PAsCAL

Enhance driver behaviour & Public Acceptance of Connected & Autonomous vehicles

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D6.2 – Pilot Setup

Version 1.0

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Version History

Version	Date	Summary of changes
0.1	26 Jan 21	First version of ToC, introduction, overview and Pilot 5 sections.
0.2	29 Jan 21	Further considerations of the KPIs defined in Deliverable 7.2.
0.3	01 Feb 21	Quotation of additional sources. Refinement of KPIs.
0.4	16 Feb 21	Reorganisation of document. Minor corrections of grammar.
0.5	22 Feb 21	Insertion of WP partner contributions. Homogenisation of content.
0.6	24 Feb 21	Enhancements of data protection concerns. Further harmonisation of WP partner contributions.
0.7	27 Apr 21	Integration of Deliverable D6.1 data points, HMI considerations of WP4, enhancement of scenarios.
0.8	29 Apr 21	Scenarios added to all pilot sections. Final proofreading.

1.0	31 May 21	Final formatting of the document. Enhancement of section 6.

List of acronyms

Acronym	**Meaning**
AV	Autonomous Vehicles
CAV	Connected and Autonomous Vehicles
ERTRAC	European Road Transport Research Advisory Council
FAIR	Findable, Accessible, Interoperable and Reusable
FDG	Focus Discussion Groups
FOT	Field Operational Test
KPI	Key Performance Indicator
PAsCAL	Enhance driver behaviour and Public Acceptance of Connected and Autonomous vehicLes
UX	User Experience
WP	Work Package
G2A	Guide2Autonomy
PT	Public Transport
ICT	Information Communication Technology

Legal Disclaimer

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Executive summary

The PAsCAL project aims to address all the issues and concerns that may delay the wide market uptake of Connected and Autonomous Vehicles (CAV) and to enhance the general public's acceptance of these vehicles. At the same time, the project also studies questions relating to the role of humans within the system, with special attention to vulnerable users, ranging from real-time driving control to long-term training needs for jobs. In order to facilitate the research process, the consortium partners collect user-related data, as well as the public opinions and acceptance via a variety of channels.

Five different real-world pilots are carried out to validate the project's findings. This document details their setup and explains in detail how these pilots are going to be performed to ensure their correct execution, making sure the information collected is homogeneous and in line with the project's objectives. Furthermore, it can act as an orientation guide for future experimental pilot setups of autonomous or connected technologies, which do not exist today.

This document contains descriptions for each of the pilots being performed in the context of the PAsCAL project with thorough descriptions of the different scenarios taking place in each of the pilots as well as different specifications for the materials needed to perform the pilots, the staff members, the expected testers, and their accessibility needs in relation with the pilot. The pilot description also specifies the information that has to be collected regarding answers to the included questionnaires, per batch incident reports and contributions to dissemination activities. Lastly, the pilot setup includes a workplan detailing al the subtasks required for each pilot execution as well as the time slot when they are being performed.

The pilots explained in this project are: “High-capacity autonomous bus operations”, “Autonomous driving Training”, “Autonomous shuttle service”, “Shared connected transport”, and “Experience of vulnerable travellers with connected transport environment”.

A common pilot design defined in deliverable D6.1 is followed and further defined in order to obtain the most relevant and precise information to be analysed in future documents from the project.

1 Introduction

The PAsCAL project aims to address all issues and concerns that may delay the wide market uptake of Connected and Autonomous Vehicles (CAV) and to enhance the general public's acceptance of these vehicles. At the same time, the project also studies the questions relating to the role of humans within the system, with special attention to vulnerable users, ranging from real-time driving control to long-term training needs for jobs. In order to facilitate the research process, the consortium partners collect user-related data, as well as the public opinions and acceptance via a variety of channels. The results are used to design the Guide2Autonomy (G2A), providing a rich set of recommendations, tools, and insights for a variety of stakeholder groups. The G2A is presented and assessed in collaboration with relevant stakeholders.

Five different real-world pilots are carried out to validate the project's findings:

1. High-capacity autonomous bus operations.
2. Autonomous driving training.
3. Autonomous bus line.
4. Shared connected transport.
5. Experience of vulnerable travellers with connected transport environment.

This document details how these pilots are to be performed to ensure the correct execution, making sure the information collected is homogeneous and in line with the project's objectives.

1.1 Purpose and organisation of the document

This document details the requirements and specification for the pilots to be carried out in the PAsCAL project. This deliverable is composed of the following sections:

- **Section 1** serves as an introduction for this document.
- **Section 2** describes the document's objectives and includes an overview of the pilots.
- **Sections 3 - 7** describe each pilot following the methodology proposed in deliverable D6.1 including the detailed requirements and specifications for each pilot setup.
- **Section 8** contains a summary on the pilots' setup and the alignment with other Work Packages.

1.2 Intended audience of this document

The main audience for this document consists of the consortium members of the PAsCAL project, specifically partners responsible for carrying out the pilots and can aid them in further refining and developing the TRL of their technologies and services throughout the project. This document can also serve as a guideline for future research involving mobility and technological pilots, which may require feedback from users. Furthermore, the insights derived from this deliverable are of interest for manufacturers of vehicles and robots, who develop CAVs as a product or service, providing them with a guideline on the structure and considerations of their own pilots for commercial purposes and market uptake. Professionals in the field of public transportation, logistics and mobility can experience and learn in-depth about the possibilities of this new branch within their industry and identify and stress their needs for training programmes as well as real-life day-to-day work requirements and use-cases. Also, this document is relevant for officials and governmental bodies to develop and craft suitable legislation and understand the necessity of pilot deployments for accurate and reasonable assessments of the TRL of CAV vehicles. Finally, the participants as well as the general public profit from the widespread dissemination of their experience during the execution of the pilots and of the project’s conclusions, which brings larger attention to the potential and value of CAV technologies for different population groups. The pilots can lower the alienation of the average citizen to autonomous vehicle technologies and thus enable a wider uptake of the vehicles in various different sectors and use-cases. The special focus of pilot 1 and pilot 5 on vulnerable users helps to not only offer vulnerable passengers to gather experience with CAVs in a safe and controlled environment but also explores the potential revolutionary impact of the vehicles to simplify the usage of public transportation or even to render it accessible in the first place, which is not only important to disabled or elderly citizens but also delivers invaluable insights for the development and funding of inclusive transportation and infrastructure strategies of officials, municipalities and regional governments.

2 Overview of the PAsCAL pilots

2.1 Objectives

In PAsCAL, all research Work Packages - from WP3 to WP8 - require a high degree of interaction and feedback information between each other, both during planning and execution. The PAsCAL pilots must de designed to provide validation of the previous WPs findings, in particular WP4 and WP5. In addition, they must also be aligned with WP3 and WP7. At the same time intermediate results of the pilots also provide feedback to those WPs. The pilot design also includes ethics and data protection handbooks from WP2, and in compliance with the data analysis and impact assessment plans defined in WP7 and the pilot results and data collected is directly transferred back to WP7 for evaluation. Tester responses and observed behaviours are analysed in task 7.3.

2.2 Pilots' summary

2.2.1 High-capacity autonomous bus operations

This pilot addresses the perception of high-capacity CAV buses in urban public transport (PT) operations from the point of view of a set of testers as well as PT stakeholders involved in the operations. The goal is to analyse the main concerns and worries of the passengers, which may negatively impact acceptance of such vehicles. In particular, the pilot studies the impact of a lack of human assistance that is normally provided by drivers during various types of incidents. One of the specific goals of the analysis is to specify and test ICT-based solutions that allow to partially replace the perceived role of a human driver. Simplified versions of the tools are designed and implemented for the pilot. The considered passengers are comprised of a diverse group, including those with special needs for (human) support and partially sighted as well as blind user groups. The pilot is designed with the input from several different PT stakeholders. It is composed of six batches split into two waves.

2.2.2 Autonomous driving training

In this pilot the training methodology created in WP5 is assessed through the use of a L3+ CAV in the "protected" and equipped environment at the Lainate safe driving centre in Milan, Italy. 70 drivers test a number of different scenarios ranging from everyday interactions with CAVs to the most critical situations, including the solutions previously identified in WP5. Moreover, the pilot assesses if there is any difference in the acceptance of CAVs between simulated conditions at a testing facility and a real situation in active traffic networks.

2.2.3 Autonomous bus line

In this pilot, a fully autonomous and connected electric bus with autonomy level 4 is tested. The system has already been implemented under real life traffic conditions in Spain. The vehicle is fully operative and commercial and is used by hundreds of active users monthly, integrating into the multi-modal transport network of the wider Madrid area. Both reactions and attitudes of external road users, who are confronted with these vehicles, and the passengers of the vehicle, including some vulnerable passengers, are studied and asked to fill out a survey. A special focus is laid on the level of success concerning the multimodal integration of the bus line. The pilot takes place in collaboration with several key shareholders, including associations, governmental bodies, commercial operators as well as the manufacturer of the vehicle.

2.2.4 Shared connected transport

Roadmaps on automation (such as the one published by ERTRAC[1]) put a lot of emphasis on shared mobility technologies. However, still little is known about the attitudes towards future sharing schemes. This pilot studies attitudes and perception of “drivers” and passengers toward different kinds of shared connected vehicles including small- and medium-size passenger cars, sport vehicles, vans, electric vehicles and vehicles with autonomous features. This study allows operators of shared fleets to optimally design and operate fleets of shared vehicles and design well-suited incentive mechanisms to increase public acceptance and improve attitudes towards different kinds of shared vehicles. Furthermore, the pilot includes an autonomous bus, which operates close to the same area in Luxembourg.

[1] https://www.ertrac.org/uploads/documentsearch/id57/ERTRAC-CAD-Roadmap-2019.pdf

2.2.5 Experience of vulnerable travellers with connected transport environment

The last pilot focuses on the acceptance and behaviour of vulnerable travellers, such as the elderly, pregnant women, disabled, with sensory impairments, travellers with heavy luggage, and parents with a baby stroller when travelling with CAVs. A digital platform is used, which advises specifically vulnerable travellers in real-time on the best routes to take, removes non-accessible routes and transfers, and alerts them of possible obstacles which may be encountered. This platform has already been extensively tested in Madrid, Spain, but in this pilot the new challenges of a more connected transport environment is addressed and the potential of CAV vehicles for a more inclusive public transportation network, can be assessed. Furthermore, Focus Discussion Groups (FDGs) shall be prepared specifically for people with sensory impairments to better understand their needs and the potential aid CAVs could represent in their lives and how these technologies could enable them to travel more independently.

2.3 Pilot timetable

In order to give a good overview over all pilot deployments and in order to keep track of any deviations of the initial plan, a common timetable has been created to structure and document the pilot deployment and subsequent development of documentation and conclusions. As the pilots take place in parallel over the months, the constant communication between the partners and an overall tracking of the project's process is of high importance in order to avoid any possible delays. The timetable has been designed and agreed upon by all partners and has been shared with the entire consortium in advance. As defined in the Grant Agreement, the months are counted starting from the beginning of the Agreement in June 2018, therefore Month 20 of the PAsCAL project corresponds to January 2021. The pilots are conducted between March 2021 and January 2022.

Table 1 Timetable of all pilots

Year	2021												2022		
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30	M31	M32	M33	M34
High-capacity autonomous bus															
Autonomous driving training															
Autonomous shuttle service															
Shared connected transport															
Experience of vulnerable travellers with connected transport environment															
Deliverable D6.1															
Deliverable D6.2															
Deliverable D6.3															

Throughout the deployment of the pilots, the progress of each partner is checked continuously to ensure a seamless and unproblematic progression and a timely delivery of the Work Package's deliverables. Furthermore, possible delays can be anticipated or spotted quickly, and strategies or pilot changes can be implemented to avoid the overall delay of the project. Due to the Covid-19 pandemic, changes may need to be implemented quickly in case of local or national curfews, lockdowns or mobility restrictions in place. Due to delays in WP5 and the subsequent extension of the project over 6 months, the delivery of the Deliverable D6.3 has been shifted to March 2022 (M34).

2.4 Dissemination activities

Industries, research institutions, professionals and the general public are updated and informed on a regular basis using a coordinated and homogenous dissemination approach. Each WP partner has committed to a fixed range and number of activities. These releases are structured, scheduled and revised by ACI staff.

In general, each pilot has to disseminate as much as possible its activities following a common approach. This comprises:

- Identify and characterize the pilot using a specific slogan if possible.
- The press, specialised and general, are invited to witness the pilot, they can follow the activities and, if feasible, may also take part in the tests. Each pilot selects the most suitable time to give access to the press.

- A press release is issued to announce and explain the pilot, its goals, and it is spread out to national and local media outlets.
- Throughout the pilot, the staff produces, edits and publishes visual material, such as photos, videos, stories and possibly direct streaming through PAsCAL social media[2].
- Video and photo footage material can be later used to create further dissemination materials for the promotion of the project in the press, on social media posts and on the PAsCAL website[3].
- A couple of weeks after the end of each pilot execution, an event presents the results of the pilot and spreads awareness of the PAsCAL project and its objectives. Local authorities and media, including specialized press, are invited in order to ensure maximum visibility.
- At least one article dedicated to each pilot and its results is published in ACI's online magazines Onda Verde[4] and most likely in other newspapers and magazines.

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[2] https://www.facebook.com/pascalprojecteu/
https://twitter.com/ProjectPascal
https://lu.linkedin.com/company/pascalprojecteu
[3] https://www.pascal-project.eu
[4] http://www.aci.it/ondaverde.html

Table 2 Dissemination activities of all pilots

	Slogan	Notice to ACI	Press release	Specialised press invitation	General press invitation	Invitation post (general public)	Social media coverage	Photo & videos	Video	Event to present results
Pilot 1		1 week in advance	x	x	Event	Post & pilot launch	x	x		x
Pilot 2	x	1 week in advance	x	x	Event		x	x	x	x
Pilot 3		1 week in advance	x	x		Post & pilot launch	x	x	x	x
Pilot 4		1 week in advance	x	x			x	x		x
Pilot 5	x	1 week in advance	x	x	x	Post & pilot launch	x	x	x	x

3 Pilot 1: High-capacity autonomous bus operations

3.1 Introduction

The integration of a specific type of CAV - high-capacity autonomous buses - into Public Transport (PT) is a challenge for the transportation sector. In many regards it cannot be compared with the integration of autonomous shuttles, due to different operating characteristics (passenger capacity, speed, acceleration, etc.) and the pure scope of the vehicle. The main question addressed by the pilot is how the absence of a human driver on board of a large vehicle, such as a bus, affects CAV acceptance by the PT users and what can be done to mitigate the identified concerns. Furthermore, the pilot explores possible solutions based on information and communications technologies (ICT) to mitigate the identified concerns. In particular, the question of what kind of technologies and software applications should be available and which ones are particularly helpful in a CAV to support passengers is addressed.

The goal of this pilot is to determine and address the key challenges related to the integration of high-capacity CAVs into PT operations. As the successful and complete integration requires cooperation of several stakeholders, the intended audience of the pilots' outcomes consists of PT authorities, PT operators, telematics providers, and bus manufacturers. A high-level overview of the pilot setup is shown in Figure 1.

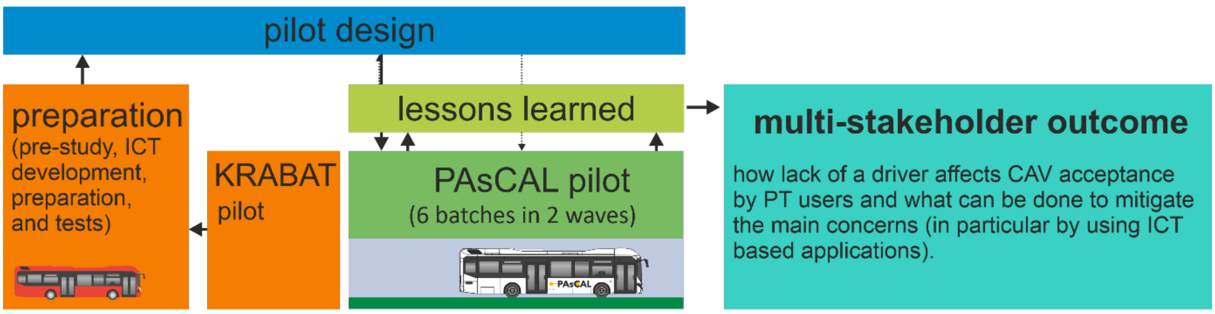

Figure 1 Pilot 1 overview

A preparation phase prior to the pilot is used to map pilot specifications and prepare the deployment. It includes the identification of potential ICT solutions to bridge communication between participants and the PT operations control centre. A prototype ICT solution is developed specifically for the pilot. In addition, outcomes of the KRABAT project[5] are used to shape the pilot setup. The plot is composed of six batches in two waves is used to help addressing the challenges via an iterative approach allowing to ameliorate the pilot in between batches and waves.

3.2 Detailed pilot description

3.2.1 Scope and purpose

The scope of this pilot includes CAV passengers and PT operators that are required to equip CAVs with additional ICT enabling novel applications providing audio-visual communication between the passengers and the PT operations control centre. In recent years such centres have already been undergoing changes due to the new possibilities enabled by digitalisation (e.g. real-time passenger information support) and challenges introduced by electrification of vehicles (e.g. battery charging management). The introduction of driverless vehicles requires extending these kinds of centres with new applications that can replace passenger support that is currently provided by drivers. Such applications do not yet exist in the PT market. Hence, their specification is an open question.

The main purpose of the pilot is to determine the most important obstacles that might reduce the acceptance of CAVs as well as to evaluate the need and potentials of new applications that can address some of these obstacles. Prototypes of the applications are tested and evaluated during the pilot. A special focus lies on visually impaired passengers, of which some are participating in this pilot.

3.2.2 Scenarios

The core of all proposed scenarios is a common 12 metre low floor bus from the Volvo 7900 family, detailed in Figure 2. Scenarios are constructed to simulate operating conditions of City 1 and City 2 operating cycles that are common in urban environments (shown in Figure 2).

[5] https://www.drivesweden.net/en/projects-5/krabat

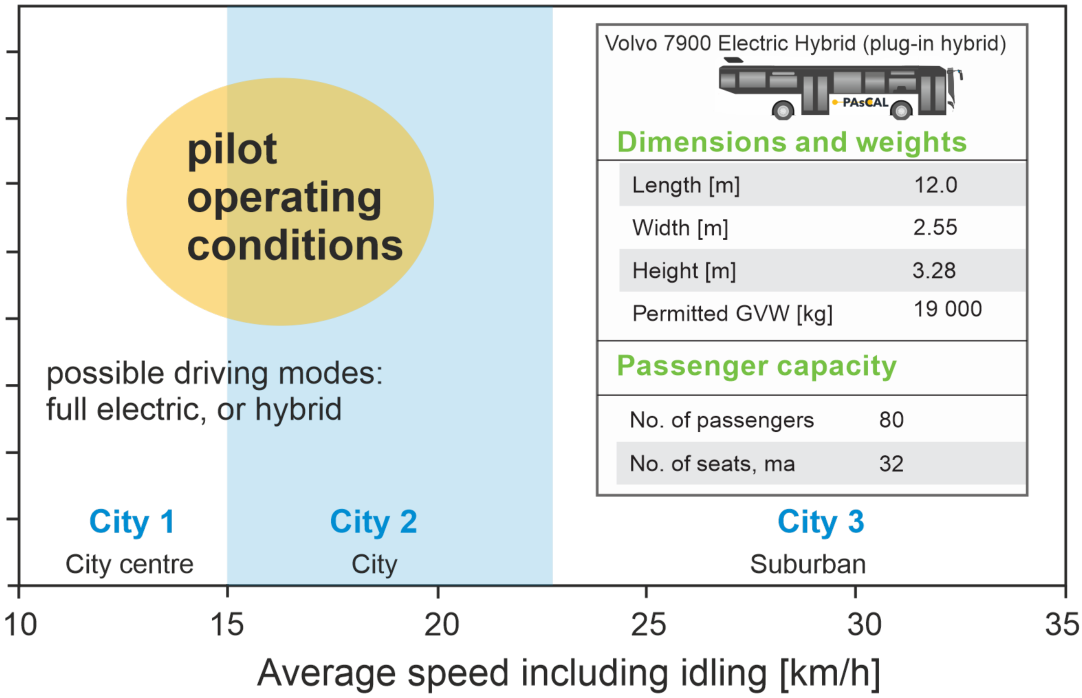

Figure 2 Pilot 1 operating conditions and vehicle specifications

The pilot execution takes place in Luxembourg. The bus, specified in Figure 2 is transformed to imitate a driverless CAV. That is, the bus is not autonomous and requires a human driver, but passengers are not aware of the driver's presence on board of the vehicle and are not able to contact or interact with the driver. Due to the ongoing Covid-19 pandemic at the time of the execution of this pilot, the pilot is split into two waves. This allows to reduce the number of passengers being simultaneously present during the pilot execution and react quickly in case of local or national lockdowns or restrictions due to the pandemic. One wave consists of 4, the other of 2 batches of 10 participants each. The waves are referred to as "summer" and "fall". The main experiments (four batches) are carried out in the summer wave. The goal of the fall wave is to address all questions that might arise in the summer wave, and to test the impact of different conditions (e.g. darker evenings). The fall wave has at least two batches, with additional batches to be added subject to the needs.

3.2.2.1 Summer wave

Due to the ongoing Covid-19 pandemic the Luxembourg pilot is split into four smaller batches executed within one month. This allows to reduce the number of passengers being simultaneously present during the pilot execution. Each wave consists of one batch of 10 participants. Two scenarios have been pre-defined. Each batch tests only one of these scenarios. The first scenario (referred to as "*control scenario*") assumes that no operating issues such as harsh driving or malfunctioning doors occur. The second scenario (referred to as "*event scenario*") includes scheduled technical and operational issues referred to as *events*. The first event is harsh braking (preceded by high-speed driving, above 30 km/h). The second event is an extended idling while on route and not at a stop. The third event simulates issues concerning the opening and closing of the doors. The last event is an obstacle that blocks the bus (car or truck) altogether. In two waves the vehicle is equipped with passenger support provided by an on-board application developed specifically for the pilot. It provides information about the issue at hand (graphical/vocal) and offers the option to contact an operator at the control centre (communication can be initiated from both ends). Specifically, the bus is equipped with a big screen showing a live camera feed of a forward-facing camera. In addition, one tablet is installed centrally, which runs a mobile app that could in principle also be run on the participants private smartphones but does not have to. This mobile app consists at all times of a main view that displays a map of the pilot location with the planned route, and all stops shown along with the current up-to-date position of the bus. In the top of the main view all relevant messages are displayed and at the same time announced as voice messages. An emergency button in the main view initiates a video call to the control centre if needed.

Execution of a scenario is shown in Figure 3.

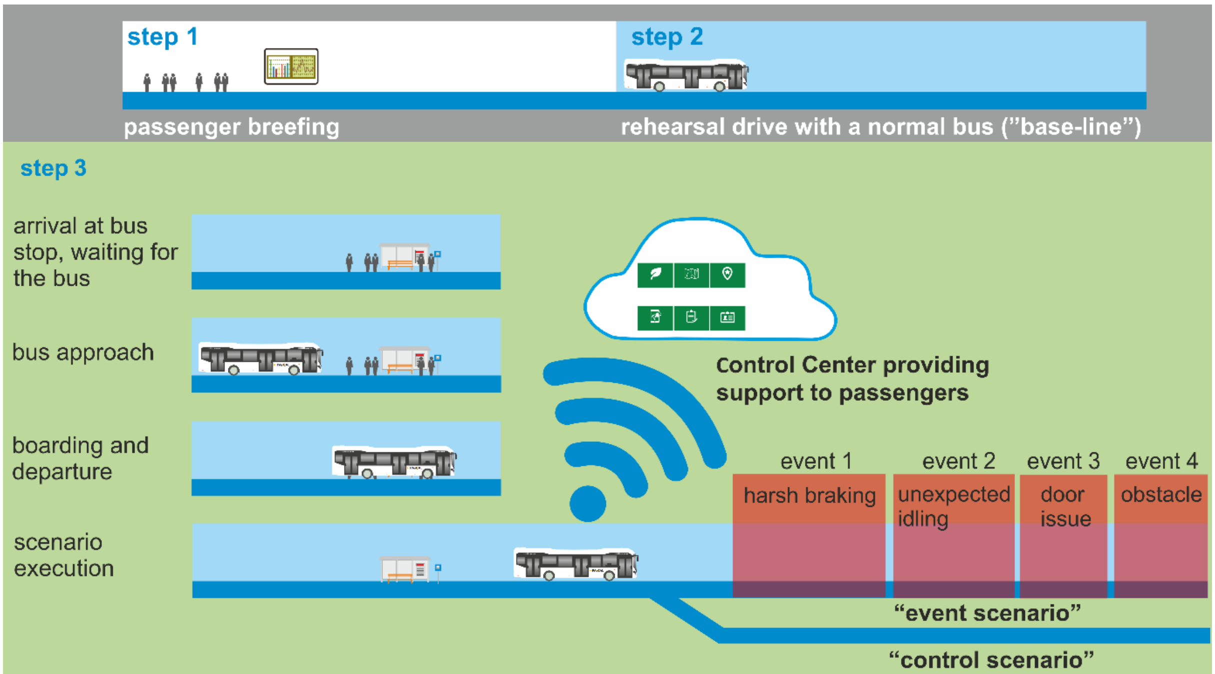

Figure 3 Pilot 1 scenario overview

Each wave execution starts with a detailed passenger briefing. It contains practical information about the pilot schedule as well as societal, environmental, and economic benefits of CAV's ("eco-motivation"). It also gives some basic information on what CAVs are and some general information about the PAsCAL project. Following the briefing, a ride in a conventional 12m bus with a visible driver is scheduled to generate a normal (familiar) baseline experience of using a PT bus in operating conditions simulated in the pilot. Once the baseline is established, the scenario starts after boarding at "bus stop 1" (see Figure 4) and the passengers proceed to board the seemingly autonomous bus.

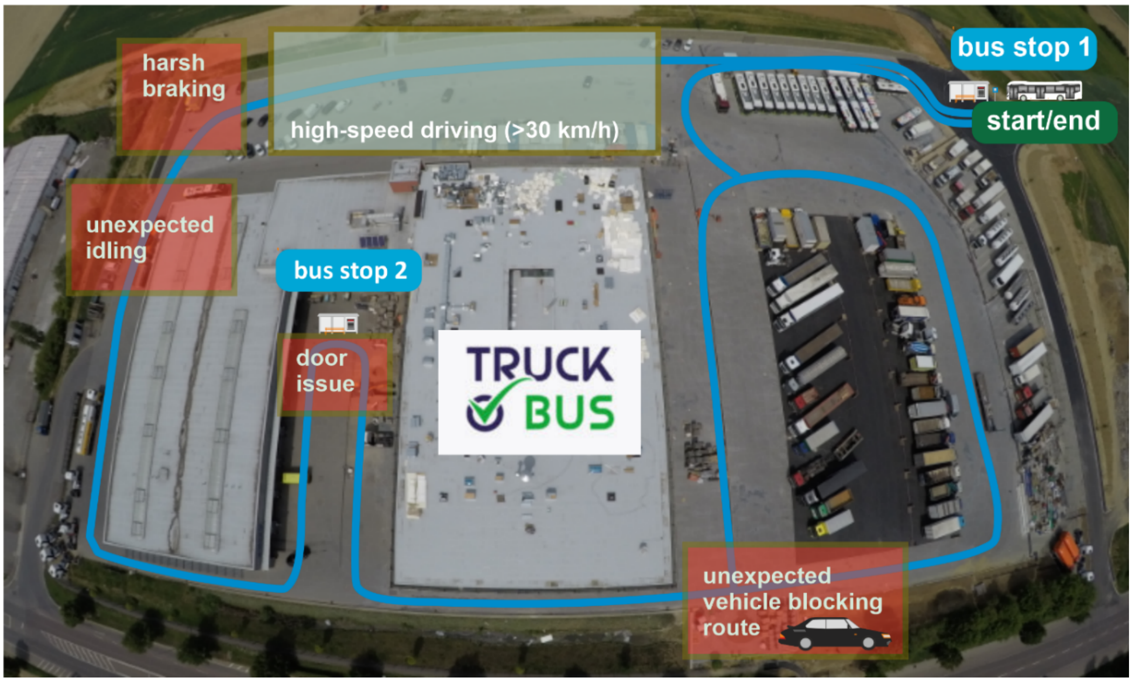

Figure 4 Pilot 1 scenario overview on test track

Scenario details (e.g. distance driven, duration of each event) are determined during the pilot preparation/test phase. Setup of the batches for wave 1 is summarised in *Table 4*. Two batches of testers follow the *control scenario*, while the remaining batches focus of the *event scenario*. Each scenario is executed in two variants - with and without passenger support.

Table 3 Pilot 1 wave 1 batches overview

	Scenario	Passenger support
Batch 1	control	no

Batch 2	control	yes
Batch 3	event	no
Batch 4	event	yes

This wave is subject to the adjustments according to the findings of the autonomous bus pilot carried out within project KRABAT (Drive Sweden Programme). The pilot of the KRABAT project has a single user batch with 20 persons on a Volvo prototype autonomous bus (with similar technical specifications as the bus in the Luxembourg pilot). Although, due to technical limitations, the pilot uses a different driving cycle its outcomes provide very valuable input to the PAsCAL pilot design.

3.2.2.2 Fall wave

Research goals of the fall wave are determined based on the outcomes of the summer wave and the conclusions of the KRABAT project. It is expected that the batches within this wave focus on one of the following aspects:

- Lighting conditions (waves executed without daylight hours);
- Specific passenger profile determined in the “summer” wave;
- Test of improved passenger support (ICT application) developed and implemented between the batches.

3.2.3 Assumptions

The pilot assumes that even if safe, and reliable high-capacity CAVs are available on the market, their integration to PT systems has several challenges that need to be addressed. That is, technical readiness of a CAV is not enough for PT application. The reason is that today drivers play an important role in assisting passengers and provide especially aid to vulnerable travelers. Thus, their absence has to be substituted with some kind of assistance to mitigate major concerns that might potentially reduce trust towards CAVs. It is also assumed that the passenger experience of driving high-capacity buses cannot be compared to using autonomous shuttles, mainly to differences in vehicle size (passenger capacity) and operating speed.

In collaboration with WP 4, several Human Machine Interfaces (HMIs) have been considered. For pilot 3, the HMIs 2.7 In-car communication as well as 2.8 Explain deviant driving behaviour has been considered and could be implemented into the existing technology. These HMI can both be integrated into CAVs of 3, 4 and 5 level of autonomy and use communication technology within a vehicle using a device or interface to inform passengers on the status of the vehicle.

3.2.4 Questionnaires

The questionnaires are conducted by interviewers using smartphones or tablets or are filled out by the participants themselves using their personal devices following the pilot using the interface of the tool Qualtrics[1] as has been decided on by the WP partners. During the dedicated Focus Discussion Group including people with visual impairments, enough assistants are present to ask the questions to the participants out loud and record their responses using the same interface. The questionnaire consists of 23 background questions, and 23 technical questions, which require multiple choice or single choice answers. Background information inquires on participants' demographic information, including the level and type of visual impairment of the test participant. The survey ends with an open text box option for feedback and commentary. The questionnaire has been attached in full in Annex I: Surveys. Every question seeks to answer one of the Key Performance Indicators (KPIs) defined and detailed in by project partners in Deliverable 7.2 of WP7. The KPIs addressed by the pilot 1 questionnaire for users belong to the following indicator categories:

- Indicators of acceptance by end users;
- Indicators of acceptance by vulnerable user groups;
- Indicators of society level acceptance.

3.2.5 Tester considerations

Different groups of test participants take part in the experiment. Special focus lies on blind and visually impaired passengers. Targeted number of participants is a total of 50 people of which around 10 could be visually impaired. It is envisioned that no more than half of participants in any batch are visually impaired to ensure a seamless pilot execution with a manageable number of staff members.

[1] https://www.qualtrics.com

3.2.6 Location and equipment needed

The pilot is carried out on a track set in the Truck & Bus Service area[6] in Livange, Luxembourg (see Figure 4).. Two different buses are used– a normal bus (i.e. without "autonomous" modifications) for the baseline drive, and an "autonomous experience" bus with a hidden driver for the pilot execution. Both buses are of same type from passengers' perspective (technical details shown in Figure 1). The "autonomous experience" bus has the following modifications: an installation of foil to tint windows around the driver and a wooden board to cut off the driving compartment from the passengers ensures that the passengers are under the impression that they are riding an autonomous vehicle. They are not informed that a driver is on board but instead that they made to believe that they have embarked on a fully autonomous vehicle. A front facing camera streams live to a screen in the passenger compartment is considered as the forward view is blocked. Additional equipment for the passenger support consists of two screens (with speakers) interfacing custom developed applications. Pilot preparation and testing takes place from January to May 2021. The four batches of the summer wave take place in June and July, while the fall wave is executed in September 2021. This timing might be adjusted due to the Covid-19 situation if needed. However, the pilot is divided into several batches to minimise the re-scheduling risks.

3.2.7 Scheduling

The scheduling is as follows:

T1.1 (M20-M24) pilot design and preparation of bus setup for tests (modification of a serial production bus to imitate an autonomous bus) preparation of test scenario/track, development of passenger assistance application, briefing meetings and completion of questionnaires, execution;

T1.2 (M25-M30) Execution of six batches divided into two waves, data analysis and subsequent conclusions.

3.2.8 Staff

Staff is composed of 9 persons covering the following roles required for each pilot wave execution:

[6] https://www.truck-bus.lu/

- Pilot production managers who take care of the moderation and documentation of the pilots;
- Participants' recruitment manager;
- Passengers' manager accompanying the testers during all stages of the pilot execution;
- Pollsters to conduct the surveys and interviews and assist the visually impaired participants;
- Technology trainer responsible for introduction of demo to passengers and "eco-training";
- "Game master" responsible for controlling the application assisting passengers;
- PT operations officer seated at simulated operator's control room;
- Professional bus driver who operates the bus;
- Track supervisor responsible for preparing the pilot track, and ensuring track safety during the pilot;
- In-vehicle and at bus stops support staff helping to steer experiments in the pre-defined direction;
- Vehicle preparation manager responsible for vehicle preparation.

Furthermore, the European Blind Union [7] (EBU) assists during the recruiting of visually impaired participants and offers support to render the questionnaires and pilot execution accessible to these participants. Volvo Buses provides the buses as well as technical guidance related to autonomous buses.

3.2.9 Pilot documentation

The progression and execution of each pilot is documented through the number of surveys filled out, completed interviews, and the report made by the pilot production manager for each batch of any wave. In addition, observations of staff present during the pilot are documented in notes and integrated into the Incident Reporting Form [8]. Bus operations are documented using the connected fleet management system's historic data logging capabilities. The external conditions (weather, lighting, etc.) are reported on by the pilot staff by means of the common form. A separate

[7] http://www.euroblind.org/

[8] https://docs.google.com/forms/d/e/1FAIpQLSdlVsNafDPBqn3aHZdLEsPzUyklNdStZYpCiTWIqrfIGUUmUw/viewform

form is completed for each batch of participants. It collects information related to the following topics:

- ToolID;
- CountryID;
- ScenarioID;
- TestID;
- UserID;
- StartTime;
- StopTime;
- Pilot name;
- Wave number (if applicable);
- Incidents related to the pilot (if any);
- Incidents unrelated to the pilot (if any);
- Weather conditions;
- Size of batches;
- Additional comments & feedback.

The final documentation summarising all waves and batches also includes a detailed description of the use passenger's assistance application developed for the pilot.

3.2.10 Test moderation

The pilot is moderated by the pilot production managers, who give an introduction to CAV technologies, the PAsCAL project and the participants' role within the pilot execution. Furthermore, they accompany them throughout their entire journey and work closely with the passengers' supervisors. The pilot production managers are also responsible for the "eco training" focusing on societal and environmental benefits of CAVs applied to PT. The pilot production managers are responsible for filling out the Incidence Reporting Form during the pilot execution. The passenger supervisor assists the production manager with the documentation of such incidences. The passenger's supervisors also inform the participants of data protection policies, the goal of the pilots, and where they can find out about the conclusions of the project.

3.2.11 Accessibility

During the pilot execution, the only participants with specific accessibility needs are the blind and visually impaired passengers' group. Their responses and perceptions are one of the main focus points of this pilot and therefore, the entire pilot is rendered accessible for blind or partially sighted users. Any text messages or announcements are available in audible form. If another interaction is required, accessibility functionalities of Apple's VoiceOver and Google's Talkback are leveraged on any devices used in the pilot execution. They allow any application to read text out loud when single-touching the screen as well as navigating the UI elements sequentially with double touches.

3.2.12 Data collection from users

Users fill in questionnaires composed of two main parts being i) background questions related to the participant and their prior CAV experience, ii) technical questions predominantly related to the evaluation of the perceived CAV technology and passenger assistance applications. These technical questions seek to evaluate the level of acceptance by society and (vulnerable) users in a series of qualitative questions influenced by the prior pilot experience. In addition, an interview is carried with selected participants. Vehicle-related data (trajectory, idling profile, etc.) are logged using a fleet management system. Furthermore, each participant is asked to sign or otherwise agree to a data protection policy, informing each user of the kind of data gathered over the course of the pilot execution and how their data is handled. Visually impaired participants receive support to sign such document from volunteers/staff of the DBSV[9] (the German member of the EBU). The full data protection agreement for both individual participants as well as organisations has been attached in full to Annex II.

3.2.13 Contribution to dissemination activities

Data collected from the surveys, interviews, report forms, video recordings and staff observations is used to build a comprehensive analysis for each pilot. The preliminary conclusions are presented in the Deliverable D6.3, presenting the dynamics of all stakeholders involved in CAV integration to PT operations. The assignment of specific responsibilities to each of stakeholders is defined, with justifications obtained thanks to the project. Results and conclusions of the pilot are communicated to several stakeholders in order to generate awareness about specific challenges related to CAV integration that cannot be addressed by a single authority. A roadmap emphasizing the need for a collaborative, multi-stakeholder

[9] https://www.dbsv.org/

approach to address the integration challenges is created. Project results are discussed in focus groups involving selected PT authorities and operators to better shape the project outcomes and dissemination strategies. Wider public dissemination takes place by using the platforms of several technical-oriented conferences such as ERTICO ITS Congresses [10] as well as public transport events (e.g. UITP Public Transport Summit[11]). Photo footage gathered during the pilot executions can further be diffused in magazines or news articles (in particular Paper Jam[12], Luxembourg) or social media posts and on the website of the project of the E-Bus Competence Centre[13]. Any dissemination activity is shared and communicated in advance with all WP partners to ensure a coordinated and shared dissemination strategy is followed (see Table 2).

3.3 Workplan

The workplan for pilot 1 is given in Table 4 and illustrated in Figure 5 It starts with pilot preparation which is composed of pre-study and design phase of the pilot waves. The design phase includes developing applications providing passenger assistance. This is followed testing and execution of the pilot.

Table 4 Pilot 1 overall workplan

Year	2021											2022		
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30	M31	M32	M33	M34
Pilot preparation	■	■	■	■	■										
Pilot follow-up						■	■	■	■	■	■				

The Workplan for the pilot is composed of the pilot preparation, a focus group meeting and four batches of testers in the summer wave and two batches in the fall wave. The benefit of dividing the pilot into multiple waves is that it allows to optimise the pilot based on the experiences and especially the shortcomings or oversights of previous waves. Each of the waves spans over 3 days. It consists of staff briefing, preparation of equipment-bus/assistance applications/test track, wave execution,

[10] https://ertico.com/its-congress/
[11] https://uitpsummit.org/
[12] https://paperjam.lu/
[13] https://ebcc.lu/

collection of surveys, and debriefing. The wave execution includes the briefing of the testers, the implementation of the pilot as well as the monitoring of and interviews with the testers.

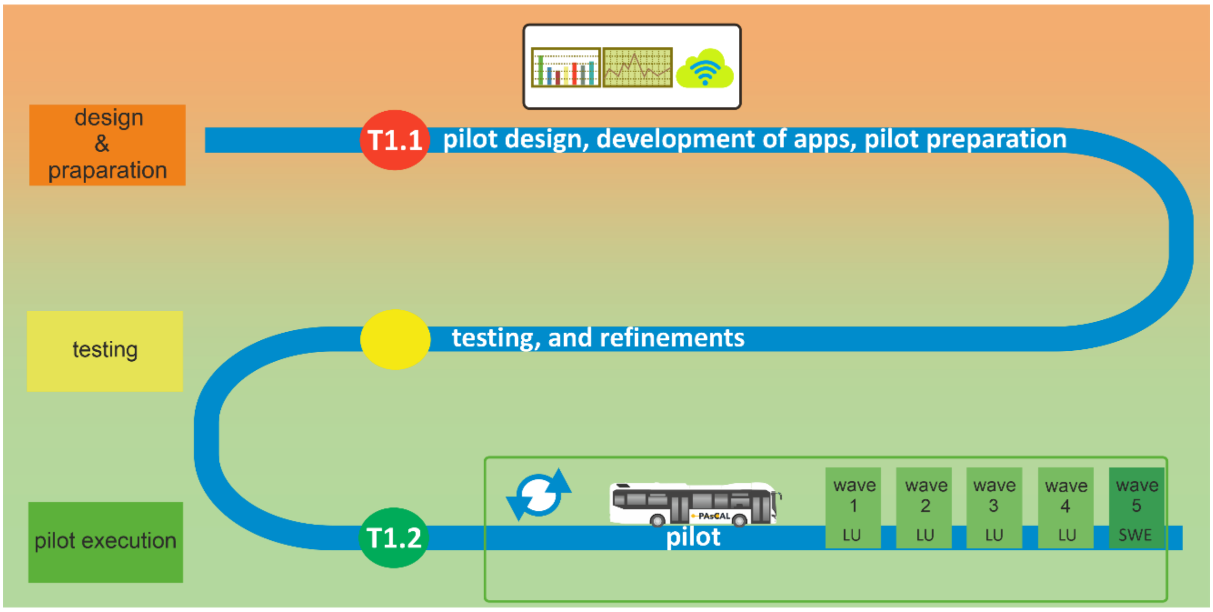

Figure 5 Pilot 1 workplan

This Workplan is periodically reviewed and edited if necessary, the eventual actual workplan is presented in Deliverable D6.3 following the pilot execution. The partners stay in close contact and exchange constant feedback to be able to modify their respective workplans spontaneously in case of needs.

4 Pilot 2: Autonomous driving training

4.1 Introduction

It is widely recognised that current driving training offerings need to be updated and adapted to enable drivers to gather new knowledge and skills to properly manage and interact with the new technologies embedded in connected and automated vehicles progressively sharing the roads with traditional ones. Today, as a matter of fact, the teaching given in the driving schools in the European Union generally does not consider any level of autonomy of the vehicle, apart from some cases, some system ascribable to level 1, whereas safe driving centres' activities mostly focus on the correct use of level 2 automated systems, which are implemented in the latest vehicle models but are still unknown in their operational use by most users. In the near future, first level 3 and later, level 4 automated vehicles progressively start to share the roads with lower-level vehicles. For road safety reasons, the drivers of these vehicles should be aware of automated vehicles' abilities, how to correctly use them and when and to what extent the responsibility for driving are attributable to the driver or to the vehicle. To assess to what extent and how to innovate road education is one of the goals of the PAsCAL project, as well as to assess if and how a targeted road education can help users to accept these new technologies. The dedicated road training methods, which have been developed in Work Package 5 are to be tested and further enhanced in this pilot execution.

This pilot's goal is to test the functionality of the training methodology developed in WP5 using a real CAV, in specific critical situations simulated and to collect information about the level of acceptance of the test on a real vehicle, to allow comparison with those collected in the test phase with the simulator.

4.2 Detailed pilot description

4.2.1 Scope and purpose

The Autonomous driving training pilot tests in a real but safe environment the functionality of the driving training guidelines and recommendations for level 3 and level 4 automated vehicles drivers developed within the simulated environment in WP 5. The pilot takes place at the ACI - Sara

Safe Driving Centre [14] in Lainate, Italy, where ordinary daily driving situations as well as the most challenging and/or uncertain situations are reproduced under realistic yet safe road and traffic conditions. All of the three categories of drivers considered in WP5 (trainers, learner/experienced and professional drivers) experience these situations using at least a level 3 automated CAV. With reference to driving training, the pilot's goal is to ascertain the validity and efficiency of the training guidelines and methodology developed through the observation of the tests performed with the so-called Home Study Simulator, a driving simulator which has been specifically developed by LIST[15] with the help of the other WP5 partners with regard to driving education needs. Moreover, the pilot also assesses wherever there is any difference in the acceptance of CAVs between simulated conditions and real conditions by involving a mixed group of testers some of which already participated in the WP5 simulations and, therefore, should be more familiar with higher levels of automation while others have not.

4.2.2 Scenarios

The design of pilot's scenarios refers, in whole or in part, to the scenarios proposed in WP5 and its simulations. The pilot consists of two waves of 2 batches of 15-20 testers each and the entire pilot includes a total of at least 75 participants.

The first wave consists of 35 testers, made up of 30 experienced and 5 professional drivers. They are grouped in two batches according to whether or not they previously participated in the WP5 simulations.

The second wave is dedicated to 35 novice drivers and 5 trainers. Novice drivers participate to the tests together with their usual well-known trainers, to avoid adding unnecessary stress to an unknown situation. Also, this group is divided in 2 batches, according to whether or not they previously participated to the WP 5 simulations.

At the beginning of each day, the ACI Ready2Go[16] staff introduces the concept of CAVs, presents the PAsCAL project, illustrates the objectives and motivations of the pilot as well as the daily agenda and which concrete activities are carried out by the participants.

[14] https://guidasicura.vallelunga.it
[15] https://www.list.lu/
[16] http://www.ready2go.aci.it/

The tests reproduce as much as possible the scenarios tested in WP5 through the use of the simulator, as allowed by the characteristics of the vehicle and of the Laiante Safe Driving Centre.

The WP5 simulations take into account the following considerations on and distinctive features of an urban environment: road intersections (crossroads and roundabouts), vertical/horizontal road signs, traffic lights, pedestrian crossings, public transport stops, traffic volumes and types of road users.

As to the experienced drivers, the test assesses their level of acceptance of autonomous driving systems. In particular, during the level 3 CAV test, the driver should avoid interacting with the vehicle controls. Conversely, during level 4 CAV simulations, the tests assess the ability of the driver to regain control of the vehicle, by analysing their ability to evaluate and react to a CAV system request.

As to the learner drivers, the urban environment is always the first and most complex situation in which to learn to drive. Differently from the experienced driver, in the level 3 CAV simulation, the tests must focus on the driver's ability to promptly and correctly assess the circumstances in which it would be better/necessary to regain control of the vehicle. In level 4 CAV driving, tests must evaluate the driver's ability to respond to the CAV's request to regain control of the vehicle as well as their ability to correctly interact with the vehicle controls to continue a safe journey.

The WP5 tests consider 4 main features:

4.2.2.1 *Intersections*

The simultaneous presence of a number of vehicles with different automation levels (from 0 to 4) is envisaged. The staff evaluates:

1. The driver's ability to rely on the autonomous vehicle to engage and then correctly clear the intersection;

2. Their ability to assess the situation and regain control of the vehicle to safely engage and clear the intersection.

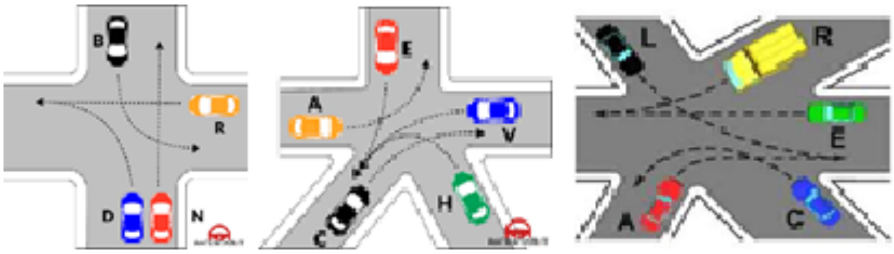

Figure 6 Pilot 2 examples of intersections

4.2.2.2 Roundabouts

The simultaneous presence of a number of vehicles with different automation levels (from 0 to 4) is envisaged. The staff evaluates:

1. The driver's ability to rely on the autonomous vehicle to engage and then correctly clear the roundabout;
2. Their ability to assess the situation and regain control of the vehicle to safely engage and clear the roundabout.

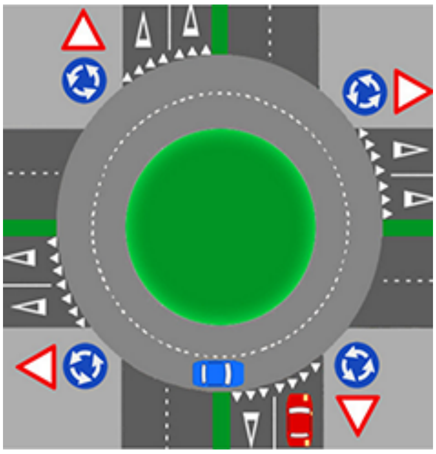

Figure 7 Pilot 2 example of roundabout

4.2.2.3 Pedestrian crossing

The presence of an obstacle (person or object) not clearly visible is envisaged. The staff evaluates:

1. The driver's ability to rely on the autonomous vehicle;
2. Their ability to assess the situation and regain control of the vehicle if required to do so by the vehicle.

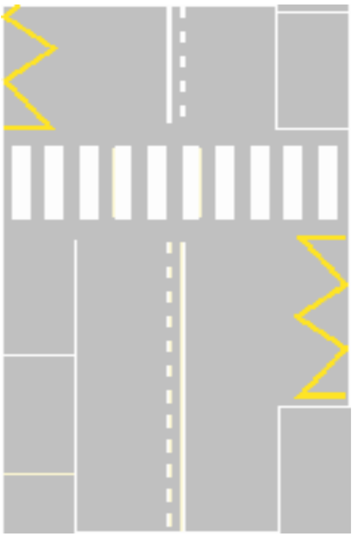

Figure 8 Pilot 2 example of pedestrian crossing

4.2.2.4 Pedestrian and cycle crossing

The simultaneous presence of a number of vehicles with different automation levels (from 0 to 4) as well as of pedestrians and cyclists is envisaged. The staff evaluates:

1. The driver's ability to rely on the autonomous vehicle;
2. Their ability to assess the situation and regain control of the vehicle if required to do so by the vehicle.

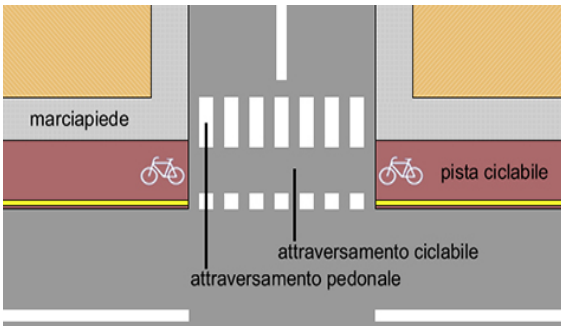

Figure 9 Pilot 2 example of pedestrian and cycle crossing

In all of these situations, an additional variable is constituted by the behaviour of the other subjects present (vehicles, pedestrians, cyclists), who in some cases must have a conscientious and conservative attitude and in others less so.

After the pilot execution, each participant fills out a questionnaire on a smartphone or tablet and eventually answers to interviews, while a final group debriefing of each batch closes each days' sessions.

4.2.3 Assumptions

This pilot works on the assumption that present road education does not respond to the needs introduced by vehicles with higher levels of automation. Therefore, it has to be updated and adapted to teach regular and professional drivers how to drive in the new, different CAV's populated environment.

WP5 is able to contribute to this document by providing only general indications as the initial planning has been postponed. Despite the preliminary release of the urban environment part of the Home Study Simulator by WP5 partners, the final version is yet to be released at the moment of publishing this document and the subsequent test phase with drivers is about to start. This updated time line is reflected in the new Gantt of PAsCAL linked to the amendment request for a 6 months extension of the project. WP 5 initiated the development of a dedicated road training method and guidelines with the help of simulations.

The adequacy of the guidelines and methodologies are operationally tested in the protected and safe environment of the Safe Driving centre. This environment makes it possible to safely reproduce realistic, non-motorway, urban road traffic situations.

It is in fact impossible to reproduce, in the limited area of a safe driving centre, the most relevant characteristic that influences the driving of a CAV in a motorway environment, namely the length and monotony of driving. This is the characteristic that can affect the driver's ability to correctly evaluate and react promptly to an unforeseen situation that requires the driver to regain control of the automated vehicle.

From the test carried out by those who have been able to try both the simulator and the test vehicle, useful information can be acquired to refine and accredit the proposed methodology.

In collaboration with WP4, several Human Machine Interfaces (HMIs) have been considered. For pilot 2, the HMIs 2.1 Click Wheel, 2.2 Vibration steering wheel or gloves, 2.5 Visual clues about sound signals, 2.7 In-car communication, 2.8 Explain deviant driving behaviour as well as 2.10 Vehicle information in mixed traffic has been considered and could be implemented into the existing technology. These HMIs can both be integrated into CAVs of 3, 4 and 5 level of autonomy.

4.2.4 Questionnaires

The questionnaires are conducted by interviewers and/or the participants themselves following the on-site deployment of the pilot using the tool Qualtrics that has been selected by the Work Package partners. The questionnaire for the autonomous driving training pilot consists of 36 questions. The questionnaire is attached in full in Annex I: Surveys. It is administered in the same form to all categories of drivers who participate including trainers, learner, experienced and professional drivers, to also highlight whether a different level of experience, knowledge and perspective may influence the participant's perception. The questionnaire contains 19 questions regarding background information, which are partially multiple choice, single choice or require demographic information, as well as 17 technical questions which are also single choice or multiple choice focussing on the acceptance of CAVs and the adequacy and relevance of the training the participants receive as well as an open text field at the end of the questionnaire to give any feedback on the pilot and the project. The questions seek to answer to the Key Performance Indicators (KPIs) defined and detailed in Deliverable 7.2 of WP7. Subsequently, each question is classified according to its' type (technical or background) and a KPI, which it seeks to explore. The KPIs addressed by the pilot questionnaire for users belong to the following indicator categories:

- Indicators of acceptance by end users;
- Indicators of society level acceptance.

Furthermore, interviews are conducted on-site aimed at assessing the validity and effectiveness of the didactic methods developed. These interviews are prepared, adapted and perfected during WP 5 and the obtained information is documented by the staff's reports.

4.2.5 Tester considerations

The targeted number of testers is at least 75 persons. They are recruited partly among the driving schools' learners and the experienced/professional drivers who previously participated in the WP 5 simulations, others are recruited among driving schools' trainers and learners and among participants to the ordinary safe driving courses (expert and professional drivers) held at the Lainate centre who experience the CAV drive without previous exposure to any simulation. At least 5 of them are professional drivers - persons whose occupation involves driving a vehicle, such as taxi drivers, bus or truck drivers- and 30 are experienced drivers - persons who have obtained their driving licence since at least three years and have thus acquired three years long driving experience. Among participants there are also at least 2 of the trainers who previously participated in the WP 5 simulation tests as well as 2 trainers who did not participate in the simulation tests and do not have CAV driving experience. Also, the remaining 35 novice drivers are partly selected among those who previously participated in WP 5 simulations.

Moreover, the modality of execution of the pilot's tests is influenced by the Covid-19 pandemic at the actual time of execution of the pilot, by requiring the vehicle and other equipment to be sanitized in-between tests and by imposing greater distances between testers and observers, which could make the work of the latter difficult and less precise.

4.2.6 Location and equipment needed

As stated above, the pilot takes place at the ACI - Sara Safe Driving Centre in Lainate, near Milan, Italy. This kind of safe driving centre is usually meant for already licensed drivers who improve their knowledge and ability to control their reactions, to anticipate the behaviour of the vehicle and to choose the best manoeuvre to avoid any accidents.

Figure 10 Pilot 2 ACI Sara Safe Driving Centre overview

The facility includes five areas featuring technologies such as low grip resins applied to the tarmac surface, water walls and other devices to simulate sudden obstacles, low visibility and unexpected skidding. These areas render it possible to simulate dangerous driving situations such as aquaplaning, reduced grip, understeer or oversteer at low speeds. The ACI[17] and ACI Ready2Go staff cooperates with the centre's staff to plan and implement with the help of the centre's facilities and technologies the necessary activities to reproduce the critical situations selected to test drive with a CAV and validate the teaching methodology developed for this purpose.

One or several level 3+ CAVs are used at the pilot site by the testers to test the selected road driving situations. The actual technical characteristics of the vehicle that can be used for the pilot test phase are also decisive and affect how much and how it allows the interaction with scenarios at the Safe Driving Centre. The pilot vehicle, still experimental, has to be supplied by a manufacturer external to the project.

4.2.7 Scheduling

The pilot consists of a preparation phase, a public testing phase and a final phase dedicated to the analysis of the results. The preparation phase is based on the results of WP 5 to decide which critical CAV driving situations are best suited to validate the training methodology developed in WP 5.

The public testing phase of the pilot is executed over the course of sixteen days and takes place once the simulations planned in WP 5 have been carried out.

The final phase takes place in the immediately following days after the end of the public testing phase.

The pilot takes place after WP5 has elaborated the driving training methodology for levels 3 and 4 of automation.

T1.1 (M24-M30) Validation of the outcomes of WP5 in a real CAV environment using a rented CAV at the ACI Vallelunga Safe Driving centre of Lainate, reproducing on track the most challenging situations previously identified. The tests compare trained to untrained drivers following a randomized controlled trial design on a total of 70 drivers/non drivers. The

[17] http://www.aci.it/

tests also enquire possible drivers' behavioural changes and different acceptance between simulated and real environment.

T1.2 (M31-M34) Validation of the outcomes of WP5 in a real CAV environment using a rented CAV at the ACI Vallelunga Safe Driving Centre of Lainate targeted at professional drivers. It is carried out over a period of 16 days on at least 5 professional drivers. The tests enquire possible drivers' behavioural changes and different acceptance between simulated and real environment.

4.2.8 Staff

In order to successfully conduct and complete this pilot a group of qualified staff members are included, namely as follows:

- Four ACI Ready2Go staff members who participated in the training methodology development, and who take care of the moderation and documentation of the pilots and accompany the testers during all stages of the pilot execution. They aid during the execution of interviews and provide feedback. Other staff of the Safe Driving Centre is involved from the early stages of the pilot planning.
- Two social media mangers and one photographer and video editor with standard equipment to produce, post produce and publish visual materials, such as photos, videos, stories and possibly direct streaming for dissemination purposes.
- Moreover, the trainers of ACI's Ready2Go and RED [18] driving schools who actively participated in the WP 5's development of the training method dedicated to CAV vehicles are present and cooperate with the other staff with interviews, observations and evaluating activities and gather insightful valuable feedback.

4.2.9 Pilot documentation

The pilot progression and execution are documented through the number of surveys filled out, the available video recordings, the interview recordings and/or notes of the staff and data from the application as well as observations of the partners, documented in notes. The related external conditions are reported on by the pilot staff by means of an Incidence

[18] https://www.reddrivingschool.com. RED is the driving school partner of PAsCAL involved with ACI in WP 5 in the development of the driving training methodology dedicated to higher levels of automation vehicles planned.

reporting form. This form collects information of each pilot respectively related to the following topics:

- ToolID;
- CountryID;
- ScenarioID;
- TestID;
- UserID;
- StartTime;
- StopTime;
- Pilot name;
- Wave number (if applicable);
- Incidents related to the pilot (if any);
- Incidents unrelated to the pilot (if any);
- Weather conditions;
- Size of batches;
- Additional comments & feedback.

This provides additional information for the data analysis. Subsequently, an Incident Reporting Form has been created and shared with the pilot staff and has to be completed at the end of each pilot wave to document possible issues or obstacles which can be taken into account for the planning and execution of the following pilot waves.

4.2.10 Test moderation

Throughout each testing day of the pilot, the ACI Ready2Go staff takes on the role of the moderator, they introduce the testers to the scenario beforehand, explain the purpose of the tests and their practical development, and answer any questions the participants may have. The team also informs the participants of data protection policies, the goal of the pilots and where they can find out the conclusions of the project after its end. This ensures that the moderators can fill out the documentation form during the tests and note down any and all obstacles as well as any reaction of the testers as well as any problem they may encounter.

4.2.11 Accessibility

Due to the characteristics of the pilot, the participation of people with disabilities is currently not envisaged. With regard to the questionnaires, they are filled out anonymously by testers directly on their personal smartphones and/or by interviewing staff in order to ensure that the participation in the questionnaire is accessible and easy for all participants, regardless of ownership over a smartphone. Therefore, full accessibility of the pilot for all participants is ensured.

4.2.12 Data collection from users

The main source of information for the PAsCAL project are the questionnaires, which are asked verbally by pollsters to the users or filled out by the users themselves using their personal smartphone. The answers are recorded using a tablet or other mobile device, using the previously mentioned survey software Qualtrics. Finally, the pooled data is exported by this WP's leader, Etelätär Innovation to be analysed by the partners in WP7 and by the pilot managers. The questionnaires are structured in such a way as they allow any tester and participant to remain anonymous and the participants are informed in detail on their privacy and data protection rights and the corresponding policy of the pilot by the respective manager of each group. Furthermore, participants can request to be excluded from any video or photo footage which may be used for dissemination purposes later.

Additional information is documented via video recordings of the interviews, the physical testing of the pilot and notes of the training instructors as well as the Incident Reporting Forms, which are filled out by each manager.

4.2.13 Contribution to dissemination activities

The press, specialised and generalist, are invited to the first two days of the pilot, they can follow the activities and may also take part in the tests. A press release is issued to announce and explain the pilot and its goals and spread out to national and local medias.

Throughout the 16 days of the pilot, two social media managers and a photographer produce, edit and publish visual material, such as photos, videos, stories and possibly direct streaming through PAsCAL social media[19].

[19] https://twitter.com/ProjectPascal
https://www.facebook.com/pascalprojecteu/
https://www.linkedin.com/company/pascalprojecteu/

Video and photo footage materials can be later used to create further dissemination materials for the promotion of the project in the press, on social media posts and on the PAsCAL website[20].

At the end of the pilot execution, an event is planned to be held within the three weeks after the pilot finalises at the premises of the Automobile Club of Milan[21], ACI's local representative office to present the results of the pilot and spread awareness of the PAsCAL project and its objectives. Local authorities and media, including specialised press, are invited to the event, in order to ensure maximum visibility. At least one article dedicated to the pilot and its results are published in ACI's online magazines Onda Verde and L'Automobile[22] and most likely in other newspapers and magazines.

4.3 Workplan

The workplan for the pilot is composed of the pilot preparation, and two waves of data collection, taking 16 days each as well as the final wave results verification. The benefit of conducting the surveys in waves is that learnings from previous waves can be used to improve the next wave of the same pilot and ensure the identification of shortcomings or disturbance variables.

The pilot preparation comprises the briefing of the staff, the verification of the pilot location and of the feasibility of the specific tests envisaged, and the preparation of equipment needed.

The first wave is dedicated to tests with experienced and professional drivers and includes the briefing of the testers, the implementation of the pilot as well as the monitoring of activities and interviews with the testers.

A day in between the two waves of data collection is dedicated to the analysis of the difficulties encountered to eventually modify the tests scenarios adapting them to the identified needs.

The second wave of data collection is dedicated to tests with learner drivers and their trainers. It includes the briefing of the testers, the implementation of the pilot test as well as the monitoring of activities and the interviews with the testers.

[20] https://www.pascal-project.eu/concept
[21] http://www.milano.aci.it/
[22] https://www.lautomobile.aci.it/

Each of the phases consists of several subtasks.

This workplan shall be reviewed and edited if necessary. The partners stay in close contact and exchange constant feedback in order to be able to modify the workplan spontaneously in case it is needed.

Table 5 Pilot 2 overall workplan

Year	2021												2022		
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30	M31	M32	M33	M34
Pilot preparation															
First wave															
Second wave															
Wave result verification															

Table 6 Pilot 2 wave workplan

Day	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Wave setup																
Team briefing																
Material preparation																
Location verification																
Wave ready																
Wave execution																
Briefing with testers																
Tests																
Monitoring and Documentation																
Surveys/Interviews																
Wave completed																

5 Pilot 3: Autonomous bus line

5.1 Introduction

The main subject of this pilot is a fully operational autonomous bus line within in the public transport system of Madrid, Spain. The line is part of a wider network and connects to several other modes of transport within the system, making it multi-modal and accessible to the paying general public. The bus itself is a level 4 autonomous vehicle, which operates on a public road, where it shares a lane with other traffic participants such as individual traffic and pedestrians as well as commercial busses. The bus line is commercial and has been created through a collaboration between the biggest Spanish bus operator, ALSA[23], the Spanish Road Traffic Directorate (Dirección General de Tráfico, DGT [24]) and Madrid's Regional Transport Authority (Consorcio Regional de Transportes de Madrid, CRTM)[25]. Furthermore, the Spanish Road Association[26] (AEC) is involved in the planning and execution of the pilot as local subcontractor.

Figure 11 Pilot 3 autonomous bus

The line has been fully operational since its implementation in October 2020 and has been tested extensively for over 8 months before the pilot

[23]https://www.alsa.es/

[24] https://www.dgt.es/es/

[25] https://www.crtm.es/

[26] https://www.aecarretera.com/

implementation takes place. Due to legal requirements, a so-called instructor has to be on-board at all times to take control over the vehicle in case of emergencies – they are equipped with a remote control, which is connected to the steering function of the CAV. Although the bus has been designed to be fully autonomous, it is also possible for the operator to connect a steering wheel in the front of the vehicle and turn it into a manually steered bus where needed.

Figure 12 Pilot 3 remote control

Throughout the pilot execution, participants follow a specific scenario to experience all of the autonomous features of the bus. They are then asked to fill out a survey and give their opinion and share their impressions on the service as well as define their overall willingness to pay for such a bus line. Furthermore, other traffic participants are asked to fill out a second survey to explore whether they find the CAV disruptive for traffic flows and what aspects of the vehicle they believe to be particularly disruptive. One of the focal points of this pilot is to also explore the integration of CAVs into multimodal systems and networks, including their added value, potential hurdles, overall success of the integration and their perceived safety.

5.2 Detailed pilot description

5.2.1 Scope and purpose

This pilot explores the perception of users of a commercial autonomous bus line on their way to run errands or commute to and from their place of work. Suitable testers from Madrid, also including some vulnerable travellers are recorded using the autonomous bus service, following several predefined scenarios. They are asked to navigate around the bus in the context of a fully developed multimodal system, and later complete the questionnaires. Other participants consist of normal road users, including pedestrians, bicyclists, and car drivers, who are asked to complete the survey in-situ and on the spot. Throughout the entire process, the testers are observed, and possible issues can be documented and recorded. The pilot is deducted in collaboration with the *Universidad Autónoma de Madrid* (UAM)[27], which apart from providing direct contact to testers who use the bus on a daily basis on their commute and are used to the service, are also able to point out additional common issues that users may have pointed out over the previous 8 months of testing.

The bus line itself has a total length of 3.7 kilometres and is comprised of 7 bus stops in total. The stops are connected to the “Cantoblanco Universidad” suburban railway station as well as the interurban bus network of the wider Madrid area. It runs once an hour and its’ track is marked by a green line, to draw other road user’s attention to the direction and course the bus follows as to avoid accidents and give an intuitive indication of its’ trajectory. The bus line crosses a mixture of roads, including pedestrian passing and roundabouts as well as intersections and it mostly shares the street with other modes of transport.

The pilot consists of 3 waves, which include a sufficient number of batches of testers each (200 testers in total). For each wave, a scenario has been constructed, which 25 batches of 6 testers each follow during the execution of the physical pilot. Their input specifically on their willingness to pay, the perceived usefulness of the service and its compatibility with existing multimodal transport systems is of great interest. Furthermore, at least 50 other road users are asked to fill out a second survey focussing on their perception on the CAV under normal traffic conditions. Their input focusses specifically on the disruptiveness and perceived usefulness of the service and is also of great interest.

[27] http://www.uam.es/uam/inicio

Figure 13 Pilot 3 track overview

Ideally, both pilot parts shall lead to interesting insights on the existing service and its acceptance with users and explore possibilities to significantly improve the service, identify its most striking shortcomings and identify ways to better cater to several different user groups.

5.2.2 Scenarios

Multiple possible scenarios have been considered for the pilot deployment of this autonomous bus line. Several different navigation routes within the platform have been consulted, and different research questions and aspects of the bus service have been explored. Since the purpose of the pilot is to explore especially the multimodal aspect of the service, to explore the integrability of the service into the wider traffic network and research the attitude of individual traffic users towards the vehicle, three scenarios have been designed.

Figure 14 Pilot 3 bus stops on a screen aboard the bus

The pilots are conducted in waves, ensuring that oversights can be communicated, taken into account and straightened out in following wave executions. This approach ensures efficient and quick adaptability of the pilot to any possible external disruption, especially taking into account the uncertain situation of the Covid-19 pandemic in Madrid at this time and the limited number of users who can take the bus at any given time. The currently proposed scenarios have been tested in May 2021, when the service ran smoothly, and all stops were available. A few alternative routes can be used in case of unforeseen disturbances. Also, an Incidence Reporting Form is completed for each of the wave iterations in order to document incidences during the implementation.

5.2.2.1 Pilot 3 scenario 1

The first route picks up some testers at “Cantoblanco Universidad” railway station. Here, the bus is connected to the suburban train line C4[28], which crosses Madrid centre from the north, connecting either Colmenar Viejo or Alcobendas to the south, in Parla. Most students, employees, and visitors of the UAM campus arrive here and need to cover sometimes up

[28] http://www.mapamadrid.net/linea-de-cercanias-c4-parla-colmenar-viejo-san-sebastian-de-los-reyes/

to 2 km of walking distance across the area. The scenario ends at the bus stop “Politécnica”.

Figure 15 Pilot 3 scenario 1 stops schematic

The total trip covers one kilometre and passes two other bus stops. The route lasts a duration of 14 minutes on average under normal conditions. In this scenario, the multimodal integration of the bus service can be explored and is highlighted to the testers by asking them to start their trip inside a train.

5.2.2.2 Pilot 3 scenario 2

The second scenario starts in the bus stop in front of the Polytechnic School, which also doubles as a bus station for medium-distance buses “Interurbanos”[29] connecting the campus to Madrid centre and other suburbs in the area. It ends at the residence hall, stop “Residencia” where some of the students in the university live. This route takes around 12 minutes covering 1,3 Km in a road shared under regular traffic conditions. This scenario simulates a common trajectory and explores the participants’ acceptance of the vehicle on their daily commute.

[29] https://www.redtransporte.com/madrid/autobuses-interurbanos/

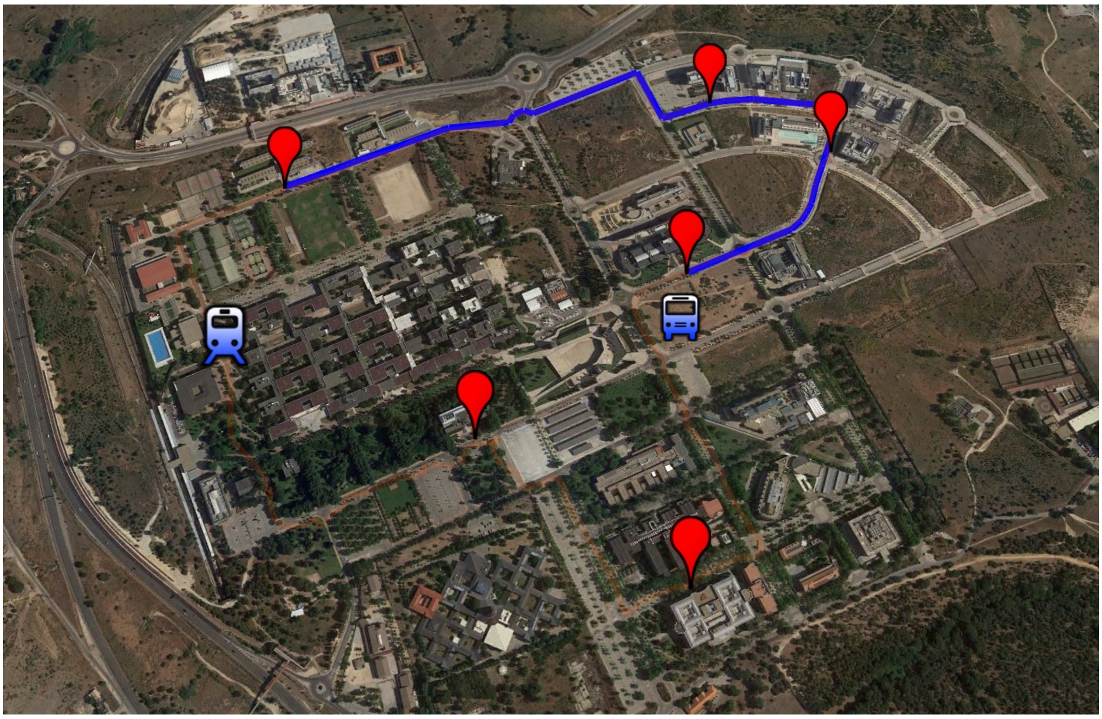

Figure 16 Plot 3 scenario 2 stops schematic

5.2.2.3 Pilot 3 scenario 3

The final scenario consists of a loop around the entire path. The bus circles this area several times repeatedly without the need of any passengers on board, except the instructor for safety reasons.

During this scenario, the staff stops several different road users such as cyclists, pedestrians and other car drivers to ask them to respond to a questionnaire asking them about their perception of the autonomous bus service in normal traffic flows they have just witnessed.

This scenario is of great importance to understand the actual level of disruptiveness of the vehicle and subsequently the adapted traffic rules in the area (e.g. change of the usual right of way in roundabouts).

5.2.3 Assumptions

Most current and running applications of autonomous vehicles do not yet connect to or are not integrated with other modes of transportation and usually have a dedicated lane where they have the right of way, if they are implemented into a regular urban traffic network. Furthermore, much of the information on the perceived usefulness of multimodal CAVs and their perceived disruptiveness by other road users is still missing or incomplete.

Finally, many active services today are not operating commercially and therefore do not charge their users a fee for using the bus – pilot 3 offers a rare insight into the commercial viability of autonomous vehicles. In conclusion, autonomous vehicles need to be piloted under more realistic conditions, including other modes of transport, and other vehicles or co-road users and their economic viability needs to be further explored. It can be assumed that this pilot delivers important new insights on all of these aspects and beyond.

In collaboration with WP4, several Human Machine Interfaces (HMIs) have been considered. For pilot 3, the HMIs 2.7 In-car communication as well as 2.8 Explain deviant driving behaviour has been considered and could be implemented into the existing technology. These HMIs can both be integrated into CAVs of 3, 4 and 5 level of autonomy and use communication technology within a vehicle using a device or interface to inform passengers on the status of the vehicle, it's progress along the route, estimated time of arrival (ETA) and warn the passengers in case of emergencies, perturbations or constructions on their way or inform them on a modified route in case of barred streets or pathways. Some of these features are included in the bus by default.

Figure 17 Pilot 3 existing HMI onboard

In addition, the HMIs can be further improved, adding additional information such as the ETA of trains and buses in connecting stations as well as logging the deviant driving behaviour of the vehicle, like sudden stops, to later compare it with the responses to the questionnaire and measure the impact such deviations have on the perception of the service.

5.2.4 Questionnaires

The questionnaires are conducted by the participants themselves on their personal smartphones following the on-site deployment of the pilot using the tool Qualtrics, as has been decided on by the work package partners. The questionnaire for regular users consists of 23 and the one for other road users on the street consists of 27 questions. These questionnaires have been attached in full in Annex I: Surveys. They contain technical questions, which are multiple choice as well as questions regarding background information, which are partially multiple choice and partially require demographic information to be entered as well as an option for open commentary. Every question seeks to answer one of the Key Performance Indicators (KPIs) defined and detailed in by project partners in Deliverable 7.2 of WP7. Subsequently, each question is classified according to its type (technical or background) and a KPI, which it seeks to explore. The KPIs addressed by the pilot 3 questionnaires for users all belong to the following indicator categories:

- Indicators of acceptance by end users;
- Indicators of acceptance by vulnerable users;
- Indicators of society level acceptance;
- Indicators of acceptance by road co-users.

The questionnaires have been carefully crafted using the feedback and experience of partners who worked on previous WP questionnaires of the project as well as the close exchange with the manufacturer of the bus, EasyMile[30], ALSA and UMA and the transport operators of Madrid.

5.2.5 Tester considerations

The targeted number of testers is 200 persons, including both bus users as well as other road users. Anyone can qualify as a tester, as long as they make use of the bus in a multi-modal way in combination with other means of public transport, to move within the university campus or have shared the road with the vehicle. Also, road users that share the street with the bus are considered as qualified testers. The questionaries are expected to be asked to a reasonable number of vulnerable passengers, such as people with disabilities, elderly persons, parents with a stroller, and travellers with heavy luggage.

[30] https://easymile.com/

The testers are recruited on the spot as people who would normally want to use the bus regardless of the pilot execution, through the University administration and in collaboration with different faculties of the University and through a local association for the elderly, called "Nadiesolo". Some testers might also come from a collaboration agreement Etelätär Innovation has with *Universidad Alfonso X* in Madrid[31] (UAX-Etelätär Centre for Collaborative Mobility), as well as the staff's personal network. The testers are expected to bring their smartphones; however, some can be provided in case they are needed. Testers are provided with the necessary tickets for each physical pilot testing within their batches as well as a water bottle or a soft drink.

5.2.6 Location and equipment needed

The pilot is conducted in the city of Madrid, Spain on the *Universidad Autónoma de Madrid* campus in Cantoblanco, a peripheral neighbourhood of the city. Madrid centre can easily be reached by either using a suburban train or a long-distance coach, which are located on opposite ends of the campus. On the University campus however, not many bus services operate on a continuous basis. Due to the large size of the campus, students, employees and visitors regularly need to walk up to 2 km to reach other parts of the campus.

After identifying the trajectories most frequently travelled by locals, several paths have been determined for the autonomous bus line. After thorough testing, one bus line has proven to be the most effective - it has been implemented across the campus and can be seen in Figure 13.

The bus itself is the EZ10 model[32], manufactured by EasyMile and operated by ALSA. The bus offers enough space to comfortably fit 6 seated and additionally 4 standing passengers at any time. However, due to covid restrictions, the bus capacity is limited to 7 travellers, which limits

[31] https://www.uax.com/en
[32] https://easymile.com/vehicle-solutions/ez10-passenger-shuttle

the batch size in the pilot execution. The vehicle is powered 100% by electricity and drives at an average speed of 15 km/h around the area.

Figure 18 Pilot 3 autonomous bus service model

This bus service has been the first to offer a fully autonomous vehicle without driver commercially to clients. It uses GPS geo-location as well as built-in sensors to navigate around the area and has been calibrated to follow a predetermined route.

The materials needed for this pilot consist of the users' smartphones to fill the surveys, the autonomous vehicle as well as the long-distance coaches and the train in order for users to follow Pilot 3 scenario 1.

Also, a sensor is included while the pilot is being performed in order to correlate users who respond very negatively to the survey with sudden breaking or other manoeuvres the bus may perform. Project partners from WP4 provide an HMI (Human-Machine Interface) to provide testers additional information on multi modal transport in order to complement the currently existing screens that informs the users.

5.2.7 Scheduling

T1.1 (M22-M24) The pilot setup serves in creating a detailed plan of the pilot executions including various different perspectives and consultants, investigating any possible obstacles and it is also used to inform all stakeholders of the planned activities. Together with the manufacturer, the operator and the University staff, realistic and valuable scenarios are defined. The scenarios are tested in person and the corresponding questionnaires are created and refined if needed. Following a kick-off meeting, all aspects and plans concerning the pilot are discussed and shared with all stakeholders and first interviews with students are conducted to identify the best possible timeslots throughout the months to follow for the pilot execution, taking into account summer break at the campus and vacations.

T1.2 (M25-M27) The first wave of the pilot execution takes place in Madrid, the participants follow Pilot 3 scenario 1 around the campus. The data collected focusses in particular on the multimodality of the autonomous bus line and it's perceived integrability and convenience. Participants are grouped into batches of 7 persons, due to the reduced capacity of the bus during the Covid-19 pandemic. The data is collected using the questionnaires, as well as the Incidence Reporting Form, the staff's observations and general feedback by the participants. Before the wave execution, a short FDG takes place at the meeting point to brief the participants, explain to them the scope and purpose of the project and this particular pilot and gather first impressions. After the pilot wave execution, the data is pooled and homogenised. The plans for the following pilot waves are revised and adapted where needed.

T1.3 (M28) The second wave of the pilot is scheduled to take place in the following month, allowing for enough time to adapt the schedule of this second wave in case of unforeseen obstacles or delays. During the execution of this pilot wave, vulnerable travellers are integrated into the group, including some elderly persons as well as some people with mobility constraints such as wheelchairs and crutches. The testers follow Pilot 3 scenario 2 and test the multimodality of the line within the overall system on the campus. Similar to the first pilot wave, a FDG takes place shortly before the pilot starts in person. Following the FESTA approach, the results of the second pilot wave are pooled, homogenised and evaluated to spot any inconsistencies or abnormalities in the data collection. Any deviations can be used to adapt the following and final pilot wave 3.

T1.4 (M29-M30) The third pilot wave also takes place after the summer break, during which the bus service is inactive due to low activity on and around the university campus. Participants of this last pilot wave follow Pilot 3 scenario 3, which focusses more on the perspective of other road users on the service. The group of testers consists other road participants such as pedestrians, cyclists and car drivers. As in the previous pilot waves, participants fill out a questionnaire after testing the bus. The last pilot wave is followed by a big data analysis and all data is forwarded to the partners in WP 7 (Impact).

5.2.8 Staff

In order to successfully conduct and complete this pilot a group of qualified staff is needed, including:

- One pollster to conduct the surveys and interviews;
- A manager who takes care of the moderation and documentation of the pilots and accompany the testers during all stages of the pilot execution;
- One videographer to record the interviews and create video content of the pilot testing for the dissemination videoclip;
- The AEC team is required to check the pilot scenario shortly beforehand to avoid unforeseen incidents and aid with the instructions concerning the functionality of the autonomous bus.

During the early stages of the planning and scheduling of all pilot 3 activities, several different stakeholders such as the operator ALSA, the operator of the surrounding transport network CRTM, the manufacturer of the bus EasyMile as well as the association representing the vulnerable travellers, namely “Nadiesolo” for elderly participants for participants with mobility constraints.

5.2.9 Pilot documentation

The pilot progression and execution are documented through the number of surveys, which have been filled out, the available video recordings as well as observations of the partners, documented in notes. The related external conditions are reported on by the pilot staff by means of a form. This form collects information of each pilot respectively related to the following topics:

- TestID;
- ToolID;
- CityID;
- ScenarioID;
- User Category;
- TripID;
- StartTime;

- StopTime;
- TripDuration;
- TripDistance;
- TripCost;
- Pilot name;
- Wave number (if applicable);
- Incidents related to the pilot (if any);
- Incidents unrelated to the pilot (if any);
- Weather conditions;
- Size of batches;
- Additional comments & feedback.

All of this data provides additional information for the data analysis that may explain the perceived ease of use, the willingness to adopt and the perceived usefulness of the autonomous bus.

Subsequently, a pilot documentation form has been created and shared with the pilot staff and must be completed at the end of each pilot batch to document possible issues or obstacles which can be taken into account for the planning and execution of the following pilot waves.

5.2.10 Test moderation

During the physical testing phase of the pilot, the responsible manager takes on the role of the moderator, they introduce the testers to the scenario beforehand, answer any questions the participants may have and accompany them throughout their entire journey. This ensures that the moderators can fill out the documentation form during the trip and note down all obstacles and incidents. During the rest of the focus groups and interviews, there is also a moderator, introducing and guiding the participants throughout the pilot and replying to any questions they may have. Finally, the team also informs the participants of data protection policies, the purpose of the pilots, the goal of the pilots and where they can find out the conclusions and dissemination videos of the project after its end.

5.2.11 Accessibility

Some passengers with mobility constraints as well as elderly persons are expected to participate as testers in the pilot. The bus is equipped with an automatic ramp that provides users with wheelchairs, strollers, or even heavy luggage step-free access to the autonomous bus.

As there is no driver on the bus, this is operated on user demand: the ramp extends upon request by pressing a button available both outside and inside the bus. The button has been installed at a wheelchair accessible height and is easily visible from the first use. Furthermore, the bus has 6 seats and 2 standing seats for persons who might require seating as well as a dedicated area for passengers in wheelchairs with special holds on the floor.

Figure 19 Pilot 3 bus ramp and button

The briefings and focus discussion groups are fully accessible for all participants.

In case that participants do not use any mobile devices or are not used to handling digital equipment, or in case any of them are not fully literate, a sufficient number of pollsters are present to help the participants to fill out any survey manually by reading the questions and answer options to them aloud.

5.2.12 Data collection from users

The main source of information for the PAsCAL project are the questionaries, which can be asked verbally by pollsters to the users or filled out by the users themselves. The answers are recorded using the testers mobile device, smartphone or tablet, additional devices can be provided by the pilot staff in case users have problems filling the survey, using the previously mentioned survey software Qualtrics. Finally, the pooled data is exported to be analysed by the partners in further deliverables. The questionnaires are structured in a way to inform the participants in detail on their privacy and data protection rights and the corresponding policy of the pilot by the respective manager of each group. Furthermore, participants can request to be excluded from any video or photo footage which may be used for dissemination purposes later.

Additional information is documented via video recordings of the interviews, the physical testing of the pilot as well as the documentation forms, which are filled out by each manager.

5.2.13 Contribution to dissemination activities

Video and photo footage are recorded during the waves in the pilot. This material may be used to create a dissemination videoclip containing both regular and disabled bus testers exploiting the features of intermodal transport. The pictures may further be used for articles and publications on the pilot in various different journals or social media posts by both the consortium, it’s partners and the involved commercial stakeholders. Additionally, an event is held after the pilot has been completed to spread awareness of the PAsCAL project as well as the pilot in the general population and inform citizens of the significance and scale of the project.

5.3 Workplan

The workplan for the pilot is composed of the pilot preparation, a focus group meeting and three waves of data collection spread through the whole pilot as well as the final wave result verification. The benefit of doing the surveys in waves is that learnings from previous waves can be used to improve the next wave of the same pilot and ensure the identification of shortcomings or disturbance variables.

Table 7 Pilot 3 overall workplan

Year	2021												2022		
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30	M31	M32	M33	M34
Pilot preparation															
Focus discussion group															
First wave															
Second wave															
Third wave															
Wave result verification															

Each of the three waves follows their own workplan, which spans over 10 days in total and can be separated into two sections: wave setup, which takes up to three days and serves the briefing of the staff, the preparation of equipment and the verification of the pilot locations; and wave execution, which takes a week and includes the briefing of the testers, the implementation of the pilot as well as the monitoring of and interviews with the testers. Each of the phases consists of several subtasks.

Table 8 Pilot 3 wave workplan

Day	01	02	03	04	05	06	07	08	09	10
Wave setup										
Team briefing										
Location verification										
Wave ready										
Wave execution										
Briefing with testers										
Tests										
Monitoring and Documentation										
Surveys/Interviews										
Wave completed										

This workplan shall be reviewed and edited if necessary. The partners stay in close contact and exchange constant feedback in order to be able to modify the workplan spontaneously in case it is needed.

6 Pilot 4: Shared connected transport

6.1 Introduction

While for end users (drivers or passengers) CAVs have obvious benefits such as an improved safety or time optimization, the outcome of this pilot is providing indication on the commercial potential of CAV fleet. In the next decades, mobility companies (bus operators, taxi companies, shared mobility operators) have to adapt their business plan. On the other hand, individuals or employers may still be reluctant to rely on CAV for personal or private trips.

With this pilot, the aim is to collect qualitative and quantitative information on the motivations and usage reluctance of end users towards CAV. A second objective is to explore the commercial potential of CAV from the perspective of mobility solutions providers.

Sales-Lentz, Moovee and LuxMobility researches the interest of an integrated the autonomous carsharing and shuttle service concept in Belval and Differdange in the framework of the PAsCAL project.

6.1.1.1 Shared car services

Practically speaking, a fleet of shared vehicles is already available for the employees of the University of Luxembourg[33] based in the Belval area[34]. In controlled experiments, the pilot participants are asked to drive a shared

Figure 20 Pilot 4 shared car models

[33] https://wwwen.uni.lu/
[34] More Information on Belval: https://www.belval.lu/en/

car with the autonomous features and to provide relevant information in form of a survey on their driving experience. In order to evaluate the acceptance and the usage of the autonomous features of the car, a briefing and a guidance during the service usage followed by a survey are organised.

Moovee[35], a Luxembourgian company, is providing the shared mobility solutions to employees of the University. The service is very flexible and allows to integrate vehicles – electric or not – such as: bike, cars or kickscooters. Moovee is also well known for its digital platform, which allows end users to book their vehicles intuitively and for the employers to have a monitoring dashboard.

6.1.1.2 Autonomous shuttle bus

As the largest bus operator in Luxembourg, Sales-Lentz[36] is running fleets made of more than 650 vehicles that can be very diverse.

Up to date, Sales-Lentz is operating two lines with autonomous vehicles, the Navia shuttle in Luxembourg-city and the Contern shuttle. The plan is to create a new shuttle line in Differdange, which can be explored within

Figure 21 Pilot 4 autonomous shuttle bus

the framework of this pilot. The experience and knowledge of Sales-Lentz with both public and private clients is a strong added value and permits to understand how passenger and public administrations consider CAV as a potential solution to their mobility challenges.

[35] https://moovee.lu/en/
[36] https://www.sales-lentz.lu/en/

6.2 Detailed pilot description

6.2.1 Scope and purpose

The main scope of this pilot is to test and understand the benefits and interest of an integrated implementation of two types of innovative services (an autonomous shuttle and a fleet of shared cars with autonomous

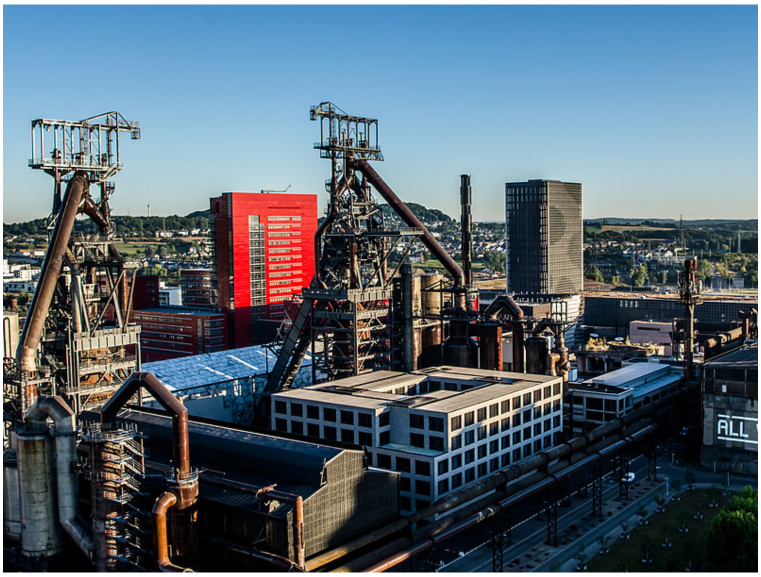

Figure 22 Pilot 4 Belval area

features) in a specific zone of Esch-sur-Alzette, the second largest *commune* in Luxembourg in term of inhabitants (36,000 inhabitants).

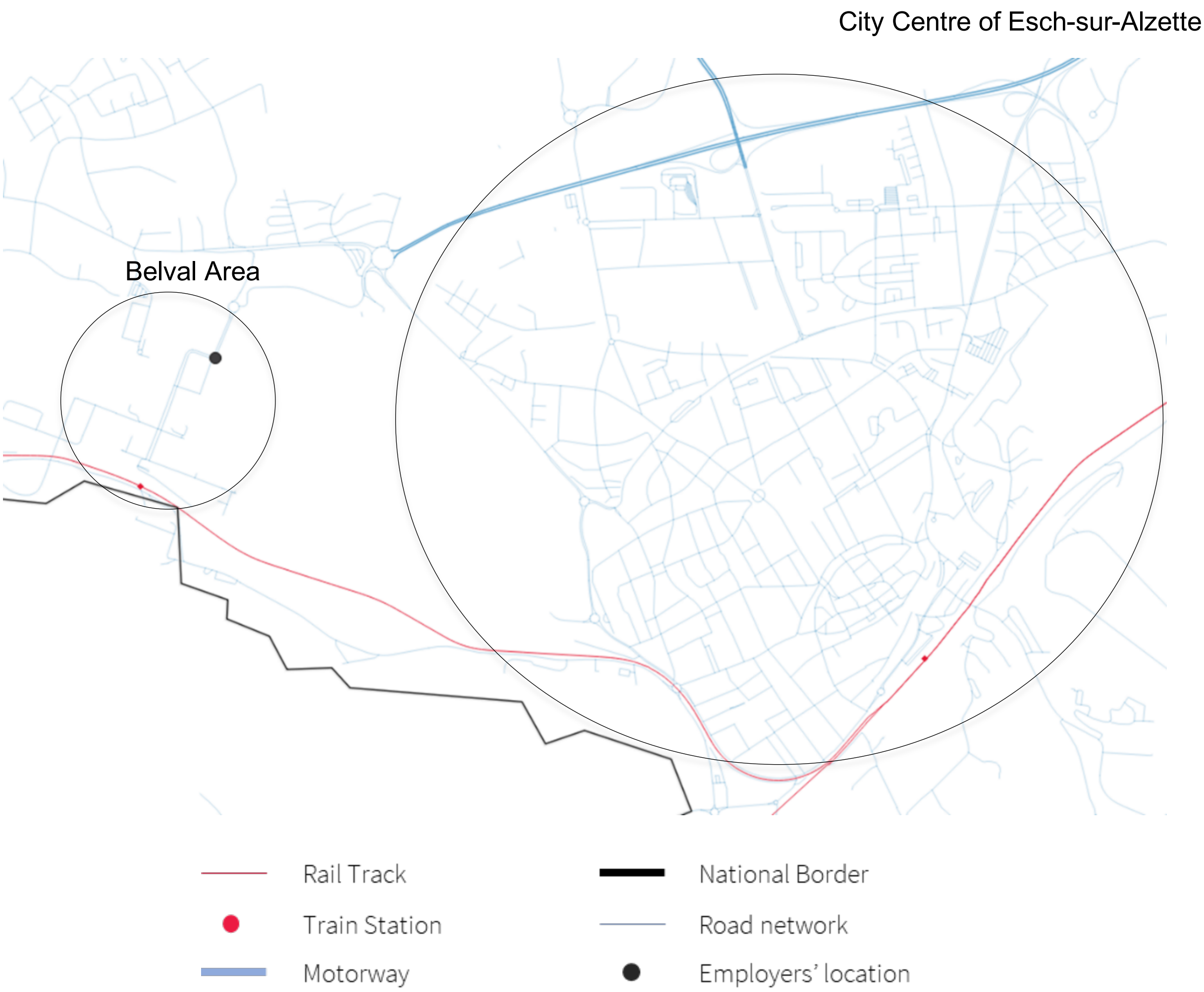

Figure 23 Pilot 4 location in the Belval area

The pilot implementation takes place in the newly developed area of Belval. The University of Luxembourg has been relocated there together with other research centres and firms, in order to create a new activity pole that attracts over 20.000 workers when fully completed. The area is characterised by a low parking offering which is decreasing due to new urban developments and, consequently, leading to more people travelling to this area. This pilot is combining 2 mobility solutions providers (Moovee and Sales-Lentz) in 2 different locations (Belval and Differdange respectively), the expertise in understanding mobility needs of Luxmobility and the University of Luxembourg.

Within the PAsCAL, the purpose of the "Shared Connected Transport" pilot is twofold. The first objective is about assessing the commercial potential of integrating CAVs into shared fleets of mobility service providers. The second purpose of this pilot is collecting both qualitative and quantitative information on the acceptance of CAVs in the current daily life of professionals and inhabitants. In terms of data collection, 100 cars fleets users and 50 autonomous bus users are responding to the survey.

6.2.2 Scenarios

To start with, all the participants are either working, studying or conducting random activities around the Belval or Differdange areas. The experiment (shared cars or autonomous shuttle) is affecting the type of users / participants that are recruited for this pilot.

6.2.2.1 Shared car service

A service of shared cars is already implemented at the University of Luxembourg by Moovee. Employees of the University of Luxembourg are using this service to reach another campus or professional meetings in Luxembourg or beyond. This experiment is aiming at testing the acceptance of users when integrating also cars with autonomous features as opposed to the classical cars currently in the fleet of the University of Luxembourg (Peugeot 108[37]).

Frequent users of the University car fleet service are being contacted and asked to participate in the controlled experiment. They are already familiar with the service and understand intuitively how it works. Because they are frequent users of the service of shared cars, the experiment consists in driving a car with autonomous features in particular.

The interested participants are taking part in a digital briefing session where details about the PAsCAL projects and the experiment are presented.

In order to keep a setting and an experience which is as close as possible to a normal usage, the cars with autonomous features are parked in the same place than the other University shared cars and can be accessed with the staff' badges, just like regular cars of the fleet.

After the briefing, the participants book a time slot of 1 hour that fits their agenda to run the experiment. The booking is done through the same booking platform than a normal booking of the regular cars.

On the day of the pilot execution, each participant is welcomed with an incentive and a summary of the pilot. In this case, the pilot is consisting of a 15 min drive on a pre-define trip on open road. The trip as shown in

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[37] https://www.peugeot.es/gama/peugeot-108.html

Figure 24, the same for every participant, is combining parts of highways, countryside roads and urban environment (traffic lights) around Belval. This 11 km trip on open road is considered similar to trips that the employees of the University of Luxembourg are doing when booking a car from the shared fleet.

After driving for approximately 15 minutes, participants are responding on-site to the survey on their smartphone or on a tablet equipped with a 4g connection.

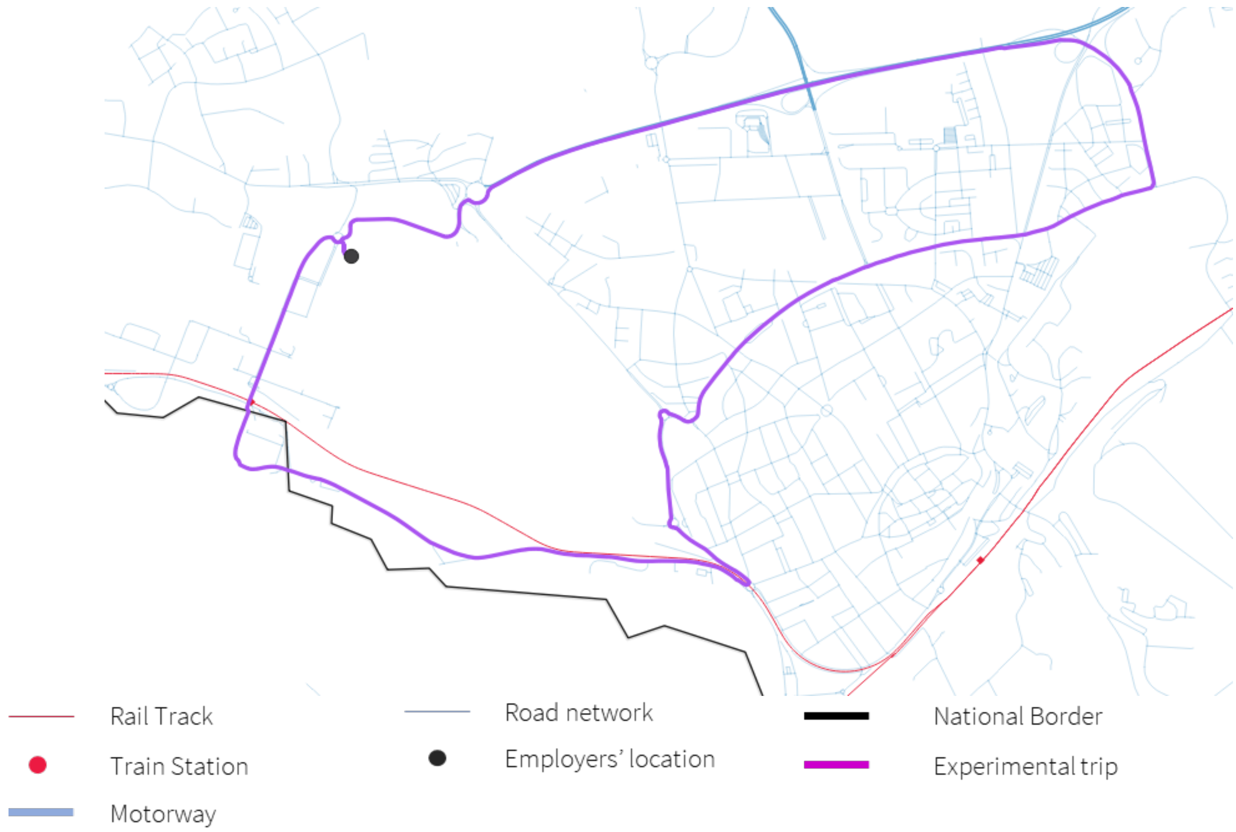

Figure 24 Pilot 4 shared car service overview

6.2.2.2 Autonomous shuttle bus

Sales-Lentz is responsible for implementing the autonomous shuttle as the operator of this service.

The objective of this scenario is to measure the perception of the participants related to the implementation of a bus connection running with autonomous vehicles. This is done in a real-life environment in Differdange.

Although the implementation of the shuttle in Differdange is not final at the time of publishing this document, a comparable plan for the Belval area can be used to illustrate the future pilot setup. The length of this previously envisioned Belval trip is about 3.2km for a roundtrip and it takes 16-18 minutes to perform this trip. In the 2 scenarios (described below) the autonomous shuttle is stopping in front of the train station without connecting to the station to simulate a relevant bus stop.

Figure 25 Pilot 4 autonomous bus overview

The participants are, first, taking part to an online briefing webinar explaining them the PAsCAL project and the main theoretical concepts associated with CAVs.

An automated Navya Shuttle (8 seats) connects the parking “Hauts Fourneaux” to the Science Centre. A dedicated complex dedicated to the roll-out of science and technology. Visitors, families and school groups are able to travel the 700m distance in a secure way and avoiding bad weather conditions. The deployment in Differdange has the advantage that it allows integration into the daily traffic. The already installed bus lane is used by the shuttle. It is an on-demand service, usable through a special application.

Due to the size of the autonomous shuttle, only 5 participants are onboarding at the same time during the pilot which consist of a few minutes long trip on the road. Afterwards, participants are responding to the dedicated questionnaire. Participants of the pilot provide their response using their smartphone (QR code). In case of issues, the pilot coordinator is using their own equipment (smartphone or computer).

During a regular day of pilot executions, 6 batches of 5 participants each are taking part, which is organised for 6 days (weekdays). During the pilot execution, which takes place on open roads and in an urban environment (see Figure 25), no human driver aboard the bus need to use a steering wheel or perform manual operations to manoeuvre the vehicle.

6.2.2.2.1 Baseline scenario

In this scenario, the shuttle is running smoothly and no perturbance (except traffic conditions) are implemented on purpose.

6.2.2.2.2 Incidence’s scenario

In this scenario, the autonomous shuttle is not running smoothly, and an irregular behaviour of the shuttle is created on purpose. The chaotic driving is obtained by programming the shuttle to stop, go back and deviate from the expected trip.

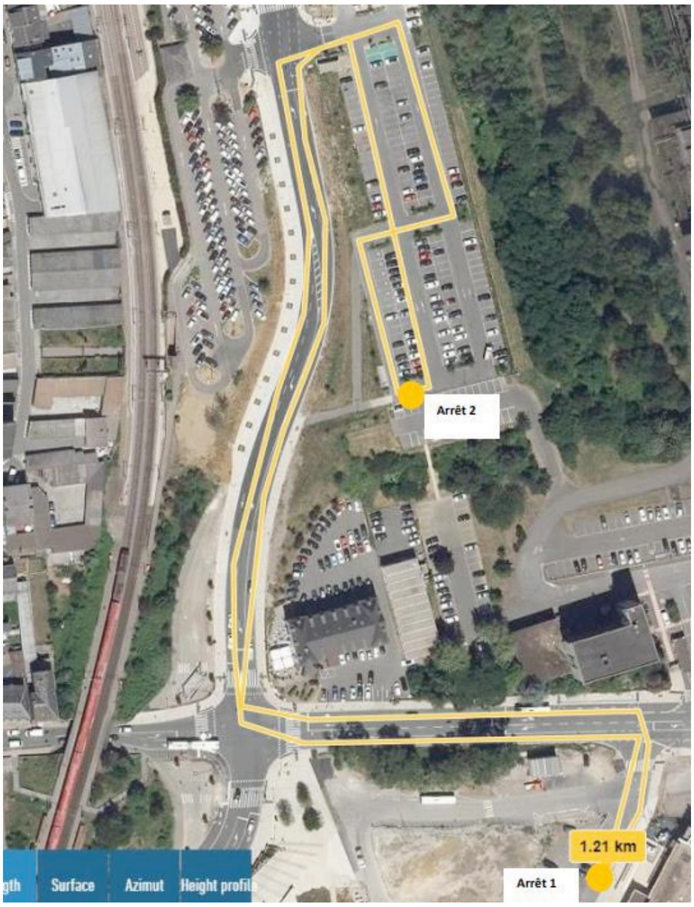

Figure 26 Pilot 4 overview incidence's scenario

Because the experiment is taking place on open road, this chaotic or hectic behaviour cannot be simulated on the road but are taking place close to the starting place and at the turning point of the loop.

6.2.3 Assumptions

Within this pilot, the effect of 2 different services (autonomous shuttle and a fleet of shared cars with autonomous features) and different assumptions are linked to each of these two experiments.

6.2.3.1 Assumptions shared car service

Participants of the fleet of shared vehicles services with autonomous features are all employees (PhD students, researchers, admin staff) of the University of Luxembourg. During the pilot, participants are driving the car with autonomous features exactly in the way they would drive a regular car of the shared fleet.

From the end user perspective, the assumption is that using a shared car with advanced autonomous features does not change drastically the user experience or behaviour. Indeed, most the autonomous features are related to safety features rather than comfort features and accordingly the autonomous features are activated only in the rare case of a road issue or imminent potential accident. These road issues are extreme braking, drivers falling asleep or not attentive for a long period. These specific and occasional events happen but are not expected to take place during the experiment.

From the employer's perspective (the University of Luxembourg), the assumption is that implementing a fleet of shared cars with autonomous features is perceived positively. Autonomous features can be associated with more safety or more comfort and thus represent an added value. Additionally, a secondary assumption is that the willingness to pay an increased budget for having CAV in the fleet of shared vehicles is limited. The implementation of a fleet of shared cars is gaining popularity but is still a niche market and the assumption is that employers are not willing to pay an extra budget for autonomous features of the vehicles.

6.2.3.2 Assumptions autonomous shuttle bus

While the autonomous shuttle has been implemented by Sales-Lentz as a public line, no information has been collected previously to analyse the public acceptance of such service.

With the Baseline scenario, from the users' perspective, the assumption is that good performance of the vehicle associated with the novelty and innovation aspect of an autonomous shuttle are leading to positive perception on the short term. On the other hand, with the Incidence's scenario, it is expected that the experience is perceived negatively and that the confidence in this type of technology is negatively affected.

From the perspective of the public authority, the assumption is rather similar than for the end users: a positive perception towards autonomous vehicles due to its novelty and innovation on the short term and a long-term perception similar to traditional shuttle. Another assumption is that employers would not be willing to spend extra monetary resources only for the sake of implementing an autonomous shuttle.

Concerning the experiment with the autonomous shuttle, in collaboration with Work Package 4, several Human Machine Interfaces (HMIs) have been considered. For pilot 4, the HMI 2.6 "Waze" kind of system with TTS seems to be the most relevant and could be technologically implemented. Indeed, the HMI can be implemented into CAVs' screen and made visible to the vehicle users. This technology is used to show the position of the vehicle in its direct environment and the time remaining to reach the next bus stops. Similarly to the Waze service, additional information on relevant geographically close POI are displayed.

6.2.3.3 Assumptions commercial potential of CAVs

While from the users' perspective, regarding shared cars or autonomous shuttle the usage perception might be positive, this is not an indication of a future commercial success. Indeed, one assumption is that employers or public authority are reluctant to dedicate more resources for providing vehicles (shared cars or shuttle) having autonomous features. Of course, this leads to discussions on the short- and long-term financial sustainability of integrating CAVs for B2B mobility services.

6.2.4 Questionnaires

Participants of the experiment with the autonomous shuttle are requested to reply to the survey after the trip with the Navya shuttle[38]. The questionnaire for passengers of the vehicle is made of 33 questions. Some questions provide information on basic personal characteristics of the participants and the main focus remain their confidence and acceptance level towards autonomous vehicles.

Participants of the shared car service are asked to respond to the survey just after they drive the shared car with autonomous feature. The survey is made of maximum 36 questions.

In both cases, participants are asked to reply to the survey directly after their experiment and always in the presence of the pilots' coordinator. Having the pilots' coordinator at the disposal of the participants is helpful to solve minor technical issues (survey access, question understanding, etc).

6.2.5 Tester considerations

Participants of the Shared car service are sharing various commonalities. First, all participants are employees or students of the University of Luxembourg, they also all have a valid driving licence, have used the University car sharing system multiple times and are aged between 18 and 65. Among the University staff, very few of them have any kind of disability or handicap. Around 50% of the pilots' participants are residents from

[38] https://navya.tech/en/

Luxembourg, 25% from France, 12.5% from Belgium and, finally, 12.5% from Germany. The objective for this scenario is to obtain at least 100 data points (survey responses).

Participants of the Autonomous shuttle bus have less commonalities than for the shared cars scenarios. Indeed, participants are not required to have a driving licence or to be employees of the University of Luxembourg. Accordingly, more interpersonal variability is observed in the participants' personal characteristics. In general, students from the university, people who live or work in the area and possibly some tourists are expected to participate. The objective for this scenario is to obtain at least 50 data points (survey responses).

In both experiments, the pilots' participants are receiving a reward in form of a voucher for their involvement in the experiment.

6.2.6 Location and equipment needed

The pilots are conducted in Belval, a newly developed urban area in the commune of Esch-sur-Alzette, the second largest commune of Luxembourg. The operational part of the autonomous shuttle testing is taking place in Differdange a nearby city. More precisely, Moovee is providing the fleet of shared cars to the employees of the University of Luxembourg and Sales-Lentz is implementing the autonomous shuttle accessible for a large range of users. The indications on the starting point / ending point of both services can be seen in Figure 24 and Figure 25.

In the case of the shared car service, in addition to the three regular shared cars that the university is already using in Belval, Moovee is providing one additional car with autonomous features specifically for the implementation of the PAsCAL project. Naturally, an additional parking space is also used. To make the scenario as realistic as possible, the employees of the University joining the experiment as participants are using the usual Moovee booking platform as well as their regular access cards (University badge to access their office, meeting rooms and to unlock the shared cars).

The equipment needed to run the autonomous shuttle bus is mostly associated to the vehicle itself and its operation (operator, maintenance, charging point, storage area, etc).

In the two scenarios participants are replying to the corresponding survey with their own devices but pilots' coordinators are on-site to solve minor technical issues. A tablet with a 4G connection is always available as a backup solution to reply to the survey.

6.2.7 Scheduling

The objective is to run the two experiments of the Shared connected transport pilot in M26 (July 2021) and M27-M31 (August – December 2021).

The implementation of the two pilot placements (shared car fleet, autonomous shuttle bus) could have been implemented in parallel but this is not possible due to human resource limitations and present restrictions of the Covid-19 pandemic.

6.2.7.1 Shared car service

T1.1 Pilot preparation (M20-M26) involves primarily the selection of the vehicle that is used in the experiment. To be selected the car is expected to have autonomous features and the electric powertrain is not favoured to keep some similarities with the current and classic benzine cars of the university shared cars fleet. Some technical preparation on the car is needed (Badge access, OBD sensors) and some adaptation of the booking system as well. Participant selection is done at this stage.

T1.2, T1.3 First and second wave (M27, M28) are related to the experiment's implementation. This includes the briefing, the driving experiment by the participant, the survey time and then the incentive distribution. The time needed for one participant (briefing, car trip and survey time) is close to 45 minutes. Because only one car is available between 8 to 10 data points are collected daily.

T1.4 The results analysis (M28-M30) is mainly about making sure that the data collection has been smooth and making sure that the pilot documentation form is linked to participants' responses. Some aggregated and general KPI are also being produced at this stage.

6.2.7.2 Autonomous shuttle bus

T2.1 Pilot preparation (M20-M26) involves administrative work such as requesting the proper authorization to public administrations (Ministry of Infrastructure and Ministry of transport) to use the Navia shuttle on open roads.

T2.2 *Shuttle Technical Implementation* (M26-M28) refers to the technical steps that allow the shuttle to recognise its environment on the selected trip. Indeed, the path and its specificities (intersection, type of pavement, white lines, etc) are registered and "uploaded" in the Navya IT system. This process is lengthy and required to spend some time both, in situ, and with technical engineer to parametrise the vehicle. Because this vehicle is electric, solutions have to be identified for charging it and storing it overnight.

T2.3, 2.4 First and second wave (M28, M29) involves to have the autonomous shuttle travelling on the selected path (on open road) with 6 pilot participants by experiment (one loop with the shuttle). Similarly to the other experiment, the briefing before entering the vehicle and filling the survey after the ride is part of this task.

T2.5 Wave result verification (M28-M30) is necessary to make sure that the data is reliable and consistent. A comparison between the collected survey and the pilot documentation form is also needed. Indeed, the Incidence Report Form may help to understand unexpected data results. In this task preliminary data analysis (descriptive analysis) is also carried out.

6.2.8 Staff

The implementation of this pilot involves several companies and good coordination is important. As responsible of this pilot's implementation, LuxMobility dedicates 3 managers to prepare, implement the pilot and collect all the material needed (surveys, interviews).

As the expert of shared mobility solutions, Moovee is responsible for the setup of the fleet of shared cars. Currently, two managers are working in this company and are available for the implementation of the experiment related to the shared cars experiment.

Sales-Lentz is responsible for the implementation and the operations related to the autonomous shuttle bus. Concerning this part of the pilot, substantial resources are needed to prepare the trajectories of the autonomous bus and prepare the vehicle. Accordingly, more people are required to prepare the implementation rather than during the implementation itself. Indeed, three people from Sales-Lentz are working for 8 weeks to prepare the setting while, during the implementation, only one operator works actively on the pilot.

A videographer is also hired to capture footage (video and pictures) of the pilot. This person joins the pilot execution for one day for each service. Their work is useful both for communication purposes and to have visual information on the pilots' implementation.

6.2.9 Pilot documentation

The documentation of our pilot is done mainly thanks to the survey response and information on the services' usage (shared cars and autonomous shuttle).

In order to be consistent, similar data and information is collected for the two different types of scenarios.

- VehicleID;
- TestID;
- ToolID;
- DayID;
- StartTime;
- StopTime;
- UserID;
- QuestionnaireID;
- Pilot name;
- Wave number (if applicable);
- Incidents related to the pilot (if any);
- Incidents unrelated to the pilot (if any);
- Weather conditions;
- Size of batches;
- Additional comments & feedback.

In order to capture information regarding the context and setting of the pilot, but also the remarks or feeling of the participants, a specific Incidence Reporting Form is used. This small digital survey helps to quickly and simply link contextual or external information with the participants surveys.

6.2.10 Test moderation

During the experiments (4 weeks in M29), two persons of LuxMobility are dedicated to the communication with the participants. This includes contacts (by phone, mails) related to the onboarding of the participants, the experiment itself and the data collection using a smartphone or a tablet.

Due to the ongoing Covid-19 pandemic, the briefing is organised digitally. The main objective of this briefing is to describe the PAsCAL project and the detail of the pilot and providing the practical information of the experiment (meeting place & time).

During the experiment related to the shared car service, one member of the coordinating team – an employee of Moovee – is in the car with the driver to make sure that the protocol (defined path, speed limit) is respected.

Concerning the autonomous bus, the shuttle operator of the vehicle (an employee of Sales-Lentz) has to stay, by law, in the vehicle. Due to the size of the vehicle, 5 participants are seating in the shuttle at the same time. The loop as it has been designed is taking (see section 6.2.2) is taking around 20 minutes. Two other members of the pilot coordination team are available at the start and end point of the loop to ensure surveys are filled in and that new participants are welcomed properly.

6.2.11 Accessibility

The target users of this pilot are mainly workers, students and people conducting activities in Belval. Due to the presence of the University, students (bachelor and master) are also using the autonomous shuttle (but not the shared cars). Accordingly, this pilot is not specifically targeting people with handicap or specific conditions and no accessibility issues are expected in the implementation of this pilot.

6.2.12 Data collection from users

The sources of data collected in our pilot in the framework of our pilot can be divided in two groups; the users and the decision makers. Information from the decision makers are collected using semi-directed interviews. The objective is to collect information on commercial aspect of mobility services that includes vehicles with autonomous features.

Data from the end users (pilot participants) is collected through digital surveys (Qualtrics). Using professional data collection tool like Qualtrics has several benefits. Surveys can be in different languages and the database can be exported in the main or default languages. Qualtrics software also embedded additional variables that are useful for data cleaning (too short response time). The Qualtrics platform is also providing several descriptive data analyses that are useful for very preliminary reporting or simply to monitor the evolution of the data collection.

For instance, concerning the shared car service, it is possible to extract the number of trips done, the total distance travelled, Similarly, it is possible to derive interesting indicators with the autonomous shuttle bus (occupancy rate).

6.2.13 Contribution to dissemination activities

Moovee, Sales-Lentz and Luxmobility are well-established companies with an important visibility on social networks such as LinkedIn. For instance, LinkedIn post of LuxMobility often reach 10 000 views. Additionally, Sales-Lentz and Luxmobility are sponsors of a media platform[39] related to sustainable development. Relevant information can be published on this platform which is getting more and more attention in Luxembourg.

Videos are shot during the implementation of the experiments and promote the PAsCAL project on popular platform. The objective is to have materials showing participants driving the shared cars, using the booking app or travelling with the autonomous shuttle.

Because Moovee, Sales-Lentz and LuxMobility are among the key players in terms of mobility in Luxembourg, a press release is being prepared and is sent in an appropriate time (beginning of M29).

One week after the end of the experiment, a closing event gathering selected officials and journalists is scheduled.

6.3 Workplan

One specificity of the workplan related to the shared connected transport is the clear distinction between the two technologies which involve different types of vehicles, technologies and target users.

Table 9 Pilot 4 overall workplan

Year	2021											2022		
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30	M31	M32	M33	M34
Pilot preparation															
Shared cars wave 1															
Shared cars wave 2															
Shuttle implementation															
Shuttle wave 1															
Shuttle wave 2															
Wave result verification															

For both experiments, a preparation time is needed but more time is required to prepare technical aspects related to the autonomous shuttle.

[39] https://www.infogreen.lu/

Each of the 2 waves per experiment follows their own workplan, which spans over 15 days in total. The wave setup (team briefing, material preparation, briefing with participants & on-site testing) takes 6 days and the implementation takes 9 days.

Table 10 Pilot 4 wave workplan

Day	01	02	03	04	05	06	07	08	09	10	11	13	14	15
Team briefing	■													
Material preparation		■	■											
Briefing with Participants				■	■									
On site testing						■								
Surveys/Interviews							■	■	■	■	■	■	■	■

This workplan shall be reviewed and edited if necessary. The partners stay in close contact and exchange constant feedback in order to be able to modify the workplan spontaneously in case it is needed.

7 Pilot 5: Experience of vulnerable travellers with connected transport environment

7.1 Introduction

The subjects of this pilot are an in-depth FDG with members of the EBU as well as an existing digital platform and mobile application called Apertum[40], which guides and advises users in real-time on the best routes to use within the public transport system and points out possible obstacles that may be encountered along the proposed way. In order to optimise navigation for passengers with mobility constraints, every bus stop and metro station within the public transportation network of Madrid, Spain, including stops of Madrid's light rail (Metro Ligero), has been assessed accordingly. In order to classify any station and stop from green (accessible), yellow (partially accessible) to red (inaccessible), a number of key factors have been measured and tested. In particular, the stations were separated in bus stops, metro stations and light rail station, each type of station was then further assessed accordingly.

The *metro stations* have been screened for disabled parking spots, the condition of ramps and elevators from the street and lobby to the platforms, accessibility between platforms and vehicle doors and accessibility of opening or operating assistance of gates between platforms as well as ticket vending machines across the stations. The *light rail stations* have been screened for disabled parking spots, the condition of ramps and elevators from the street and lobby to the platforms, accessibility of ticket vending machines as well as the existence of a sheltered lobby and ischiatic supports across the station. The *bus stops* have been screened for parking lines in front of the bus stops, location of the stops, potential obstacles and road configurations around the stops, the existence of shelters and functional designated boarding areas at the stop as well as possible tree pits limiting the ramp access deployment area. Furthermore, several different passenger modes can be selected, proposing by default different maximum walking distances any given passenger can cover without additional aid. For example, the average wheelchair user can easily cover a distance of up to 200 metres without assistance, while a passenger with a stroller can walk 400 metres. In total,

40 https://www.apertum.world/#map

8 such categories are available, and the individual walking distance can be modified to suit each user's needs and fitness levels:

- Wheelchair users, limited to a maximum personal mobility distance of 200 metres;
- Elderly passengers, limited to a maximum walking distance of 250 metres;
- Hand luggage users, limited to a maximum walking distance of 500 metres;
- Children with their parents, limited to a maximum walking distance of 300 metres;
- Pregnant women, limited to a maximum walking distance of 250 metres;
- Stroller users, limited to a maximum walking distance of 400 metres;
- Injured passengers, limited to a maximum walking distance of 400 metres;
- Heavy luggage users, limited to a maximum walking distance of 350 metres.

Finally, the user can also choose, wherever they prefer using only metro and light rail, only busses or only metro and busses in case any of the transportation modes is entirely unsuitable for their mobility needs. This platform has already been tested extensively and fully deployed in Madrid[41], Spain placing the TRL at an already advanced level of 7. With this pilot, new challenges of a more connected transport environment can be addressed, the routing algorithm and the current user experience can be improved using the testers feedback and comments.

The second part of this pilot consists of four consecutive detailed Focus Discussion Groups with 10 participants each. The focus groups are held in person in UICI subsidiaries in Milano, Bologna, Rome and Naples in Italy and explore the expectations and fears of people with sensory impairments towards CAVs. The FDGs consist of a short introduction into the PAsCAL project, the participants are asked to fill out a survey and then participate in an active discussion to add further comments and continue to improve the questionnaire further and render it more valuable to persons with sensory impairments. The meeting focuses on the needs and problems visually impaired persons face when they are confronted with CAVs in their daily life.

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[41] http://smart-transportation.org/wp-content/uploads/2017/08/TH-Vol-12-No-1-June-2017-Mapping-Transport-disadvantage-in-Europe-Jos%C3%A9-F.-Pap%C3%AD.pdf

7.2 Detailed pilot description

7.2.1 Scope and purpose

This pilot explores the mobility patterns and needs of vulnerable travellers, such as the elderly, pregnant women, disabled, travellers with heavy luggage, and parents with a baby stroller, and how can a connected application make their life easier. Suitable testers from Madrid with respective mobility constraints are recorded using the platform, following several predefined scenarios. They also have to navigate through the metro according to the route defined by Apertum, and later complete the questionnaires. Throughout the entire process, the testers are observed, and possible issues can be documented and recorded. The pilot is deducted in collaboration with FLM[42], which apart from providing direct contact to testers with disabilities impairing their mobility, are also able to point out additional common issues that users may have when operating the mobile application.

The pilot consists of 3 waves, which include a sufficient number of batches of testers each (200 testers in total). For each wave, a scenario has been constructed, which 16 batches of 5-8 testers follow during the execution of the physical pilot. Furthermore, a considerable number of testers are asked to test the platform and fill out surveys without following the proposed routes physically. Their input specifically on the accessibility and perceived usefulness of the service is invaluable for the further development of the application.

Finally, several focus groups including the EBU shall aid the partners in analysing preconceptions and hopes of persons with sensory impairment for the wider deployment of CAVs in different aspects of their lives. The meetings are co-moderated in Italian to ensure that all participants understand the introduction and can actively participate in the feedback and discussion rounds.

Ideally, both pilot parts shall lead to an important update of the existing Apertum platform and explore possibilities together to render the platform usable for visually impaired users as well as improving the overall design and functionality of the application to cater better to people with disabilities.

[42] Fundación Lesionado Medular, https://www.medular.org/en/

7.2.2 Scenarios

Multiple possible scenarios have been considered for the pilot deployment of the Apertum platform. Several different navigation routes within the platform have been consulted, and some of them have been discarded due to lack of accessibility or temporary perturbations of the transportation infrastructure such as broken-down elevators or construction works. For the sake of a homogeneous and comparable presentation of the different scenarios, the default wheelchair user category and the default metro & light rail mode have been selected in the platform. During the pilot wave execution, each tester selects the user category which best describes their personal mobility constraints as well as the mode of transportation mode they prefer.

The pilots are conducted in waves, ensuring that oversights can be communicated, taken into account and straightened out in following wave executions. This approach ensures efficient and quick adaptability of the pilot to any possible external disruption, especially taking into account the uncertain situation of the Covid-19 pandemic in Madrid at this time. The currently proposed scenarios have been tested in January 2021, when all the stations involved met the required accessibility criteria. Furthermore, the routes are tested again shortly before the deployment of the pilot in order to ensure their continuous functionality and a few alternative routes can be used in case of unforeseen disturbances. Also, a reporting form is completed for each of the wave iterations in order to document incidences during the implementation.

7.2.2.1 Pilot 5 scenario 1

The first route leads the testers from “Príncipe Pío” train station, which is connected to the metro and bus network to Goya station, which is also connected to both the metro and bus network of Madrid. The route predicts a duration of 17 minutes on average under normal conditions covering 4.4 km by public transportation as well as including waiting times and a transfer in Opera station.

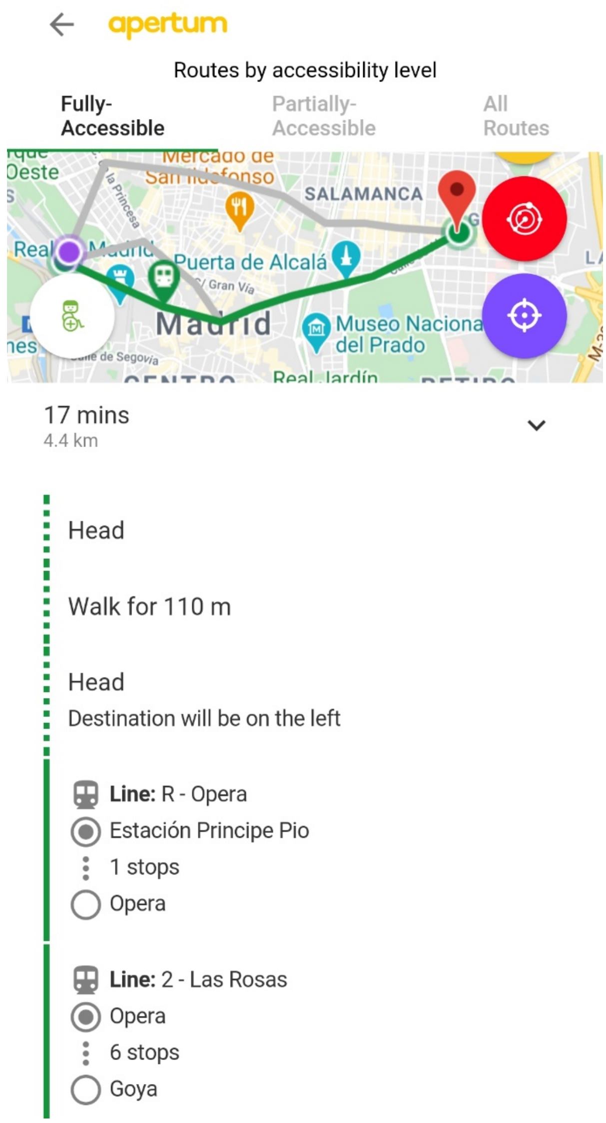

Figure 27 Pilot 5 scenario 1 overview in Apertum application

Using a conventional general-purpose routing application, Moovit[43], which does not take into account any mobility constraints, traveling between these two stations takes only 13 minutes, but it proposes an alternative transfer at Alonso Martínez station, which does not meet the accessibility criteria because it lacks elevators. Therefore, passengers with mobility constraints have to overcome big hurdles to follow this itinerary or in the worst case get stuck in the station and require assistance from staff or other passengers.

[43] https://moovitapp.com/nycnj-121/poi/en-gb

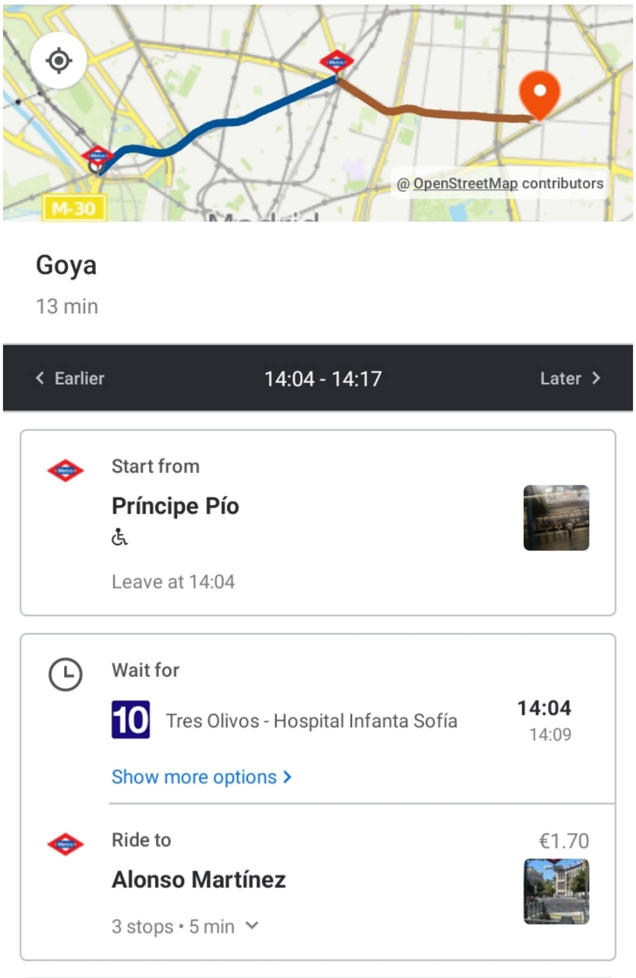

Figure 28 Pilot 5 scenario 1 overview in Moovit application

7.2.2.2 Pilot 5 scenario 2

The second connection starts at Opera bus stop and metro station to Plaza De Castilla, which is also connected to both metro and bus networks. The Apertum platform calculated that the proposed route takes 30 minutes, covering 8.1 km and includes a transfer at the Príncipe Pío station in order to avoid changing metros at Alonso Martínez station and adding only 3 minutes to the trip duration proposed by conventional routing applications.

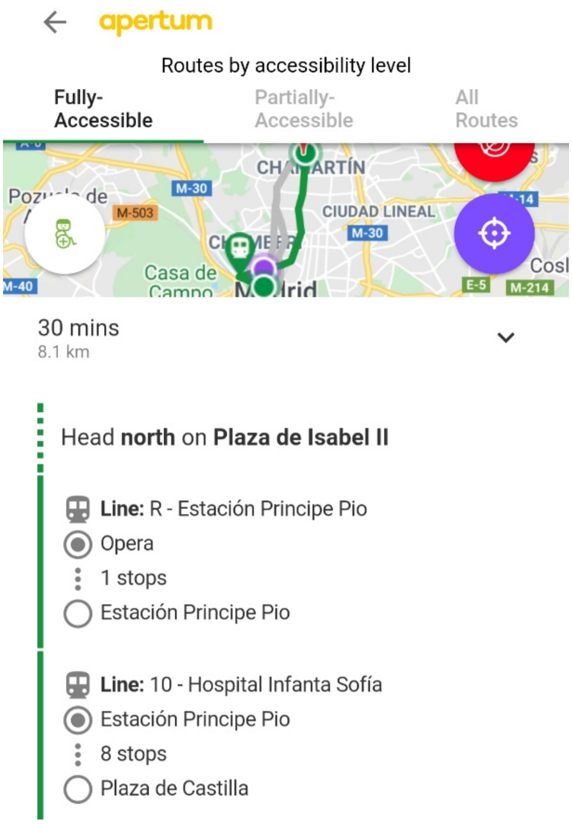

Figure 29 Pilot 5 scenario 2 overview in Apertum application

7.2.2.3 Pilot 5 scenario 3

In this third scenario, the testers travel from the Sainz de Baranda metro and bus station to the Canal metro and bus station in Madrid. According to the Apertum platform the trip takes 22 minutes under normal conditions covering 6.6 km by public transportation as well as a transfer in Cuatro Caminos Metro station.

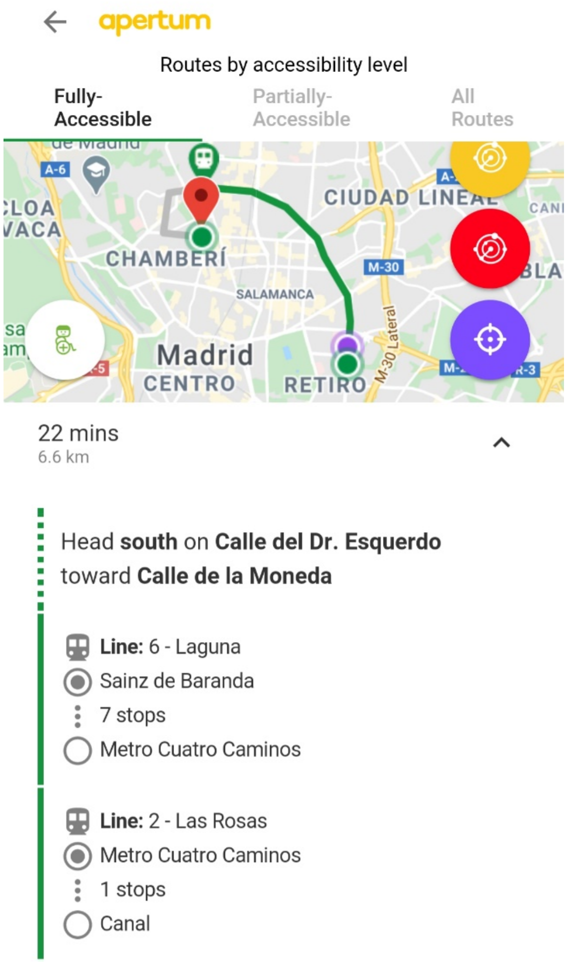

Figure 30 Pilot 5 scenario 3 overview in Apertum application

As described in the previous scenario, this is not the fastest route according to traditional navigation applications, however, it avoids transfers in stations such as Avenida de América or Príncipe de Vergara, which are both non accessible stations and prevent citizens with mobility constraints from using the normal public transportation network of the city.

7.2.2.4 Pilot 5 scenario 4

The last scenario starts at Portazgo station, near Spinal Cord Injury Foundation in Madrid, and ends in Nuevos Ministerios. This route usually takes 25 minutes taking line 1 and 10 with a transfer at Tribunal. However, as Tribunal is not an accessible station, Apertum sends users through lines 1 and 6 with a transfer at Pacífico taking 2 additional minutes as shown in Figure 31.

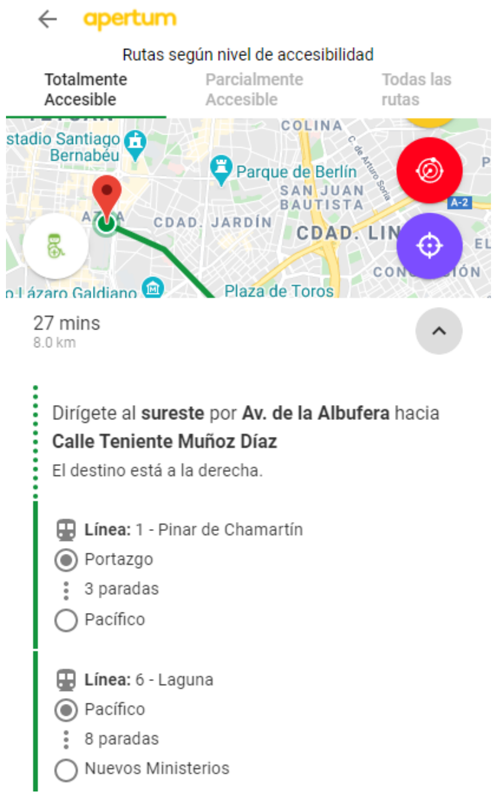

Figure 31 Pilot 3 scenario 4 route overview in Apertum application

7.2.3 Assumptions

This pilot works on the assumption that conventional wayfinding and routing application do not accommodate users with mobility constraints or sensory impairments adequately. Most applications do not offer any options for persons with disabilities, luggage or children and if they do, users can usually not differentiate between the options or modify walking distances nor select their preferred modes of transportation. Furthermore, a lot of the information on accessibility in and around train stations is missing or simply outdated as the majority of passengers without mobility constraints do not consider obstacles as disruptive and thus have no incentive to report them, they might also simply be unaware of certain missing, but vital accessible features and functions such as accessible ticket vending machines. In conclusion, passengers with mobility constraints need a dedicated application to safely navigate public transit and keep the data within the application such as the accessibility of entire stations up to date. Since the manual surveillance and updating of each station and stops status is a tedious and extensive task and would be ultimately too expensive, users need also a function to alert each other of obstacles and temporary perturbations in order to keep the platform updated in an inexpensive and simple, crowd-funded way.

In collaboration with WP 4, several Human Machine Interfaces (HMIs) have been considered. For pilot 5, the HMI 2.6 “Waze” kind of system with TTS has been considered and could be implemented into the existing technology. The HMI can be integrated into CAVs of TRL 3,4 and 5 and uses GPS technology in a vehicle or device and a smart algorithm such as Waze to propose an adaptive itinerary to the user, which can change in case of emergencies, perturbations or constructions on their way. This application to Apertum could also include a text-to-speech feature for people unable to navigate on a regular smartphone.

7.2.4 Questionnaires

The questionnaires are conducted by interviewers or the participants themselves following the on-site deployment of the pilot using the tool Qualtrics[44] as has been decided on by the work package partners as well as in dedicated focus groups including people with mobility constraints. The questionnaire for Apertum vulnerable users consists of 25, the one for the EBU focus consists of 27 questions and the interview for Operators consists of 9 open ended questions. These questionnaires have been attached in full in Annex I: Surveys. They contain technical questions, which are multiple choice or rating scale choice as well as questions regarding background information, which are partially multiple choice and partially require demographic information to be entered as well as an option for open commentary. Every question seeks to answer one of the Key Performance Indicators (KPIs) defined and detailed in by project partners in Deliverable 7.2 of WP7. Subsequently, each question is classified according to its type (technical or background) and a KPI, which it seeks to explore. The KPIs addressed by the pilot 5 questionnaires for users belong to the following indicator categories:

- Indicators of society level acceptance;
- Indicators of acceptance by vulnerable user groups;
- Indicators of acceptance by end users.

The KPIs addressed by the pilot 5 questionnaires for operators are:

- Indicators of acceptance by end users;
- Indicators of acceptance by other stakeholders;
- Indicators of acceptance by road co-users;
- Indicators of acceptance by vulnerable user groups.

[44] https://www.qualtrics.com

The KPIs addressed by the pilot 5 questionnaires for the FDGs are:

- Indicators of acceptance by vulnerable user groups;
- Indicators of society level acceptance;
- Indicators of acceptance by end users.

The questionnaires for the operators are open ended questions meant to be asked in form of an interview and recorded in video. The other questionnaires are completed by the testers themselves on their personal smartphones or alternatively by interviewing staff directly on tablets or smartphones in order to ensure that the participation in the questionnaire is accessible and easy for all participants, regardless of disabilities or ownership over a smartphone. The questionnaires have been carefully crafted using the feedback and experience of partners who worked on previous WP questionnaires of the project as well as the close exchange with the FDG led by the EBU and feedback from FLM.

7.2.5 Tester considerations

The targeted number of testers is 200 persons, including their corresponding stakeholders. Anyone can qualify as a tester, as long as they fit one of the platform's predefined user categories and thus suffer from a mobility constraint. The questionaries are expected to be asked to a reasonable amount of disabled people with family members or caretakers, elderly persons, parents with a stroller, and travellers with heavy luggage.

As mentioned before, disabled testers are recruited from FLM, a non-profit foundation for disabled people in Madrid, testers also come from a collaboration agreement Etelätär Innovation has with *Universidad Alfonso X* in Madrid (UAX-Etelätär Centre for Collaborative Mobility), and Elderly associations in Madrid, the EBU as well as the staff's personal network. The testers are expected to bring their smartphones; however, some can be provided in case they are needed. Testers are provided with the necessary metro tickets for each physical pilot testing within their batches as well as a water bottle or a soft drink.

7.2.6 Location and equipment needed

The pilot is conducted within the public transportation network of Madrid (Spain) where Apertum has already been deployed, which facilitates the pilot deployment since all the stations and stops have already been checked, classified and many requirements of vulnerable passengers have already been taken into account during the development of the application. No further mapping or assessment of the stations in Madrid is needed. The first wave of the pilot takes place in and around the stations of Príncipe Pío, Opera and Goya; the second wave in the stations of Sainz De Baranda, Cuatro Caminos and Canal; and the third wave takes place in the stations of Opera, Cuatro Caminos and Plaza De Castilla. The scenarios can be changed in order to facilitate the participation of disabled people by moving closer to their association. Throughout the deployment, the partners are working in close collaboration with Madrid city council, local public transport services, and the Madrid Region Disabled Association to ensure the legal and safe deployment of the pilot without interruption of the normal transportation services. The equipment needed to fill out the digital surveys are provided by the partners and consist of tablets, power banks and a clipboard with a back-up of several printed surveys. The equipment needed to travel within the transportation network shall be provided by the testers themselves and consist of the mobility assistances they are used to, among other wheelchairs, crutches, white canes, hearing aids, prosthetics, heavy luggage, walking canes or service dogs. The testers are expected to use the mobile Apertum application in their own smartphones to ensure accessibility and usability as testers with disabilities might not be able to operate commonly available smartphone and rely on a specific interface or hardware type, but the partners can also provide common smartphones in case that the testers do not own a device themselves or do not carry it on themselves. For the testers who conduct the travels through the Madrid transportation network, screen recordings of each pilot wave are made to document the progression and interface throughout the journey. Furthermore, the partners provide a number of baby strollers for the testers during of the in-situ pilot execution.

The FDG in collaboration with the EBU takes place in Rome, Italy within the facilities of their member of the Italian Union of the Blind and Partially Sighted (UICI[45]) in person. The groups consist of local members of the later association and take part in a separate survey on the perceived usefulness of CAVs for persons with sensory impairments.

7.2.7 Scheduling

T1.1 (M20-M21) A focus group is assembled and summoned, including a group of vulnerable users and their assisting aids. Together with the partners, the defined scenarios and considered variables to be investigated are reviewed and feedback shall be provided. Furthermore, the related survey questionnaire is reviewed and enhanced by including further questions of relevance to the group or modifying existing questions to better suit the user's needs. An 'inception meeting' is also called, including vulnerable users and representatives of the public transport operators, in order to assimilate the planned data collection process and timetable. This task also relates partially to the activities conducted in the project Task 6.2 (Pilot setup).

T1.2 (M22-M26) The first wave of pilot execution, following scenario 1 is conducted including at least four batches of testers. Data shall be collected regarding the challenges and unforeseen obstacles the users have to face in the scenario through the questionnaire survey, observation log and the technical operations, as provided by the Apertum platform, the screen recordings and other third-party applications. After the physical testing of the pilot, vulnerable passengers are asked to fill out further questionnaires and the partners search for and identify possible deviations between the in-situ testing and the average user experience. Furthermore, this data is pooled, harmonised and analysed in order to adapt the other pilot waves accordingly if needed, such as modification of the time of day the pilot shall be conducted at or alternative locations for the scenarios in case of spontaneous construction works or obstacles.

Surveys for the FDGs are to be ameliorated, enhanced and improved with the feedback of visually impaired persons as well as considerations of the guidelines proposed by WP3 partners. The final version of this survey should be agreed upon and published internally.

T1.3 (M23) The next wave of data collection starts, which follows scenario 2 and includes the same testing- and data analysis process to identify further issues or shortcomings quickly and to be able to prevent them from impeding on the successful completion of wave three. Furthermore, a focus group of vulnerable users and blind people shall be called to deepen the analysis of the questionnaire and eventually integrate proposed changes or modify the survey accordingly in case that any aspects might have been overlooked by the involved parties in former meetings.

The FDGs with EBU members in Rome, Italy take place and shall be conducted in the matter of a week. Alternatively, if the ongoing pandemic does not allow for in-person interviews and group meetings, the meetings can be postponed to later in M29). Since the participants may encounter barriers in accessing video call software, the FDGs must be conducted in person with respective safety measures in place.

T1.4 (M24-28) The last wave of data collection begins and scenario 3 is tested extensively. The data which can be collected during pilot wave 3 is analysed in this timeframe and a final assessment report shall be created to summarise and highlight any and all changes, modifications, challenges and solutions which were necessary to ensure the successful completion of the pilots and a subsequent improvement of the Apertum application.

7.2.8 Staff

In order to successfully conduct and complete this pilot a group of qualified staff is needed, including:

- Four pollsters to conduct the surveys and interviews.
- Four managers who take care of the moderation and documentation of the pilots and accompany the testers during all stages of the pilot execution.
- One videographer to record the interviews and create video content of the pilot testing for the dissemination videoclip.
- The Apertum team is required to check the pilot stations shortly beforehand to avoid unforeseen incidents and aid with the instructions concerning the functionality of the mobile application to the testers.

Furthermore, staff of the Madrid Regional Transport Authority (*Consorcio de Transportes de Madrid*, the public entity operating Madrid's metro network) shall be involved in the early stages of the pilot planning.

For the FDGs, Etelätär Innovation's staff works in conjunction with the UICI staff, EBU supervision as well as one translator, who can interpret in real-time to convey the instructions to the participants and allow an interactive exchange between Etelätär Innovation's staff and the participants to ask and answer questions and gather insightful feedback. Additional pollsters may be included to help the participants in completing the surveys.

7.2.9 Pilot documentation

The pilot progression and execution is documented through the number of surveys, which have been filled out, the available video recordings as well as the screen recordings and data from the application as well as observations of the partners, documented in notes. The related external conditions are reported on by the pilot staff by means of a form. This form collects information of each pilot on the data collection specified in *Deliverable D6.1* respectively related to the following topics:

- Pilot name;
- TestID;
- ToolID;
- CityID;
- ScenarioID;
- UserID;
- TripID;
- StartTime;
- StopTime;
- Route;
- TripDuration;
- TripDistance;
- TripCost;
- Wave number (if applicable);
- Incidents related to the pilot (if any);
- Incidents unrelated to the pilot (if any);
- Weather conditions;
- Size of batches;
- Additional comments & feedback.

This provides additional information for the data analysis that may explain the perceived ease of use, the willingness to adopt and the perceived usefulness of Apertum.

Subsequently, a pilot documentation form[46] has been created and shared with the pilot staff and has to be completed at the end of each pilot wave to document possible issues or obstacles which can be taken into account for the planning and execution of the following pilot waves.

7.2.10 Test moderation

During the physical testing phase of the pilot, the responsible manager takes on the role of the moderator, they introduce the testers to the scenario beforehand, answer any questions the participants may have and accompany them throughout their entire journey. This ensures that the moderators can fill out the documentation form during the trip and note down any and all obstacles. During the rest of the focus groups and interviews, Etelätär Innovation's staff takes on the role as moderator, introducing and guiding the participants throughout the entire pilot and replying to any questions they may have. Finally, the team also informs the participants of data protection policies, the purpose of the pilots, the goal of the pilots and where they can find out the conclusions of the project after its end.

During the FDGs, Etelätär Innovation's staff takes on the role of moderators and shares this task with a representative of the local UICI to ensure that the participants feel comfortable and at ease during the completion of the surveys and the subsequent discussion groups.

7.2.11 Accessibility

The Apertum application is designed to facilitate the navigation within the Madrid public transportation network for people with mobility constraints, therefore, the pilot must be ready for people with multiple kinds of disabilities to perform it without problems. This includes people with missing limbs, visual impairments or learning disabilities. The platform is fully accessible, has an intuitive design and offers simple language. Rigorous testing and involvement of several different associations of the disabled have led to a mobile application which is easily usable with most disabilities.

The FDGs are fully accessible for people with sensory impairments and the surveys are adapted so that they can be detected by screen reading software, which the participants might use on their personal smartphones. If they do not use any mobile devices or are not used to handling digital equipment, a sufficient number of pollsters are present to help the participants to fill out any survey manually by reading the questions and answer options to them aloud. Furthermore, the entire presentation of the PAsCAL project and any supporting material to introduce the pilot to the participants cannot rely on visuals to ensure the easy accessibility and intelligibility of the meeting.

7.2.12 Data collection from users

The main source of information for the pascal project are the questionaries, which can be asked verbally by pollsters to the users or filled out by the users themselves. The answers are recorded using a tablet or other mobile device, using the previously mentioned survey software Qualtrics. Finally, the pooled data is exported to be analysed by the partners in further deliverables. The questionnaires are structured in a way to allow any tester and participant to remain anonymous and the participants are informed in detail on their privacy and data protection rights and the corresponding policy of the pilot by the respective manager of each group. Furthermore, participants can request to be excluded from any video or photo footage which may be used for dissemination purposes later.

Additional information is documented via video recordings of the interviews, the physical testing of the pilot and screen recordings performed to testers using the Apertum application as well as the documentation forms, which are filled out by each manager.

7.2.13 Contribution to dissemination activities

Video and photo footage are recorded during each wave testing of the pilot. This material may be used to create a dissemination videoclip containing users with limited mobility calculating routes in the Apertum application and navigating through the metro. The pictures may further be used for articles and publications on the pilot in various different journals or social media posts. Additionally, an event is held after the pilot has been completed to spread awareness of the PAsCAL project as well as the Apertum pilot in the general population and inform citizens of the significance and scale of the project. In collaboration with FLM, a retrospective reflection meeting is held to discuss the importance and potential of CAVs for the disabled community and its contents are published across several social media channels.

During the FDGs in Rome, UICI's, EBU's and Etelätär Innovation's staff produce video recordings and photos of the meeting and publish updates across several different social media channels.

7.3 Workplan

The workplan for the pilot is composed of the pilot preparation, a focus group meeting and three waves of data collection spread through the whole pilot as well as the final wave result verification. The benefit of doing the surveys in waves is that learnings from previous waves can be used to improve the next wave of the same pilot and ensure the identification of shortcomings or disturbance variables.

Table 11 Pilot 5 overall workplan

Year	2021												2022		
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30	M31	M32	M33	M34
Pilot preparation															
Focus discussion groups															
First wave															
Second wave															
Third wave															
Wave result verification															

Each of the three waves follows their own workplan, which spans over 15 days in total and can be separated into two sections: wave setup, which takes up to five days and serves the briefing of the staff, the preparation of equipment and the verification of the pilot locations; and wave execution, which takes ten days and includes the briefing of the testers, the implementation of the pilot as well as the monitoring of and interviews with the testers. Each of the phases consists of several subtasks.

Table 12 Pilot 5 wave workplan

Day	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Wave setup															
Team briefing															
Material preparation															
Location verification															
Wave ready															
Wave execution															
Briefing with testers															
Tests															
Monitoring and Documentation															
Surveys/Interviews															
Wave completed															

This workplan shall be reviewed and edited if necessary. The partners stay in close contact and exchange constant feedback in order to be able to modify the workplan spontaneously in case it is needed.

8 Conclusions

All of the pilots described in this document are carried out by the corresponding WP partners:

1. High-capacity autonomous bus operations by EBUS;
2. Autonomous driving training by ACI;
3. Autonomous bus line by Etelätär Innovation;
4. Shared connected transport by LuxMobility;
5. Experience of vulnerable travellers with connected transport environments by Etelätär Innovation.

They explore and assess the perception of users after using a CAV under real-life conditions and interacting with a fully functional CAV technology. The results of each of the pilots, including the qualitative and quantitative data collected throughout the pilot executions are analysed and documented both in Deliverable D6.3 of this same WP as well as in the following work carried out by WP7 partners. Finally, it contributes to the Guide2Autonomy of WP8 and is expected to significantly add to the scientific insight on the acceptance of CAVs. WPs 2, 3, 4, 5 and 7 have delivered important contributions to the work of this Deliverable and all of the available work done by these WPs has been considered for each of the pilot descriptions and setups. This document can also act as a handbook on the optimal and efficient setup of pilots in the field of innovative and new transport technologies.

8.1 High-capacity autonomous bus operations

The high-capacity autonomous bus operations pilot takes place between January and November 2021 and explores mainly the effect of incidents and the (in)ability to communicate to the operator of the bus under such circumstances on the perception of the users. The main tool to achieve this is a 12-metre bus, which is prepared to give a driverless experience and it is connected to the Public Transport Operator. Several different HMIs, developed by the WP partner or available on the market are tested to test what kind of connected information and communication devices matter to passengers onboard an autonomous vehicle.

8.2 Autonomous driving training

Following the development of simulations within WP5, some of the developed training methodologies are tested in a safe driving centre in

Lainate, Italy. The pilot includes the interaction with a CAV on the test track and includes various different kind of drivers with differing levels of experience and expertise. Some of the participants receive a training beforehand where they learn how to interact with CAVs while driving a car. Some scenarios are triggered to see their different reaction in situations with varying levels of safety and complexity.

8.3 Autonomous bus line

The third pilot, the autonomous bus line takes place in Madrid between March and November 2021 and focus specifically on the aspects of commercial CAV operations, potential advantages of using such services for vulnerable travellers as well as the integration of CAV systems into a wider multimodal public transport network. Furthermore, it explores the perception of other road users such as car drivers, cyclists or pedestrians towards the CAV from the passenger's as well as co-road user's perspective. The final assessment of the autonomous bus line pilot can be complemented by the available data for previous months provided by the operator to draw conclusions on the commercial viability and success of the autonomous line.

8.4 Shared connected transport

Pilot 4 takes place in Luxembourg and consists of two different technologies: A shared fleet of cars and an autonomous bus. The former can be tested through the exclusive implementation of the service into a University, where employees are able to use the fleet free of charge over the course of some months. The autonomous bus is available also for free to any user and is tested concerning some incidents or simulated seemingly dangerous situations.

8.5 Experience of vulnerable travellers with connected transport environment

The experience of vulnerable travellers within connected transport environments is a largely unexplored field and this pilot greatly contributes to capture the opinion and needs of vulnerable travellers. It not only tests available solutions but also gives insight into additional services or features vulnerable persons might need to feel safe and easily navigate within large transport networks on their own. The pilot not only includes people in wheelchairs, with reduced hand mobility or visually impaired persons, but also the elderly and people with temporary mobility constraints.

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Annex I: Surveys

1. Pilot 1: High-capacity autonomous bus operations

	Type	Indicator Category	Indicator	Question	Options	Additional information
1	Background			Are you	Female	
					Male	
					Other	
					Prefer not to say	
2	Background			Please tell us your age		
3	Background			What country do you currently live in?		
4	Background			Which city do you currently live in?		
5	Background			Do you have a visual impairment?	No	
					Yes	
					I am blind	
					I am partially sighted	

					I am deaf-blind.	
6	Background			When did your visual impairment first occur?	I was born visually impaired	
					The visual impairment occurred later in life	
7	Background			How would you describe your freedom of mobility?	I can travel alone	
					I can travel alone, but I have difficulties	
					I can only travel with someone else	
8	Background			What kind of Connected and/or Automated Vehicle (CAV) have you tried before?	Navigation & routing services (GoogleMaps, Waze,...)	
					Bike-, Scooter-, Car-sharing services (ShareNow, Free2Move, Lime,...)	
					Ride-sharing (Uber, Cabify, taxi apps,...)	
					Carpooling (BlaBlaCar, Leadmee,...)	

					Connected features (next stop indicator in buses,...)	
					Driver assistance (speed limit indicator, blind spot detection, lane assist,...)	
					Adaptative cruise control (the vehicle controls the speed according to traffic)	
					Automatic steering (autonomous parking or vehicle keeping itself in lane)	
					I don't know	
					I have never tried a CAV before	
8a	Background			Were you a passenger and/or a driver in the Connected and Automated Vehicle (CAV)?	A passenger	if Q5 has been answered with yes
					A driver	
					Both	
8b	Background			Was the CAV you have tried an autonomous shuttle service?	Yes	if Q8 has been answered with yes
					No	
					I don't know	

8c	Background			How many times have you ever used a CAV?	Never	if Q8 has been answered with yes
					Only once	
					Rarely	
					Occasionally	
					Systematically	
9	Background			How confident are you with CAVs?	Not confident at all	
					Barely confident	
					Medium confident	
					Very confident	
10	Background			Do you regularly use a smartphone or a computer?	Yes	
					No	
10a	Background			How long have you been using it?	I have recently started	if Q10 has been answered with yes
					From 1 to 3 years	
					From 3 to 5 years	
					More than 5 years	
10b	Background			Do you use one or several of the following applications?	Routing and guidance application	if Q10 has been answered with yes
					Shared mobility application	
					Public transport application	

					No, I don't	
11	Background			Do you have a full driving license?	Valid for motorcycles (Type A)	
					Valid for cars (Type B)	
					Valid for both, cars and motorcycles (A-B)	
					Valid for trucks (C)	
					None	
12	Background			How long have you owned a full driving license?	I don't have one	
					1-5 years	
					5-10 years	
					10-15 years	
					15+ years	
13	Background			What educational level do you have? Please choose the highest educational qualification you have achieved so far.	School finished without school leaving certificate	
					Still at school	
					Elementary or lower secondary school qualification	
					Middle School, High School or	

					Secondary School or equivalent qualification	
					Completed apprenticeship	
					Advanced Vocational Certificate of Education, vocational baccalaureate diploma, technical diploma	
					A levels, high school diploma or other university entrance qualification	
					Polytechnic degree, university of applied sciences degree, other university degree	
14	Background			What is your monthly net income approximately?	less than € 250	
					€ 250 to under € 1000	
					€ 1000 to under € 2000	

					€ 2000 to under € 3000	
					€ 3000 to under € 5000	
					€ 5000 and over	
					I do not want to answer that	
15	Background			Which is your current occupation?	Student	
					Full-time work (over 30 h a week)	
					Part-time work (30 h per week or less)	
					Currently not employed	
					Retired	
					Other	
15a	Background			How often do you travel to work or to your place of education?	Less than once a week	only if Q15 has been answered with "Student", "Full-time work (over 30 h a week)" or "Part-time work (30 h per week or less)"
					Once a week	
					2-6 times per week	
					Everyday	
					More often than once a day	
15b	Background				Public transport	

				Which system do you usually use for commuting/daily transport?	Private vehicle (car, motorcycle, etc.)	only if Q15 has been answered with "Student", "Full-time work (over 30 h a week)" or "Part-time work (30 h per week or less)"
					Sharing services	
					Light vehicles (bicycle, electric bicycle, etc.)	
					Walking	
					None of the above	
15c	Background			What is the average once-way distance for this trip?	Up to 5 km	only if Q15 has been answered with "Student", "Full-time work (over 30 h a week)" or "Part-time work (30 h per week or less)"
					5-15 km	
					16-25 km	
					26+ km	
16	Technical	Indicators of acceptance by end users	Attitudes and human factors	How were your feelings during the "autonomous driverless experience" ?	Trustful	
					Insecure	
					Safe	
					Nervous	
					Curious	
					Unaffected	
17	Technical				Positively surprised	

		Indicators of acceptance by end users	Attitudes and human factors	Was this experience as you had anticipated?	Negatively surprised	
					It was as I expected	
					I don't know	
18	Technical	Indicators of acceptance by end users	Perceived quality of travel	Was the experience comfortable compared with a conventional bus ride?	More comfortable	
					Less comfortable	
					No difference	
					I don't know	
19	Technical	Indicators of acceptance by end users	Perceived usefulness	Which potential benefits do you see in using autonomous buses?	Increased safety (e.g. lower risk of accidents, less harsh manouvers)	Choose all that apply
					Increased convenience	
					Increased punctuality	
					Better service	
					Lower price	
					Less congestion	
					Lower pollution	
					Time saving	
					None of the above	
20	Technical	Indicators of	Perceived usefulness	Which potential shortcomings do you see	Decreased safety (e.g. higher risk of	Choose all that apply

		acceptance by end users		about using autonomous buses?	accidents, more harsh manouvers)	
					Worse service (difficulties in boarding and allighting)	
					Less information onboard	
					Loss of jobs	
					Less security	
					Higher price	
					None of the above	
21	Technical	Indicators of acceptance by end users	Attitudes and human factors	Could you see yourself using autonomous buses in the future?	Certainly	
					Probably	
					Depends on how technology evolves	
					Probably not	
					Not at all	
22	Technical	Indicators of acceptance by end users	Willingness to let other use	Would you let other members of your family or close circle use autonomous buses?	Certainly	
					Probably	
					Depends on how technology evolves	
					Probably not	
					Not at all	

23	Technical	Indicators of acceptance by end users	Perceived quality of travel	How did you find entering/exiting the bus at the stop, compared to a conventional bus?	Easier	
					More difficult	
					Stressing	
					No difference	
24	Technical	Indicators of acceptance by end users	Perceived risk	Do you think that emergency situations will be more difficult to handle without a driver?	Yes	
					No	
					No difference	
					I don't know	
25	Technical	Indicators of acceptance by end users	Changed mobility behaviour	Would you feel stressed without a driver whom you can ask for information?	Yes	
					No	
					No difference	
					I don't know	
26	Technical	Indicators of acceptance by end users	Perceived risk	Do you think that users of autonomous buses will be more vulnerable to robbers/pickpocketing/violent passengers?	Yes	
					No	
					No difference	
					I don't know	
27	Technical	Indicators of acceptance by end users	Perceived risk	Do you think that on-demand contact with the control center from the bus is important?	Yes	
					No	
					No difference	
					I don't know	

28	Technical	Indicators of acceptance by vulnerable users	Social inclusion	How do you think autonomous buses will affect the lives of people with disabilities ?	Improve them	
					May cause some problems	
					No difference	
					I don't know	
29	Technical	Indicators of acceptance by end users	Perceived risk	Did you feel at risk when the bus started moving without a visible driver during the "autonomous driverless experience"?	Yes	if tester experiences specific scenarios
					No	
30	Technical	Indicators of acceptance by end users	Perceived risk	Did you feel at risk when the bus was approaching the stops?	Yes	if tester experiences specific scenarios
					No	
					I didn't notice	
31	Technical	Indicators of acceptance by end users	Perceived risk	Did you feel at risk when the bus performed a sudden emergency braking or obstacle avoiding manoeuvre?	Yes	if tester experiences specific scenarios
					No	
					I didn't notice	
32	Technical	Indicators of acceptance by end users	Perceived risk	Did you feel at risk when the bus stopped in the middle of the line?	Yes	if tester experiences specific scenarios
					No	
					I didn't notice	
33	Technical				Yes	

		Indicators of acceptance by end users	Perceived risk	Did you feel at risk when the bus stopped, but the doors did not open as expected?	No I didn't notice	if tester experiences specific scenarios
34	Technical	Indicators of acceptance by vulnerable users	Social inclusion	Did the IT solutions help increase your confidence during the "autonomous driverless experience"?	Yes No I didn't notice I don't know	if tester experiences specific scenarios
35	Technical	Indicators of acceptance by vulnerable users	Social inclusion	Did the voice announcements help increase your confidence during the "autonomous driverless experience" ?	Yes No I didn't notice I don't know	if tester experiences specific scenarios
36	Technical	Indicators of acceptance by end users	Willingness to adopt	If autonomous buses were available I would use them.	I would be willing to switch to autonomous buses. I would be willing to switch to autonomous buses only if IT support was available on the bus (e.g. allowing to connect to control center).	choose all that apply

					I would not like to use autonomous buses.	
					I would try to avoid autonomous buses as much as possible.	
37	Technical	Indicators of society level acceptance	Public acceptance	Please imagine that large sections of the population would use autonomous buses. To what degree do the following statements apply to you?	The idea that large sections of the population use autonomous buses feels bad.	choose all that apply
					The idea that large sections of the population use autonomous buses feels good.	
					I think it is great if large sections of the population use autonomous buses.	
38	Technical	Indicators of society level acceptance	Quality of life	Do you think autonomous buses can significantly improve citizens' everyday mobility (make public transport more attractive)?	Yes	
					No	
					I don't know	
39				Do you have any additional comments or suggestions?		

2. Pilot 2: Autonomous driving training

	Type	Indicator Category	Indicator	Question	Options	Additional information
1	Background			Are you	Female	
					Male	
					Other	
					Prefer not to say	
2	Background			Please tell us your age		
3	Background			What country do you currently live in?		
4	Background			Which city do you currently live in?		
5	Background			What kind of Connected and/or Automated Vehicle (CAV) have you tried before?	Navigation & routing services (GoogleMaps, Waze,...)	
					Bike-, Scooter-, Car-sharing services (ShareNow, Free2Move, Lime,...)	
					Ride-sharing (Uber, Cabify, taxi apps,...)	
					Carpooling (BlaBlaCar, Leadmee,...)	
					Connected features (next stop indicator in buses,...)	

					Driver assistance (speed limit indicator, blind spot detection, lane assist,...)	
					Adaptative cruise control (the vehicle controls the speed according to traffic)	
					Automatic steering (autonomous parking or vehicle keeping itself in lane)	
					I don't know	
					I have never tried a CAV before	
5a	Background			Were you a passenger or/and a driver in the Connected and Automated Vehicle (CAV)?	A passenger	if Q5 has been answered with yes
					A driver	
					Both	
5b	Background			How many times have you ever used a CAV?	Never	if Q5 has been answered with yes
					Only once	
					Rarely	
					Occasionally	
					Systematically	
6	Background				Not confident at all	

				How confident are you with CAVs?	Barely confident	
					Medium confident	
					Very confident	
7	Background			Do you regularly use a smartphone or a computer?	Yes	
					No	
7a	Background			How long have you been using it?	I have recently started	if Q7 has been answered with yes
					From 1 to 3 years	
					From 3 to 5 years	
					More than 5 years	
7b	Background			Do you use one or several of the following applications?	Routing and guidance application	if Q7 has been answered with yes
					Shared mobility application	
					Public transport application	
					No, I don't	
8	Background			Do you have a full driving license?	Valid for motorcycles (Type A)	
					Valid for cars (Type B)	
					Valid for both, cars and motorcycles (A-B)	
					Valid for trucks (C)	
					None	

9	Background			How long have you owned a full driving license?	I don't have one	
					1-5 years	
					5-10 years	
					10-15 years	
					15+ years	
10	Background			What educational level do you have? Please choose the highest educational qualification you have achieved so far.	School finished without school leaving certificate	
					Still at school	
					Elementary or lower secondary school qualification	
					Middle School, High School or Secondary School or equivalent qualification	
					Completed apprenticeship	
					Advanced Vocational Certificate of Education, vocational baccalaureate diploma, technical diploma	
					A levels, high school diploma or other university entrance qualification	

					Polytechnic degree, university of applied sciences degree, other university degree	
11	Background			What is your monthly net income approximately?	less than € 250	
					€ 250 to under € 1000	
					€ 1000 to under € 2000	
					€ 2000 to under € 3000	
					€ 3000 to under € 5000	
					€ 5000 and over	
					I do not want to answer that	
12	Background			Which is your current occupation?	Student	
					Full-time work (over 30 h a week)	
					Part-time work (30 h per week or less)	
					Currently not employed	
					Retired	
					Other	
12a	Background			How often do you travel to work or to your place of education?	Less than once a week	only if Q12 has been answered with "Student", "Full-time work (over 30 h a week)" or "Part-
					Once a week	
					2-6 times per week	

					Everyday	time work (30 h per week or less)"
					More often than once a day	
12b	Background			Which system do you usually use for commuting/daily transport?	Public transport	only if Q12 has been answered with "Student", "Full-time work (over 30 h a week)" or "Part-time work (30 h per week or less)"
					Private vehicle (car, motorcycle, etc.)	
					Sharing services	
					Light vehicles (bicycle, electric bicycle, etc.)	
					Walking	
					None of the above	
12c	Background			What is the average once-way distance for this trip?	Up to 5 km	only if Q12 has been answered with "Student", "Full-time work (over 30 h a week)" or "Part-time work (30 h per week or less)"
					5-15 km	
					16-25 km	
					26+ km	
13	Technical	Indicators of acceptance by end users	Attitudes and human factors	How did you feel while traveling in a CAV?	Trustful	
					Careful	
					Insecure	
					Safe	
					Nervous	
					Curious	
					Critical	

					Unaffected	
14	Technical	Indicators of acceptance by end users	Attitudes and human factors	Was using a CAV the experience you had anticipated?	Positively surprised	
					Negatively surprised	
					It was as I expected	
					I don't know	
15	Technical	Indicators of acceptance by end users	Perceived quality of travel	Was the trip comfortable compared with a human-driven bus?	More comfortable	
					Less comfortable	
					No different	
					I don't know	
16	Technical	Indicators of acceptance by end users	Perceived quality of travel	How well do you think that the partially-automated car performed regarding steering, acceleration and braking?	Better than a human driver	
					Same as a human driver	
					Worse than a human driver	
					Just different	
17	Technical	Indicators of acceptance by end users	Perceived risk	How do you describe the partially-automated car reactions?	Very good	
					Safe	
					Neutral	
					Unpredictable	
					Dangerous	
18	Technical				No reaction	

		Indicators of acceptance by end users	Changed mobility behaviour	Which was your reaction to cars manouvers?	I followed the training	
					I had a different reaction	
19	Technical	Indicators of acceptance by end users	Perceived ease of use	How difficult and stressful was to use a real partially-automated car?	Very difficult	
					Moderately difficult	
					Not very difficult	
					Not difficult at all	
20	Technical	Indicators of acceptance by end users	Attitude and human factor	Did you notice any difference in your behaviour compared to the simulation?	No difference	
					Difference 1	
					Difference 2	
21	Technical	Indicators of acceptance by end users	Attitude and human factor	Did you notice any difference in the car behaviour compared to the simulation?	No difference	
					Difference 1	
					Difference 2	
22	Technical	Indicators of acceptance by end users	Perceived usefulness	Do you think that the training received improved your reactions?	Yes	
					Partially	
					No	
					I don't know	
23	Technical	Indicators of	Perceived usefulness		Yes	
					Partially	

		acceptance by end users		Do you think that the training received was adequate?	No	
					I don't know	
24	Technical	Indicators of acceptance by end users	Willingness to adopt	After this experience, would you use a partially-automated car for your daily trips?	Certainly	
					Probably	
					Depends on how technology evolves	
					Probably not	
					Not at all	
25	Technical	Indicators of acceptance by end users	Willingness to let other use	Would you encourage your family or friends to use partially-automated cars?	Certainly	
					Probably	
					Depends on how technology evolves	
					Probably not	
					Not at all	
26	Technical	Indicators of acceptance by end users	Changed mobility behaviour	Would you advise others to follow a similar training?	Yes	
					No	
					I don't know	
27	Technical				More affordable	

		Indicators of society level acceptance	Socio-economic impacts	How do you think CAVs will affect transport prices	No difference	
					More expensive	
					I don't know	
28	Technical	Indicators of acceptance by end users	Willingness to adopt	If partially-automated cars were available, I would use them.	I am willing to accept the effort to switch to partially-automated cars (e.g. special courses).	choose all that apply
					The switch to partially-automated cars is unacceptable.	
					I would not like to use partially-automated cars.	
					I would try to avoid partially-automated cars as much as possible.	
29	Technical	Indicators of society level acceptance	Public acceptance	Please imagine that large sections of the population would use partially-automated cars . To what degree do the following statements apply to you?	The idea that large sections of the population use partially-automated cars feels bad.	choose all that apply
					The idea that large sections of the population use partially-automated cars feels good.	

					I think it is great if large sections of the population use partially-automated cars.	
				Do you have any additional comments or suggestions?		

3. Pilot 3: Autonomous bus line

3.1. Bus line – Users

	Type	Indicator Category	Indicator	Question	Options	Additional information
1	Background			Are you	Female	
					Male	
					Other	
					Prefer not to say	
2	Background			Please tell us your age		
3	Background			What country do you currently live in?		
4	Background			Which city do you currently live in?		
5	Background			What kind of Connected and/or Automated Vehicle (CAV) have you tried before?	Navigation & routing services (GoogleMaps, Waze,...)	
					Bike-, Scooter-, Car-sharing services (ShareNow, Free2Move, Lime,...)	
					Ride-sharing (Uber, Cabify, taxi apps,...)	
					Carpooling (BlaBlaCar, Leadmee,...)	
					Connected features (next stop indicator in buses,...)	

					Driver assistance (speed limit indicator, blind spot detection, lane assist,...)	
					Adaptative cruise control (the vehicle controls the speed according to traffic)	
					Automatic steering (autonomous parking or vehicle keeping itself in lane)	
					I don't know	
					I have never tried a CAV before	
5a	Background			Were you a passenger and/or a driver in the Connected and Automated Vehicle (CAV)?	A passenger	if Q5 has been answered with yes
					A driver	
					Both	
5b	Background			How many times have you ever used a CAV?	Never	if Q5 has been answered with yes
					Only once	
					Rarely	
					Occasionally	
					Systematically	
6	Background			How confident are you with CAVs?	Not confident at all	
					Barely confident	
					Medium confident	
					Very confident	

7	Background			What educational level do you have? Please choose the highest educational qualification you have achieved so far.	School finished without school leaving certificate	
					Still at school	
					Elementary or lower secondary school qualification	
					Middle School, High School or Secondary School or equivalent qualification	
					Completed apprenticeship	
					Advanced Vocational Certificate of Education, vocational baccalaureate diploma, technical diploma	
					A levels, high school diploma or other university entrance qualification	
					Polytechnic degree, university of applied sciences degree, other university degree	
8	Background			What is your monthly net income approximately?	less than € 250	
					€ 250 to under € 1000	
					€ 1000 to under € 2000	
					€ 2000 to under € 3000	
					€ 3000 to under € 5000	
					€ 5000 and over	
					I do not want to answer that	
9	Background			Which is your current occupation?	Student	
					Full-time work (over 30 h a week)	

					Part-time work (30 h per week or less)	
					Currently not employed	
					Retired	
					Other	
9a	Background			How often do you travel to work or place of education?	Less than once a week	only if Q9 has been answered with "Student", "Full-time work (over 30 h a week" or "Part-time work (30 h a week or less)
					Once a week	
					2-6 times per week	
					Everyday	
					More often than once a day	
9b	Background			What is the average once-way distance for this trip?	Up to 5 km	only if Q9 has been answered with "Student", "Full-time work (over 30 h a week" or "Part-time work (30 h a week or less)
					5-15 km	
					16-25 km	
					26+ km	
10	Background				Private car	

				Which is your preferred transport mode?	Public transport - Bus	
					Public transport - Subway	
					Walking	
					None of the above	
11	Background			Do you regularly use a smartphone or a computer?	Yes	
					No	
11a	Background			How long have you been using it?	I have recently started	if Q12 has been answered with yes
					From 1 to 3 years	
					From 3 to 5 years	
					More than 5 years	
11b	Background			Do you use one or several of the following applications?	Routing and guidance application	if Q12 has been answered with yes
					Shared mobility application	
					Public transport application	
					No, I don't	
12	Background			In a typical month, how often do you use public transport?	Less than once a week	
					Once or twice a week	
					Daily	
					Never	
13	Technical	Indicators of			Trustful	choose all that apply
					Careful	

		acceptance by end users	Attitudes and human factors	How did you feel while traveling in a CAV?	Insecure	
					Safe	
					Nervous	
					Curious	
					Critical	
					Unaffected	
14	Technical	Indicators of acceptance by end users	Attitudes and human factors	Was using a CAV the experience you had anticipated?	Positively surprised	
					Negatively surprised	
					It was as I expected	
					I don't know	
15	Technical	Indicators of acceptance by vulnerable users	Adequacy of the solution	Do you think this kind of vehicle is safe to use for vulnerable users? (wheelchair users, visually impaired persons, the elderly, injured persons)	Yes	
					No	
					It does not make a difference	
					I don't know	
16	Technical	Indicators of society level acceptance	Safety and security at societal level / Mobility and	Have you witnessed that the autonomous bus line you have just tried influences the traffic conditions of	Yes, it influenced public transport	choose all that apply
					Yes, it influenced other cars	
					Yes, it influenced pedestrians	
					Yes, it influenced cyclists	

			transport network	the surrounding road users?	I have not witnessed any influence on the traffic conditions	
16a	Technical	Indicators of society level acceptance	Mobility and transport network	What kind of influence have you witnessed?	Increased traffic congestion (more traffic jams, bottlenecks, queues)	choose all that apply
					Decreased traffic congestion (less traffic jams, bottlenecks, queues)	
					Increased safety conditions on the road (lowered risk of collision, safer overtaking, less risky manoevres, etc.)	
					Decreased safety conditions on the road (higher risk of collision, dangerous overtaking, risky manoevres, etc.)	
					Increased degree of road anger and/or anxiety in other road users	
					Decreased degree of road anger and/or anxiety in other road users	
					Other road users do not respect the corridor defined for the autonomous bus line	
					Other road users respect the corridor defined for the autonomous bus line	
					Increased availability of parking spaces	
					Decreased availability of parking spaces	
17	Technical	Indicators of society level acceptance	Willingness to let other use	Would you let other members of your family or close circle use an	Certainly	
					Probably	
					Depends on how technology evolves	
					Probably not	

				autonomous bus service?	Not at all	
18	Technical	Indicators of acceptance by end users	Perceived Ease of Use	Do you think that information inside the autonomous bus line is sufficient for your usual trips?	Yes	
					No	
					It does not make a difference	
18a	Technical	Indicators of acceptance by end users	Perceived Ease of Use	What addtional information should ideally be available onboard the autonomous bus line?		if Q19 has been answered with no, text box
19	Technical	Indicators of acceptance by end users	Perceived quality of travel	Are you missing any features onboard the autonomous bus line?	Yes	
					No	
					I don't know	
19a	Technical	Indicators of acceptance by end users	Perceived quality of travel	Which features in particular are you missing?	Seatbelts	If Q20 has been answered Yes or I don't know
					Radio / Music	
					Information	
					Alarms	
					Other (Please specify):	
20	Technical	Indicators of society level acceptance	Quality of life	Do you believe that CAVs can lower emissions and contribute to	Yes	
					No	
					It does not make a difference	

				making transport networks more sustainable?	I don't know	
21	Technical	Indicators of acceptance by end users	Willingness to pay	Would you pay for using an autonomous bus service?	I would not pay for this kind of service	
					Yes, I would be willing to pay a separate fee	
					Yes, if the fee was included in my monthly ticket (public transport pass)	
22	Technical	Indicators of society level acceptance	Mobility and transport network	Do you believe that the transport system as a whole can be improved by the integration of such kind of autonomous bus services?	Yes	
					No	
					It does not make a difference	
					I don't know	
23	Technical	Indicators of acceptance by end users	Willingness to adopt	If the autonomous bus line were available to me, I would use it.	I am willing to accept the effort to switch to autonomous buses (e.g. special courses).	choose all that apply
					The switch to autonomous buses is unacceptable.	
					I would not like to use autonomous buses.	
					I would try to avoid autonomous buses as much as possible.	
24	Technical	Indicators of society level acceptance	Public acceptance	Please imagine that large sections of the population would use the autonomous bus line. To what	The idea that large sections of the population use autonomous buses feels bad.	choose all that apply
					The idea that large sections of the population use autonomous buses feels good.	

				degree do the following statements apply to you?	I think it is great if large sections of the population use autonomous buses.	
25	Background			Do you have any additional comments or suggestions?		

3.2. Bus line – Road co-users

	Type	Indicator Category	Indicator	Question	Options	Additional information
1	Background			Are you	Female	
					Male	
					Other	
					Prefer not to say	
2	Background			Please tell us your age		
3	Background			What country do you currently live in?		
4	Background			Which city do you currently live in?		
5	Background			What kind of Connected and/or Automated	Navigation & routing services (GoogleMaps, Waze,...)	

				Vehicle (CAV) have you tried before?	Bike-, Scooter-, Car-sharing services (ShareNow, Free2Move, Lime,...)	
					Ride-sharing (Uber, Cabify, taxi apps,...)	
					Carpooling (BlaBlaCar, Leadmee,...)	
					Connected features (next stop indicator in buses,...)	
					Driver assistance (speed limit indicator, blind spot detection, lane assist,...)	
					Adaptative cruise control (the vehicle controls the speed according to traffic)	
					Automatic steering (autonomous parking or vehicle keeping itself in lane)	
					I don't know	
					I have never tried a CAV before	
5a	Background			Were you a passenger and/or a driver in the Connected and Automated Vehicle (CAV)?	A passenger	if Q5 has been answered with yes
					A driver	
					Both	
5b	Background			How many times have you ever used a CAV?	Never	if Q5 has been answered with yes
					Only once	
					Rarely	

					Occasionally	
					Systematically	
6	Background			How much confidence do you have in CAVs?	Not confident at all	
					Barely confident	
					Medium confident	
					Very confident	
7	Background			What educational level do you have? Please choose the highest educational qualification you have achieved so far.	School finished without school leaving certificate	
					Still at school	
					Elementary or lower secondary school qualification	
					Middle School, High School or Secondary School or equivalent qualification	
					Completed apprenticeship	
					Advanced Vocational Certificate of Education, vocational baccalaureate diploma, technical diploma	
					A levels, high school diploma or other university entrance qualification	
					Polytechnic degree, university of applied sciences degree, other university degree	
8	Background				less than € 250	
					€ 250 to under € 1000	

				What is your monthly net income approximately?	€ 1000 to under € 2000	
					€ 2000 to under € 3000	
					€ 3000 to under € 5000	
					€ 5000 and over	
					I do not want to answer that	
9	Background			Which is your current occupation?	Student	
					Full-time work (over 30 h a week)	
					Part-time work (30 h per week or less)	
					Currently not employed	
					Retired	
					Other	
9a	Background			How often do you travel to work or place of education?	Less than once a week	only if Q9 has been answered with "Student", "Full-time work (over 30 h a week" or "Part-time work (30 h a week or less)
					Once a week	
					2-6 times per week	
					Everyday	
					More often than once a day	
9b	Background			What is the average once-way distance for this trip?	Up to 5 km	only if Q9 has been answered with "Student", "Full-time work
					5-15 km	
					16-25 km	

					26+ km	(over 30 h a week" or "Part-time work (30 h a week or less)
11	Background			Which is your preferred transport mode?	Private car	
					Public transport - Bus	
					Public transport - Subway	
					Walking	
					None of the above	
12	Background			Do you regularly use a smartphone or a computer?	Yes	
					No	
12a	Background			How long have you been using it?	I have recently started	if Q12 has been answered with yes
					From 1 to 3 years	
					From 3 to 5 years	
					More than 5 years	
12b	Background			Do you use one or several of the following applications?	Routing and guidance application	if Q12 has been answered with yes
					Shared mobility application	
					Public transport application	
					No, I don't	
13	Background				Less than once a week	
					Once or twice a week	

				In a typical month, how often do you use public transport?	Daily	
					Never	
14	Technical	Indicators of society level acceptance	Willingness to let other use	Would you let other members of your family or close circle use autonomous bus services?	Certainly	
					Probably	
					Depends on how technology evolves	
					Probably not	
					Not at all	
15	Technical	Indicators of acceptance by end users	Changed mobility behaviour	Have you noticed a different behaviour in traffic flows around the Universidad Autónoma area in the last few months?	Yes, there is less traffic	
					Yes, there is more traffic	
					No	
					I don't know	
16	Technical	Indicators of society level acceptance	Safety and security at societal level / Mobility and transport network	Have you witnessed that the autonomous bus line influences the traffic conditions of the surrounding road users?	Yes, it influenced public transport	choose all that apply
					Yes, it influenced other cars	
					Yes, it influenced pedestrians	
					Yes, it influenced cyclists	
					I have not witnessed any influence on the traffic conditions	
16a	Technical	Indicators of society level acceptance	Mobility and transport network	What kind of influence have you witnessed?	Increased traffic congestion (more traffic jams, bottlenecks, queues)	choose all that apply
					Decreased traffic congestion (less traffic jams, bottlenecks, queues)	

					Increased safety conditions on the road (lowered risk of collision, safer overtaking, less risky manoevres, etc.)	
					Decreased safety conditions on the road (higher risk of collision, dangerous overtaking, risky manoevres, etc.)	
					Increased degree of road anger and/or anxiety in other road users	
					Decreased degree of road anger and/or anxiety in other road users	
					Other road users do not respect the corridor defined for the autonomous bus line	
					Other road users respect the corridor defined for the autonomous bus line	
					Increased availability of parking spaces	
					Decreased availability of parking spaces	
17	Technical	Indicators of acceptance by road co-users	Perceived risk	Do you believe that an autonomous bus service sharing the road with you is dangerous?	Yes	
					No	
					I don't know	
18	Technical	Indicators of	Attitudes and	Would you feel comfortable sharing the	Yes, in all traffic conditions	
					Yes, in low traffic areas	

		acceptance by road co-users	willingness to accept	road with an autonomous bus service?	Yes, if the autonomous vehicle has a dedicated lane	
					Yes, if the autonomous vehicle drives slowly (<20 km/h)	
					No	
					I don't know	
19	Technical	Indicators of society level acceptance	Mobility and transport network	Do you believe that the transport system as a whole can be improved by the integration of autonomous bus services?	Yes	
					No	
					It does not make a difference	
					I don't know	
20	Technical	Indicators of acceptance by end users	Willingness to adopt	If the autonomous bus service were available to me, I would use it.	I am willing to accept the effort to switch to autonomous buses (e.g. special courses).	
					The switch to autonomous buses is unacceptable.	
					I would not like to use autonomous buses.	
					I would try to avoid autonomous buses as much as possible.	
21	Technical	Indicators of society level acceptance	Public acceptance	Please imagine that large sections of the population would use autonomous bus services. To what degree do the following	The idea that large sections of the population use autonomous buses feels bad.	
					The idea that large sections of the population use autonomous buses feels good.	

				statements apply to you?	I think it is great if large sections of the population use autonomous buses.	
22	Background			Do you have any additional comments or suggestions?		

3.3. Bus line – Operator

	Type	Indicator Category	Indicator	Question	Options
1	Technical	Indicators of acceptance by end users	Perceived usefulness	In your opinion, how may an automated transport environment improve user experience?	
2	Technical	Indicators of acceptance by other stakeholders	Willingness to pay/invest and to adopt to increase efficiency	How do you think a automated transport environment may increase the number of public transport users? If so, by how many users do you estimate this increase?	
3	Technical	Indicators of acceptance by road co-users	Data collection.	In your opinion, what kind of data collected by a connected transport environment may reveal insights concerning user patterns?	
4	Technical	Indicators of acceptance by other stakeholders	Willingness to pay/invest and to adopt to increase efficiency	Do you think a automated transport environment may change interchanges between different modes of transport? If so, by how much?	
5	Technical		Perceived risk		

		Indicators of acceptance by road co-users		Which kind of obstacles do you see for implementing this kind of environment in your network?	
6	Technical	Indicators of acceptance by vulnerable user groups	Accessibility	How do you think that an automated transport environment could help ensure full access for passengers with disabilities to all the services provided?	
	Technical	Indicators of society level acceptance	Safety and security at societal level	What do you think about the ongoing efforts from national and international entities when it comes to autonomous transport?	
8	Technical	Indicators of society level acceptance	Socio-economic impacts	How can an automated transport environment help the transport network to meet the targets included in Sustainable Urban Mobility Plans (SUMPs)?	
9	Technical	Indicators of acceptance by other stakeholders	Willingness to pay/invest for business opportunities	Which general features should a connected transport environment have for improving the public transport network?	
10	Technical	Indicators of acceptance by end users	Willingness to adopt	What can be done to let people know the existence of these vehicles and increase their number of users?	
				Do you have any additional comments or suggestions?	

4. Pilot 4: Shared connected transport

4.1. Shared fleet – Driver

	Type	Indicator Category	Indicator	Question	Options	Additional information
1	Background			Are you	Female	
					Male	
					Other	
					Prefer not to say	
2	Background			Please tell us your age		
3	Background			What country do you currently live in?		
4	Background			Which city do you currently live in?		
5	Background			What kind of Connected and/or Automated Vehicle (CAV) have you tried before?	Navigation & routing services (GoogleMaps, Waze,...)	
					Bike-, Scooter-, Car-sharing services (ShareNow, Free2Move, Lime,...)	
					Ride-sharing (Uber, Cabify, taxi apps,...)	

					Carpooling (BlaBlaCar, Leadmee,...)	
					Connected features (next stop indicator in buses,...)	
					Driver assistance (speed limit indicator, blind spot detection, lane assist,...)	
					Adaptative cruise control (the vehicle controls the speed according to traffic)	
					Automatic steering (autonomous parking or vehicle keeping itself in lane)	
					I don't know	
					I have never tried a CAV before	
5a	Background			Were you a passenger or/and a driver in the Connected and Automated Vehicle (CAV)?	A passenger	if Q5 has been answered with yes
					A driver	
					Both	
5b	Background			How many times have you ever used a CAV?	Never	if Q5 has been answered with yes
					Only once	
					Rarely	
					Occasionally	
					Systematically	
6	Background				Not confident at all	

				How confident are you with a shared fleet composed of CAVs ?	Barely confident	
					Medium confident	
					Very confident	
7	Background			Do you have a full driving license?	Valid for motorcycles (Type A)	
					Valid for cars (Type B)	
					Valid for both, cars and motorcycles (A-B)	
					Valid for trucks (C)	
					None	
8	Background			How long have you owned a full driving license?	I don't have one	
					1-5 years	
					5-10 years	
					10-15 years	
					15+ years	
9	Background			What educational level do you have? Please choose the highest educational qualification you have achieved so far.	School finished without school leaving certificate	
					Still at school	
					Elementary or lower secondary school qualification	
					Middle School, High School or Secondary School or equivalent qualification	
					Completed apprenticeship	

					Advanced Vocational Certificate of Education, vocational baccalaureate diploma, technical diploma	
					A levels, high school diploma or other university entrance qualification	
					Polytechnic degree, university of applied sciences degree, other university degree	
10	Background			What is your monthly net income approximately?	less than € 250	
					€ 250 to under € 1000	
					€ 1000 to under € 2000	
					€ 2000 to under € 3000	
					€ 3000 to under € 5000	
					€ 5000 and over	
					I do not want to answer that	
11	Background			Which is your current occupation?	Student	
					Full-time work (over 30 h a week)	
					Part-time work (30 h per week or less)	
					Currently not employed	
					Retired	
					Other	

11a	Background			How often do you travel to work or to your place of education?	Less than once a week	only if Q11 has been answered with "Student", "Full-time work (over 30 h a week" or "Part-time work (30 h a week or less)
					Once a week	
					2-6 times per week	
					Everyday	
					More often than once a day	
11b	Background			What is the average once-way distance for this trip?	Up to 5 km	only if Q11 has been answered with "Student", "Full-time work (over 30 h a week" or "Part-time work (30 h a week or less)
					5-15 km	
					16-25 km	
					26+ km	
12	Background			Do you regularly use a smartphone or a computer?	Yes	
					No	
12a	Background			How long have you been using it?	I have recently started	if Q12 has been answered with yes
					From 1 to 3 years	
					From 3 to 5 years	
					More than 5 years	
12b	Background			Do you use one or several of the following applications?	Routing and guidance application	if Q12 has been answered with yes
					Shared mobility application	
					Public transport application	
					No, I don't	

13	Background			Which type of shared connected vehicle did you try?		
14	Background			Which was the level of automation of the vehicle?	I don't know	
					Driver assistance (navigator, speed limit indicator, blind spot detection)	
					Partial automation: the car was able to brake/accelerate OR change direction, but not both things at the time (adaptative cruise control, lane assistance)	
					The car could accelerate/brake AND change direction at the same time (auto-pilot)	
15	Technical	Indicators of acceptance by end users	Attitudes and human factors	How did you feel while traveling in a CAV?	Trustful	
					Careful	
					Insecure	
					Safe	
					Nervous	
					Curious	
					Critical	
					Unaffected	
16	Technical	Indicators of			Positively surprised	
					Negatively surprised	

		acceptance by end users	Attitudes and human factors	Was using a CAV the experience you had anticipated?	It was as I expected	
					I don't know	
17	Technical	Indicators of acceptance by end users	Perceived quality of travel	Was the trip comfortable compared with a conventional vehicle?	More comfortable	
					Less comfortable	
					No different	
					I don't know	
18	Technical	Indicators of acceptance by end users	Perceived quality of travel	How well do you think that the self-driving car performed regarding steering, acceleration, brake?	Better than a human driver	
					Same as a human driver	
					Worse than a human driver	
					Just different	
19	Technical	Indicators of acceptance by end users	Perceived risk	How do you describe the self-driving car reactions?	Very good	
					Safe	
					Neutral	
					Unpredictable	
					Dangerous	
20	Technical	Indicators of acceptance by end users	Changed mobility behaviour	Which was your reaction to the car manouvers?	I was totally confident	
					I watched carefully but let the car take control	
					I took back the control	
21	Technical				Very difficult	

		Indicators of acceptance by end users	Perceived ease of use	How difficult did you find it to book and access the shared connected vehicle?	Moderately difficult	
					Not very difficult	
					Not difficult at all	
22	Technical	Indicators of acceptance by end users	Perceived ease of use	How difficult and stressful was to use the shared connected vehicle?	Very difficult	
					Moderately difficult	
					Not very difficult	
					Not difficult at all	
23	Technical	Indicators of acceptance by end users	Perceived ease of use	How difficult and stressful was to return the shared connected vehicle?	Very difficult	
					Moderately difficult	
					Not very difficult	
					Not difficult at all	
24	Technical	Indicators of acceptance by end users	Willingness to adopt	After this experience, would you use a shared connected vehicle for your daily trips?	Yes	
					No	
					Depends on how technology evolves	
					I don't know	
25	Technical	Indicators of acceptance by end users	Willingness to let other use	Would you encourage your family or friends to use shared connected vehicles?	Yes	
					No	
					Depends on how technology evolves	
					I don't know	

26	Technical	Indicators of acceptance by end users	Willingness to pay	Would you pay a higher price for a shared vehicle with autonomous features?	Yes	
					No	
					Depends on how technology evolves	
					I don't know	
27	Technical	Indicators of acceptance by end users	Perceived usefulness	Which potential benefits do you see in using a shared fleet composed of CAVs ?	Increased safety	
					Increased punctuality	
					Better service	
					Lower price	
					Less congestion	
					Lower pollution	
					Time savings	
					None of the above	
28	Technical	Indicators of acceptance by end users	Perceived usefulness	Which potential shortcomings do you see about using a shared fleet composed of CAVs ?	Decrased safety	
					Worse service	
					Less information onboard	
					Loss of jobs	
					Less security	
					Higher price	
					None of the above	

29	Technical	Indicators of acceptance by end users	Willingness to adopt	If a shared fleet composed of CAVs were available, I would use them.	I am willing to accept the effort to switch to a shared fleet composed of CAVs (e.g. special courses).	choose all that apply
					The switch to a shared fleet composed of CAVs is unacceptable.	
					I would not like to use a shared fleet composed of CAVs .	
					I would try to avoid a shared fleet composed of CAVs as much as possible.	
30	Technical	Indicators of society level acceptance	Public acceptance	Please imagine that large sections of the population would use shared fleets of CAVs. To what degree do the following statements apply to you?	The idea that large sections of the population use a shared fleet composed of CAVs feels bad.	choose all that apply
					The idea that large sections of the population use a shared fleet composed of CAVs feels good.	
					I think it is great if large sections of the population use a shared fleet composed of CAVs .	
				Do you have any additional comments or suggestions?		

4.2. Shared fleet – Passenger

	Type	Indicator Category	Indicator	Question	Options	Additional information
1	Background			Are you	Female	
					Male	
					Other	
					Prefer not to say	
2	Background			Please tell us your age		
3	Background			What country do you currently live in?		
4	Background			Which city do you currently live in?		
5	Background			What kind of Connected and/or Automated Vehicle (CAV) have you tried before?	Navigation & routing services (GoogleMaps, Waze,...)	
					Bike-, Scooter-, Car-sharing services (ShareNow, Free2Move, Lime,...)	
					Ride-sharing (Uber, Cabify, taxi apps,...)	
					Carpooling (BlaBlaCar, Leadmee,...)	
					Connected features (next stop indicator in buses,...)	

					Driver assistance (speed limit indicator, blind spot detection, lane assist,...)	
					Adaptative cruise control (the vehicle controls the speed according to traffic)	
					Automatic steering (autonomous parking or vehicle keeping itself in lane)	
					I don't know	
					I have never tried a CAV before	
5a	Background			Were you a passenger or/and a driver in the Connected and Automated Vehicle (CAV)?	A passenger	if Q5 has been answered with yes
					A driver	
					Both	
5b	Background			How many times have you ever used a CAV?	Never	if Q5 has been answered with yes
					Only once	
					Rarely	
					Occasionally	
					Systematically	
6	Background			How confident are you with CAVs?	Not confident at all	
					Barely confident	
					Medium confident	
					Very confident	

7	Background			Do you have a full driving license?	Valid for motorcycles (Type A)	
					Valid for cars (Type B)	
					Valid for both, cars and motorcycles (A-B)	
					Valid for trucks (C)	
					None	
8	Background			How long have you owned a full driving license?	I don't have one	
					1-5 years	
					5-10 years	
					10-15 years	
					15+ years	
9	Background			What educational level do you have? Please choose the highest educational qualification you have achieved so far.	School finished without school leaving certificate	
					Still at school	
					Elementary or lower secondary school qualification	
					Middle School, High School or Secondary School or equivalent qualification	
					Completed apprenticeship	
					Advanced Vocational Certificate of Education, vocational baccalaureate diploma, technical diploma	

					A levels, high school diploma or other university entrance qualification	
					Polytechnic degree, university of applied sciences degree, other university degree	
10	Background			What is your monthly net income approximately?	less than € 250	
					€ 250 to under € 1000	
					€ 1000 to under € 2000	
					€ 2000 to under € 3000	
					€ 3000 to under € 5000	
					€ 5000 and over	
					I do not want to answer that	
11	Background			Which is your current occupation?	Student	
					Full-time work (over 30 h a week)	
					Part-time work (30 h per week or less)	
					Currently not employed	
					Retired	
					Other	
11a	Background				Less than once a week	only if Q11 has been
					Once a week	

				How often do you travel to work or to your place of education?	2-6 times per week Everyday More often than once a day	answered with "Student", "Full-time work (over 30 h a week" or "Part-time work (30 h a week or less)
11b	Background			What is the average once-way distance for this trip?	Up to 5 km 5-15 km 16-25 km 26+ km	only if Q11 has been answered with "Student", "Full-time work (over 30 h a week" or "Part-time work (30 h a week or less)
12	Background			Do you regularly use a smartphone or a computer?	Yes No	
12a	Background			How long have you been using it?	I have recently started From 1 to 3 years From 3 to 5 years More than 5 years	if Q12 has been answered with yes

12b	Background			Do you use one or several of the following applications?	Routing and guidance application	if Q12 has been answered with yes
					Shared mobility application	
					Public transport application	
					No, I don't	
13	Background			Which type of shared connected vehicle did you try?		
14	Background			Which was the level of automation of the vehicle?	I don't know	
					Yes, driver assistance (navigator, speed limit indicator, blind spot detection)	
					Yes, partial automation: the car was able to brake/accelerate OR change direction, but not both things at the time (adaptative cruise control, lane assistance)	
					Yes, the car could accelerate/brake AND change direction at the same time (auto-pilot)	
15	Technical	Indicators of acceptance by end users	Attitudes and human factors	How did you feel while traveling in a CAV?	Trustful	
					Careful	
					Insecure	
					Safe	
					Nervous	

					Curious	
					Critical	
					Unaffected	
16	Technical	Indicators of acceptance by end users	Attitudes and human factors	Was using a CAV the experience you had anticipated?	Positively surprised	
					Negatively surprised	
					It was as I expected	
					I don't know	
17	Technical	Indicators of acceptance by end users	Perceived quality of travel	Was the trip comfortable compared with a conventional vehicle?	More comfortable	
					Less comfortable	
					No different	
					I don't know	
18	Technical	Indicators of acceptance by end users	Perceived quality of travel	How well do you think that the self-driving car performed regarding steering, acceleration and braking?	Better than a human driver	
					Same as a human driver	
					Worse than a human driver	
					Just different	
19	Technical	Indicators of acceptance by end users	Perceived risk	How do you describe the self-driving car reactions?	Very good	
					Safe	
					Neutral	
					Unpredictable	
					Dangerous	

20	Technical	Indicators of acceptance by end users	Perceived ease of use	How difficult did you find it to book and access the shared connected vehicle?	Very difficult	
					Moderately difficult	
					Not very difficult	
					Not difficult at all	
21	Technical	Indicators of acceptance by end users	Willingness to adopt	After this experience, would you use a shared connected vehicle for your daily trips?	Yes	
					No	
					Depends on how technology evolves	
					I don't know	
22	Technical	Indicators of acceptance by end users	Willingness to let other use	Would you encourage your family or friends to use shared connected vehicles?	Yes	
					No	
					Depends on how technology evolves	
					I don't know	
23	Technical	Indicators of acceptance by end users	Willingness to pay	Would you pay a higher price for a shared vehicle with autonomous features?	Yes	
					No	
					Depends on how technology evolves	
					I don't know	
27	Technical	Indicators of acceptance by end users	Perceived usefulness	Which potential benefits do you see in using a shared fleet composed of CAVs ?	Increased safety	
					Increased punctuality	
					Better service	

					Lower price	
					Less congestion	
					Lower pollution	
					Time savings	
					None of the above	
					Decrased safety	
25	Technical	Indicators of acceptance by end users	Perceived usefulness	Which potential shortcomings do you see about using CAVs?	Worse service	
					Less information onboard	
					Loss of jobs	
					Less security	
					Higher price	
					None of the above	
26	Technical	Indicators of acceptance by end users	Willingness to adopt	If CAVs were available, I would use them.	I am willing to accept the effort to switch to CAVs (e.g. special courses).	choose all that apply
					The switch to CAVs is unacceptable.	
					I would not like to use CAVs.	
					I would try to avoid CAVs as much as possible.	
27	Technical	Indicators of society level acceptance	Public acceptance	Please imagine that large sections of the population would use CAVs. To what	The idea that large sections of the population use CAVs feels bad.	choose all that apply
					The idea that large sections of the population use CAVs feels good.	

				degree do the following statements apply to you?	I think it is great if large sections of the population use CAVs.	
				Do you have any additional comments or suggestions?		

5. Pilot 5: Experience of vulnerable travellers with connected transport environment

5.1. Apertum – Users

	Type	Indicator Category	Indicator	Question	Options	Additional information
1	Background			Are you	Female	
					Male	
					Other	
					Prefer not to say	
2	Background			Please tell us your age		
3	Background			What country do you currently live in?		
4	Background			Which city do you currently live in?		
5	Background			What kind of Connected and/or Automated Vehicle (CAV) have you tried before?	Navigation & routing services (GoogleMaps, Waze,...)	
					Bike-, Scooter-, Car-sharing services (ShareNow, Free2Move, Lime,...)	
					Ride-sharing (Uber, Cabify, taxi apps,...)	
					Carpooling (BlaBlaCar, Leadmee,...)	
					Connected features (next stop indicator in buses,...)	
					Driver assistance (speed limit indicator, blind spot detection, lane assist,...)	

					Adaptative cruise control (the vehicle controls the speed according to traffic)	
					Automatic steering (autonomous parking or vehicle keeping itself in lane)	
					I don't know	
					I have never tried a CAV before	
5a	Background			Were you a passenger and/or a driver in the Connected and Automated Vehicle (CAV)?	A passenger	if Q5 has been answered with yes
					A driver	
					Both	
5b	Background			How many times have you ever used a CAV?	Never	if Q5 has been answered with yes
					Only once	
					Rarely	
					Occasionally	
					Systematically	
6	Background			How confident are you with Apertum?	Not confident at all	
					Barely confident	
					Medium confident	
					Very confident	
7	Background			What educational level do you have? Please choose the highest	School finished without school leaving certificate	
					Still at school	

				educational qualification you have achieved so far.	Elementary or lower secondary school qualification	
					Middle School, High School or Secondary School or equivalent qualification	
					Completed apprenticeship	
					Advanced Vocational Certificate of Education, vocational baccalaureate diploma, technical diploma	
					A levels, high school diploma or other university entrance qualification	
					Polytechnic degree, university of applied sciences degree, other university degree	
8	Background			What is your monthly net income approximately?	less than € 250	
					€ 250 to under € 1000	
					€ 1000 to under € 2000	
					€ 2000 to under € 3000	
					€ 3000 to under € 5000	
					€ 5000 and over	
					I do not want to answer that	
9	Background			Which is your current occupation?	Student	
					Full-time work (over 30 h a week)	
					Part-time work (30 h per week or less)	

					Currently not employed	
					Retired	
					Other	
9a	Background			How often do you travel to work or place of education	Less than once a week	only if Q9 has been answered with "Student", "Full-time work (over 30 h a week" or "Part-time work (30 h a week or less)
					Once a week	
					2-6 times per week	
					Everyday	
					More often than once a day	
9b	Background			What is the average once-way distance for this trip?	Up to 5 km	only if Q9 has been answered with "Student", "Full-time work (over 30 h a week" or "Part-time work (30 h a week or less)
					5-15 km	
					16-25 km	
					26+ km	
10	Background			What distance do you feel safe to travel on your own?	<1 km	
					1-3 km	
					3-7 km	
					>7 km	
11	Background			Which is your preferred transport mode?	Private car	
					Public transport - Bus	

					Public transport - Subway	
					Walking	
					None of the above	
12	Background			Do you regularly use a smartphone or a computer?	Yes	
					No	
12a	Background			How long have you been using it?	I have recently started	if Q12 has been answered with yes
					From 1 to 3 years	
					From 3 to 5 years	
					More than 5 years	
12b	Background			Do you use one or several of the following applications?	Routing and guidance application	if Q12 has been answered with yes
					Shared mobility application	
					Public transport application	
					No, I don't	
13	Background			In a typical month, how often do you use public transport?	Less than once a week	
					Once or twice a week	
					Daily	
					Ever	
14	Technical	Indicators of society level acceptance	Mobility and transport network	When using public transport for your urban trips, how often are you	Very often	
					Sometimes	
					Rarely	

				facing unexpected obstacles?	Never	
15	Technical	Indicators of acceptance by vulnerable users	Availability of the solution	Do you think that the current transport network offers sufficient accessibility and information?	Totally sufficient	
					Very sufficient	
					Sufficient	
					Not sufficient	
16	Technical	Indicators of acceptance by vulnerable users	Human dignity and ethics	Is being able to travel independently important for you?	Very important	
					Important	
					Less important	
					Not important	
					I don't know	
17	Technical	Indicators of acceptance by vulnerable users	Adequacy of the solution	Do you think that a connected transport environment will help you use public transport independently?	Yes	
					Partially	
					No	
					I don't know	
18	Technical	Indicators of acceptance by vulnerable users	Adequacy of the solution	Which information do you consider important in a connected trip?	Station/stop information (accessibility level, elevator, distance to lane, etc.)	
					Accessible routes inside stations	
					Real-time information about arrivals	
					Learn in advance if the station/stop is fully-accessible, partially-accessible or non-accessible	

					Routing adapted to the type of non-conventional user (e.g. maximum walking distance, etc.)	
19	Technical	Indicators of society level acceptance	Mobility and transport network	Would you share information with other users regarding accessibility conditions (e.g. broken elevators)?	Yes	
					No	
					I don't know	
20	Technical	Indicators of acceptance by end users	Willingness to adopt	Would you use connected transport applications in the future?	Yes	
					No	
					I don't know	
21	Technical	Indicators of acceptance by end users	Perceived usefulness	Do you think these applications will save you time in your daily life?	Yes	
					possibly	
					No	
					I don't know	
22	Technical	Indicators of acceptance by vulnerable users	Affordability	Would you pay for using a connected transport environment?	I would not pay for this kind of service	
					<5 Euros per month	
					5 to 10 Euros per month	
					>10 Euros per month	
23	Technical	Indicators of acceptance by end users	Willingness to adopt	If Apertum were available to me, I would use it.	I am willing to accept the effort to switch to Apertum (e.g. special courses).	choose all that apply
					The switch to Apertum is unacceptable.	
					I would not like to use Apertum.	

					I would try to avoid Apertum as much as possible.	
24	Technical	Indicators of society level acceptance	Public acceptance	Please imagine that large sections of the population would use Apertum. To what degree do the following statements apply to you?	The idea that large sections of the population use Apertum feels bad.	choose all that apply
					The idea that large sections of the population use Apertum feels good.	
					I think it is great if large sections of the population use Apertum.	
25	Background			Do you have any additional comments or suggestions?		

5.2. EBU Focus group

	Type	Indicator Category	Indicator	Question	Options	Additional information
1	Background			Are you	Female	
					Male	
					Other	
					Prefer not to say	
2	Background			Please tell us your age		
3	Background			What country do you currently live in?		

4	Background			Which city do you currently live in?		
5	Background			Do you have a visual impairment?	No	
					Yes	
					I am blind	
					I am partially sighted	
					I am deaf-blind.	
6	Background			When did your visual impairment start?	I was born visually impaired	
					The visual impairment occurred later in life	
7	Background			How would you describe your freedom of mobility?	I can travel alone	
					I can travel alone, but I have difficulties	
					I can only travel with someone else	
8	Background			What kind of Connected and/or Automated Vehicle (CAV) have you tried before?	Navigation & routing services (GoogleMaps, Waze,...)	
					Bike-, Scooter-, Car-sharing services (ShareNow, Free2Move, Lime,...)	
					Ride-sharing (Uber, Cabify, taxi apps,...)	
					Carpooling (BlaBlaCar, Leadmee,...)	
					Connected features (next stop indicator in buses,...)	
					Driver assistance (speed limit indicator, blind spot detection, lane assist,...)	
					Adaptative cruise control (the vehicle controls the speed according to traffic)	

					Automatic steering (autonomous parking or vehicle keeping itself in lane)	
					I don't know	
					I have never tried a CAV before	
8a	Background			Were you a passenger and/or a driver in the Connected and Automated Vehicle (CAV)?	A passenger	if Q5 has been answered with yes
					A driver	
					Both	
8b	Background			How many times have you ever used a CAV?	Only once	if Q8 has been answered with yes
					Rarely	
					Occasionally	
					Systematically	
9	Background			How confident are you with CAVs?	Not confident at all	
					Barely confident	
					Medium confident	
					Very confident	
10	Background			What educational level do you have? Please choose the highest educational	School finished without school leaving certificate	
					Still at school	
					Elementary or lower secondary school qualification	

				qualification you have achieved so far.	Middle School, High School or Secondary School or equivalent qualification	
					Completed apprenticeship	
					Advanced Vocational Certificate of Education, vocational baccalaureate diploma, technical diploma	
					A levels, high school diploma or other university entrance qualification	
					Polytechnic degree, university of applied sciences degree, other university degree	
11	Background			What is your monthly net income approximately?	less than € 250	
					€ 250 to under € 1000	
					€ 1000 to under € 2000	
					€ 2000 to under € 3000	
					€ 3000 to under € 5000	
					€ 5000 and over	
					I do not want to answer that	
12	Background			Which is your current occupation?	Student	
					Full-time work (over 30 h a week)	
					Part-time work (30 h per week or less)	
					Currently not employed	
					Retired	
					Other	

12a	Background			How often do you travel to work or place of education?	Less than once a week	only if Q12 has been answered with "Student", "Full-time work (over 30 h a week" or "Part-time work (30 h a week or less)
					Once a week	
					2-6 times per week	
					Everyday	
					More often than once a day	
12b	Background			What is the average once-way distance for this trip?	Up to 5 km	only if Q12 has been answered with "Student", "Full-time work (over 30 h a week" or "Part-time work (30 h a week or less)
					5-15 km	
					16-25 km	
					26+ km	
13	Background			Do you feel safe to travel on your own?	No	
					Only known routes, for short distances	
					Known routes any distance	
					Yes, even unknown routes	
14	Background				Private car	

				Which is your preferred transport mode?	Public transport - Bus	
					Public transport - Subway or train	
					Walking	
					None of the above	
15	Background			Do you regularly use a smartphone or a computer?	Yes	
					No	
15a	Background			How long have you been using it?	I have recently started	if Q15 has been answered with yes
					From 1 to 3 years	
					From 3 to 5 years	
					More than 5 years	
15b	Background			Do you use one or several of the following applications?	Routing and guidance application	if Q15 has been answered with yes
					Shared mobility application	
					Public transport application	
					No, I don't	
16	Background			How often do you leave your home?	Several times a day	
					Once a day	
					4 to 6 days a week	
					2 to 3 days a week	
					Once a week	
					More seldom than once a week	

17	Background			Do you use one or more of the following tools (multiple answers possible)?	I do not use any tools.	
					Stick	
					GPS	
					Guide dog	
					sighted assistance	
					Other (please specify)	
18	Background			In a typical month, how often do you use public transport?	Less than once a week	
					Once or twice a week	
					Daily	
					Never	
19	Technical	Indicators of acceptance by vulnerable users	Human dignity and ethics	Is being able to travel independently important for you?	Very important	
					Important	
					Less important	
					Not important	
					I don't know	
20	Technical	Indicators of acceptance by vulnerable users	Availability of the solution	Do you think that the current transport network offers sufficient accessibility and information?	Totally sufficient	
					Very sufficient	
					Sufficient	
					Not sufficient	
21	Technical				Very often	

		Indicators of society level acceptance	Mobility and transport network	When using public transport for your urban trips, how often are you facing unexpected obstacles?	Sometimes	
					Rarely	
					Never	
22	Technical	Indicators of acceptance by vulnerable users	Adequacy of the solution	Do you think that a connected transport environment will help you use public transport independently?	Yes	
					Partially	
					No	
					I don't know	
23	Technical	Indicators of acceptance by vulnerable users	Adequacy of the solution	Which information do you consider important in a connected trip?	Station/stop information (accessibility level, elevator, distance to lane, etc.)	
					Accessible routes inside stations	
					Real-time information about arrivals	
					Learn in advance if the station/stop is fully-accessible, partially-accessible or non-accessible	
					Routing adapted to the type of non-conventional user (e.g. maximum walking distance, etc.)	
24	Technical	Indicators of society level acceptance	Mobility and transport network	Would you share information with other users regarding accessibility conditions (e.g. broken elevators)?	Yes	
					No	
					I don't know	

25	Technical	Indicators of acceptance by end users	Willingness to adopt	Would you use connected transport applications in the future?	Yes	
					No	
					I don't know	
26	Technical	Indicators of acceptance by vulnerable users	Affordability	Would you pay for using a connected transport environment?	I would not pay for this kind of service	
					<5 Euros per month	
					5 to 10 Euros per month	
					>10 Euros per month	
27	Technical	Indicators of acceptance by end users	Willingness to adopt	If driverless vehicles were available, I would use them.	Certainly	
					Probably	
					Depends on how technology evolves	
					Probably not	
					Not at all	
				Do you have any additional comments or suggestions?		

5.3. Apertum – Operator

	Type	Indicator Category	Indicator	Question	Options	Additional information

1	Technical	Indicators of acceptance by end users	Perceived usefulness	In your opinion, how may a connected transport environment improve user experience?		
2	Technical	Indicators of acceptance by other stakeholders	willingness to pay/invest and to adopt to increase efficiency	How do you think a connected transport environment may increase the number of public transport users? If so, by how many users do you estimate this increase?		
3	Technical	Indicators of acceptance by road co-users	Data collection.	In your opinion, what kind of data collected by a connected transport environment may reveal insights concerning user patterns?		
4	Technical	Indicators of acceptance by other stakeholders	willingness to pay/invest and to adopt to increase efficiency	Do you think a connected transport environment may increase interchanges between different modes of transport? If so, by how many interchanges do you estimate this increase?		
5	Technical	Indicators of acceptance	Perceived risk	Which kinds of obstacles do you see for implementing this kind of environment in your network?		

		by road co-users				
6	Technical	Indicators of acceptance by vulnerable user groups	Accessibility	How do you think that a connected transport environment could help ensure full access for passengers with disabilities to all the services provided?		
7	Technical	Indicators of society level acceptance	Safety and security at societal level	What do you think about the EU accessibility recommendations?		
8	Technical	Indicators of society level acceptance	Socio-economic impacts	How can a connected transport environment help the transport network to meet the targets included in Sustainable Urban Mobility Plans (SUMPs)?		
9	Technical	Indicators of acceptance	Willingness to pay/invest for	Which general features should a connected transport environment have for improving the public transport network?		

		by other stakeholders	business opportunities			
				Do you have any additional comments or suggestions?		

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