be provided
		Rationale:
SP3-7-0019	UH	**Description**: To avoid unnecessary stops at traffic lights the ecoSmartDriving HMI should communicate to the driver the currently appropriate target speed for passing the traffic light at green and /or the timeframe until the lights will change.
		Rationale:
SP3-7-0020	UH	**Description**: To support efficient driving in dense traffic the ecoSmartDriving HMI should communicate to the driver the currently appropriate target speed.
		Rationale:
SP3-7-0021	UH	**Description**: The ecoSmartDriving HMI should be providing visual, auditive and/or tactile information as system feedback based on the settings
		Rationale: Mapping appropriate feedback to driver input enhances the transparency and comprehensibility of the system. The frequency of erroneous driver inputs decreases.
SP3-7-0022	UH	**Description**: While navigating in the system menu the ecoSmartDriving HMI should always be showing where the user currently is.
		Rationale: Enhances the transparency and comprehensibility of the system. The frequency of erroneous driver inputs decreases.
SP3-7-0023	UH	**Description**: The ecoSmartDriving HMI should prevent the user from selecting incorrect options, avoiding unintended activation possibilities.
		Rationale: Enhances the transparency and comprehensibility of the system. The frequency of erroneous driver inputs decreases.
SP3-7-0024	UH	**Description**: The ecoSmartDriving HMI should make the possible choices menu (settings) visible for the user
		Rationale: Enhances the transparency and comprehensibility of the system. The frequency of erroneous driver inputs decreases.

SP3-7-0025	UH	**Description**: The ecoSmartDriving HMI should permit easy reversal of actions
		Rationale: Enhances the transparency and comprehensibility of the system. The frequency of erroneous driver inputs decreases.
SP3-7-0026	L	**Description**: The ecoSmartDriving HMI should be in compliance to the following standards & regulations - Commission Recommendation of 26/V/2008 on safe and efficient in-vehicle information and communication systems: Update of the European Statement of Principles on Hum
		Rationale:
SP3-7-0027	UH	**Description**: The ecoSmartDriving HMI should minimize distraction from the primary driving task. Thus the system should fulfill the following needs: - Visual feedback should be in the primary field of view - Visual / cognitive demand should be minimized - Visual information should be perceptible and understandable at a glance
		Rationale: Enhances the transparency and comprehensibility of the system. The frequency and duration of glances to the driver display should be minimised.
SP3-7-0028	UH	**Description**: The ecoHMI should encourage the user to use the system
		Rationale: An ecoHMI must be accepted by the driver. If not the driver will not use (shut off) the system
SP3-7-0029	UH	**Description**: The ecoHMI should show only the most important information in the specific situation, respectively not too much information
		Rationale: The driver will possibly get much information. There has to be a solution that the driver will not get too much information.
SP3-7-0030	UH	**Description**: Easy to understand green driving strategy in energy relevant situations
		Rationale: The driver should be able to directly understand the messages of the system aiminig to realize green driving. All parts of the

		strategy such as coasting while approaching a STOP sign should be communicated clearly.

8.9. ecoCooperativeHorizon

The ecoCooperativeHorizon component is an entity containing information relevant for driving within a specific range of the route driven in the near future.

8.9.1. Functional Requirements

SP3-8-0001	F	**Description**: Information about the vehicle's own • location incl. lane information • speed • heading in the road network is available.
		Rationale: Building block for detailed information on vehicle environment
SP3-8-0002	F	**Description**: Vehicle's most probable path ahead in the road network is available. content of MPP for further description
		Rationale: Building block for detailed information on vehicle environment
SP3-8-0003	F	**Description**: The vehicle system has information about • number and usage of lanes (is it a bus lane, turning lane etc.) • overtake prohibits • speed limits • geometrical properties • eco properties • traffic state of the most probable path MPP in the road network
		Rationale: Building block for detailed information on vehicle environment
SP3-8-0004	F	**Description**: The system has information about vehicle specific data such as fuel consumption depending on slopes, speed, gear, and load condition. Other information may be necessary and will be defined during the

		project.
		Rationale: Building block for detailed information on vehicle environment
SP3-8-0005	F	**Description**: Vehicle system has information about calculated route
		Rationale: Building block for cooperative routing
SP3-8-0006	F	**Description**: The ecoMap available in the system contains precise (accuracy tbd.) information about the slopes of the streets including altitudes, curves as well as driving attributes such as speed limits, number of lanes etc. (the precise list of needed attributes is tbd).
		Rationale: Building block for ecoDriving and ecoRouting.
SP3-8-0007	F	**Description**: The system is able to calculate a slope going out of a path (MPP) and precise geometry information
		Rationale: Building block for ecoDriving and ecoRouting. In Case slope is not available from ecoMap
SP3-8-0008	F	**Description**: The ecoMap available in the system contains precise (accuracy tbd.) information about the curvatures of the streets including altitude, slopes, as well as driving attributes such as speed limits, number of lanes etc. (the precise list of needed attributes is tbd).
		Rationale: Building block for ecoDriving and ecoRouting.
SP3-8-0009	F	**Description**: The system is able to calculate a curve radius going out of a path (MPP) and precise geometry information
		Rationale: Building block for ecoDriving and ecoRouting. In case curves not available from ecoMap
SP3-8-0010	F	**Description**: The ecoMap available in the system contains precise (accuracy tbd.) information about the geometry of the streets including altitude slopes, curves as well as driving attributes such as speed limits, number of lanes etc. (the precise list of needed attributes is tbd).
		Rationale: Building block for ecoDriving and ecoRouting.

SP3-8-0011	F	**Description**: The system is able to receive and process information via the V2V communication unit. This information include: - MPP of the sending vehicle - Next maneuver attempted by the sending vehicle - Distance to the next maneuver - Current speed and position of the sending vehicle

8.9.2. Interface Requirements

SP3-8-0012	OE	**Description**: The ecoCooperativeHorizon should provide the Most Probable Path to the: a. ecoDrivingSupport application; b. dynamic ecoNavigation application;
		Rationale: This information is required by other application
SP3-8-0013	OE	**Description**: The system is able to communicate with other vehicles
		Rationale: Building block for detailed information on vehicle environment
SP3-8-0014	OE	**Description**: The system is able to communicate with oncoming vehicles
		Rationale: Building block for detailed information on vehicle environment
SP3-8-0015	OE	**Description**: V2V communication transmits and receives • Position (WGS84) incl. lane info • Speed (km/h) • Heading (degree against north) • MPP (e.g. location reference following AGORA-C) of each communication participant within reach.
		Rationale: Building block for detailed information on vehicle environment
SP3-8-0016	OE	**Description**: The system is able to communicate with other vehicles on its

		calculated route
		Rationale: Building block for detailed information on vehicle environment
SP3-8-0017	OE	**Description**: V2V communication transmits and receives • Position (WGS84) incl. lane info • Speed (km/h) • Heading (degree against north) • MPP (location reference following AGORA-C) of each communication participant of the MPP.
		Rationale: Building block for detailed information on vehicle environment
SP3-8-0018	OE	**Description**: The system is able to communicate with other vehicles queing
		Rationale: Building block for detailed information on vehicle environment
SP3-8-0019	OE	**Description**: The system is able to communicate with traffic lights controller
		Rationale: Building block for detailed information on vehicle environment
SP3-8-0020	OE	**Description**: V2V communication transmits and receives • Position (WGS84) incl. lane info • Speed (km/h) • Heading (degree against north) • MPP (e.g. location reference following AGORA-C) of each communication participant queing.
		Rationale: Building block for detailed information on vehicle environment
SP3-8-0021	OE	**Description**: The system is able to communicate with other vehicles on ist MPP.
		Rationale: Building block for ecoDriving.
SP3-8-0022	OE	**Description**: The system is able to communicate with slower vehicles ahead
		Rationale:

		Building block for ecoDriving: To avoid unnecessary braking and acceleration.
SP3-8-0023	OE	**Description**: Traffic lights controller transmits • Location reference of traffic lights • Residual red display times for each driving direction to each eCoMove vehicle within reach.
		Rationale: Building block for ecoDriving: To avoid unnecessary braking and acceleration.
SP3-8-0024	OE	**Description**: V2V communication transmits and receives • Position (WGS84) incl. lane info • Speed (km/h) • Heading (degree against north) • MPP (e.g. ocation reference following AGORA-C) of each communication participant slower ahead.
		Rationale: Building block for ecoDriving: To avoid unnecessary braking and acceleration.

8.9.3. Non-Functional Requirements

SP3-8-0025	P	**Description**: The accuracy of both • the measurement of position, speed and heading and • the stored map data allows the system to calculate the accurate distance to the slope (in real time).
		Rationale: General requirement on precision of the map and the position calculation and on the system performance
SP3-8-0026	P	**Description**: The location reference transmitted by the V2V communication partners is described unambiguously (e.g. AGORA-C)
		Rationale: General requirement on precision of location referencing

SP3-8-0027	P	**Description**: The Location reference transmitted by the traffic light controllers and by the vehicles at the queue is described unambiguously (e.g. AGORA-C)
		Rationale: General requirement on precision of location referencing
SP3-8-0028	P	**Description**: The Location reference is described unambiguously (e.g. AGORA-C)
		Rationale: General requirement on precision of location referencing

8.10. TripDataSet

This component is a database in which all trip data that is relevant for fuel consumption is stored, e.g. road parameters, traffic state, vehicle state, driver operation, etc.

8.10.1. Functional Requirements

SP3-9-0001	F	**Description**: the application must be able to store the destination
		Rationale: To be made available for analysis
SP3-9-0002	F	**Description**: the application must be able to store the different driver profile, using the same vehicle
		Rationale: Need for the analysis
SP3-9-0003	F	**Description**: the application must be able to store the vehicle information
		Rationale: Need for the analysis
SP3-9-0004	F	**Description**: The TripDataSet should store trip data of each trip containing the TBD information for example a. Driver ID (in case more than one driver is using the vehicle) b. Date & time of trip c. Speed profile (incl. accelerations & decelerations) d. Gear choice e. Engine RPM f. Engine on/off at stop g. Road segment parameters (speed limit, slope, road signs/traffic

		signals, tbd.,) – the exact position where the driver has been? Or only the road characteristics? h. Fuel consumption (CAN)

8.10.2. Interface Requirements

SP3-9-0005	OE	**Description**: The TripDataSet should be accessible for the following applications / components: a. PostTrip analysis – on board b. PostTrip analysis – off board c. ecoMonitoring d. ecoDrivingSupport e. ecoRouting

8.10.3. Non-Functional Requirements

SP3-9-0006	P	**Description**: The TripDataSet should be able to store at least TBD km of trips
		Rationale: Need for the analysis

References

1. N. Eikelenberg e.a., D2.1 System concept, use cases and Requirements, eCoMove project deliverable, November 2010
2. S. Trommer e.a., D6.1 Requirements and motivators for private and commercial drivers, eCoMove project deliverable, November 2010
3. ETSI EN 302 665 V1.1.1, (2010-09), Intelligent Transport Systems (ITS); Communications Architecture, September 2010

Annex I ecoSmartDriving requirements

ecoTripPlanning

Requirement No:	SP3-1-0001	**Requirement Type**	F	**Usecase No:**	UC_SP3_02
Description	The system needs to collect from the user and/or from the vehicle the necessary information in order to determine an optimal route. The necessary data are the following: • Vehicle type (in case it is a vehicle that is not enabled to drive through certain areas) • From (start location) • To (location destination) • When (date and time of the trip)				
Rationale	Building block for ecoTripPlanning				
Originator	CRF				
Fit Criterion	Availability of preTrip information from the user				
Implementation Priority	2		**Conflicts**	None	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	CRF	9/29/2010		New	

Requirement No:	SP3-1-0002	**Requirement Type**	F	**Usecase No:**	UC_SP3_02
Description	The system needs enhanced maps data to determine the ecoRoute. To determine the ecoRoute the system needs additional data from digital maps (e.g. road slope)				
Rationale	Building block for ecoTripPlanning				
Originator	CRF				
Fit Criterion	Availability of additional data (e.g. slope) from the digital maps				
Implementation Priority	2		**Conflicts**	None	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	CRF	9/29/2010		New	

Requirement No:	SP3-1-0003	**Requirement Type**	F	**Usecase No:**	UC_SP3_02

	Availability of additional information to increase the function performance.				
Description	The preTrip function will be able to perform better route computing if historical traffic data will be available for each road segment. These data potentially are provided by external service / function.				
Rationale	Building block for ecoTripPlanning				
Originator	CRF- MMSE				
Fit Criterion	Availability from external service/function of historical traffic data for each segment of road.				
Implementation Priority	1	**Conflicts**	None		
Notes					
Status:	New	**Target:**	TBD		
History	**Who**	**When**	**What**		
	CRF- MMSE	9/29/2010	New		

Requirement No:	SP3-1-0004	**Requirement Type**	F	**Usecase No:**	UC_SP3_02
	The functions should be able to take care of local traffic restrictions.				
Description	Municipality frequently proposes temporary traffic restriction. The ability to consider them makes the result more useful. These data potentially are provided by external service / function.				
Rationale	Building block for ecoTripPlanning				
Originator	CRF				
Fit Criterion	Availability from external service/function of temporary traffic restrictions data.				
Implementation Priority	2	**Conflicts**	None		
Notes					
Status:	New	**Target:**	TBD		
History	**Who**	**When**	**What**		
	CRF	9/29/2010	New		

Requirement No:	SP3-1-0005	**Requirement Type**	F	**Usecase No:**	UC_SP3_02
Description	A link to external services is necessary to provide the system with data which are not locally available.				

	Data as historical data, traffic limitation etc. are available from external services.				
Rationale	Building block for ecoTripPlanning				
Originator	CRF - MMSE				
Fit Criterion	Availability of a link to external services.				
Implementation Priority	2		**Conflicts**	None	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	CRF - MMSE	9/29/2010		New	

Requirement No:	SP3-1-0006	**Requirement Type**	F	**Usecase No:**	UC_SP3_02
Description	In case the departure / arrival time entry of the user is not specified, the ccoTripPlanning application should enable trip timing optimisation (departure/arrival time) based on TrafficStatePrediction if fuel consumption can be reduced with an alternative timing.				
Rationale	Building block for ecoTripPlanning				
Originator	CRF				
Fit Criterion	Alternative way to perform fuel consumption reducion				
Implementation Priority	2		**Conflicts**	None	
Notes	To establish a target of >2% should be restrictive or unreachable. There is not evidence to put a number.				
Status:		**Target:**		TBD	
History	**Who**	**When**		**What**	
	CRF	10/15/2010		Modifeid	

Requirement No:	SP3-1-0007	**Requirement Type**	F	**Usecase No:**	UC_SP3_02
Description	In case the arrival time is fixed the ecoTripPlanning application should be able to warn the driver if the travel time changes before the trip has started.				
Rationale	Building block for ecoTripPlanning				
Originator	CRF				
Fit Criterion	Possibility to warn the driver about changes in the planned route				
Implementation Priority	2		**Conflicts**	None	
Notes					

Status:	New	**Target:**	TBD
History	**Who**	**When**	**What**
	CRF	9/20/2010	New

Requirement No:	SP3-1-0008	**Requirement Type**	OE	**Usecase No:**	
Description	The ecoTripPlanning application should use the ecoRouting component to determine the least fuel consuming route based on one or more of the following entries from the user: a. Origin b. Destination c. Intermediate destination d. Arrival time e. Departure time f. Vehicle ID				
Rationale	In order to calculate the optimal route.				
Originator	CRF				
Fit Criterion					
Implementation Priority	2		**Conflicts**	None	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	CRF	9/20/2010		New	

Requirement No:	SP3-1-0009	**Requirement Type**	OE	**Usecase No:**	
Description	The ecoTripPlanning application should be available off board and on-board of the vehicle a. Off-board availability should be enabled via a mobile device or via PC b. On-board access via TBD device				
Rationale	In order to help the user plan ahead of the trip and indpendent of the car				
Originator	CRF				
Fit Criterion					

Implementation Priority	2	**Conflicts**	None
Notes			
Status:	New	**Target:**	TBD
History	**Who**	**When**	**What**
	CRF	9/20/2010	New

Requirement No:	SP3-1-0010	**Requirement Type**	OE	**Usecase No:**	
Description	The ecoTripPlanning application should be able to access TrafficStatePredictions (SP5) to enable the user to perform the following check: a. One day or more before the trip: based on historic traffic profiles – check should be done daily b. Day of the trip: prediction of traffic state based on actual traffic situation – check should be done each hour				
Rationale	For providing optimal suggestions				
Originator	CRF				
Fit Criterion					
Implementation Priority	2		**Conflicts**	None	
Notes					
Status:	New		**Target:**	TBD	
History	**Who**		**When**	**What**	
	CRF		9/20/2010	New	

Requirement No:	SP3-1-0011	**Requirement Type**	UH	**Usecase No:**	
Description	Acceptance for ecoTripPlanning: the function should represent an opportunity for the user				
Rationale					
Originator	CRF				
Fit Criterion	Must be tested with a questionnaire/interview				
Implementation Priority	2		**Conflicts**	None	
Notes					
Status:	New		**Target:**	TBD	
History	**Who**		**When**	**What**	
	CRF		9/20/2010	New	

Requirement No:	SP3-1-0012	**Requirement Type**	UH	**Usecase No:**	
Description	Usability of data input: the interface should be easy to use				
Rationale					
Originator	CRF				
Fit Criterion	Must be tested with experts and users as defined by the user centred HMI design process				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	CRF	9/20/2010		New	

Requirement No:	SP3-1-0013	**Requirement Type**	UH	**Usecase No:**	
Description	Usability of data output: the result should be easy to be used				
Rationale					
Originator	CRF				
Fit Criterion	Must be tested with experts and users as defined by the user centred HMI design process				
Implementation Priority	2		**Conflicts**	None	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	CRF	9/29/2010		New	

Requirement No:	SP3-1-0014	**Requirement Type**	UH	**Usecase No:**	
Description	Usability the ecoTripPlanning: the system should be easy, effective and safe to interact with				
Rationale					
Originator	CRF				
Fit Criterion	Must be tested with experts and users as defined by the user centred HMI design process				
Implementation	2		**Conflicts**	None	

Priority Notes			
Status:	New	**Target:**	TBD
History	**Who**	**When**	**What**
	CRF	9/29/2010	New

dynamic ecoNavigation

Requirement No:	SP3-3-0001	**Requirement Type**	F	**Usecase No:**	UC_SP3_0004
Description	User must be able to select destination.				
Rationale	Routing requires a destination to route to.				
Originator					
Fit Criterion	Try to select a destination. This must be possible.				
Implementation Priority	2	**Conflicts**			
Notes	dynamic ecoNavigation would be able to work by just using destinations from trip planning, thus only second priority class.				
Status:	NEW	**Target:**		TBD	
History	**Who**	**When**		**What**	
	Johannes Stille	9/17/2010		Created.	

Requirement No:	SP3-3-0002	**Requirement Type**	F	**Usecase No:**	UC_SP3_0004
Description	dynamic ecoNavigation must generate a route to the destination.				
Rationale	This is the very purpose of routing.				
Originator					
Fit Criterion	Plan a route to a previously defined destination. If it is legally possible to reach the destination from the current vehicle position, a route must be generated that leads from the current vehicle position to the destination in a legal way.				
Implementation Priority	1	**Conflicts**			
Notes					
Status:	NEW	**Target:**		TBD	
History	**Who**	**When**		**What**	
	Johannes Stille	9/17/2010		Created.	

Requirement No:	SP3-3-0003	**Requirement Type**	F	**Usecase No:**	UC_SP3_0005
Description	dynamic ecoNavigation must check alternatives to MPP when no destination is known.				

Rationale	Even without a final destination, it's possible to find more fuel-efficient alternatives to the road ahead of the vehicle.		
Originator			
Fit Criterion	Do not select a destination. Drive toward a road segment that is blocked according to information from traffic centre. dynamic ecoNavigation should guide the driver around the road block.		
Implementation Priority	3	**Conflicts**	
Notes	For testing, a virtual road block may be used that only exists in fake traffic messages. dynamic ecoNavigation should also route around a stretch of road that is very inefficient to drive e.g. due to congestion; it would be very hard to construct a sample case, though.		
Status:	NEW	**Target:**	TBD
History	**Who**	**When**	**What**
	Johannes Stille	9/27/2010	Created.

Requirement No:	SP3-3-0004	**Requirement Type**	F	**Usecase No:**	UC_SP3_0004 UC_SP3_0005
Description	dynamic ecoNavigation should warn of impossible routes.				
Rationale	The system shouldn't guide the driver through illegal maneuvers without at least informing the driver.				
Originator					
Fit Criterion	Select a destination situated in a pedestrian area or otherwise unreachable. Ask the system to plan a route. The system should issue a warning.				
Implementation Priority	3	**Conflicts**			
Notes	It is open to the implementation whether an illegal route is generated or no route at all.				
Status:	NEW	**Target:**		TBD	
History	**Who**	**When**		**What**	
	Johannes Stille	9/17/2010		Created.	

Requirement No:	SP3-3-0005	**Requirement Type**	F	**Usecase No:**	UC_SP3_0004 UC_SP3_0005
Description	Green route must be fuel-efficient.				
Rationale	This is what makes the route a green route. Unfortunately, there is no way to set a requirement on the actual				

	fuel savings (compared to what?) in advance; and since routing needs some heuristics for performance reasons, it's not feasible to require the route to be the very optimum route – one at most can require a good enough route.		
Originator			
Fit Criterion	When measuring actual fuel consumption or when using an arbitrary (but sufficiently realistic) fuel consumption model, on average (over many routes), the fuel consumption for green routes is less than for fast or short routes. When using the same fuel consumption model for verification as used internally in dynamic ecoNavigation, the fuel consumption for an arbitrary green route is not higher than for a short or fast route to the same destination.		
Implementation Priority	1	**Conflicts**	
Notes	Fuel consumption is equivalent to energy consumption and CO2 production.		
Status:	NEW	**Target:**	
History	**Who**	**When**	**What**
	Johannes Stille	9/17/2010	Created.

Requirement No:	SP3-3-0006	**Requirement Type**	F	**Usecase No:**	UC_SP3_0004 UC_SP3_0005
Description	dynamic ecoNavigation should make use of vehicle parameters.				
Rationale	The least fuel consuming route might depend in some cases on vehicle data like mass, cw (aerodynamic drag coefficient), cross section, or motor properties.				
Originator					
Fit Criterion	A large set of green routes is planned for several different vehicles. For each route and for each vehicle, the fuel consumption is checked for the route planned for this vehicle as well as for the same route (i.e. same start and destination) planned for other vehicles.On average the routes calculated planned for a vehicle-should be more fuel efficient for this vehicle than the routes calculated for other vehicles.				
Implementation Priority	3	**Conflicts**			
Notes	The Fit Criterion implicitly requires some way to configure vehicle-specific data. The composition of this data very much depends on the fuel consumption model used internally by dynamic ecoNavigation, it might e.g. be physical vehicle				

	parameters like mass and cross-section or a table of fuel consumption by speed and grade; thus there are no specific requirements on how to configure these data. The effects might be small; often routes will be identical even for different vehicle parameters, so a large number of routes is needed to measure the effects. The size of the effects might be an interesting research result by itself. If fuel consumption is simulated/modeled, the model used for verification needs to agree with the model used for dynamic ecoNavigation. The actual list of vehicle parameters to be used depends on the fuel consumption model used and thus is left open to the implementation.		
Status:	NEW	**Target:**	
History	**Who**	**When**	**What**
	Johannes Stille	9/17/2010	Created.

Requirement No:	SP3-3-0007	**Requirement Type**	F	**Usecase No:**	UC_SP3_0004 UC_SP3_0005
Description	dynamic ecoNavigation should make use of historic traffic patterns.				
Rationale	The least fuel consuming route depends on the possible speeds along the route which can be estimated from collected data.				
Originator					
Fit Criterion	A large set of green routes is planned both using historic traffic patterns and without access to historic traffic patterns. On average the routes calculated using historic traffic patterns should be more fuel efficient than the routes calculated without historic traffic patterns.				
Implementation Priority	3	**Conflicts**			
Notes	Historic traffic pattern data might be superseded by dynamic traffic flow data, so it might be necessary to disable access to dynamic traffic flow data to measure the effects of the historic traffic patterns. The effects are expected to be small; in most cases routes will be identical, so a large number of routes is needed to measure the effects. The size of the effects might be an interesting research result by itself. If fuel consumption is simulated/modeled, the model used for verification needs to agree with the model used for dynamic				

	ecoNavigation.		
Status:	NEW	**Target:**	
History	**Who**	**When**	**What**
	Johannes Stille	9/17/2010	Created.

Requirement No:	SP3-3-0008	**Requirement Type**	F	**Usecase No:**	UC_SP3_0004 UC_SP3_0005
Description	dynamic ecoNavigation should make use of dynamic traffic information and situational data.				
Rationale	The least fuel consuming route depends on the possible speeds along the route; this information can be collected and distributed centrally. Also incidents need to be taken into account. Roadside units can distribute situational information about local traffic and near-future events like traffic light phases.				
Originator					
Fit Criterion	A large set of green routes is planned both using dynamic traffic information and situational data and without access to dynamic traffic information and situaltional data. On average the routes calculated using dynamic traffic information and situational data should be more fuel efficient than the routes calculated without.				
Implementation Priority	3	**Conflicts**			
Notes	Dynamic traffic information probably is available only for major roads, so routes are affected only as long as they use major roads. Short-to-medium distance routes might not be affected at all. The effects are expected to be small; in most cases routes will be identical, so a large number of routes is needed to measure the effects. The size of the effects might be an interesting research result by itself. If fuel consumption is simulated/modeled, the model used for verification needs to agree with the model used for dynamic ecoNavigation.				
Status:	NEW	**Target:**			
History	**Who**	**When**	**What**		
	Johannes Stille	9/17/2010	Created.		

Requirement No:	SP3-3-0009	**Requirement Type**	F	**Usecase No:**	UC_SP3_0004 UC_SP3_0005
Description	dynamic ecoNavigation should make use of floating vehicle data from other vehicles.				
Rationale	Information from other vehicles might allow conclusions on where it's currently possible to drive in a fuel efficient way.				
Originator					
Fit Criterion	Find a situation with two almost equivalent routes (e.g. using two parallel roads). Now have several eCoMove equipped vehicles on the one road driving in a stop-and-go style, have several eCoMove equipped vehicles on the other road driving in a steady way. dynamic ecoNavigation should select the road with steady flow when in the range of V2V transmissions from the other vehicles. The other vehicles may be simulated by a single unit transmitting V2V data for several virtual vehicles.				
Implementation Priority	3	**Conflicts**			
Notes	V2V data usually is available only when near the location of the other participating vehicles, so usually it won't be used for the initial route planning, but only for dynamic rerouting. V2V communications range might limit the possibilities of using V2V communication for routing.				
Status:	NEW	**Target:**			
History	**Who**	**When**		**What**	
	Johannes Stille	9/17/2010		Created.	

Requirement No:	SP3-3-0010	**Requirement Type**	F	**Usecase No:**	UC_SP3_0004 UC_SP3_0005
Description	dynamic ecoNavigation should make use of route advice from a traffic centre.				
Rationale	A traffic centre might have route advice that takes into account on the one hand planned measured like future traffic light control settings, on the other hand the effects of one vehicle on the total fuel consumption of the vehicles in the area.				
Originator					
Fit Criterion	When a traffic centre gives route advice to a vehicle, this advice is generally followed (unless it results in a large individual disadvantage regarding travel time or fuel consumption).				
Implementation Priority	3	**Conflicts**		<Requirement for fuel efficient route.>	

Notes	Following route advice from a traffic centre might result in a reduced overall fuel consumption cumulated over all vehicles, but it can increase travel time and fuel consumption of an individual vehicle.		
Status:	NEW	**Target:**	
History	**Who**	**When**	**What**
	Johannes Stille	9/17/2010	Created.

Requirement No:	SP3-3-0011	**Requirement Type**	F	**Usecase No:**	UC_SP3_0004 UC_SP3_0005
Description	When new floating vehicle data or dynamic traffic information is available, the route is recalculated. If the newly calculated route shows a significant fuel saving compared to the previous one, it replaces the previous route for further guidance.				
Rationale	New dynamic traffic information orV2V information (or even the ego vehicle moving with a different speed than assumed, for the time dependency of traffic pattern data) might outdate a route.				
Originator					
Fit Criterion	When new data arrives, a route recalculation is triggered. This can be tested using dynamic traffic data that contains a blocked road somewhere along the route. If new data arrives very frequently (i.e. the time interval between data receptions is not significantly above the time it takes to check/recalculate the route), then it suffices to recalculate the route after an appropriate time interval.				
Implementation Priority	2	**Conflicts**			
Notes	Most often the recalculation will result in an unchanged route, so the effect is difficult to verify.				
Status:	NEW	**Target:**			
History	**Who**	**When**	**What**		
	Johannes Stille	9/17/2010	Created.		

Requirement No:	SP3-3-0012	**Requirement Type**	F	**Usecase No:**	UC_SP3_0004 UC_SP3_0005
Description	When the vehicle leaves the route, the route is recalculated.				
Rationale	When the driver misses some manoeuvre, new guidance is needed within a short time.				
Originator					
Fit Criterion	When driving along a route, turn away from the route. A short				

	time later, a new route must be calculated and used for guidance.		
Implementation Priority	1	**Conflicts**	
Notes			
Status:	NEW	**Target:**	
History	**Who**	**When**	**What**
	Johannes Stille	9/17/2010	Created.

Requirement No:	SP3-3-0013	**Requirement Type**	F	**Usecase No:**	UC_SP3_0004 UC_SP3_0005
Description	dynamic ecoNavigation guides the driver along the route and informs about impending manoeuvres.				
Rationale	Just having a route is not enough; it needs to be used to guide the driver.				
Originator					
Fit Criterion	When driving along a route, the driver is informed at an appropriate time about impending manoeuvres.				
Implementation Priority	2	**Conflicts**			
Notes	The driver may be informed visually or acoustically or preferably both, this and the details are left open to the implementation.				
Status:	NEW	**Target:**			
History	**Who**	**When**	**What**		
	Johannes Stille	9/17/2010	Created.		

Requirement No:	SP3-3-0014	**Requirement Type**	F	**Usecase No:**	UC_SP3_0004 UC_SP3_0005
Description	dynamic ecoNavigation gives lane information to the driver.				
Rationale	Lane information enables early lane choice which improves traffic flow and thus reduces fuel consumption.				
Originator					
Fit Criterion	When driving along a route, the driver is informed at an appropriate time which lane to take.				
Implementation Priority	2	**Conflicts**			
Notes	The driver may be informed visually or acoustically or preferably both, this and the details are left open to the implementation.				
Status:	NEW	**Target:**			
History	**Who**	**When**	**What**		
	Johannes Stille	9/27/2010	Created.		

Requirement No:	SP3-3-0015	**Requirement Type**	F	**Usecase No:**	UC_SP3_0004 UC_SP3_0005
Description	Optionally, the route can be optimized for a configurable combination of fuel consumption and travel time.				
Rationale	In real life, drivers wouldn't use a green route if that means unreasonably high travel times, so there's a trade-off between the two that should be reflected in the application.				
Originator					
Fit Criterion	It should be possible to configure a trade-off between fuel consumption and travel time. Higher priority for travel time results in faster routes, higher priority for fuel consumption results in more fuel-efficient routes.				
Implementation Priority	3	**Conflicts**			
Notes	To clearly see the effect of the configuration setting, a large number of routes needs to be tested.				
Status:	NEW	**Target:**			
History	**Who**	**When**		**What**	
	Johannes Stille	9/17/2010		Created.	

Requirement No:	SP3-3-0016	**Requirement Type**	OE	**Usecase No:**	UC_SP3_0004 UC_SP3_0005
Description	dynamic ecoNavigation must access the static ecoMap, the interface is TBD.				
Rationale	The map is the very base for routing. Details of the interface will be defined in task 2.4.3.1.				
Originator					
Fit Criterion	dynamic ecoNavigation providing a route at all will show that dynamic ecoNavigation has access to the ecoMap.				
Implementation Priority	1	**Conflicts**			
Notes					
Status:	NEW	**Target:**			
History	**Who**	**When**		**What**	
	Johannes Stille	10/14/2010		Created.	

Requirement No:	SP3-3-0017	**Requirement Type**	OE	**Usecase No:**	UC_SP3_0004 UC_SP3_0005

Description	dynamic ecoNavigation should access dynamic traffic information.		
Rationale	Dynamic traffic information helps avoiding traffic incidents and delivers information on possible speeds which are important for fuel consumption estimation.		
Originator			
Fit Criterion	dynamic ecoNavigation reacts appropriately on available dynamic traffic information.		
Implementation Priority	3	**Conflicts**	
Notes	Dynamic traffic information need not originate from a SP5 traffic center, but it's also possible to use public or commercial sources.		
Status:	NEW	**Target:**	
History	**Who**	**When**	**What**
	Johannes Stille	10/14/2010	Created.

Requirement No:	SP3-3-0018	**Requirement Type**	OE	**Usecase No:**	UC_SP3_0005
Description	dynamic ecoNavigation should access situational data from Road-Side Units and floating car data from other vehicles via the dynamic ecoMap.				
Rationale	Situational data helps locally optimizing the route.				
Originator					
Fit Criterion	dynamic ecoNavigation reacts appropriately on FVD and data from RSU.				
Implementation Priority	3	**Conflicts**			
Notes	It is expected that data received from the communication platform will be collected in the dynamic ecoMap and be accessed there by dynamic ecoNavigation. But this is open for discussion when needed.				
Status:	NEW	**Target:**			
History	**Who**	**When**		**What**	
	Johannes Stille	10/14/2010		Created.	

Requirement No:	SP3-3-0019	**Requirement Type**	OE	**Usecase No:**	UC_SP3_0005
Description	dynamic ecoNavigation should access MPP from ecoHorizon.				
Rationale	Without a planned route, dynamic ecoNavigation still can propose better alternatives to the MPP.				
Originator					

Fit Criterion	dynamic ecoNavigation proposes an alternative route when the MPP leads through a blocked or very fuel-inefficient road.		
Implementation Priority	3	**Conflicts**	
Notes			
Status:	NEW	**Target:**	
History	**Who**	**When**	**What**
	Johannes Stille	10/14/2010	Created.

Requirement No:	SP3-3-0020	**Requirement Type**	OE	**Usecase No:**	UC_SP3_0004 UC_SP3_0005
Description	dynamic ecoNavigation should receive route advice from traffic centre.				
Rationale	This is the counterpart to SP5 route advice.				
Originator					
Fit Criterion	dynamic ecoNavigation reacts appropriately on route advice.				
Implementation Priority	3	**Conflicts**			
Notes	Interface is yet TBD.				
Status:	NEW	**Target:**			
History	**Who**	**When**	**What**		
	Johannes Stille	10/14/2010	Created.		

Requirement No:	SP3-3-0021	**Requirement Type**	OE	**Usecase No:**	UC_SP3_0004 UC_SP3_0005
Description	dynamic ecoNavigation should use driver profiles created by TripDataSet.				
Rationale	Driver behaviour has a large influence on fuel consumption, and this influence can vary much depending on the road properties, so the most fuel-efficient route may be different for different drivers.				
Originator					
Fit Criterion	dynamic ecoNavigation adapts to driver behaviour, e.g. a driver driving 90 km/h on motorways gets a higher motorway preference in comparison to a driver driving 150 km/h on motorways.				
Implementation Priority	3	**Conflicts**			
Notes	It still is TBD where and how a driver profile is generated from collected data.				
Status:	NEW	**Target:**			
History	**Who**	**When**	**What**		

	Johannes Stille	10/14/2010	Created from proposal by Jayavel Subbian.

Requirement No:	SP3-3-0022	**Requirement Type**	OE	**Usecase No:**	UC_SP3_0004 UC_SP3_0005
Description	ecoNavigation should be available as a component to applications; interfaces are yet TBD.				
Rationale	dynamic ecoNavigation will be used by both pre-trip planning and on-board navigation; as a modular component, it shouldn't need knowledge about the applications that use it.				
Originator					
Fit Criterion	Both pre-trip planning and on-board navigation can use dynamic ecoNavigation.				
Implementation Priority	1	**Conflicts**			
Notes	If there are multiple implementations of dynamic ecoNavigation, then not every one of them must necessarily be available in both pre-trip and on-board environments.				
Status:	NEW	**Target:**			
	Who	**When**		**What**	
History	Johannes Stille	10/14/2010		Created from proposal by Jayavel Subbian.	

Requirement No:	SP3-3-0023	**Requirement Type**	P	**Usecase No:**	UC_SP3_0004
Description	A route calculation should take at most one minute for a route up to 500 km.				
Rationale	We cannot keep the user waiting too long for a route. On the other hand, dynamic ecoNavigation algorithms may be considerably more complex than the fastest/shortest route calculation in commercial navigation systems (which usually are highly optimized), so we have to allow (at least in this research project) considerably longer computing times.				
Originator					
Fit Criterion	For several routes up to 500 km in length, the time to plan a green route is measured. The times should be below one minute.				
Implementation Priority	3	**Conflicts**			

Notes	This time constraint still requires heuristic optimizations, so there is a trade-off: The narrower the time constraint, the lower will be the quality of the route (in this case meaning higher fuel consumption). It needs to be investigated what time constraint may actually be set while keeping the route quality sufficiently high.		
Status:	NEW	**Target:**	
History	**Who**	**When**	**What**
	Johannes Stille	9/17/2010	Created.

Requirement No:	SP3-3-0024	**Requirement Type**	P	**Usecase No:**	UC_SP3_0004
Description	A route recalculation due to new/updated information should take at most one minute for a route up to 500 km.				
Rationale	Dynamic traffic information and V2V information needs to be processed in a timely fashion to be useful.				
Originator					
Fit Criterion	For several routes up to 500 km in length, driving along the route is started, then dynamic traffic information is injected that affects the route. The route should be recalculated in a time below one minute.				
Implementation Priority	3	**Conflicts**			
Notes	In this case, the driver is still guided along the original route until the new route is calculated, so there is no particular urgency.				
Status:	NEW	**Target:**			
History	**Who**	**When**	**What**		
	Johannes Stille	9/17/2010	Created.		

Requirement No:	SP3-3-0025	**Requirement Type**	P	**Usecase No:**	UC_SP3_0004
Description	A route recalculation after leaving the route should take at most 10 seconds.				
Rationale	When the driver has left the route, new guidance is required almost immediately; in this case, time is more important than route quality. Usually, just a way back to the previous route is calculated.				
Originator					
Fit Criterion	When driving along a route, the route is left intentionally. In at most 10 seconds, guidance for a new route should be available.				
Implementation Priority	3	**Conflicts**			
Notes	It is assumed that in a second step, standard recalculation will be triggered to search for a better route to the destination.				

Status:	NEW	**Target:**		
History	**Who**	**When**	**What**	
	Johannes Stille	9/17/2010	Created.	

ecoDriving Support

Requirement No:	SP3-4-0001	**Requirement Type**	F	**Usecase No:**	
Description	The system has to consider the driving safety in the determination of the driving strategies				
Rationale	The system has to determine a driving strategy that considers driving safety. Although hard braking maneuvers are inefficient these should be recommended when the vehicles is driven above the legal speed maximum. Also too close distances to front vehicles have to be avoided in any situation.				
Originator	P.Themann				
Fit Criterion	Driving safety => how to measure?				
Implementation Priority	1		**Conflicts**	none	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	Philipp Themann	9/20/2010		Created	

Requirement No:	SP3-4-0002	**Requirement Type**	F	**Usecase No:**	UC_SP3_0003; UC_SP3_0005; UC_SP3_0006; UC_SP3_0004
Description	The system optimizes the velocity profile of the vehicle for the trip (driving strategy) dynamically. Therefore the following variables are affected: travel time, fuel consumption, driver acceptance, (electrical) power supply for different energy consumers				
Rationale	To determine an optimal driving strategy the system should consider the following information: • Velocity (current and future maximum velocity limitations) • Inclination (current and future) • Constant vehicle parameters such as engine and transmission map • Estimated inconstant vehicle parameters such as mass, rolling or aerodynamic resistant				

Originator	P.Themann		
Fit Criterion	Accuracy of optimized driving strategy => to be simulated		
Implementation Priority	1	**Conflicts**	the specific driver use has to be considered => see requirement SP3-006 and SP3-006a
Notes			
Status:	Open	**Target:**	TBD
History	**Who**	**When**	**What**
	Philipp Themann	9/20/2010	Created

Requirement No:	SP3-4-0003	**Requirement Type**	F	**Usecase No:**	
Description	The recommended green driving strategy considers the type of driver to reach a maximum driver acceptance.				
Rationale	The system has to assess the standard driving style of a specific driver (e.g. sporty or highly efficient driving style). Depending on this driving style recommendations for a more fuel efficient driving style have to be proceeded.				
Originator	P.Themann				
Fit Criterion	High driver acceptance => how to be measured?				
Implementation Priority	2		**Conflicts**	none	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	Philipp Themann	9/20/2010		new	

Requirement No:	SP3-4-0004	**Requirement Type**	F	**Usecase No:**	
Description	The system shold consider a holistic use function of the driver including travel time as well as fuel consumption.				
Rationale	The green driving strategies should be tunable to consider the benefits of a driver to move as well as the cost arising from fuel consumption. A faster arriving at the target destination and a lower usage of fuel is beneficial for the driver. A higher velocitiy is nearly in all situations accompanied by higher fuel consumption. Thus the driver decides on his driving behaviour in a trade off between driving time and fuel consumption. This trade off is driver specific and has to be estimated by the system to ensure optimal results.				
Originator	P.Themann				

Fit Criterion	Driver acceptance => how to be measured?				
Implementation Priority	1		**Conflicts**	none	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	Philipp Themann	9/20/2010		Created	

Requirement No:	SP3-4-0005	**Requirement Type**	F	**Usecase No:**	
Description	The driving strategies consider information about the driving style of front vehicle to improve the prediction of future driving situations and thereby improve the calculation of green driving strategies.				
Rationale	The front vehicle affects the driving strategy of the following vehicle. A probable behavior of the front vehicle can be assessed taking a standard driver into account. The system should also be able to assess the driving style of the front driver using several sensor informations. If the front vehicle is equipped with a eCoMove system it should determine and predict the driving style of its driver. This information should be transmitted to the following vehicle to increase the predicion accuracy and thus the effectiveness of driving strategies.				
Originator	P.Themann				
Fit Criterion	Increased prediction accuracy => assess system effectiveness with and without this feature				
Implementation Priority	2		**Conflicts**	none	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	Philipp Themann	9/20/2010		Created	

Requirement No:	SP3-4-0006	**Requirement Type**	F	**Usecase No:**	
Description	Determination and prediction of the effectiveness of different driving strategies				
Rationale	The system has to assess the effectiveness of different driving strategies (e.g. coasting, deceleration with engine in trailing throttle mode or braking) and communicate their probable effectiveness (this is the energy consumption) to the driver. This comparison enables the driver to see the benefits of a predictive driving style.				

Originator	P.Themann		
Fit Criterion	Visiblity of different driving strategies		
Implementation Priority	1	**Conflicts**	Implementation of HMI and danger of distracting the driver
Notes			
Status:	New	**Target:**	TBD
History	**Who**	**When**	**What**
	Philipp Themann	9/20/2010	Created

Requirement No:	SP4-4-0007	**Requirement Type**	F	**Usecase No:**	UC_SP4_0005
Description	The system considers both fuel economy and the potential trade-off with travel time while optimizing the trip and the driving strategies for a specific traffic stituation.				
Rationale	driver acceptance can only be ensured, if besides fuel consumption als other relevant parameters such as travel time and acceleration profile are considered. The holistic use function has to be adjustable by the driver				
Originator	P.Themann				
Fit Criterion					
Implementation Priority	1		**Conflicts**	none	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	Philipp Themann	10/8/2010		new	

Requirement No:	SP4-4-0008	**Requirement Type**	F	**Usecase No:**	UC_SP4_0006
Description	The system dynamically determines the optimal driving strategy and communicates it to the driver.				
Rationale	The ecoDriver Coaching system is aware about the vehicle status (e.g. load) and the route to be driven. Furthermore it considers the environmental conditions of the vehicle (e.g. other vehicles, infrastructure, weather, legal restrictions) to adjust driving behavior to the current driving situation. Based on all this information it supports the driver in using the vehicle in the most fuel efficient way.				
Originator	P.Themann				
Fit Criterion					
Implementation	1		**Conflicts**	none	

Priority Notes			
Status:	New	**Target:**	TBD
History	**Who**	**When**	**What**
	Philipp Themann	10/8/2010	new

Requirement No:	SP4-4-0009	**Requirement Type**	F	**Usecase No:**	UC_SP4_0006
Description	System does not recommend something which is against any legal restriction (such as maximum speed)				
Rationale	The driving strategy must come up with optimization results that do not exceed the legal maximum speed.				
Originator	P.Themann				
Fit Criterion					
Implementation Priority	1		**Conflicts**	none	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	Philipp Themann	10/8/2010		new	

Requirement No:	SP4-4-0010	**Requirement Type**	F	**Usecase No:**	UC_SP4_0008
Description	The performance of the chosen driving strategy is analyzed and stored for further evaluation.				
Rationale	To educate the driver to a more eco friendly driving style feedback of how he performed on the trip has to be provided.				
Originator	P.Themann				
Fit Criterion					
Implementation Priority	1		**Conflicts**	none	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	Philipp Themann	10/8/2010		new	

Requirement No:	SP3-4-0011	**Requirement Type**	OE	**Usecase No:**	UC_SP3_0002
Description	The system estimates the travel time for the journey based on calculations considering different driving strategies. The driving				

	strategies system thus should be equipped with an interface to support this.				
Rationale	To inform the driver about the estimated travel time this value has to be calculated dynamically. The estimated travel time of the journey also affects the behavior of the driver. For example he is willed to drive more eco friendly if he knows that he will arrive in time.				
Originator	P.Themann				
Fit Criterion	accuracy of estimation				
Implementation Priority	2		**Conflicts**	none	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	Philipp Themann	10/8/2010		new	

Requirement No:	SP3-4-0012	**Requirement Type**	OE	**Usecase No:**	UC_SP3_0007; UC_SP3_0008
Description	The system stores relevant data during the trip and analyses the driving behavior/ the driving strategy of the driver to allow a post trip feedback to the driver. Therefore an interface of the driving strategies should be implemented if necessary.				
Rationale	The post trip analysis and feedback to the driver requires stored data derived from the evaluation of driving strategies. Therefore relevant data has to be stored depending on the specific hardware specificaions. For example the total amount of fuel that could have been saved driving optimally can be derived and stored.				
Originator	P.Themann				
Fit Criterion					
Implementation Priority	2		**Conflicts**	none	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	Philipp Themann	10/8/2010		new	

Requirement No:	SP4-4-0013	**Requirement Type**	OE	**Usecase No:**	UC_SP4_0005
Description	The on-board navigation guides the driver along the planned ecoTrip containing the application of green driving strategies.				
Rationale	The system is guiding the driver how to drive energy efficiently following the planned ecoTrip.				

Originator	P.Themann				
Fit Criterion					
Implementation Priority	2		**Conflicts**	none	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	Philipp Themann	10/8/2010		new	

ecoPostTrip application

Requirement No:	SP3-5-0001	**Requirement Type**	F	**Usecase No:**	UC_SP3_0007
Description	At the end of the trip - the application must be able to store the trip details based on the defined parameters (TBD) for a defined period of time(TBD)				
Rationale	The trip data should be stored for future analysis and reporting				
Originator	N.E				
Fit Criterion	The data should be retrievable for a defined period of time(TBD)				
Implementation Priority	1		**Conflicts**	None	
Notes	The prerequisites to reach the end of trip state have to be defined clearly.				
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	J.Subbian	9/20/2010		Initial creation	

Requirement No:	SP3-5-0002	**Requirement Type**	F	**Usecase No:**	UC_SP3_0008
Description	At the end of the trip - the application must be able to provide a detailed analysis report of the trip (onboard) with TBD parameters such as a. Gear change behaviour b. Acceleration behaviour c. Deceleration behaviour d. Constant speed e. Anticipative driving f. Distance keeping (if possible based on vehicle sensors) g. Engine idling h. Drive style related to road geometry				

Rationale	Inform the driver how fuel efficient he / she has driven and which aspects of the drive contributed to this				
Originator	N.E				
Fit Criterion	The driver gets a detailed report on how fuel efficient the trip was				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	J.Subbian	9/20/2010		Initial creation	

Requirement No:	SP3-5-0003	**Requirement Type**	F	**Usecase No:**	UC_SP3_0008
Description	The application must be able to analyze certain parameters (TBD) of the trip details and provide an advice on improving the fuel efficiency				
Rationale	To make the driver aware of the ways to save fuel				
Originator	JS				
Fit Criterion	The driver gets a detailed report on how to improve the fuel efficiency				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	J.Subbian	9/20/2010		Initial creation	

Requirement No:	SP3-5-0004	**Requirement Type**	F	**Usecase No:**	UC_SP3_0008
Description	The stored trip data should be exportable to PDAs and PCs				
Rationale	For offline analysis of the data				
Originator	JS				
Fit Criterion	The exported data should be easily viewable in the imported PDA/PC				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	J.Subbian	9/20/2010		Initial creation	

Requirement No:	SP3-5-0005	**Requirement Type**	F	**Usecase No:**	UC_SP3_0008
Description	The application should be able to compare the current trip data with the previous trip data of the same driver and provide a comparison report				
Rationale	To motivate the driver to improve from his current best				
Originator	JS				
Fit Criterion					
Implementation Priority	1		**Conflicts**	None	
Notes	It has to be decided whether we compare the current data with only the previous best trip data or it should also be possible to compare the current data with any of the previously stored data				
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	J.Subbian	9/20/2010		Initial creation	

Requirement No:	SP3-5-0006	**Requirement Type**	F	**Usecase No:**	UC_SP3_0007 UC_SP3_0008
Description	The application should be able to share the specific parameters (TBD) of the trip data to TBD-application in order to improve the green routing				
Rationale	To improve the accuracy of the fuel consumption prediction on a particular route				
Originator	N.E				
Fit Criterion	Other TBD-application should be able to access these data's				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	J.Subbian	9/20/2010		Initial creation	

Requirement No:	SP3-5-0007	**Requirement Type**		**Usecase No:**	
Description	The application should enable identification of single trips				
Rationale	To compare each single trip with other trips made				
Originator	N.E				
Fit Criterion					
Implementation Priority	2		**Conflicts**	None	

Notes			
Status:	New	**Target:**	TBD
History	**Who**	**When**	**What**
	J.Subbian	10/14/2010	Initial creation

Requirement No:	SP3-5-0008	**Requirement Type**	**Usecase No:**
Description	The application should be able to identify the driver- when there is more than one driver using the same vehicle		
Rationale	to avoid ambiguities		
Originator	N.E		
Fit Criterion			
Implementation Priority	3	**Conflicts**	None
Notes			
Status:	New	**Target:**	TBD
History	**Who**	**When**	**What**
	J.Subbian	10/14/2010	Initial creation

Requirement No:	SP3-5-0009	**Requirement Type**	**Usecase No:**
Description	the application should be able to determine the remaining saving potential of trip		
Rationale	as an awareness for the user		
Originator	N.E		
Fit Criterion			
Implementation Priority	4	**Conflicts**	None
Notes			
Status:	New	**Target:**	TBD
History	**Who**	**When**	**What**
	J.Subbian	10/14/2010	Initial creation

Requirement No:	SP3-5-0010	**Requirement Type**	**Usecase No:**
Description	The ecoPostTrip application that is available off-board should enable a detailed analysis of a trip on fuel consumption related behaviour like for example: a. Gear change behaviour b. Acceleration behaviour		

	c. Deceleration behaviour d. Constant speed e. Anticipative driving f. Distance keeping (if possible based on vehicle sensors) g. Engine idling h. Drive style related to road geometry		
Rationale	For offline analysis of the data		
Originator	N.E		
Fit Criterion			
Implementation Priority	5	**Conflicts**	None
Notes			
Status:	New	**Target:**	TBD
History	**Who**	**When**	**What**
	J.Subbian	10/14/2010	Initial creation

Requirement No:	SP3-5-0011	**Requirement Type**	OE	**Usecase No:**	UC_SP3_0008
Description	The application should enable downlaod of trip data onto a USB-stick or other devices such as PDAs and PCs				
Rationale	For offline analysis of the data				
Originator	N.E				
Fit Criterion	The exported data should be easily viewable in the imported PDA/PC				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	J.Subbian	10/14/2010		Initial creation	

Requirement No:	SP3-5-0012	**Requirement Type**	OE	**Usecase No:**	
Description	The ecoPostTrip application should be able to provide input to the ecoHMI on the trip evaluation including a selection of the following parameters:				

	a. fuel saved by following system recommendations b. evaluation of selected drive style parameters (e.g. gear shift, anticipative driving or a driver preference) c. tips for better driving			
Rationale				
Originator	N.E			
Fit Criterion				
Implementation Priority	1		**Conflicts**	None
Notes				
Status:	New	**Target:**		TBD
History	**Who**	**When**		**What**
	J.Subbian	10/14/2010		Initial creation

Requirement No:	SP3-5-0013	**Requirement Type**	OE	**Usecase No:**
Description	The ecoPostTrip application should be able to store and retrieve trip data from the TripDataSet component			
Rationale	As a storage database			
Originator	N.E			
Fit Criterion	Able to access the database			
Implementation Priority	1		**Conflicts**	None
Notes				
Status:	New	**Target:**		TBD
History	**Who**	**When**		**What**
	J.Subbian	10/14/2010		Initial creation

Requirement No:	SP3-5-0014	**Requirement Type**	UH	**Usecase No:**
Description	the readability of the report should be more clear also when it is exported to an external devices			
Rationale	to be able to analyze offboard			
Originator	JS			
Fit Criterion				
Implementation Priority	3		**Conflicts**	None

Notes	This is more of the format of the content should remain in a proper form		
Status:	New	**Target:**	TBD
History	**Who**	**When**	**What**
	J.Subbian	10/14/2010	Initial creation

Requirement No:	SP3-5-0015	**Requirement Type**	S	**Usecase No:**	
Description	the report should be secure enough and should not be editable by unauthorized persons				
Rationale	to maintain privacy and secure the data				
Originator	JS				
Fit Criterion					
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	J.Subbian	10/14/2010		Initial creation	

Requirement No:	SP3-5-0016	**Requirement Type**	L	**Usecase No:**	
Description	Sharing of the report to others should be authorized by the user				
Rationale	to identify the willingness of the user to share his data				
Originator	JS				
Fit Criterion					
Implementation Priority	2		**Conflicts**	None	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	J.Subbian	10/14/2010		Initial creation	

ecoMonitoring

Requirement No:	SP3-6-0001	**Requirement Type**	F	**Usecase No:**	
Description	The ecoMonitoring system sends to the control centre (and to external vehicles if required from them to refine their pre – trip algorithms) some TBD parameters related to the last executed trip, after the post trip application.				

	[The parameters could be: - vehicle parameters: speed, rpm, brake pedal status, fuel level, cruise control if available, clutch status, stop&start if available, external temperature, fuel consumption, gas pedal, acceleration longitudinal/lateral. - trip parameters: starting and ending position, travelling time, travelling distance, roads slope.]			
Rationale	Send to other vehicles and to the control centre the data related to the last executed trip.			
Originator	Magneti Marelli			
Fit Criterion	The raw data should be available in the control centre.			
Implementation Priority	1	**Conflicts**	None	
Notes				
Status:	New	**Target:**	TBD	
	Who	**When**	**What**	
History	M. De Gennaro / F.Tosetto	20.09.2010	Initial content	

Requirement No:	SP3-6-0002	**Requirement Type**	F	**Usecase No:**
Description	The ecoMonitoring system sends to the control centre (and to external vehicles if required from their pre-trip applications) the results of the post trip application.			
Rationale	Inform the control centre and the other cars of eventual results of the post trip application.			
Originator	Magneti Marelli			
Fit Criterion	The results of the post trip application should be available in the control centre.			
Implementation Priority	1	**Conflicts**	None	
Notes				
Status:	New	**Target:**	TBD	
	Who	**When**	**What**	
History	M. De Gennaro / F.Tosetto	20.09.2010	Initial content	

Requirement No:	SP3-6-0003	**Requirement Type**	F	**Usecase No:**
Description	The data sent from the ecoMonitoring to the control centre must be			

	standardized. All OEM must make available to the ecoMonitoring the same data with the same TBD format. The ecoMonitoring can work on all the OEM vehicles in the same way.			
Rationale	The control centre must receive the data required from all the vehicles with the same standard format, independently of the OEM.			
Originator	Magneti Marelli			
Fit Criterion	The data received from the control centre have all the same TBD format independently of the sending vehicle.			
Implementation Priority	1	**Conflicts**	None	
Notes				
Status:	New	**Target:**	TBD	
	Who	**When**	**What**	
History	M. De Gennaro / F.Tosetto	20.09.2010	Initial content	

Requirement No:	SP3-6-0004	**Requirement Type**	F	**Usecase No:**
Description	The ecoMonitoring system sends to the control centre and to external vehicles as floating car data, some TBD parameters related to the vehicle itself and to the current trip: [The parameters could be: vehicle parameters: GPS position, speed, rpm, brake pedal status, cruise control if available, clutch status, stop&start if available, gas pedal, acceleration longitudinal/lateral. - trip parameters: destination of the trip, road slope.]			
Rationale	Send to other vehicles and to the control centre the real time data related to the current trip of the vehicle.			
Originator	Magneti Marelli			
Fit Criterion	The raw data should be available in the control centre and for all close vehicles.			
Implementation Priority	1	**Conflicts**	None	
Notes				
Status:	New	**Target:**	TBD	
	Who	**When**	**What**	
History	M. De Gennaro / F.Tosetto	12.10.2010	Initial content	

Requirement No:	SP3-6-0005	**Requirement Type**	F	**Usecase No:**

Description	The ecoMonitoring system sends to the insurance company the raw paratemers related to the vehicle and to the trip. [The parameters could be: vehicle parameters: GPS position, speed, rpm, brake pedal status, fuel level, fuel consumption - trip parameters: initial position and destination of the trip.]			
Rationale	Send to insurance company data related to the trip in order to receive benefits for ecoDriving			
Originator	Magneti Marelli			
Fit Criterion	The raw data should be available to the insurance company to make their own evaluation of the driving style about the vehicle considered.			
Implementation Priority	3	**Conflicts**	None	
Notes				
Status:	New	**Target:**	TBD	
	Who	**When**	**What**	
History	M. De Gennaro / F.Tosetto	12/10/10	Initial content	

Requirement No:	SP3-6-0006	**Requirement Type**	OE	**Usecase No:**
Description	The ecoMonitoring application should be able to retrieve trip data from the TripDataSet.			
Rationale	Retreive the information about the vehicle (also the trip?) from the TripDataSet.			
Originator	Magneti Marelli			
Fit Criterion	The TripDataSet should be accessible to the ecoMonitoring application			
Implementation Priority	1	**Conflicts**	None	
Notes				
Status:	New	**Target:**	TBD	
	Who	**When**	**What**	
History	M. De Gennaro / F.Tosetto	14/10/10	Initial content	

Requirement No:	SP3-6-0007	**Requirement Type**	OE	**Usecase No:**

Description	The ecoMonitoring application should be able to provide the ecoFVD message (incl. destination information) to the communication platform		
Rationale	The ecoMonitoring should send to the communication platform the set of data to be sent out to vehicles and traffic management centre.		
Originator	Magneti Marelli		
Fit Criterion	The communication platform receives from the ecoMonitoring the FVD to be sent out to vehicles and traffic management centre.		
Implementation Priority	1	**Conflicts**	None
Notes			
Status:	New	**Target:**	TBD
	Who	**When**	**What**
History	M. De Gennaro / F.Tosetto	14/10/10	Initial content

Requirement No:	SP3-6-0008	**Requirement Type**	OE	**Usecase No:**	
Description	The control centre defines some specific TBD parameters to be received by the ecoMonitoring system for any trip of the vehicle. [The parameters could be: vehicle parameters: speed, rpm, brake pedal status, fuel level, cruise control if available, clutch status, stop&start if available, external temperature, fuel consumption, gas pedal, acceleration longitudinal/lateral. trip parameters: starting and ending position, travelling time, travelling distance, roads slope.]				
Rationale	The control centre discriminates among all data related to a generic trip, and selects a limited set of parameters to be sent from the ecoMonitoring system.				
Originator	Magneti Marelli				
Fit Criterion	The control centre receives only the interesting parameters required.				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	New		**Target:**	TBD	
History	**Who**		**When**	**What**	
	M. De Gennaro /		20.09.2010	Initial content	

	F.Tosetto

Requirement No:	SP3-6-0009	**Requirement Type**	P	**Usecase No:**
Description	Define an update rate for each post trip parameter to be sent to the control centre.			
Rationale	The ecoMonitoring system has to send to the control centre some data related to the post trip, but any parameter has its own update rate (ex. speed, acceleration, fuel consumption), and not all updates can be sent to the control centre, otherwise there is			
Originator	Magneti Marelli			
Fit Criterion	The control centre receives the post trip parameters with a TBD update rate.			
Implementation Priority	1	**Conflicts**	None	
Notes				
Status:	New	**Target:**	TBD	
	Who	**When**	**What**	
History	M. De Gennaro / F.Tosetto	20.09.2010	Initial content	

Requirement No:	SP3-6-0010	**Requirement Type**	P	**Usecase No:**
Description	The ecoMonitoring system has to collect data with a TBD precision, which is dependent from the particular parameter to be collected (as an example, the precision on speed could be at level of 0.01 m/sec, while for acceleration it could be at level of 0.01 m/sec2).			
Rationale	Set the precision of each parameter to be monitored.			
Originator	Magneti Marelli			
Fit Criterion	The control centre receives the parameters with a TBD precision.			
Implementation Priority	1	**Conflicts**	None	
Notes				
Status:	New	**Target:**	TBD	
	Who	**When**	**What**	
History	M. De Gennaro / F.Tosetto	20.09.2010	Initial content	

Requirement	SP3-6-0011	**Requirement**	S	**Usecase**

No:		**Type**	**No:**
Description	Privacy requirement. The data saved by the ecoMonitoring system should contain information about the last trip performed, without any information about the car and the driver sending the data. Transmit data without information about the source vehicle.		
Rationale	Yes: speed, acceleration lateral/longitudinal, fuel type, displacement, type of vehicle (hybrid/not), windows open/closed, driving style, and similar data. No: numberplate, chassis, brand, vehi		
Originator	Magneti Marelli		
Fit Criterion	The control centre must receive data without being able to recognize the source vehicle.		
Implementation Priority	1	**Conflicts**	None
Notes			
Status:	New	**Target:**	TBD
	Who	**When**	**What**
History	M. De Gennaro / F.Tosetto	20.09.2010	Initial content

Requirement No:	SP3-6-0012	**Requirement Type**	S	**Usecase No:**	
Description	Immunity requirement: the data sent from the ecoMonitoring should be not accessible from external programs that could modify the contents. The data format should be encrypted to be read only from an eCoMove system.				
Rationale	Immunity requirement from external illegal access.				
Originator	Magneti Marelli				
Fit Criterion	Data sent from an ecoMonitoring system should be not accessible from a no- eCoMove system.				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	New	**Target:**		TBD	
	Who	**When**		**What**	
History	M. De Gennaro / F.Tosetto	20.09.2010		Initial content	

ecoHMI

Requirement No:	SP3-7-0001	**Requirement Type**	F	**Usecase No:**	

Description	The ecoSmartDriving HMI should provide on-board training sessions. These should be complimentary to post-trip information.		
Rationale	To ensure that the driver will use the system in the intended way, the system HMI should support the driver by offering introduction and learning sessions inside the car in standstill (e.g. "How to use“, "Learn more about your system“).		
Originator	MB		
Fit Criterion	expert judgement		
Implementation Priority	3	**Conflicts**	None
Notes			
Status:	Open	**Target:**	TBD
History	**Who**	**When**	**What**
	M.Brockmann	10/6/2010	Initial creation

Requirement No:	SP3-7-0002	**Requirement Type**	F	**Usecase No:**	
Description	ecoSmartDriving HMI should provide a help function				
Rationale	A context specific help function will give the driver the opportunity to get more information about the indicated elements of the current ecoSmartDriving HMI view and driver’s options to operate the system, e.g. how to navigate in the menu or to change modes.				
Originator	MB				
Fit Criterion	expert judgement				
Implementation Priority	3		**Conflicts**	None	
Notes					
Status:	Open	**Target:**		TBD	
History	**Who**	**When**		**What**	
	M.Brockmann	10/6/2010		Initial creation	

Requirement No:	SP3-7-0003	**Requirement Type**	F	**Usecase No:**	
Description	The ecoSmartDriving HMI should indicate a possible Availability or non-availability of the system. Also the indication should be given if the system is switched to on or off.				
Rationale	If the system function is not available for a certain reason, it should be indicated to the driver. In case of a system failure the driver should be informed by issuing an appropriate message.				
Originator	MB				

Fit Criterion	expert judgement				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	Open	**Target:**		TBD	
History	**Who**	**When**		**What**	
	M.Brockmann	10/6/2010		Initial creation	

Requirement No:	SP3-7-0004	**Requirement Type**	F	**Usecase No:**	
Description	System switches silent if there are no driver reactions				
Rationale	If the driver does not want to use the system or is in a specific situation (e.g. emergency) the system should not produce too many warnings and recommendations. This would just distract the driver.				
Originator					
Fit Criterion	Driver acceptance => how to be measured?				
Implementation Priority	1		**Conflicts**		
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	Philipp Themann	9/20/2010		Created	

Requirement No:	SP3-7-0005	**Requirement Type**	F	**Usecase No:**	
Description	It should be possible to configure or even to shut down the ecoHMI by the user				
Rationale	It must be taken into account, that every user has his personal preferences and wants to decide whether he wants to use a system or in which cases he wants to use it.				
Originator					
Fit Criterion	expert judgement				
Implementation Priority	3		**Conflicts**		
Notes					
Status:	New	**Target:**		TBD	
	Who	**When**		**What**	
History	Christoph Rommerskirchen	10/6/2010		new	

Requirement	SP3-7-0006	**Requirement**	F	**Usecase**

No:		**Type**		**No:**	
Description	The ecoHMI should motivate the user to change the behaviour to a more efficient driving				
Rationale	guiding the driver how to drive energy efficiently				
Originator					
Fit Criterion	change to a more efficient driving which can be examined in the post trip analysis				
Implementation Priority	2		**Conflicts**		
Notes					
Status:	New	**Target:**		TBD	
	Who	**When**		**What**	
History	Christoph Rommerskirchen	10/6/2010		new	

Requirement No:	SP3-7-0007	**Requirement Type**	F	**Usecase No:**	UC_SP3_0006
Description	The ecoHMI should assist at obstacles by recommending an energy efficient driving.				
Rationale	The HMI has to inform the driver about obstacles (e.g. road works, congestion, speed limits, roundabouts etc.) and how fast he should drive and when he should start to coast.				
Originator					
Fit Criterion	Fuel saving, minimize brake usage, early anticipation of the situation				
Implementation Priority	2		**Conflicts**	With all other ecoHMI applications	
Notes					
Status:	New	**Target:**		TBD	
	Who	**When**		**What**	
History	Christoph Rommerskirchen	10/5/2010		new	

Requirement No:	SP3-7-0008	**Requirement Type**	F	**Usecase No:**	UC_SP3_0006
Description	The ecoHMI should help the driver to approach a slower vehicle in an energy efficient way				
Rationale	The driver is approaching a slower vehicle. He has to adopt the speed of the slower front vehicle				
Originator					
Fit Criterion	Fuel saving, distance to the front vehicle not too low				

Implementation Priority	2		**Conflicts**	With all other ecoHMI applications	
Notes					
Status:	New	**Target:**		TBD	
	Who	**When**		**What**	
History	Christoph Rommerskirchen	10/5/2010		new	

Requirement No:	SP3-7-0009	**Requirement Type**	F	**Usecase No:**	UC_SP3_0006
Description	The ecoHMI should tell the driver to turn off the car if it is stopped for traffic reasons				
Rationale	The vehicle is stopped for traffic reasons. If the motor is running then it consumes fuel				
Originator	MM, CTAG				
Fit Criterion	Turn off the motor				
Implementation Priority	2		**Conflicts**	With all other ecoHMI applications	
Notes					
Status:	New	**Target:**		TBD	
	Who	**When**		**What**	
History	Christoph Rommerskirchen	10/5/2010		new	

Requirement No:	SP3-7-0010	**Requirement Type**	OE	**Usecase No:**	
Description	The ecoHMI should provide an interface to the information identified in the ecoDrivingSupport that has to be indicated to the driver				
Rationale	the interface is required				
Originator					
Fit Criterion	Inputs from application should be indicated to the driver				
Implementation Priority	1		**Conflicts**	none	
Notes					
Status:	New	**Target:**		TBD	
	Who	**When**		**What**	
History	Christoph Rommerskirchen	10/5/2010		new	

Requirement No:	SP3-7-0011	**Requirement Type**	OE	**Usecase No:**	
Description	The ecoHMI should provide an interface to the information identified in the ecoInformation application that has to be indicated to the driver				
Rationale	the interface is required				
Originator					
Fit Criterion	Inputs from application should be indicated to the driver				
Implementation Priority	1		**Conflicts**	none	
Notes					
Status:	New	**Target:**		TBD	
	Who	**When**		**What**	
History	Christoph Rommerskirchen	10/5/2010		new	

Requirement No:	SP3-7-0012	**Requirement Type**	OE	**Usecase No:**	
Description	The ecoHMI should provide an interface to the information identified in the Dynamic ecoNavigation application that has to be indicated to the driver				
Rationale	the interface is required				
Originator					
Fit Criterion	Inputs from application should be indicated to the driver				
Implementation Priority	1		**Conflicts**	none	
Notes					
Status:	New	**Target:**		TBD	
	Who	**When**		**What**	
History	Christoph Rommerskirchen	10/5/2010		new	

Requirement No:	SP3-7-0013	**Requirement Type**	OE	**Usecase No:**	
Description	The ecoHMI should provide an interface to the ecoPostTrip application. To indicate the analysis report				
Rationale	the interface is required				
Originator					
Fit Criterion	Inputs from application should be indicated to the driver				

Implementation Priority	1	**Conflicts**	none
Notes			
Status:	New	**Target:**	TBD
	Who	**When**	**What**
History	Christoph Rommerskirchen	10/5/2010	new

Requirement No:	SP3-7-0014	**Requirement Type**	UH	**Usecase No:**	
Description	The ecoSmartDriving HMI should indicate the driver with feedback about short term and long term efficiency performance (e.g. the indication of fuel consumption rate etc)				
Rationale	The driver's motivation and excitement to use the system regularly will work on the basis of comparing efficiency performance values. Long term efficiency performance should also be the basis for rewarding the driver, e.g. with incentives.				
Originator	MB				
Fit Criterion	Comprehensibility & acceptance - Empirical user study				
Implementation Priority		**Conflicts**	None		
Notes					
Status:	Open	**Target:**		TBD	
History	**Who**	**When**		**What**	
	M.Brockmann	10/6/2010		Initial creation	

Requirement No:	SP3-7-0015	**Requirement Type**	UH	**Usecase No:**	
Description	The ecoSmartDriving HMI should provide consistent system reactions				
Rationale	As a basis for intuitiveness and comprehensibility of the ecoSmartDriving system the HMI should provide consistent system reactions to driver inputs, road conditions, traffic conditions and environmental conditions.				
Originator	MB				
Fit Criterion	Comprehensibility & acceptance - Empirical user study				
Implementation Priority		**Conflicts**	None		
Notes					

Status:	Open	**Target:**	TBD
History	**Who**	**When**	**What**
	M.Brockmann	10/6/2010	Initial creation

Requirement No:	SP3-7-0016	**Requirement Type**	UH	**Usecase No:**	
Description	The ecoSmartDriving HMI should provide information and warnings which are easy to understand by the user				
Rationale	Beside an easy-to-use menu navigation it is important to provide all information and warnings in the way that they are easy to recognize, to differentiate and easy to remember				
Originator	MB				
Fit Criterion	Comprehensibility - Empirical user study				
Implementation					
Priority		**Conflicts**	None		
Notes					
Status:	Open	**Target:**		TBD	
History	**Who**	**When**		**What**	
	M.Brockmann	10/6/2010		Initial creation	

Requirement No:	SP3-7-0017	**Requirement Type**	UH	**Usecase No:**	
Description	To support efficient deceleration the ecoSmartDriving HMI should communicate to the driver HOW to decelerate (Applying the brake pedal, Engine in trailing throttle mode or Coasting) and also WHEN to start decelerating. If applicable, the reason for decele				
Rationale					
Originator	MB				
Fit Criterion	Usability & comprehensibility - Empirical user study				
Implementation					
Priority		**Conflicts**	None		
Notes					
Status:	Open	**Target:**		TBD	
	Who	**When**		**What**	
History	M.Brockmann, P.Themann	10/6/2010		Initial creation	

Requirement No:	SP3-7-0018	**Requirement Type**	UH	**Usecase No:**	
Description	To support efficient acceleration the ecoSmartDriving HMI should communicate to the driver how to accelerate more energy efficient.				

	If applicable, the reason for acceleration (e.g. to cross the traffic light, change in speed limit) should be provided		
Rationale			
Originator	MB		
Fit Criterion	Usability & comprehensibility - Empirical user study		
Implementation Priority		**Conflicts**	None
Notes			
Status:	Open	**Target:**	TBD
	Who	**When**	**What**
History	M.Brockmann, P.Themann	10/6/2010	Initial creation

Requirement No:	SP3-7-0019	**Requirement Type**	UH	**Usecase No:**	
Description	To avoid unnecessary stops at traffic lights the ecoSmartDriving HMI should communicate to the driver the currently appropriate target speed for passing the traffic light at green and /or the timeframe until the lights will change.				
Rationale					
Originator	MB				
Fit Criterion	Usability & comprehensibility - Empirical user study				
Implementation Priority			**Conflicts**	None	
Notes					
Status:	Open	**Target:**		TBD	
History	**Who**	**When**		**What**	
	M.Brockmann	10/6/2010		Initial creation	

Requirement No:	SP3-7-0020	**Requirement Type**	UH	**Usecase No:**	
Description	To support efficient driving in dense traffic the ecoSmartDriving HMI should communicate to the driver the currently appropriate target speed.				
Rationale					
Originator	MB				
Fit Criterion	Usability & comprehensibility - Empirical user study				
Implementation Priority			**Conflicts**	None	
Notes					

Status:	Open	**Target:**	TBD
History	**Who**	**When**	**What**
	M.Brockmann	10/6/2010	Initial creation

Requirement No:	SP3-7-0021	**Requirement Type**	UH	**Usecase No:**	
Description	The ecoSmartDriving HMI should be providing visual, auditive and/or tactile information as system feedback based on the settings				
Rationale	Mapping appropriate feedback to driver input enhances the transparency and comprehensibility of the system. The frequency of erroneous driver inputs decreases.				
Originator	MB				
Fit Criterion	Usability & comprehensibility - Empirical user study				
Implementation Priority		**Conflicts**	None		
Notes	This is very much related to the overall HMI information architecture and the control strategies and can vary between OEMs				
Status:	Open	**Target:**		TBD	
History	**Who**	**When**		**What**	
	M.Brockmann	10/6/2010		Initial creation	

Requirement No:	SP3-7-0022	**Requirement Type**	UH	**Usecase No:**	
Description	While navigating in the system menu the ecoSmartDriving HMI should always be showing where the user currently is.				
Rationale	Enhances the transparency and comprehensibility of the system. The frequency of erroneous driver inputs decreases.				
Originator	MB				
Fit Criterion	Usability & comprehensibility - Empirical user study				
Implementation Priority		**Conflicts**	None		
Notes	This is very much related to the overall HMI information architecture and the control strategies and can vary between OEMs				
Status:	Open	**Target:**		TBD	
History	**Who**	**When**		**What**	
	M.Brockmann	10/6/2010		Initial creation	

Requirement No:	SP3-7-0023	**Requirement Type**	UH	**Usecase No:**	
Description	The ecoSmartDriving HMI should prevent the user from selecting incorrect options, avoiding unintended activation possibilities.				

Rationale	Enhances the transparency and comprehensibility of the system. The frequency of erroneous driver inputs decreases.		
Originator	MB		
Fit Criterion	Usability & comprehensibility - Empirical user study		
Implementation Priority		**Conflicts**	None
Notes	This is very much related to the overall HMI information architecture and the control strategies and can vary between OEMs		
Status:	Open	**Target:**	TBD
History	**Who**	**When**	**What**
	M.Brockmann	10/6/2010	Initial creation

Requirement No:	SP3-7-0024	**Requirement Type**	UH	**Usecase No:**	
Description	The ecoSmartDriving HMI should make the possible choices menu (settings) visible for the user				
Rationale	Enhances the transparency and comprehensibility of the system. The frequency of erroneous driver inputs decreases.				
Originator	MB				
Fit Criterion	Usability & comprehensibility - Empirical user study				
Implementation Priority			**Conflicts**	None	
Notes	This is very much related to the overall HMI information architecture and the control strategies and can vary between OEMs				
Status:	Open		**Target:**	TBD	
History	**Who**		**When**	**What**	
	M.Brockmann		10/6/2010	Initial creation	

Requirement No:	SP3-7-0025	**Requirement Type**	UH	**Usecase No:**	
Description	The ecoSmartDriving HMI should permit easy reversal of actions				
Rationale	Enhances the transparency and comprehensibility of the system. The frequency of erroneous driver inputs decreases.				
Originator	MB				
Fit Criterion	Usability & comprehensibility - Empirical user study				
Implementation Priority			**Conflicts**	None	
Notes	This is very much related to the overall HMI information architecture and the control strategies and can vary between OEMs				
Status:	Open		**Target:**	TBD	
History	**Who**		**When**	**What**	

	M.Brockmann	10/6/2010	Initial creation

Requirement No:	SP3-7-0026	**Requirement Type**	L	**Usecase No:**	
Description	The ecoSmartDriving HMI should be in compliance to the following standards & regulations - Commission Recommendation of 26/V/2008 on safe and efficient in-vehicle information and communication systems: Update of the European Statement of Principles on Hum				
Rationale					
Originator	MB				
Fit Criterion	expert judgement				
Implementation Priority	3		**Conflicts**	None	
Notes	List is incomplete				
Status:	Open	**Target:**		TBD	
History	**Who**	**When**		**What**	
	M.Brockmann	10/6/2010		Initial creation	

Requirement No:	SP3-7-0027	**Requirement Type**	UH	**Usecase No:**	UC_SP3_0006
Description	The ecoSmartDriving HMI should minimize distraction from the primary driving task. Thus the system should fulfill the following needs: - Visual feedback should be in the primary field of view - Visual / cognitive demand should be minimized - Visual inform				
Rationale	Enhances the transparency and comprehensibility of the system. The frequency and duration of glances to the driver display should be minimised.				
Originator	MB				
Fit Criterion	Usability & comprehensibility - Empirical user study				
Implementation Priority			**Conflicts**	None	
Notes					
Status:	Open	**Target:**		TBD	
	Who	**When**		**What**	
History	M.Brockmann, C.Rommerskirchen, P.Themann	10/6/2010		Initial creation	

Requirement No:	SP3-7-0028	**Requirement Type**	UH	**Usecase No:**	UC_SP3_0006
Description	The ecoHMI should encourage the user to use the system				
Rationale	An ecoHMI must be accepted by the driver. If not the driver will not use (shut off) the system				
Originator					
Fit Criterion	Must be tested with a questionnaire/interview				
Implementation Priority	0		**Conflicts**	With all other ecoHMI requirements	
Notes					
Status:	New	**Target:**		TBD	
	Who	**When**		**What**	
History	Christoph Rommerskirchen	10/5/2010		new	

Requirement No:	SP3-7-0029	**Requirement Type**	UH	**Usecase No:**	UC_SP3_0006
Description	The ecoHMI should show only the most important information in the specific situation, respectively not too much information				
Rationale	The driver will possibly get much information. There has to be a solution that the driver will not get too much information.				
Originator					
Fit Criterion	expert judgement				
Implementation Priority	2		**Conflicts**	With all other ecoHMI requirements and navigation (green routing)	
Notes					
Status:	New	**Target:**		TBD	
	Who	**When**		**What**	
History	Christoph Rommerskirchen	10/5/2010		new	

Requirement No:	SP3-7-0030	**Requirement Type**	UH	**Usecase No:**	
Description	Easy to understand green driving strategy in energy relevant situations				
Rationale	The driver should be able to directly understand the messages of the system aiminig to realize green driving. All parts of the strategy such as coasting while approaching a STOP sign should be communicated clearly.				

Originator					
Fit Criterion	Driver acceptance => how to be measured?				
Implementation Priority	1		**Conflicts**		
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	Philipp Themann	9/20/2010		Created	

ecoCooperativeHorizon

Requirement No:	SP3-8-0001	**Requirement Type**	F	**Usecase No:**	SP3_0004 SP3_0005 SP3_0006
Description	Information about the vehicle's own • location incl. lane information • speed • heading in the road network is available.				
Rationale	Building block for detailed information on vehicle environment				
Originator	Bosch				
Fit Criterion	Actual info about position coordinates, speed, and heading on road network are available at accuracy tbd, lane information renders at least "unknown"				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	NEW	**Target:**		TBD	
History	**Who**	**When**		**What**	
	L. Bersiner	9/14/2010		first input	

Requirement No:	SP3-8-0002	**Requirement Type**	F	**Usecase No:**	SP3_0004 SP3_0005 SP3_0006
Description	Vehicle's most probable path ahead in the road network is available. content of MPP for further description				

Rationale	Building block for detailed information on vehicle environment				
Originator	Bosch				
Fit Criterion	Most probable path ahead on road network is given out at accuracy, actuality, and reliability tbd				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	NEW	**Target:**		TBD	
History	**Who**	**When**		**What**	
	L. Bersiner	9/14/2010		first input	

Requirement No:	SP3-8-0003	**Requirement Type**	F	**Usecase No:**	SP3_0004 SP3_0005 SP3_0006
Description	The vehicle system has information about • number and usage of lanes (is it a bus lane, turning lane etc.) • overtake prohibits • speed limits • geometrical properties • eco properties • traffic state of the most probable path MPP in the road network				
Rationale	Building block for detailed information on vehicle environment				
Originator	Bosch				
Fit Criterion	Info addressed above is available, at least value “unknown” is rendered				
Implementation Priority	1		**Conflicts**	None	
Notes	“eco properties” tbd. Derived from vehicle specs?				
Status:	NEW	**Target:**		TBD	
History	**Who**	**When**		**What**	
	L. Bersiner	9/27/2010		first input	

Requirement No:	SP3-8-0004	**Requirement Type**	F	**Usecase No:**	SP3_0004 SP3_0005 SP3_0006

Description	The system has information about vehicle specific data such as fuel consumption depending on slopes, speed, gear, and load condition. Other information may be necessary and will be defined during the project.				
Rationale	Building block for detailed information on vehicle environment				
Originator	Bosch				
Fit Criterion	The information described above is available in the system.				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	NEW	**Target:**		TBD	
History	**Who**	**When**		**What**	
	M. Selem	9/22/2010		first input	

Requirement No:	SP3-8-0005	**Requirement Type**	F	**Usecase No:**	SP3_0004 SP3_0005 SP3_0006
Description	Vehicle system has information about calculated route				
Rationale	Building block for cooperative routing				
Originator	Bosch				
Fit Criterion	calculated route is given out				
Implementation Priority	1		**Conflicts**	None	
Notes	This addresses not only ecoCoopHorizon, but also ecoRouting In case of no given route MPP is to be employed				
Status:	NEW	**Target:**		TBD	
History	**Who**	**When**		**What**	
	L. Bersiner	9/14/2010		first input	

Requirement No:	SP3-8-0006	**Requirement Type**	F	**Usecase No:**	SP3_0006
Description	The ecoMap available in the system contains precise (accuracy tbd.) information about the slopes of the streets including altitudes, curves as well as driving attributes such as speed limits, number of lanes etc. (the precise list of needed attributes is tbd).				
Rationale	Building block for ecoDriving and ecoRouting.				

Originator	Bosch				
Fit Criterion	Slope information + attributes above is available in the system				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	NEW	**Target:**		TBD	
History	**Who**	**When**		**What**	
	M. Selem	9/22/2010		first input	

Requirement No:	SP3-8-0007	**Requirement Type**	F	**Usecase No:**	SP3_0006
Description	The system is able to calculate a slope going out of a path (MPP) and precise geometry information				
Rationale	Building block for ecoDriving and ecoRouting. In Case slope is not available from ecoMap				
Originator	Bosch				
Fit Criterion	The algorithms implemented in the system can calculate the slopes from 3D shape points.				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	NEW	**Target:**		TBD	
History	**Who**	**When**		**What**	
	M. Selem	9/22/2010		first input	

Requirement No:	SP3-8-0008	**Requirement Type**	F	**Usecase No:**	SP3_0006
Description	The ecoMap available in the system contains precise (accuracy tbd.) information about the curvatures of the streets including altitude, slopes, as well as driving attributes such as speed limits, number of lanes etc. (the precise list of needed attributes is tbd).				
Rationale	Building block for ecoDriving and ecoRouting.				
Originator	Bosch				
Fit Criterion	Curve radius information is available in the system				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	NEW	**Target:**		TBD	
History	**Who**	**When**		**What**	
	M. Selem	9/22/2010		first input	

Requirement No:	SP3-8-0009	**Requirement Type**	F	**Usecase No:**	SP3_0006
Description	The system is able to calculate a curve radius going out of a path (MPP) and precise geometry information				
Rationale	Building block for ecoDriving and ecoRouting. In case curves not available from ecoMap				
Originator	Bosch				
Fit Criterion	The algorithms implemented in the system can calculate the radius of the curve ahead.				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	NEW	**Target:**		TBD	
History	**Who**	**When**		**What**	
	M. Selem	9/22/2010		first input	

Requirement No:	SP3-8-0010	**Requirement Type**	F	**Usecase No:**	SP3_0006
Description	The ecoMap available in the system contains precise (accuracy tbd.) information about the geometry of the streets including altitude slopes, curves as well as driving attributes such as speed limits, number of lanes etc. (the precise list of needed attributes is tbd).				
Rationale	Building block for ecoDriving and ecoRouting.				
Originator	Bosch				
Fit Criterion	The attributes that are required (tbd!) are available in the system				
Implementation Priority	1		**Conflicts**	None	
Notes	created for special req. for maneuver communication				
Status:	NEW	**Target:**		TBD	
History	**Who**	**When**		**What**	
	M. Selem	9/22/2010		first input	

Requirement No:	SP3-8-0011	**Requirement Type**	F	**Usecase No:**	SP3_0006
Description	The system is able to receive and process information via the V2V communication unit. This information include: - MPP of the sending vehicle - Next maneuver attempted by the sending vehicle - Distance to the next maneuver				

	- Current speed and position of the sending vehicle				
Rationale	Building block for ecoDriving.				
Originator	Bosch				
Fit Criterion	The system has implemented the processing routine for the information above.				
Implementation Priority	1		**Conflicts**	None	
Notes	The system has implemented the processing routine for the information above.				
Status:	NEW	**Target:**		TBD	
History	**Who**	**When**		**What**	
	M. Selem	9/22/2010		first input	

Requirement No:	SP3-8-0012	**Requirement Type**	OE	**Usecase No:**	
Description	The ecoCooperativeHorizon should provide the Most Probable Path to the: a. ecoDrivingSupport application; b. dynamic ecoNavigation application;				
Rationale	This information is required by other application				
Originator	FFA				
Fit Criterion	The eternal application could properly receive and work on the Most probably path information provided				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	New	**Target:**			
History	**Who**	**When**		**What**	
	J.Subbian	12:00:00 AM		first input	

Requirement No:	SP3-8-0013	**Requirement Type**	OE	**Usecase No:**	SP3_0004 SP3_0005 SP3_0006
Description	The system is able to communicate with other vehicles				
Rationale	Building block for detailed information on vehicle environment				

Originator	Bosch		
Fit Criterion	Communication with other vehicles within a range of TBD meters established		
Implementation Priority	1	**Conflicts**	None
Notes	Refers to any eCoMove Vehicle. Requirements for single UCs (e.g. for locations of other vehicles) specified below		
Status:	NEW	**Target:**	TBD
History	**Who**	**When**	**What**
	L. Bersiner	9/14/2010	first input

Requirement No:	SP3-8-0014	**Requirement Type**	OE	**Usecase No:**	SP3_0006
Description	The system is able to communicate with oncoming vehicles				
Rationale	Building block for detailed information on vehicle environment				
Originator	Bosch				
Fit Criterion	Communication with oncoming vehicles within a range of TBD meters established				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	NEW	**Target:**		TBD	
History	**Who**	**When**		**What**	
	L. Bersiner	9/14/2010		first input	

Requirement No:	SP3-8-0015	**Requirement Type**	OE	**Usecase No:**	SP3_0006
Description	V2V communication transmits and receives • Position (WGS84) incl. lane info • Speed (km/h) • Heading (degree against north) • MPP (e.g. location reference following AGORA-C) of each communication participant within reach.				
Rationale	Building block for detailed information on vehicle environment				
Originator	Bosch				
Fit Criterion	Positions…MPPs of oncoming vehicles are recognized by each vehicle system				
Implementation Priority	1		**Conflicts**	None	

Notes			
Status:	NEW	**Target:**	TBD
History	**Who**	**When**	**What**
	L. Bersiner	9/16/2010	first input

Requirement No:	SP3-8-0016	**Requirement Type**	OE	**Usecase No:**	SP3_0004 SP3_0005 SP3_0006
Description	The system is able to communicate with other vehicles on ist calculated route				
Rationale	Building block for detailed information on vehicle environment				
Originator	Bosch				
Fit Criterion	Communication with vehicles ahead on the calculated route or MPP within a range of TBD meters established				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	NEW	**Target:**		TBD	
History	**Who**	**When**		**What**	
	L. Bersiner	9/14/2010		first input	

Requirement No:	SP3-8-0017	**Requirement Type**	OE	**Usecase No:**	SP3_0004 SP3_0005 SP3_0006
Description	V2V communication transmits and receives • Position (WGS84) incl. lane info • Speed (km/h) • Heading (degree against north) • MPP (location reference following AGORA-C) of each communication participant on ist calculated route.				
Rationale	Building block for detailed information on vehicle environment				
Originator	Bosch				
Fit Criterion	Positions…MPPs of vehicles on the calculated route are recognized by vehicle system				
Implementation Priority	1		**Conflicts**	None	
Notes					

Status:	NEW	**Target:**	TBD
History	**Who**	**When**	**What**
	L. Bersiner	9/16/2010	first input

Requirement No:	SP3-8-0018	**Requirement Type**	OE	**Usecase No:**	SP3_0006
Description	The system is able to communicate with other vehicles queing				
Rationale	Building block for detailed information on vehicle environment				
Originator	Bosch				
Fit Criterion	Communication with vehicles queuing at traffic light is established				
Implementation Priority	1		**Conflicts**	None	
Notes	Communication with traffic lights is addressed in other req.				
Status:	NEW	**Target:**		TBD	
History	**Who**	**When**		**What**	
	L. Bersiner	9/14/2010		first input	

Requirement No:	SP3-8-0019	**Requirement Type**	OE	**Usecase No:**	SP3_0006
Description	The system is able to communicate with traffic lights controller				
Rationale	Building block for detailed information on vehicle environment				
Originator	Bosch				
Fit Criterion	Communication with traffic light ahead is established				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	NEW	**Target:**		TBD	
History	**Who**	**When**		**What**	
	L. Bersiner	9/28/2010		first input	

Requirement No:	SP3-8-0020	**Requirement Type**	OE	**Usecase No:**	SP3_0006
Description	V2V communication transmits and receives • Position (WGS84) incl. lane info • Speed (km/h) • Heading (degree against north) • MPP (e.g. location reference following AGORA-C) of each communication participant queing.				
Rationale	Building block for detailed information on vehicle environment				

Originator	Bosch				
Fit Criterion	Positions…MPPs of vehicles waiting in front of red traffic light are recognized by vehicle system				
Implementation Priority	1		**Conflicts**	None	
Notes	Refers to each vehicle within traffic lights environment				
Status:	NEW	**Target:**		TBD	
History	**Who**	**When**		**What**	
	L. Bersiner	9/16/2010		first input	

Requirement No:	SP3-8-0021	**Requirement Type**	OE	**Usecase No:**	SP3_0006
Description	The system is able to communicate with other vehicles on ist MPP.				
Rationale	Building block for ecoDriving.				
Originator	Bosch				
Fit Criterion	Communication with vehicles ahead on MPP within a range of TBD meters established				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	NEW	**Target:**		TBD	
History	**Who**	**When**		**What**	
	M. Selem	9/22/2010		first input	

Requirement No:	SP3-8-0022	**Requirement Type**	OE	**Usecase No:**	SP3_0006
Description	The system is able to communicate with slower vehicles ahead				
Rationale	Building block for ecoDriving: To avoid unnecessary braking and acceleration.				
Originator	Bosch				
Fit Criterion	Communication with slower vehicles ahead is established				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	NEW	**Target:**		TBD	
History	**Who**	**When**		**What**	
	L. Bersiner	9/16/2010		first input	

Requirement No:	SP3-8-0023	**Requirement Type**	OE	**Usecase No:**	SP3_0006
Description	Traffic lights controller transmits				

	• Location reference of traffic lights • Residual red display times for each driving direction to each eCoMove vehicle within reach.				
Rationale	Building block for ecoDriving: To avoid unnecessary braking and acceleration.				
Originator	Bosch				
Fit Criterion	Content above is received in vehicles within traffic lights environment.				
Implementation Priority	1		**Conflicts**	None	
Notes	Refers to each vehicle within traffic lights environment				
Status:	NEW	**Target:**		TBD	
History	**Who**	**When**		**What**	
	L. Bersiner	9/28/2010		first input	

Requirement No:	SP3-8-0024	**Requirement Type**	OE	**Usecase No:**	SP3_0006
Description	V2V communication transmits and receives • Position (WGS84) incl. lane info • Speed (km/h) • Heading (degree against north) • MPP (e.g. ocation reference following AGORA-C) of each communication participant slower ahead.				
Rationale	Building block for ecoDriving: To avoid unnecessary braking and acceleration.				
Originator	Bosch				
Fit Criterion	Positions…MPPs of slower vehicles ahead are recognized by vehicle system				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	NEW	**Target:**		TBD	
History	**Who**	**When**		**What**	
	L. Bersiner	9/16/2010		first input	

Requirement	SP3-8-0025	**Requirement**	P	**Usecase**	SP3_0006

No:	Type	No:
Description	The accuracy of both • the measurement of position, speed and heading and • the stored map data allows the system to calculate the accurate distance to the slope (in real time).	
Rationale	General requirement on precision of the map and the position calculation and on the system performance	
Originator	Bosch	
Fit Criterion	tbd	
Implementation Priority	1	**Conflicts** None
Notes		
Status:	NEW	**Target:** TBD
History	**Who** M. Selem	**When** 9/22/2010 **What** first input

Requirement No:	SP3-8-0026	Requirement Type	P	Usecase No:	SP3_0006
Description	The location reference transmitted by the V2V communication partners is described unambiguously (e.g. AGORA-C)				
Rationale	General requirement on precision of location referencing				
Originator	Bosch				
Fit Criterion	tbd				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	NEW	**Target:**		TBD	
History	**Who** M. Selem	**When** 9/27/2010		**What** first input	

Requirement No:	SP3-8-0027	Requirement Type	P	Usecase No:	SP3_0006
Description	The Location reference transmitted by the traffic light controllers and by the vehicles at the queue is described unambiguously (e.g. AGORA-C)				
Rationale	General requirement on precision of location referencing				
Originator	Bosch				
Fit Criterion	tbd				

Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	NEW	**Target:**		TBD	
History	**Who**	**When**		**What**	
	M. Selem	9/27/2010		first input	

Requirement No:	SP3-8-0028	**Requirement Type**	P	**Usecase No:**	SP3_0004 SP3_0005 SP3_0006
Description	The Location reference is described unambiguously (e.g. AGORA-C)				
Rationale	General requirement on precision of location referencing				
Originator	Bosch				
Fit Criterion	tbd				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	NEW	**Target:**		TBD	
History	**Who**	**When**		**What**	
	M. Selem	9/27/2010		first input	

TripDataSet

Requirement No:	SP3-9-0001	**Requirement Type**	F	**Usecase No:**	
Description	the application must be able to store the destination				
Rationale	To be made available for analysis				
Originator	N.E				
Fit Criterion	The data being available				
Implementation Priority	1		**Conflicts**	None	
Notes	The prerequisites to reach the end of trip state have to be defined clearly.				
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	J.Subbian	9/20/2010		Initial creation	

Requirement No:	SP3-9-0002	**Requirement Type**	F	**Usecase No:**	UC_SP3_0008

Description	the application must be able to store the different driver profile, using the same vehicle				
Rationale	Need for the analysis				
Originator	N.E				
Fit Criterion	The data being available				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	J.Subbian	9/20/2010		Initial creation	

Requirement No:	SP3-9-0003	**Requirement Type**	F	**Usecase No:**	UC_SP3_0008
Description	the application must be able to store the vehicle information				
Rationale	Need for the analysis				
Originator	J.S				
Fit Criterion	The data being available				
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	J.Subbian	9/20/2010		Initial creation	

Requirement No:	SP3-9-0004	**Requirement Type**	F	**Usecase No:**	UC_SP3_0008
Description	The TripDataSet should store trip data of each trip containing the TBD information for example a. Driver ID (in case more than one driver is using the vehicle) b. Date & time of trip c. Speed profile (incl. accelerations & decelerations) d. Gear choice e. Engine RPM f. Engine on/off at stop g. Road segment parameters (speed limit, slope, road signs/traffic signals, tbd.,) – the exact position where the driver has been? Or only the road characteristics? h. Fuel consumption (CAN)				

Rationale	Need for the analysis		
Originator	N.E		
Fit Criterion	The data being available		
Implementation Priority	1	**Conflicts**	None
Notes			
Status:	New	**Target:**	TBD
History	**Who**	**When**	**What**
	J.Subbian	9/20/2010	Initial creation

Requirement No:	SP3-9-0005	**Requirement Type**	OE	**Usecase No:**	
Description	The TripDataSet should be accessible for the following applications / components: a. PostTrip analysis – on board b. PostTrip analysis – off board c. ecoMonitoring d. ecoDrivingSupport e. ecoRouting				
Rationale	For Interface				
Originator	N.E				
Fit Criterion					
Implementation Priority	1		**Conflicts**	None	
Notes					
Status:	New	**Target:**		TBD	
History	**Who**	**When**		**What**	
	J.Subbian	10/14/2010		Initial creation	

Requirement No:	SP3-9-0006	**Requirement Type**	P	**Usecase No:**	
Description	The TripDataSet should be able to store at least TBD km of trips				
Rationale	Need for the analysis				
Originator	J.S				
Fit Criterion	The data being available				
Implementation Priority	3		**Conflicts**	None	

Notes			
Status:	New	**Target:**	TBD
History	**Who**	**When**	**What**
	J.Subbian	10/14/2010	Initial creation