eCO-friendly urban Multi-modal route PlAnning Services for mobile uSers

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Summary

In this document, we lay out the plans for the eCOMPASS pilot. After a brief introduction to the goals of work package 6, we provide an overview of the objectives of this deliverable and the methodology employed to achieve them. We then review the pilot site, the city of Berlin, Germany, and describe the site's characteristic with regards to the four eCOMPASS application areas: Private vehicles traffic, vehicle fleets, multi-modal transport, and tourism. Next, we provide an elaborate description of the user groups targeted in the different application areas. We summarize our findings about them and their needs as analyzed in deliverable D1.1, and then state the expected impact of eCOMPASS applications and services on their everyday transportation habits and behavior. Finally, we define the desired characteristics of pilot participants in each application area and sketch our plans for recruiting them. Based on the expected impact of eCOMPASS applications on their users, we proceed to define validation scenarios for eCOMPASS features, and detailed test cases derived from eCOMPASS use cases defined in D1.2. For the validation of the functionality of eCOMPASS applications and services and their impact on user behavior, we list measurements and crucial aspects of user feedback which will be collected for the consolidation of pilot results.

The present document, D6.1.2, is the public version of deliverable D6.1; see D6.1.1 for a more elaborate restricted version.

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1 Introduction

This deliverable contains plans for the eCOMPASS pilot, to be conducted in months 28-30 of the project. The goal of the pilot is to

- Validate the potential impact of eCOMPASS applications and services on the eco-footprint of urban transportation,
- Compare the user benefit of the eCOMPASS applications developed in WP5 with the needs articulated in the user research conducted in WP1,
- Demonstrate the technical feasibility of the eCOMPASS system architecture.

After briefly summarizing the role of WP6 in the eCOMPASS project, this document defines a methodology to evaluate eCOMPASS applications and services against their expected impact in urban transportation, and defines a detailed plan to conduct the eCOMPASS pilot.

1.1 Goals of eCOMPASS

The predominant goals of the eCOMPASS projects are to

- Enable more eco-aware and eco-friendly route planning in urban transportation,
- Raise eco-awareness among its users,
- Cover multiple transport modes for human mobility in urban environments.

This will be achieved by addressing the transport planning needs of the following four user groups:

- Private vehicle drivers using their car as primary means of urban transportation,
- Vehicle Fleet Drivers and Operators working in urban areas,
- Urban residents using mainly public transportation options to move around their city, and
- Tourists visiting a city using multi-modal transport options.

While the project is mainly focused on the development of novel algorithms to achieve its goals, a key challenge of eCOMPASS also lies in successfully delivering results to end users, i.e. in turning the developed route planning algorithms into features of actual applications, whose usage will ultimately have an impact on the eco-footprint of users' transportation needs. This overall success of eCOMPASS will be validated in a pilot, taking place in the city of Berlin in months 28-30 of the project, which is the subject of WP6.

A key idea in eCOMPASS is to deliver the features enabled by innovative algorithms on familiar user platforms, circumventing the barriers that the introduction of new hardware devices would pose to rapid adoption. The following well familiar devices, running eCOMPASS services and applications, will be used in pilot testing:

- A portable navigation device (PND) will be used to facilitate private vehicle navigation. Alternatively, the PND can be replaced by a non-dedicated mobile device running a navigation application, such as a small tablet computer or a larger smartphone.
- For managing commercial vehicle fleets, a device similar to the above will function as on-board navigator, complemented by a central back office application used by the fleet operator.
- For the public transport-based applications aimed at residents or tourists in urban areas, a smartphone will be the device of choice.

1.2 Objectives of WP6

The objective of WP6 is to validate and assess the potential impact of eCOMPASS algorithms and services on the eco-friendliness of urban transportation. This will be achieved by conducting pilot tests with users running eCOMPASS applications, followed by a rigorous analysis of results.

1.2.1 Expected Impacts on User Behavior

In Section 3, we provide an abstract of the expected difference to be made by eCOMPASS applications and services. Some insight is provided on how typical users make transport decisions, and how they might be altered by eCOMPASS features. Moreover, we elaborate on how test subjects shall be selected for the pilot in order to accurately reflect the user groups targeted.

1.2.2 Impacts to be Validated & Assessment Objectives

Based upon the overview in the previous section, we proceed to define concrete validation scenarios to evaluate the impacts of eCOMPASS applications and services in the pilot. This is done in Section 4, which also forms the centerpiece of this document.
In the definition of validation scenarios, we follow the template depicted in Table 1, which is inspired by the CONVERGE methodology.

Table 1: Validation Scenario Definition Template.

Scenario ID	***A unique numerical identifier.***
Title	***The title for this scenario.***
User Need	*A textual description of the user need addressed.*
Objective	*A textual description of the objective of the eCOMPASS system regarding the user need.*
Expected Impact	*A textual description of the expected impact of the eCOMPASS system regarding the user need.*
Background	*Additional information on this validation scenario.*
Test Case IDs	*List of IDs of associated test cases.*

Each scenario facilitates the detailed definition of test cases. These definitions include a description of all relevant parameters and procedures for the tests, and also a list of measurable performance indicators and essential user feedback items to collect. The analysis of these figures will enable the assessment of success of eCOMPASS features with respect to their expected impacts. This evaluation will be thoroughly presented in deliverable D6.2. Moreover, D6.2 will document in detail the user and expert questionnaires to be conducted on the basis of the feedback items listed in test case definitions.
Test case definitions are based on the template depicted in Table 2, which is in part inspired by the CONVERGE methodology.

Table 2: Test Case Definition Template.

Test Case ID	***<ID of the associated validation scenario>.<a unique numerical identifier>***
Title	***The title for this test case.***
Associated Scenario ID	*The ID of the associated validation scenario.*

Test Case ID	***<ID of the associated validation scenario>.<a unique numerical identifier>***
Title	***The title for this test case.***
Hypotheses	*A textual description of the hypotheses to be validated in this test case.*
Preconditions	*A list of preconditions for this test case.*
Procedure Summary	*A textual summary of the procedure for this test case.*
Situational Variables	*A list of given variables which cannot be altered but may significantly influence the results for this test case.*
Performance Indicators	*List of descriptions of numerical values to be recorded in the test which give an indication of the performance of the eCOMPASS system in this test case.*
Essential User Feedback	*Textual description of user feedback to be collected in order to help assess the performance of the eCOMPASS system in this test case.*
Use Cases Covered	*List of IDs of use cases covered by this test case (cf. D1.2).*

1.3 Scope & Structure of this Deliverable

This document aims to provide a concise plan by which the impact of eCOMPASS applications and services can be assessed and validated. It provides a clear view of the applications and equipment that is used in the evaluation, while it also presents the definitions of the impacts to be expected together with a plan how to measure them.

Section 2 contains a detailed review of the pilot site with regards to its key characteristics relevant to eCOMPASS. Section 3 formulates the expected impacts of eCOMPASS applications and services on the targeted user groups, and defines a plan how to recruit representative users for pilot testing. Finally, in Section 4, we select the most important impacts to be validated and create test cases and validation scenarios for them.

On a final note, we would like to emphasize that this validation plan forms an important piece of input for WPs 2, 3, 4, and 5, as it defines the goals of algorithms' development regarding their impact in practice. Hence, we deliver this document in month 12 of the project already, well ahead of the actual pilot tests in months 28-30. As a result, parts of the plans defined in this deliverable are naturally subject to change if technological developments demand so. Any deviation from the pilot plan in its realization will be documented in deliverable D6.2, where we shall report on pilot results.

2 Pilot Site

According to the DoW, the eCOMPASS pilot will take place in the city of Berlin, Germany. Berlin, as a major European metropolis, exhibits many features typical of modern urban areas: For one, the city's road network is very dense and diverse, containing long stretches of all types of roads, from small residential streets to multi-lane freeways. But also transport options beyond private cars are very rich and ever-expanding: There are several competing car-sharing services, multiple city bike rental networks, and a dense network of bike ways. Moreover, there exists a full spectrum of public transportation comprising trolleys, light rail, a large subway network, busses, and even ferries.

In the following sections, we shall analyze key properties of transport in the city of Berlin in reference to the four different eCOMPASS application scenarios. In this context, the suitability of Berlin as the site of choice for carrying out the eCOMPASS pilot will be evaluated.

2.1 Private Vehicle Traffic

A key goal of eCOMPASS in this application scenario is to reduce the eco-footprint of car traffic by helping drivers to avoid traffic and congested roads more effectively. This shall be achieved by i) incorporating traffic prediction into route suggestions, ii) computing robust routes in order to avoid notorious traffic hotspots, thereby yielding more reliable ETAs and iii) suggesting departure times, aiding the user in selecting the most appropriate departure times so as to avoid the worst peaks in rush hour traffic.

The city of Berlin[1] offers a highly suitable, yet challenging, environment for testing the potential of the eCOMPASS technology to make a difference in drivers' route decisions. There are several reasons that support the selection of Berlin. Berlin has historically grown into one major city out of several small towns. Moreover, the city was divided by the Berlin wall for almost thirty years. All of this is still reflected to the fact that Berlin has not one single downtown area, but in fact several local city centers. Hence, traffic has a much more heterogeneous structure than in other cities, as commuting takes place between many different areas of the city. Moreover, the somewhat decentralized road network brings the opportunity for more route alternatives suitable to detour congestion.

According to TomTom's current congestion index[2] (Q2 2012), Berlin ranks 14th among Europe's most congested cities, with Monday mornings and Friday evenings being particularly congested times of the week. Its road network comprises 2881 kilometers, 682 kilometers of which being highways. Congestion levels on highways and non-highways are 23% and 32%, respectively. This translates to a delay of 28 minutes per hour driven in peak traffic periods, or 73 hours of delay per year for a driver with a 30 minute daily commute.

2.2 Vehicle Fleets

The eCOMPASS project addresses with its application solutions a wide range of urban mobility challenges. One focus of the test site Berlin is the field of commercial vehicle fleets. Commercial vehicle fleets present specific requirements and characteristics, as they are directly tightened to commercial interests. In comparison with the private car traffic, commercial vehicle fleets are different regarding both the task to fulfill and the human factor – the commercial driver. Drivers of commercial fleets are trained and licensed for special

[1] http://www.stadtentwicklung.berlin.de/verkehr/

[2] http://www.tomtom.com/lib/doc/congestionindex/2012-1003-TomTom-Congestion-Index-2012-Q2-europe-km.pdf

commercial tasks. Furthermore commercial drivers in Germany are obliged by Berufskraftfahrer-Qualifikations-Gesetz (BKrFQG) to perform in a regular interval a qualification procedure and to renew their certificates. Hence commercial drivers often perform differently from private drivers. On the other hand, they have special needs, which are complementary to the general commercial company needs, e.g. reliable tour plans, drive and rest rules, good tour performance.
The city of Berlin entails all the typical challenges of urban logistical, i.e. high population rate and high metro density. With 3.4 million inhabitants in the city and another 1.2 million people living in the metropolitan region, the city of Berlin is the biggest city of the country. Well performing logistics activities are vital to the city. The special challenge for logistics is on the one hand to satisfy the needed commercial transports in terms of mass. On the other hand, logistics services have to provide a sufficient service quality. The challenge of service quality is especially typical for urban environments. A special challenge of test site Berlin regards the heterogeneous traffic conditions: Peak hours with dense traffic in the city as well as commuter traffic mainly during rush hour at dedicated roads, in contrast to a fine granular road network with only little traffic.

2.3 Multi-Modal Transportation

In addition to its dense road network, Berlin also offers a broad variety of interconnected public transport systems and other modern urban mobility concepts. Public transportation comprises a subway system, buses, trams, and ferries, all operated by the Berliner Verkehrsbetriebe (BVG)[3], plus light rail (S-Bahn)[4] operated by Deutsche Bahn AG. BVG and S-Bahn jointly form the Verkehrsverbund Berlin-Brandenburg (VBB)[5] with a unified fare system for all public transport systems mentioned above. In recent years, several car sharing providers like Greenwheels[6], Flinkster[7], DriveNow[8], and Car2Go[9] have made their services available in Berlin, competing with 6,700 registered taxis[12]. Finally, bicycles are publicly available via several bike sharing services such as Nextbike[10] or Call a Bike[11], and the city has 660 kilometers of dedicated bike lanes[12], which are also frequented by numerous velo-taxis.
The availability of such broad multi-modal transport options clearly makes Berlin an excellent fit for the eCOMPASS multi-modal transport pilot.

2.4 Tourism

Berlin is a profoundly popular city trip destination with almost 10 million arrivals and close to 23 million overnights in 2011[12]. Around 41.4% of overnights are accounted for by international travelers. Berlin offers over 120,000 hotel beds, 180 museums, and 440 art galleries[12]. The top two museums, the Pergamon and the Old Museum, collocated on the museum island right in the heart of the city, are frequented by over 1 million visitors each[12]. The city also hosts three opera houses as well as 150 theatres and concert houses home to 8 professional symphonic ensembles[12]. Moreover, Berlin counts over a hundred movie theatres

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3 http://www.bvg.de/
4 http://www.s-bahn-berlin.de/
5 http://www.vbb.de/
6 http://www.greenwheels.com/
7 http://www.flinkster.de/
8 http://www.drive-now.com/
9 http://www.car2go.com/
10 http://www.nextbike.de/
11 http://www.callabike-interaktiv.de/
12 http://press.visitberlin.de/

with almost 300 screens, and 225 bars and night clubs[12]. The city is also home to the world's most diverse zoo hosting over 1,500 distinct species, and five major sports stadiums[12]. Finally, tourists can indulge in shopping at 20,000 malls and department stores with a total area of 1 million square meters, and over 10,000 restaurants, diners, and cafes[12].
This abundance of tourist sights and activities renders the city of Berlin a more than suitable site to test the eCOMPASS tourist itinerary planner application in the eCOMPASS pilot.

3 Users & Expected Impact

In deliverable D1.1, the targeted user groups of eCOMPASS, their segmentation and, most importantly, user needs were identified. In this section, for each application scenario, we will briefly recall these results and then proceed to sketch the expected impact of eCOMPASS applications and services on their users' behavior. Finally, we will describe how fitting test subjects will be recruited for the eCOMPASS pilot.

3.1 Private Vehicle Drivers

The first and utmost goal of private vehicle drivers is getting to where they want to go in their favorite way, which could be the quickest, the shortest, the most eco-friendly, the safest, the easiest, the most scenic, etc.. Moreover, combinations of these objectives could also be regarded. The goal of a navigation system is to suggest routes that the user deems to be "just right". This also means that when proposing special eco-friendly routes, great care has to be taken that these routes are presented to the user in a personalized and appealing way. In fact, according to the user research in D1.1, convenience and efficiency in terms of time are by far the most common motivations when making transport decisions. While eco-friendliness can still most likely add value to eCOMPASS applications from the user's perspective, it should not be the first or even sole differentiator from existing services. Added efficiency and convenience should be emphasized mostly in the users' experience, with the proposed eco-friendliness as an extra bonus.

Eventually, this approach will help drivers to realize the daily relevance of connected navigation and stimulate them to regularly use eCOMPASS applications and services. This, in turn, will empower them to make smarter route decisions, e.g. to avoid traffic hotspots and congestion, which will yield a reduced eco-footprint of their transportation needs.

3.1.1 Impact of eCOMPASS Applications

An important realization of D1.1 concerns the daily relevance of navigation and trip planning services. While their daily home-to-work route is the most prominent transportation need for most urban residents, there is a clear indication that they tend not to use navigation or trip planning services at all in their daily commute. Thus, in order for eCOMPASS services and applications to make a difference, the first step is to provide an incentive to the drivers to use eCOMPASS on daily commutes in familiar areas.

- Users are very aware that usually several different route options are available for their trips, and they do value the potential to make a choice. On the other hand, current applications and services seem to provide neither the right alternatives nor enough relevant information about them. The eCOMPASS application will achieve daily relevance by delivering dynamic information about different route choices in real time. This information will empower users to make smarter route choices, spending less time in traffic, reducing congestion and eventually decreasing emissions.
- In order to be able to interactively deliver dynamic information on multiple route alternatives, eCOMPASS route computations will be powered by a novel accelerated dynamic routing engine enabling real-time route queries including dynamic information through smart pre-processing and fast customization of pre-processed data. This technology will make the system highly responsive, encouraging more dynamic guidance and effortless user interaction compared to existing systems. This

will greatly improve the overall user experience, making active engagement with traffic information and routing options much more enjoyable. Hence, the daily use of connected navigation will be eventually increased.

- eCOMPASS routing and traffic information will incorporate the eCOMPASS traffic prediction mechanism, helping users to avoid traffic more effectively.
- A novel time-dependent routing algorithm will enable smart departure time suggestions, helping users to plan their day in a manner that allows them to avoid traffic hotspots.
- Another concept which turned out to be very appealing to users is the concept of robust routes, i.e. routes which are less likely to incur traffic incidents and delay. Users who are already used to high definition traffic information almost expect their device to provide information on how reliable a given ETA is. As a matter of fact, many users would regularly sacrifice a few minutes in travel time in order to travel on a more robust route.

3.1.2 Pilot Participants

Since the eCOMPASS application for private vehicle drivers is geared especially towards urban commuters, great care will be taken to recruit test participants which are well familiar with roads and traffic in the city of Berlin and who regularly travel by car during times of increased traffic, e.g. commuting during rush hour times. In line with the eCOMPASS proposal, the recruitment of at least ten participants for the private vehicle pilot will be performed by TomTom. Participants will use the eCOMPASS in-car application in their own vehicle for a period of at least some weeks, where they will use the application on all of their regular drives in the city of Berlin.
Before the start of pilot testing, participants will receive personal training and will be provided with a short handbook explaining the application and the goals of the pilot.

3.2 Fleet Management Tour Planning

In eCOMPASS D1.1 we have already pointed out the main challenges in urban logistics. In summary, commercial vehicle fleets most often act business oriented. The main target for them is to provide commercial transportation services to customers. In this context, transport services have to fulfill customer service needs and to increase the profits for the logistics company. Ecological aspects, such as de-carbonization or traffic reduction, often only play a secondary role. Anyhow, in most cases, ecological behavior is complementary to economic interests, fuel reduction, vehicle reduction, total km reduction.
The objective of the fleet management part of the eCOMPASS project is to provide innovative planning algorithms to optimize tours for urban environments and to enable interplay between mobile devices and the back-office. By this action, eCOMPASS encourages the logistics industry to make use of innovative IT support in order to be more productive. The innovative IT support of eCOMPASS will facilitate the reduction of the emitted emissions during operations.

3.2.1 Impact of eCOMPASS Applications

- Enable the logistics planner with IT support for the optimization of route planning in reference to different objectives, e.g. minimization of costs.
- Minimization of CO2-Emissions, travel time or distance and maximization of vehicle load. Of course these objectives are subject to some constraints which are given by vehicles, cargo, time frames or for example restrictions in the transportation network. Of course, objectives can also be contradictory regarding their impact on the solution,

therefore it is necessary for a tour planning system to be capable of dealing with these interdependencies.
- Improved visibility. Users can receive more information about the current status of their order. Transportation companies can employ vehicle tracking in order to supply the relevant information about orders to their customers and re-optimize or update their tours.
- Incorporation of traffic information can be useful at this point.
- Added comparability to the tour solutions.
- Vehicle and driver restrictions can be incorporated into the optimization process
- Integration of restrictions given by law such as drive-and-rest-rules.

3.2.2 Pilot Participants

According to the DoW, the tests will be realized with special focus on urban logistics problems in the metropolitan area of Berlin.

- One transport company with transport orders in the metropolitan area of Berlin will be approached and contracted by eCOMPASS.
- Recruiting will take place via the project coordinator with support of project industry partners in time at a later stage.
- Transport company will receive written information about the goals of the pilot
- Transport company will receive training for using the planning solution

3.3 Residents and Tourists with Smartphones

According to deliverable D1.1, most potential users of the eCOMPASS multi-modal trip planner already use public transportation, at least now and then. They would especially value the ease of comparing routes employing different means of transportation in a single application, instead of having to use several different services, which is often the case today. For tourists, smartphones are on their way to become a regular vacation companion and convenience, i.e. the ease of getting around, plays a big role in choosing which sights and activities to visit. Hence, the eCOMPASS integrated trip planning smartphone app will address a strong user need, encouraging an eco-friendly way to make the most out of a city trip.

3.3.1 Impact of eCOMPASS Applications

- Encourage the use of public transport through ease of trip planning as well as positive eco-feedback.
- Validate the fitness of public transport as an option by providing a comprehensive comparison of different transport modes.
- Encourage tourists to use public transport confidently.
- Help tourists to make the most out of their visit using public transport efficiently.

3.3.2 Pilot Participants

Participants in the pilot will be recruited to match the two different target groups of eCOMPASS smartphone applications: Pilot participants testing the eCOMPASS multi-modal trip planner will be at least ten Berlin residents, well familiar with the pilot site, who regularly use public transportation. They will be recruited in time by TomTom.
For the eCOMPASS tourist itinerary planning application, ten tourists visiting Berlin will be recruited by TomTom as pilot participants. In order to make sure they are open to using public transport, they will be regular users of public transportation in their home town, but they shall not be familiar with the city of Berlin.

Similar to the private vehicle application area, all participants will receive personal training and will be provided with a short handbook explaining the application and the goals of the pilot.

4 Validation Scenarios & Test Cases

A key objective of the eCOMPASS pilot is the assessment of the potential impact of eCOMPASS applications and services on user behavior, and thereby on the eco-footprint of their urban transportation needs. By application area, we proceed to define a concrete validation scenario for each area of impact described in Section 3.

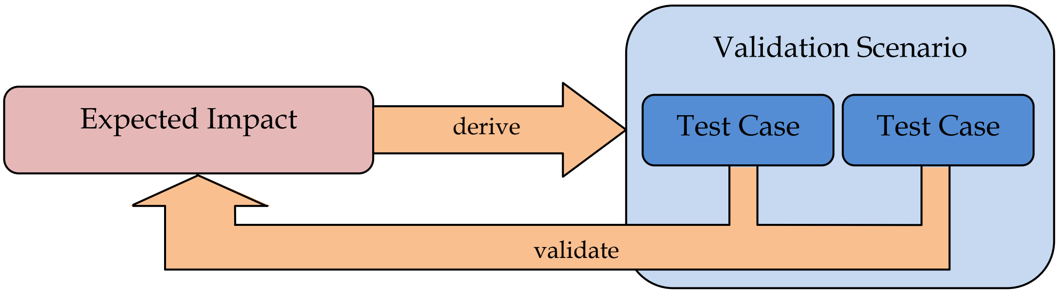

Figure 1: Deriving a validation scenario from an expected impact; test cases are used for validation.

Subsequently, we define precise test cases for each validation scenario based on the eCOMPASS use cases defined in deliverable D1.2 that were classified as essential. This methodology is illustrated in Figure 2.

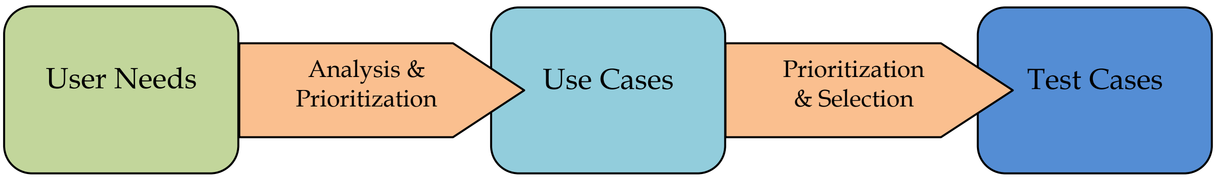

Figure 2: Illustration of the eCOMPASS Methodology for deriving pilot test cases from use cases.

In our pilot tests, which are scheduled to be conducted from February to April 2014, eCOMPASS application and services will be evaluated regarding their functionality, performance, and reliability, employing the test cases defined below. The evaluation will be based upon measured key performance indicators, but also questionnaires with users before and after the tests. In the test case definitions below, we give a general overview of relevant performance indicators to measure and essential user feedback to gather. We will refine their definitions as the feature development for eCOMPASS applications and services progresses, in due time before the start of pilot testing.
A key objective of eCOMPASS is to facilitate rapid adoption of the developed applications and services. This is to be achieved by delivering them on familiar user platforms, and a strong focus on the daily relevance on connected navigation systems. In line with this approach, our test cases are not designed to be consciously executed by users one-by-one, but they rather resemble situations which naturally come up as users use the system on an everyday basis. During the pilot, we will continuously log user interaction with their devices. This will enable us to recall situations in which each particular test case occurred with users to obtain their feedback in the evaluation phase, complementing measured performance indicators.

4.1 Private Vehicle Drivers

4.1.1 Alternative Routes

Scenario ID	**1**
Title	**Alternative Routes**
User Need	Many drivers are unaware of most of their route options, in particular eco-friendly choices. This lack of knowledge creates emissions and particular congestion, as a significant portion of the road network capacity stays unused due to drivers sticking to the same main roads. Moreover, even drivers with live traffic information services do not feel they are well informed about the overall traffic situation. Conveying traffic information for a number of alternative routes can provide a better picture of traffic in an area.
Objective	To help drivers know all their options and understand the overall traffic situation, thereby empowering them to make smarter route choices. Encourage drivers to make an eco-friendly choice. This will finally help to reduce congestion and particularly the eco-footprint of car traffic.
Expected Impact	Drivers increasingly realize the daily relevance of connected navigation and utilize alternative route and live traffic information to change their driving behavior. They begin to frequently deviate from their usual routes to previously unconsidered alternatives (potentially more eco-friendly and/or less prone to traffic).
Background	As detailed in deliverable D1.1, there is a strong connection between drivers' unawareness of (more eco-friendly) alternative routes, their perceived daily relevance of connected navigation and their perception of traffic and traffic information as a whole. The means by which alternative route information can be revealed to the driver are numerous: Alternative routes can be suggested pre-trip when planning a trip, in-trip upon request or spontaneously, or by providing the possibility for users to choose among different route planning preferences (e.g. fastest, robust, or eco-friendly routes).
Test Case IDs	1.1, 1.2

Test Case ID	**1.1**
Title	**Alternative Route Suggestions, Pre-Trip**
Associated Scenario ID	1
Hypotheses	When drivers are presented with different route suggestions when planning their journey, including feedback on their eco-footprint and specific traffic information, they are more likely to

Test Case ID	**1.1**
Title	**Alternative Route Suggestions, Pre-Trip**
	act eco-friendly and/or adapt their route choice to current traffic. When they experience that making such informed choice pays off, they are likely to adopt frequent usage of this feature.
Preconditions	Drivers plan a journey in an area and at a time with significant traffic.
Procedure Summary	When test subjects request multiple alternatives in planning their journeys, they are presented with a choice of routes, including eco-footprints and specific traffic information. Before departure, they make an informed choice based on the information provided.
Situational Variables	Current traffic situation, urgency/purpose of the journey, driver's personal preferences.
Performance Indicators	Diversity and relative characteristics of routes chosen by the user. Moreover, eco-footprint and expected delay due to traffic on chosen route compared to other routes.
Essential User Feedback	Usefulness of the feature, perceived quality of the proposed routes, change in awareness of eco-friendly route options and traffic.
Use Cases Covered	1.1, 1.2, 1.3, 1.4, 1.7

Test Case ID	**1.2**
Title	**Alternative Route Suggestions, In-Trip**
Associated Scenario ID	1
Hypotheses	As drivers proceed on their current route, their perception of the current traffic situation might change in comparison with the status before the start of the journey. Such can be the result of updated traffic information or personal observation. Hence, they may appreciate information about an alternative route turning off their route ahead, including specifically its eco-footprint and traffic information. They may then adapt their route choice. When they experience that making such informed choice pays off, they are likely to adopt frequent usage of this feature.
Preconditions	Drivers drive along a planned route in an area and at a time with significant traffic.
Procedure Summary	When driving along planned routes, test subjects are presented with an alternative route, including its eco-footprint and specific traffic information. When arriving at the turnoff, they make an informed choice based on the information provided.
Situational Variables	Current traffic situation, traffic incurred on the current route so far, urgency/purpose of the journey, driver's personal

Test Case ID	**1.2**
Title	**Alternative Route Suggestions, In-Trip**
	preferences.
Performance Indicators	Frequency with which a proposed alternative is actually chosen by the user, eco-friendliness and expected delay due to traffic on chosen route compared to the original route.
Essential User Feedback	Usefulness of the feature, perceived quality of the proposed routes, change in awareness of eco-footprint for route options and traffic.
Use Cases Covered	1.2, 1.3, 1.4, 1.7, 1.8, 1.9

4.1.2 Fast Route Planning with Live Traffic

Scenario ID	**2**
Title	**Fast Route Planning with Live Traffic**
User Need	Users today demand an interactive experience from applications and devices. Hence, a fast response time in navigation features is mandatory. If richer features in routing would entail a noticeable delay in route calculations, users would likely turn off or not use these features.
Objective	When using advanced routing features, such as live traffic information, traffic prediction, or eco-routing in eCOMPASS applications, response times for route calculations are maintained (or even improved) in comparison with basic routing queries today.
Expected Impact	Drivers are not discouraged from adopting new routing features by increased response times. Contrarily, the extraordinary responsiveness of advanced route queries in eCOMPASS applications encourages their daily regular use.
Background	Many of the advanced navigation features developed in eCOMPASS rely on the use of dynamic data in routing. This makes routing algorithmically much more complex than when it is based on static data alone. Hence, it is a key aim of eCOMPASS to develop an accelerated dynamic routing engine enabling the use of dynamic data at no runtime penalty.
Test Case IDs	2.1, 2.2

Test Case ID	**2.1**
Title	**Fast Route Planning, Pre-Trip**
Associated Scenario ID	2

Test Case ID	**2.1**
Title	**Fast Route Planning, Pre-Trip**
Hypotheses	Drivers will readily accept advanced features in basic point-to-point routing, like taking into account live traffic, traffic predictions, etc., when route computation is as fast and responsive as they expect.
Preconditions	Drivers are about to plan a single route to their destination in an area and at a time of significant traffic.
Procedure Summary	Test subjects enter their destination, select a route type, and plan a single route. The system calculates a route, regarding dynamic data, like live traffic information and traffic prediction, and displays it to the user.
Situational Variables	Distance to destination, current traffic situation.
Performance Indicators	Time to calculate the route, amount of dynamic data to be considered.
Essential User Feedback	Perceived responsiveness of route planning compared to expectations, quality of calculated routes with respect to dynamic data, perceived importance of dynamic data in routing.
Use Cases Covered	1.3, 1.6, 1.7

Test Case ID	**2.2**
Title	**Fast Alternatives, In-Trip, Upon Request**
Associated Scenario ID	2
Hypotheses	While en route, a driver's perception of the traffic situation may change, and he wants to know what other route options he has besides the current route. His navigation system has a feature to suggest alternative routes, taking into account up-to-the-minute dynamic information like traffic incidents and predictions. Drivers are likely to frequently make use of this feature, as long as this calculation is quick enough to deliver results, e.g. avoiding the driver missing a turn-off. This enhances drivers' understanding of the traffic situation and empowers them to make smarter route choices.
Preconditions	A driver is on a journey along a planned route in an area with significant traffic or delays.
Procedure Summary	While driving along a planned route, the driver is tempted by the current traffic situation to query the system for an alternative route. The system computes an alternative route, taking into account live traffic data and predictions, and displays the alternative in comparison with the current route. The driver can choose the alternative either by tapping it, or "by steering" at the turn-off.

Test Case ID	**2.2**
Title	**Fast Alternatives, In-Trip, Upon Request**
Situational Variables	Distance to destination, current traffic situation, personal user preference, availability of alternative routes.
Performance Indicators	Time to calculate the route, amount of dynamic data to be considered.
Essential User Feedback	Perceived responsiveness of alternative route planning, usability and usefulness of this feature while driving; perceived quality of alternative routes with respect to dynamic data, perceived importance of dynamic data in routing.
Use Cases Covered	1.3, 1.6, 1.7

4.1.3 Traffic Prediction

Scenario ID	**3**
Title	**Traffic Prediction**
User Need	For longer journeys in highly dynamic traffic conditions, live traffic information alone is often not sufficient to make an optimal route choice. For example, for part of the route to which the user will only get in 30 minutes, it is less relevant to know what traffic is like right now, than what it is likely to be like in 30 minutes. If this information is available at departure time, drivers might make different route choices from the start instead of attempting to detour locally later.
Objective	To accurately convey what traffic will be like on roads at the time the user actually gets there. This shall enable the user to anticipate forming (or dissolving) delays and congestion, helping him to make smarter route choices, avoiding traffic hotspots more effectively.
Expected Impact	Drivers are enabled to choose routes avoiding traffic delays before the congestion even forms. Thereby, traffic prediction can contribute to traffic-load balancing, as users can avoid traffic hotspots before congestion forms. Also, this increases the daily relevance of connected navigation, as drivers realize its benefits in everyday use even on familiar roads.
Background	Traffic prediction is a very active field of recent research, and eCOMPASS aims to contribute significantly in this field. Ideally, traffic prediction will be an integral part of all eCOMPASS routing features.
Test Case IDs	3.1

Test Case ID	**3.1**

Title	**Traffic Prediction in Routing**
Associated Scenario ID	3
Hypotheses	Traffic prediction is a powerful extension to real-time traffic information. When it becomes an integral part of routing, this shall contribute greatly to avoiding traffic hotspots, as it helps users to providently choose routes with a lower risk of becoming congested. Users will perceive traffic information to be more accurate and hence, they will eventually tend to use connected navigation more frequently even for journeys on familiar roads.
Preconditions	Drivers follow a route suggested by the system in an area and at a time of significant traffic.
Procedure Summary	Traffic prediction shall be part of any route calculation performed by the system. Hence, this test case applies whenever users follow a route planned by their system.
Situational Variables	General traffic situation.
Performance Indicators	Difference between predicted and actual conditions, difference between current and predicted conditions (w.r.t. delay and/or travel time).
Essential User Feedback	Perceived accuracy, perceived reliability of estimated arrival time, benefits to personal agenda, incentive for more frequent use of connected navigation.
Use Cases Covered	1.6, 1.7

4.1.4 Time-Dependent Routing

Scenario ID	**4**
Title	**Time-Dependent Routing**
User Need	Especially in urban areas, traffic is subject to rush hour effects. Similar to a traffic jam being a local traffic hotspot, rush hours can be seen as temporal traffic hotspots. In a traffic jam, users can save on their travel time by taking a small detour around the congested streets. During rush hour, drivers might be able to greatly save on travel time by shifting their departure time forward or back, avoiding the worst rush hour peaks.
Objective	To employ live traffic information, traffic prediction, and time-dependent routing algorithms to help users dodge temporal traffic hotspots like rush hour peaks, e.g. by smartly choosing their departure times.
Expected Impact	Users will become more aware of temporal traffic hotspots and start to choose departure times for their journeys more consciously. Thereby, users will spend less time in traffic delays

Scenario ID	**4**
Title	**Time-Dependent Routing**
	and thus reduce the eco-footprint of their movements.
Background	Time-dependent routing goes beyond basic routing in explicitly considering arrival time functions in routing, as opposed to just arrival times based on an assumed departure time. While this poses a significant algorithmic challenge, it enables the benefit of departure time suggestions, and the visualization of all routes which might temporarily be fastest in a specified time frame.
Test Case IDs	4.1

Test Case ID	**4.1**
Title	**Departure Time Suggestion**
Associated Scenario ID	4
Hypotheses	When users become more aware of the potential travel time savings when avoiding rush hour peaks, they will be more likely to try to avoid driving at these times. When their navigation system provides travel time to a destination as a function over time in a user-specified time-window, drivers will frequently try to optimize their departure time for a lower travel time. This will save drivers delays due to traffic and thereby contribute to reducing emissions. Moreover, this will also increase the daily relevance of connected navigation systems.
Preconditions	Drivers plan a journey in an area and at a time with significant traffic. They allow for a certain departure time window (e.g., leave within the next hour).
Procedure Summary	When planning their journeys, test subjects are presented with their expected travel time as a function of their departure time in the specified time window, along with the different routes which are optimal at different times in this time window. Test subjects then make informed decisions regarding their departure time based on the information provided.
Situational Variables	Traffic situation at time of test, time and length of user-specified departure time-window.
Performance Indicators	Usage frequency, departure time windows, traffic situations present, travel time saved due to optimized departure time.
Essential User Feedback	Perceived usefulness of feature, acceptance of departure time suggestions, and added value of different routes over time.
Use Cases Covered	1.5, 1.6, 1.7

4.1.5 Robust Routes

Scenario ID	**5**
Title	**Robust Routes**
User Need	Many drivers are quite keen on avoiding the risk of being stuck in a traffic jam. As was also an outcome of eCOMPASS user research documented in D1.1, drivers would frequently prefer a route with a slightly longer travel time, if this significantly reduced their risk of running into traffic delays.
Objective	To help drivers avoid notorious traffic hotspots. Robust route suggestions will transparently convey the tradeoff between fastest (expected) travel time on one, and a low probability of traffic incidents on a different route.
Expected Impact	In certain situations, many drivers will opt for the more robust route, decreasing their risk of getting stuck in traffic, and eventually helping to defuse traffic hotspots.
Background	Models for robust route optimization have been an active field of research in recent years, a major issue under investigation being the assumed correlation between delay probabilities on different roads in the network. eCOMPASS aims to significantly contribute to models and algorithms in this field.
Test Case IDs	5.1, 5.2

Test Case ID	**5.1**
Title	**Robust Route Calculation**
Associated Scenario ID	5
Hypotheses	When drivers are made aware that by choosing a route with insignificantly longer travel time, they can greatly reduce their risk of incurring traffic delays forming as they are en route, they will begin to frequently use the option to plan a robust route. In the long run, this can help defuse traffic hotspots.
Preconditions	Drivers are about to plan a single route to their destination in an area and at a time of significant traffic.
Procedure Summary	When planning a route to their destination, test subjects choose the robust route option. The system displays a route with a particularly low probability of traffic incidents with its key characteristics.
Situational Variables	Current traffic situation, urgency/purpose of the journey, driver's personal preferences.
Performance Indicators	Traffic incidents incurred on the robust route, deviation from anticipated ETA, frequency with which users select this route option.

Test Case ID	**5.1**
Title	**Robust Route Calculation**
Essential User Feedback	Usefulness of the feature, perceived quality and actual robustness of the proposed routes, actual reliability of the ETA.
Use Cases Covered	1.2, 1.6, 1.7

Test Case ID	**5.2**
Title	**Robust Alternatives, Pre-Trip**
Associated Scenario ID	5
Hypotheses	When users see a robust option among some alternative routes suggested by the system, they are likely to frequently choose it, i.e. to sacrifice some travel time in favor of a reliable ETA and less risk of running into traffic delays.
Preconditions	Drivers plan a journey in a well-known area and at a time with significant traffic.
Procedure Summary	Upon requesting alternative routes to his destination, the test subject chooses a particularly robust option.
Situational Variables	Current traffic situation, urgency/purpose of the journey, driver's personal preferences, availability of alternative routes.
Performance Indicators	Characteristics of and tradeoffs between the alternatives offered, and the route chosen by the user; frequency with which a particularly robust alternative is chosen.
Essential User Feedback	Assessment of suggested routes and usefulness of the tradeoffs offered; motivations for making a particular choice; perceived accuracy of reliability indication.
Use Cases Covered	1.2, 1.7

4.1.6 Eco Routes

Scenario ID	**6**
Title	**Eco Routes**
User Need	As an outcome of eCOMPASS user research that has been documented in D1.1., a significant ratio of drivers do care about their environmental footprint, However, most of them currently lack the tools to know how they can drive in a more eco-friendly mode. This clearly implies a need for an eco-routing feature in car navigation. Moreover, eco-routes frequently also tend to exhibit other benefits, like avoiding traffic, an easy route with fewer changes in speed, etc. Via an eco-routing feature, such benefits can effectively be conveyed to the user.

Scenario ID	**6**
Title	**Eco Routes**
Objective	To encourage drivers to opt for eco-alternatives by quantifying the ecological benefit and helping them to realize other benefits of eco-routes such as avoiding traffic.
Expected Impact	When drivers see that eco-alternatives only take slightly longer, but can make a difference in the eco-footprint of their journeys, plus frequently reduce travel stress by avoiding traffic, more drivers will frequently opt for an eco-friendly route, making an informed decision that otherwise they would not be able to make, hence also increasing the daily relevance of connected navigation.
Background	As user research documented in D1.1 demonstrates, drivers are frequently interested in reducing their environmental impact, but often as a second priority to avoiding traffic. Hence, eco-routes should also cater to the latter objective for increased acceptance among users.
Test Case IDs	6.1, 6.2

Test Case ID	**6.1**
Title	**Eco Route Calculation**
Associated Scenario ID	6
Hypotheses	When drivers are made aware that eco-routes are not significantly slower than other routes, but can significantly reduce the eco-footprint of their journey, while these routes also exhibit other qualities, such as being easy to follow or avoiding traffic, then the drivers will begin to frequently use the option to plan an eco-route.
Preconditions	Drivers are about to plan a single route to their destination.
Procedure Summary	When planning a route to their destination, test subjects choose the eco-route option. The system displays an eco-friendly route with its key characteristics.
Situational Variables	Current traffic situation, urgency/purpose of the journey, driver's personal preferences.
Performance Indicators	Eco-footprint of eco-friendly route, tradeoff with other route characteristics, frequency with which users select this route option.
Essential User Feedback	Usefulness of the feature, desirability of the suggested routes, reasons for making or not making an eco-friendly choice.
Use Cases Covered	1.1, 1.7, 1.12

Test Case ID	**6.2**
Title	**Eco Alternatives, Pre-Trip**
Associated Scenario ID	6
Hypotheses	When users see a more eco-friendly option among some alternative routes suggested by the system, they are likely to frequently choose it, i.e. to sacrifice some travel time in favor of a reduced eco-footprint of their journey.
Preconditions	Drivers plan a journey in a well-known area.
Procedure Summary	Upon requesting alternative routes to his destination, the test subject chooses a particularly eco-friendly option.
Situational Variables	Current traffic situation, urgency/purpose of the journey, driver's personal preferences, availability of alternative routes.
Performance Indicators	Characteristics of and tradeoffs between the alternatives offered, and the route chosen by the user; frequency with which a particularly eco-friendly alternative is chosen.
Essential User Feedback	Assessment of suggested routes and usefulness of the tradeoffs offered; motivations for making a particular choice; perceived desirability of eco-friendly options.
Use Cases Covered	1.4, 1.7

4.2 Commercial Vehicle Fleets

4.2.1 Fleet Management Tour Planning

Scenario ID	**7**
Title	**Tour planning with optimization of compactness and balancing**
User Need	Logistics planning for a commercial fleet is a stiff job. The user need here is to have an IT support for planning to enable ecological savings.
Objective	Support the logistics company planner with IT – based solutions to plan transport orders. Provide a solution that performs a planning and an optimization
Expected Impact	Planners can plan more efficient tours. Tour structure will be designed to be compact in principle. Compact tours have the advantage that driving distance between stops is being reduced. Traffic influence while driving between stops should be reduced. Balanced tours introduce the advantage of the improved reactivity potential. During mission execution, additional ad-hoc

Scenario ID	**7**
Title	**Tour planning with optimization of compactness and balancing**
	stops can be easily integrated to the existing tour. A further advantage of balancing is the smoothing aspect of tour KPI`s, e.g. distance, driving time.
Background	As detailed in deliverable D1.1 – questionnaire chapter- , there is a strong need for the improvement of efficiency in logistics company fleets. An Increase of efficiency can be reached by optimized planning and improved dispatching.
Test Case IDs	7.1

Test Case ID	**7.1**
Title	**IT based tour planning and optimization**
Associated Scenario ID	7
Hypotheses	IT based planning support shall improve the optimization of the planed tours in regard to the ecological performance.
Preconditions	Transport orders are available. Back-office system is fully operational.
Procedure Summary	Planner imports transport orders to planning application. Planner prepares the planning procedure; therefore planner provides boundary information, e.g. time restrictions, fleets composition, depot location. Planner runs the planning and optimization. Planner receives an optimized result.
Situational Variables	Current traffic situation, urgency/purpose of the journey, driver's personal preferences.
Performance Indicators	Total planned driving time of vehicles, vehicle number, total tour km, balanced structure of vehicle utilization
Essential User Feedback	Usefulness of the feature, perceived quality of the proposed tours.
Use Cases Covered	2.01, 2.02, 2.03

4.2.2 Fleet Management Dispatching

Scenario ID	**8**
Title	**Tour planning with optimization of compactness and balancing**
User Need	Logistics in urban areas is influenced to a large extent by urban traffic and dynamic order dispatching. Ad-hoc orders, delays in

Scenario ID	**8**
Title	**Tour planning with optimization of compactness and balancing**
	transport order execution due to traffic congestions or barriers at the stop location foster the complexity. Therefore, the planning and the control of a commercial fleet is a stiff job for the planner and the dispatcher. The user need here is to have an IT support for planning and transport execution.
Objective	Support the logistics company planner with IT – based solutions to plan and dispatch transport orders. Provide a solution that performs interplay between back-office and vehicles.
Expected Impact	Planners can plan more efficiently tours. Tour structure will be designed compact. Compact tours have the advantage that driving distance between stops is being reduced. Traffic influence while driving between stops should be reduced. Balanced tours introduce the advantage of the improved reactivity potential. During mission execution, additional ad-hoc stops can be easily integrated to the existing tour. A further advantage of balancing is the smoothing aspect of tour KPI`s, e.g. distance, driving time.
Background	As detailed in deliverable D1.1 – questionnaire chapter- , there is a strong need for the improvement of efficiency in logistics company fleets. An Increase of efficiency can be reached by optimized planning and improved dispatching.
Test Case IDs	8.1

Test Case ID	**8.1**
Title	**Tour planning and dispatching**
Associated Scenario ID	8
Hypotheses	Tracing and tracking improves the visibility of logistical operations. The dispatcher is can better plan and dispatch his vehicle fleet with knowledge on position and status of each vehicle.
Preconditions	Transport orders are available. Back-office system is fully operational. System communication channel is fledged to communicate bi-directional with external device.
Procedure Summary	Planner runs the planning and optimization. Planner receives an optimized result. Tours are being sent to the mobile application of fleet management. Mobile application device streams its positions and status messages. Fleet management back-office visualizes position and status. Back-office can send updates of the tour to the mobile app.

Test Case ID	8.1
Title	Tour planning and dispatching
Situational Variables	Planning restrictions, driver and vehicle profile
Performance Indicators	Communication channel is working. Back-office can monitor vehicle positions live.
Essential User Feedback	Usefulness of the feature, dispatcher rates value-add of live tracking and streamlined communication.
Use Cases Covered	2.04, 2.05, 2.06

4.3 Residents with Smartphones

4.3.1 Multi-Modal Route Planning

Scenario ID	9
Title	Multi-Modal Route Planning
User Need	With the wide range of different transport modes available in modern public transport, multi-modal options are becoming an increasingly desirable option for the urban resident or tourist to get around town. In order to make use of all options and optimize routes employing multiple means of transport, there is a great need for integrated applications enabling route planning across all available modes.
Objective	To enable and encourage the use of multi-modal transport for everyday door-to-door routes by making multi-modal route planning both convenient and efficient through an integrated tool enabling route-planning across all available transport modes.
Expected Impact	Users will realize the benefits of modern multi-modal transport and appreciate the convenience and efficiency enabled by integrated route planning.
Background	Multi-modal route planning poses significant algorithmic challenges, which contributes to the fact that few truly practical solutions are available today.
Test Case IDs	9.1,9.2

Test Case ID	9.1
Title	Door-to-Door Multi Modal Route
Associated Scenario ID	9
Hypotheses	Employing an application for integrated optimized multi-modal route planning will help users realize how efficient and

Test Case ID	9.1
Title	**Door-to-Door Multi Modal Route**
	convenient modern multi-modal transport can be.
Preconditions	Multiple modes of public transport are available in the city of deployment; a resident is about to plan a door-to-door multimodal route after optionally having entered his personal multi-modal transport preferences.
Procedure Summary	The test subject requests a door-to-door multi-modal route; he can choose among various options like fastest, fewest transfers, lowest fare, most eco-friendly, or most robust. The system displays a route according to preferences with all important characteristics.
Situational Variables	Potential public transport disruptions, personal multi-modal preferences, urgency/purpose of the journey.
Performance Indicators	Frequency of usage, route options selected, characteristics of planned routes.
Essential User Feedback	Practicability, convenience, and efficiency of route suggestions; fitness of and compliance with personal preference options.
Use Cases Covered	3.2

Test Case ID	9.2
Title	**Door-to-Door Multi Modal Route Alternatives**
Associated Scenario ID	9
Hypotheses	Offering multiple alternatives for door-to-door multi-modal route queries increases the attractiveness of multi-modal transport, as users can choose among options by their own personal preference. Displaying alternatives conveying important tradeoffs to be made, e.g. between robustness and travel time of routes, helps users to make an informed decisions for their personal favorite option.
Preconditions	Multiple modes of public transport are available in the city of deployment; a resident is about to plan a door-to-door multimodal route after optionally having entered his personal multi-modal transport preferences.
Procedure Summary	The test subject requests door-to-door multi-modal route alternatives. The system presents various alternative routing options, along with their characteristics and an eco-footprint comparison, revealing important tradeoffs to be made. The user selects one of the options.
Situational Variables	Potential public transport disruptions, multi-modal preferences, urgency/purpose of the journey, availability of alternatives.

Test Case ID	9.2
Title	**Door-to-Door Multi Modal Route Alternatives**
Performance Indicators	Frequency of usage, characteristics of options selected compared to other options.
Essential User Feedback	Usefulness and attractiveness of alternatives; relevance of different characteristics shown for routes; perceived benefit of route comparison; practicability, convenience, and efficiency of route suggestions; fitness of and compliance with personal preference options.
Use Cases Covered	3.1, 3.7

4.4 Tourists with Smartphones

4.4.1 Itinerary Planning

Scenario ID	10
Title	**Itinerary Planning**
User Need	Tourists on city trips frequently face the challenge of selecting an optimal set of sights to visit which fits into the time frame they have available while in the city. Naturally, the time it takes them to get around from sight to sight in the city plays a major role in their planning. When transport consumes less time, more time is available to visit sights. Also, most tourists are unaware of everything that is available to do in a city, and especially are likely to ignore public transport as their primary mode of transport since this can be understandably stressful for those who do not use it regularly.
Objective	To provide tourists with a tool to plan a personalized itinerary, maximizing the fun of visiting sights for their available time, and to encourage them to use public transport as an efficient and eco-friendly way of moving from sight to sight.
Expected Impact	Users of the eCOMPASS itinerary planning application will not only have especially rich itineraries catering to their personal tastes, but also increasingly realize that they do not need to hire a car or hail a taxi in order to get around when visiting an unknown city, thereby reducing the eco-footprint of their city trips effectively.
Background	Personalized itinerary planning poses a particularly challenging algorithmic task, as very many constraints such as opening hours and the availability of transport options need to be taken into account, while optimizing various objectives related to personal preference.
Test Case IDs	10.1

Test Case ID	**10.1**
Title	**Itinerary Planning Based on Personal Preferences**
Associated Scenario ID	10
Hypotheses	The optimized itinerary suggestions computed will enable a particularly rich and pleasurable city trip for the user. Itineraries will cater to the users' personal preferences well, and will be feasible regarding e.g. opening hours and transport times. Moreover, tourists will confidently rely on multi-modal transportation to get around an unfamiliar town.
Preconditions	The tourist has entered their personal preferences for sights and transport, and one or several time windows for one or several days while visiting the city.
Procedure Summary	Upon request, the test subject will be given a suggested itinerary with multi modal routes between stops. Key characteristics will be given including number of stops, budget and times of the itinerary.
Situational Variables	Personal preferences of the user, traffic situation for multi modal routes, special events or unique extended opening times for attractions, popularity of the attraction on any given day.
Performance Indicators	Personal preferences entered; how closely users follow the itinerary; how accurate is the timing assumed in itinerary planning.
Essential User Feedback	Compliance to user's preferences, feasibility of itineraries, overall attractiveness and quality of suggested itineraries, perceived benefit of eco-feedback, reliability/feasibility of planned routes.
Use Cases Covered	3.8, 3.9

5 Summary & Conclusions

This document has laid the groundwork for the assessment of the applications and services being developed in the eCOMPASS project in a pilot test in the city of Berlin in February to April 2014. In our review of the pilot site in Section 2, we have identified unique characteristics of the city of Berlin regarding private vehicle traffic, vehicle fleets, multi-modal transport, and tourism, which make this site an excellent fit for the evaluation of innovative eCOMPASS features in these four application areas.

In Section 3, we have reviewed the targeted user groups and formulated the impact we expect eCOMPASS applications and services to have on their transportation habits. Major goals of eCOMPASS to this end include:

- Encouraging the regular use of advanced connected navigation systems in private vehicles by convenient features of great daily relevance, helping users to avoid traffic more effectively, and hence travel more efficiently. This increased efficiency can significantly contribute to the reduction of the eco-footprint of private vehicle traffic.
- Increasing the efficiency, transparency, and visibility in planning for fleets of vehicles. Making planners aware of eco-friendly alternatives, visualizing trade-offs, and overall increasing the efficiency of vehicle fleet operations will help to reduce their eco-footprint.
- Encouraging the use of eco-friendly multi-modal transport alternatives. Since modern cities like Berlin provide an increasingly broad spectrum of transport modes, users will greatly appreciate an integrated route planning tool, making these journeys more convenient and efficient.

In Section 4, we have defined a validation scenario for each category of new features enabled by eCOMPASS algorithms in the applications being developed, including for instance alternative routes for private vehicles, fast route planning with live traffic, and robust as well as ecological routes. For each validation scenario, we have defined a set of precise test cases, based upon which we will evaluate the pilot when consolidating results.

Test cases are defined such that they occur naturally as pilot participants use eCOMPASS applications and services. This approach is of key importance to the success of the pilot, as it enables the realistic assessment of the impact of new features in everyday situations. Also, test cases state measurements to be conducted for each test case during the pilot, and essential user feedback to gather. The more precise definition of these measurements and the design of user questionnaires will depend on the final nature of the features currently being developed, and the user experience they will deliver, and will hence be given in deliverable D6.2.