



Autonomous Vehicles to Evolve to a New Urban Experience

DELIVERABLE 3.6
**Final Community for urban transport automation
report**



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Acronyms

ADS	Automated Driving Systems	LIDAR	Light Detection And Ranging
AM	Automated Mobility	MEM	Monitoring and Evaluation Manager
AV	Automated Vehicle	MT	MobileThinking
BM	Bestmile	OCT	General Transport Directorate of the Canton of Geneva
BMM	Business Modelling Manager	ODD	Operational Domain Design
CAV	Connected and Automated Vehicles	OEDR	Object And Event Detection And Response (Swiss) Federal Office of Communications
CCAM	Cooperative, connected and automated mobility	OFCOM	(Swiss) Federal Office of Communications
CB	Consortium Body	PC	Project Coordinator
CERN	European Organization for Nuclear Research	PEB	Project Executive Board
D7.1	Deliverable 7.1	PGA	Project General Assembly
DC	Demonstration Coordinator	PRM	Persons with Reduced Mobility
DI	The department of infrastructure (Swiss Canton of Geneva)	PSA	Group PSA (PSA Peugeot Citroën)
DMP	Data Management Plan	PTO	Public Transportation Operator
DSES	Department of Security and Economy - Traffic Police (Swiss Canton of Geneva)	PTS	Public Transportation Services
DTU	Technical University of Denmark	QRM	Quality and Risk Manager
track	test track	QRMB	Quality and Risk Management Board
EAB	External Advisory Board	RN	Risk Number
EC	European Commission	SA	Scientific Advisor
ECSEL	Electronic Components and Systems for European Leadership	SAE Level	Society of Automotive Engineers Level (Vehicle Autonomy Level)
EM	Exploitation Manager	SAN	(Swiss) Cantonal Vehicle Service
EU	European Union	SDK	Software Development Kit
EUCAD	European Conference on Connected and Automated Driving	SLA	Sales Lentz Autocars
F2F	Face to face meeting	SMB	Site Management Board
FEDRO	(Swiss) Federal Roads Office	SoA	State of the Art
FOT	(Swiss) Federal Office of Transport	SOTIF	Safety Of The Intended Functionality
GDPR	General Data Protection Regulation	SWOT	Strengths, Weaknesses, Opportunities, and Threats.
GIMS	Geneva International Motor Show	T7.1	Task 7.1
GNSS	Global Navigation Satellite System	TM	Technical Manager
HARA	Hazard Analysis and Risk Assessment	TPG	Transport Publics Genevois Union Internationale des Transports Publics (International Transport Union)
IPR	Intellectual Property Rights	UITP	Transport Publics (International Transport Union)
IT	Information Technology	V2I	Vehicle to Infrastructure communication
ITU	International Telecommunications Union	WP	Work Package
LA	Leading Author	WPL	Work Package Leader

Executive Summary

At the start of the project, very few communities of interest in autonomous mobility existed, and the project considered to undertake the creation of community federating the different actors. However, thanks to the advances in technology the interest in all European countries for autonomous mobility increased and several national initiatives and communities were organised in all European countries, where many of the project partners joined or contributed in their creation.

Today, all project partners participate in international communities (ERTICO, POLIS, EIT Urban Mobility), while all our PTOs actively participate in their corresponding national communities.

In France, Keolis created the Autonomous Vehicles Club and participated in SAM, in Switzerland TPG, UniGe and bestmile participate in SAAM (national Swiss level association) and TPG and UniGe in Nomads (Geneva canton association), in Luxembourg Sales-Lents is part of the working group "CCAM Readiness Luxembourg", and in Denmark and Norway, Amobility is an active member of the 2 linked Scandinavian communities ITS Denmark and ITS Norway, while having joined the YAGO collaboration Cluster.

1 Introduction

AVENUE aims to design and carry out full-scale demonstrations of urban transport automation by deploying, for the first time worldwide, fleets of Automated minibuses in low to medium demand areas of 4 European demonstrator cities (Geneva, Lyon, Copenhagen, and Luxembourg) and 2 to 3 replicator cities. The AVENUE vision for future public transport in urban and suburban areas, is that Automated vehicles will ensure safe, rapid, economic, sustainable, and personalised transport of passengers. AVENUE introduces disruptive public transportation paradigms based on demand, door-to-door services, aiming to set up a new model of public transportation, by revisiting the offered public transportation services, and aiming to suppress prescheduled fixed bus itineraries.

Vehicle services that substantially enhance the passenger experience as well as the overall quality and value of the service will be introduced, also targeting elderly people, people with disabilities and vulnerable users. Road behaviour, security of the Automated vehicles and passengers' safety are central points of the AVENUE project.

At the end of the AVENUE project four-year period the mission is to have demonstrated that Automated vehicles will become the future solution for public transport. The AVENUE project will demonstrate the economic, environmental, and social potential of Automated vehicles for both companies and public commuters while assessing the vehicle road behaviour safety.

1.1 On-demand Mobility

Public transportation is a key element of a region's economic development and the quality of life of its citizens.

Governments around the world are defining strategies for the development of efficient public transport based on different criteria of importance to their regions, such as topography, citizens' needs, social and economic barriers, environmental concerns, and historical development. However, new technologies, modes of transport and services are appearing, which seem very promising to the support of regional strategies for the development of public transport.

On-demand transport is a public transport service that only works when a reservation has been recorded and will be a relevant solution where the demand for transport is diffuse and regular transport is inefficient.

On-demand transport differs from other public transport services in that vehicles do not follow a fixed route and do not use a predefined timetable. Unlike taxis, on-demand public transport is usually also not individual. An operator or an automated system takes care of the booking, planning and organization.

It is recognized that the use and integration of on-demand Automated vehicles has the potential to significantly improve services and provide solutions to many of the problems encountered today in the development of sustainable and efficient public transport.

1.2 Fully Automated Vehicles

A self-driving car, referred in the AVENUE project as a **Fully Automated Vehicle (AV)**, or as Autonomous Vehicle, is a vehicle that can sense its environment and moving safely with no human input.

The terms *automated vehicles* and *autonomous vehicles* are often used together. The Regulation 2019/2144 of the European Parliament and of the Council of 27 November 2019 on type-approval

requirements for motor vehicles defines "automated vehicle" and "fully automated vehicle" based on their autonomous capacity:

An "automated vehicle" means a motor vehicle designed and constructed to move autonomously for certain periods of time without continuous driver supervision but in respect of which driver intervention is still expected or required

"Fully automated vehicle" means a motor vehicle that has been designed and constructed to move autonomously without any driver supervision

In AVENUE we operate **Fully Automated minibuses for public transport**, (previously referred as Autonomous shuttles, or Autonomous buses), and we refer to them as simply *Automated minibuses* or *the AVENUE minibuses*.

In relation to the SAE levels, the AVENUE project will operate SAE Level 4 vehicles.



SAE J3016™ LEVELS OF DRIVING AUTOMATION

	SAE LEVEL 0	SAE LEVEL 1	SAE LEVEL 2	SAE LEVEL 3	SAE LEVEL 4	SAE LEVEL 5
What does the human in the driver's seat have to do?	You <u>are</u> driving whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering			You <u>are not</u> driving when these automated driving features are engaged – even if you are seated in "the driver's seat"		
	You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety			When the feature requests, you must drive	These automated driving features will not require you to take over driving	
What do these features do?	These are driver support features			These are automated driving features		
	These features are limited to providing warnings and momentary assistance	These features provide steering OR brake/acceleration support to the driver	These features provide steering AND brake/acceleration support to the driver	These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met	This feature can drive the vehicle under all conditions	
Example Features	<ul style="list-style-type: none"> • automatic emergency braking • blind spot warning • lane departure warning 	<ul style="list-style-type: none"> • lane centering OR • adaptive cruise control 	<ul style="list-style-type: none"> • lane centering AND • adaptive cruise control at the same time 	<ul style="list-style-type: none"> • traffic jam chauffeur 	<ul style="list-style-type: none"> • local driverless taxi • pedals/steering wheel may or may not be installed 	<ul style="list-style-type: none"> • same as level 4, but feature can drive everywhere in all conditions

Table 1: SAE Driving Automation levels (©2020 SAE International)

1.2.1 Automated vehicle operation overview

We distinguish in AVENUE two levels of control of the AV: micro-navigation and macro-navigation. Micro navigation is fully integrated in the vehicle and implements the road behaviour of the vehicle, while macro-navigation is controlled by the operator running the vehicle and defines the destination and path of the vehicle, as defined the higher view of the overall fleet management.

For micro-navigation Automated Vehicles combine a variety of sensors to perceive their surroundings, such as 3D video, LIDAR, sonar, GNSS, odometry and other types of sensors. Control software and systems, integrated in the vehicle, fusion and interpret the sensor information to identify the current position of

the vehicle, detecting obstacles in the surround environment, and choosing the most appropriate reaction of the vehicle, ranging from stopping to bypassing the obstacle, reducing its speed, making a turn etc. For the Macro-navigation, that is the destination to reach, the Automated Vehicle receives the information from either the in-vehicle operator (in the current configuration with a fixed path route), or from the remote-control service via a dedicated 4/5G communication channel, for a fleet-managed operation. The fleet management system considers all available vehicles in the services area, the passenger request, the operator policies, the street conditions (closed streets) and send route and stop information to the vehicle (route to follow and destination to reach).

1.2.2 Automated vehicle capabilities in AVENUE

The Automated vehicles employed in AVENUE fully and automatically manage the above defined, micro-navigation and road behaviour, in an open street environment. The vehicles are automatically capable to recognise obstacles (and identify some of them), identify moving and stationary objects, and automatically decide to bypass or wait behind them, based on the defined policies. For example, with small changes in its route the AVENUE minibus is able to bypass a parked car, while it will slow down and follow behind a slowly moving car. The AVENUE mini-buses are able to handle different complex road situations, like entering and exiting round-about in the presence of other fast running cars, stop in zebra crossings, communicate with infrastructure via V2I interfaces (ex. red light control).

The minibuses used in the AVENUE project technically can achieve speeds of more than 60Km/h. However, this speed cannot be used in the project demonstrators for several reasons, ranging from regulatory to safety. Under current regulations the maximum authorised speed is 25 or 30 Km/h (depending on the site). In the current demonstrators the speed does not exceed 23 Km/h, with an operational speed of 14 to 18 Km/h. Another, more important reason for limiting the vehicle speed is safety for passengers and pedestrians. Due to the fact that the current LIDAR has a range of 100m and the obstacle identification is done for objects no further than 40 meters, and considering that the vehicle must safely stop in case of an obstacle on the road (which will be “seen” at less than 40 meters distance) we cannot guarantee a safe braking if the speed is more than 25 Km/h. Note that technically the vehicle can make harsh break and stop with 40 meters in high speeds (40 -50 Km/h) but then the break would too harsh putting in risk the vehicle passengers. The project is working in finding an optimal point between passenger and pedestrian safety.

Due to legal requirements a **Safety Operator** must always be present in the vehicle, able to take control any moment. Additionally, at the control room, a **Supervisor** is present controlling the fleet operations. An **Intervention Team** is present in the deployment area ready to intervene in case of incident to any of the minibuses. Table 2 provides an overview of the AVENUE sites and ODDs.

Site	Summary of AVENUE operating sites demonstrators							
	TPG		Holo		Keolis	Sales-Lentz		
	Geneva		Copenhagen	Oslo	Lyon	Luxembourg		
Site	Meyrin	Belle-Idée	Nordhavn	Ormøya	ParcOL	Pfaffental	Contern	Esch sur Alzette
Funding	TPG	EU + TPG	EU + Holo	EU + Holo	EU + Keolis	EU + SLA	EU + SLA	EU + SLA
Start date of project	August 2017	May 2018	May 2017	August 2019	May 2017	June 2018	June 2018	February 2022
Start date of trial	July 2018	June 2020	September 2020	December 2019	November 2019	September 2018	September 2018	April 2022
Type of route	Fixed circular line	Area	Fixed circular line	Fixed circular line	Fixed circular line	Fixed circular line	Fixed circular line	Fixed circular line
Level of on-demand service*	Fixed route / Fixed stops	Flexible route / On-demand stops	Fixed route / Fixed stops	Fixed route / Fixed stops	Fixed route/Fixed stops	Fixed route / Fixed stops	Fixed route / Fixed stops	Fixed route / Fixed stops
Route length	2,1 km	38 hectares	1,3 km	1,6 km	1,3 km	1,2 km	2,3 km	1 km
Road environment	Open road	Semi-private	Open road	Open road	Open road	Public road	Public road	Main pedestrian road
Type of traffic	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Pedestrians, bicycles, delivery cars
Speed limit	30 km/h	30 km/h	30 km/h	30 km/h	8 to 10 km/h	30 km/h	50 km/h	20 km/h
Roundabouts	Yes	Yes	No	No	Yes	No	No	No
Traffic lights	No	No	No	No	Yes	Yes	Yes	No
Type of service	Fixed line	On demand	Fixed line	Fixed line	Fixed line	Fixed line	Fixed line	On Demand
Concession	Line (circular)	Area	Line (circular)	Line (circular)	Line (circular)	Line (circular)	Line (circular)	Line (circular)
Number of stops	4	> 35	6	6	2	4	2	3
Type of bus stop	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
Bus stop infrastructure	Yes	Sometimes, mostly not	Yes	Yes	Yes	Yes	Yes	Yes
Number of vehicles	1	3-4	1	2	2	2	1	1
Timetable	Fixed	On demand	Fixed	Fixed	Fixed	Fixed	Fixed	On-demand
Operation hours	Monday-Friday (5 days)	Sunday-Saturday (7 days)	Monday-Friday (5 days)	Monday-Sunday (7 days)	Monday-Saturday (6 days)	Tuesday & Thursday Saturday, Sunday & every public holiday	Monday - Friday	Monday – Saturday
Timeframe weekdays	06:30 – 08:30 / 16:00 – 18:15	07:00 – 19:00	10:00 – 18:00	7:30 – 21:30	08:30 – 19:30	12:00 – 20h00	7:00 – 9:00 16:00 – 19:00	11:00 – 18:00 11:00 – 18:00
Timeframe weekends	No service	07:00 – 19:00	No service	9:00 – 18:00	08:30 – 19:30	10:00 – 21:00	No Service	On Suterday only
Depot	400 meters distance	On site	800 meters distance	200 meters distance	On site	On site	On site	500 m distance
Driverless service	No	2021	No	No	No	No	No	No
Drive area type/ODD	B-Roads	Minor roads/parking	B-Roads/minor roads	B-Roads	B-Roads	B-Roads	B-Roads/parking	
Drive area geo/ODD	Straight lines/plane	Straight lines/ plane	Straight lines/ plane	Curves/slopes	Straight Lines/ plane	Straight lines/ plane	Straight lines/ plane	Straight lines / plane
Lane specification/ODD	Traffic lane	Traffic lane	Traffic lane	Traffic lane	Traffic lane	Traffic lane	Traffic lane	Open area
Drive area signs/ODD	Regulatory	Regulatory	Regulatory, Warning	Regulatory	Regulatory	Regulatory	Regulatory	Regulatory
Drive area surface/ODD	Standard surface, Speedbumps	Standard surface, Speedbumps	Standard surface Speedbumps, Roadworks	Frequent Ice, Snow	Standard surface, Potholes	Standard surface	Standard surface	Standard Surface

Table 2: Summary of AVENUE operating site (+ODD components)

1.3 Preamble

Work package 3 “Cooperation for value creation” aims to gather different stakeholders involved in autonomous vehicles projects and to create a web of collaborations to reach a broader spectrum of people to maximize the output value of AVENUE.

One of the means to reinforce the collaboration is the creation and active participation in related communities. The original idea of the project was to create a community for Urban transport, bringing together all the actors in Europe and internationally. At the time of the proposal this type of communities was under development and the project proposal considered that we would be able to create and federate the related actors under an AVENUE community. However, very fast, and due to the interest of the autonomous vehicles in public transportation, several major actors, be national or international, created interest groups bringing together large numbers of actors.

Therefore, our strategy changed and instead of creating yet-another-community, we decided that it would be best to actively join the existing international communities and join/initiate new national communities.

1.3.1 Changes from D3.5

Added sections 2.2.1.3 and 2.2.1.4 for the Geneva canton (local and international communities for carbon reduction, where automated mobility is one of the under-consideration solutions).

Updated information from Luxembourg: the final report of the working group was published.



2 Communities of Urban Transport

2.1 Existing Urban Transport Communities

In Europe we have an important number of communities in the domain of Urban transport, bringing together different actors in the public transportation arena. The AVENUE project, either as a project or via its project partners, has an active presence and participation in almost all of the major European and international communities, where it has established itself as the leading project in the deployment of fully Automated Vehicles in Urban Transportation. In the following we give a brief presentation of the most important international and European communities and describe briefly the AVENUE involvement.

The first community for Public Transport is **UITP** (<https://www.uitp.org/>) - The International Association of Public Transport. Established in 1885, it is a worldwide network bringing together all public transport stakeholders and all sustainable transport modes. AVENUE, has established direct contact and participates in events and discussions organised by UITP (which is the coordinator of the SHOW project, where many AVENUE partners participate).

POLIS (<https://www.polisnetwork.eu/>) is the community of cities and city authorities. It was established in 1989 by European local and regional authorities with target to promote sustainable mobility through the deployment of innovative transport solutions. POLIS organizes events and promotes the exchange of experiences and the transfer of knowledge between European local and regional authorities. CERTH, project partner, is member of POLIS and is actively promoting the AVENUE project to other POLIS members.

EIT Urban Mobility (<https://www.eiturbanmobility.eu/>) is an initiative of the European Institute of Innovation and Technology (EIT). Since 2019 it targets to encourage “positive changes in the way people move around cities in order to make them more liveable places”. The EIT partners include cities and regions, academic, Industry and research actors in the domain of Urban Mobility, CERTH and Siemens are partners of the EIT Urban Mobility, promoting and communicating the AVENUE advances and results.

CIVITAS (<https://civitas.eu/>) is a network *of and for cities*. Launched in 2002, it has today over 330 local authorities as members. CIVITAS acts as a “network of cities, for cities, dedicated to sustainable urban mobility”, fostering political commitment and boosting collective expertise, with target the creation of climate-neutral and resilient cities.

ERTICO – ITS Europe (<https://ertico.com/>) is a public-private partnership of 120 companies and organizations representing service providers, suppliers, traffic and transport industry, research, public authorities, user organisations, mobile network operators, and vehicle manufacturers. ERTICO develop, promote and deploys Intelligent Transport Systems and Services (ITS) through a variety of activities including European co-funded projects, innovation platforms, international cooperation, advocacy and events. ERTICO is the organiser of the annual ITS regional and global Congress in Europe. CERTH and Siemens are partners of ERTICO. The AVENUE project is actively collaborating with ERTICO and has been invited and participated in many events organized by ERTICO.

2.2 National Urban Transport communities

Our adapted strategy was to concentrate in the creation and/or participation to about to be created/new/existing communities in the different countries, and especially in those where we operate demonstrators or have major technical partners.

2.2.1 Switzerland

2.2.1.1 Swiss Association for Autonomous Mobility

Although Switzerland was one of the first countries to experiment with Automated min-buses, there was no formal entity/body/community to allow exchange of information between the different actors. Each city, organisation was testing automated vehicles and informal information was provided in meetings. The demonstrator of the TPG changed the Swiss point of view, since the ambition and results were beyond what was until AVENUE done in Switzerland. The Federal Authorities took a more active role (join the AVENUE project as advisory board member), the other sites realised that on-demand is feasible and the services provided by Bestmile showed that Switzerland has all the ingredients to further develop automated mini-busses in public transportations.

With the Initiative of TPG, a new body was created, the SAAM - Swiss Association for Autonomous Mobility (<https://www.swissaam.ch/>), where all the major actors in Switzerland participate.



Two current AVENUE partners are members of SAAM (TPG and Bestmile) and two more from the new, under integration partners for the replicator site of Uvrier (PostAuto and HES-SO). Furthermore the managing director is Mr. Martin Neubauer, (leader of the under integration in the AVENUE project replicator site of Uvrier) while Mme Anne Mellano is member of the board.

SAAM considers that Autonomous vehicles will fundamentally change mobility as we know it today. Its mission *is to enable the introduction of new technologies and offerings in Switzerland for the common good.*

SAAM is targeting to advance and promote new concepts at all related domains, and namely Regulatory, Public Acceptance, Technology and Commercial Offering.

SAAM unites all active projects deploying automated vehicles in Switzerland, and namely

- Sion, Uvrier – PostAuto (AVENUE future duplicator site)
- Marly - Transports publics fribourgeois
- Schaffhausen – Swizz Transit Lab
- Bell-Idee – PTG (AVENUE site)
- Zug - SBB
- Bern – BERNMOBIL
- Zurich – VBZ Zurich.

and federates academia, industry and public operators from all over Switzerland.

2.2.1.2 Nomads Mobility Hub

The Greater Geneva area, which is experiencing strong and sustained economic and demographic growth, is facing considerable mobility challenges. This population basin of just over one million inhabitants, straddling two countries, must continually monitor its mobility dynamics. As a result, travel within this territory is considered a strategic axis to be developed and maintained by the authorities of Greater Geneva. A clear orientation is also displayed: the mobility solutions introduced must be clean and sustainable. Mobility is one of the main vectors of efforts to reduce our environmental impact.



Based on this observation and the desire to associate institutional, private and academic actors in this collective commitment, the Mobility Hub (<https://nomadsfoundation.com/hub-mobilite-2/>) was born during the European Assizes of the Energy Transition in February 2018. The objective of the Mobility Hub is to develop sustainable and innovative mobility solutions to promote the energy transition on roads, railways, waterways or in the air and to integrate them into Smart Cities projects, building on the shared know-how and the multiple specialized skills gathered within the Mobility Hub.

The Geneva based Swiss AVENUE partners (university of Geneva, TPG, State of Geneva) have joined the hub from its first days in 2018, where they promote the AVENUE results and collaborate in the creation of policies for the mobility in the Greater Geneva Area.

2.2.1.3 Geneva 2050

The Geneva canton parliament, initiated a process and think-tank group with as target to “*Shed light on today's public action by integrating the issues and transformations that guide our societies in the long Term*”¹. One of the elements in the development of the canton is mobility. The State of Geneva, department of Transport, joined by the TPG and the University of Geneva, were members of the group that develops the vision of mobility for the canton, introducing the notion of multimodal mobility and automated vehicles for public transportation.

2.2.1.4 2050Today

2050Today (<https://2050today.org/>) is an initiative of the International Geneva with target the zeroing CO2 emissions by 2050. For this the first target is the reduction by 50% of the CO2 emissions by 2030. The initiative brings together 60 institutions in international Geneva, ranging from Permanent Missions, to international organisations, academic institutions and civil society entities, that have “*committed to measure and reduce their emissions while confirming their willingness to cooperate together for effective, inclusive and sustainable climate action*”. The University of Geneva has joined the initiative (and the TPG is planning to joining in 2023), participating in the mobility chapter, with as target to promote automated mobility transportation under the on-demand model, thus demonstrating the reduction of CO2 emissions, without loss of public transport quality.

¹ *Geneva 2050: Forecasting and Implementation*, volume 2, October 2022, Canton of Geneva, <https://www.ge.ch/document/30017/annexe/1>

2.2.2 France

2.2.2.1 Autonomous Vehicles Club - Keolis

In order to bring together experts and other players in the autonomous vehicle market, Keolis has created the Autonomous Vehicle Club, a community of external and internal Keolis members. The aim of this club is to better understand the key challenges of operating a fleet of autonomous vehicles. This internal Keolis group club was launched in September 2019 with brainstorming, lessons learned and discussions on the future of autonomous vehicle services.



This community should enable the Keolis group to pool the experience gained to benefit all the group's subsidiaries, but also to create partnerships with autonomous shuttle manufacturers. The aim is to exchange information on the industrial specificities of manufacturers and PTOs in order to help the market deliver approved and operational vehicles as soon as possible.

2.2.2.2 SAM - Sécurité et Acceptabilité de la Mobilité autonome

In April 2019, the French Ministry of Transportation has launched an RFP thru the “Investissement d’Avenir” ADEME structure. This initiative and the EVRA “Expérimentation du Véhicule Routier Autonome” take part of the government willingness to promote autonomous vehicles solutions

The SAM project for Safety and Acceptability of Autonomous Driving and Mobility (<https://www.lvmt.fr/projets/securite-et-acceptabilite-de-la-conduite-et-de-la-mobilite-autonome/>) brings together a consortium of industrial players, research and territorial partners, in response to the Call for Autonomous Road Vehicle Experimentation Projects (EVRA) launched by ADEME as part of the Future Investment Program (PIA) in June 2018. The project started in July 2019 for 3 years.



The 13 experiments carried out and studied within the SAM project cover five use cases of autonomous vehicles: autonomous driving on divided lanes, parking valet, on-demand transport services, autonomous bus line services and last mile delivery. This project aims to create a common good by pooling technical and academic knowledge on safety, acceptability and environmental and socio-economic impacts.

Keolis is part of one of the awarded consortia (SAM “Sécurité et Acceptabilité de la Mobilité autonome”) and as a consequence is deeply involved in the workshops that are related to operations, safety, cybersecurity, passenger acceptability, homologation, etc. with partners such as Renault, PSA, Alstom, EasyMile, RATP, Vedecom, IRT SystemX etc. A part of this activity is dedicated to public entities (PTA Public Transport Authorities, Cities, Metropolis, etc.) that form the “Collège des Territoires”, a place where they will be able to brainstorm with the industry experts on the possibilities and the conditions to deploy autonomous vehicle solutions.

Navya is part of the other awarded consortia (ENA “Expérimentation de Navettes Autonomes”).

2.2.2.3 STPA - Services de Transports Publics Autonomes

In addition of this initiative, the French mobility industry leaders are also involved at the Ministry level into missions to help the public bodies to legislate to allow the future autonomous mobility services. Within the STPA (Services de Transports Publics Autonomes <https://www.ecologie.gouv.fr/vehicules-automatisees>) group, public transport operators like Keolis are involved to imagine the future conditions of operation. From the homologation of the vehicle, to the security of the operation and the list of use cases, the deliverable created will allow the government to foster competitiveness of the French industry.

2.2.3 Denmark

Amobility is active member in the 2 linked Scandinavian communities ITS Denmark (<https://its.dk/en/>) and ITS Norway (<https://its-norway.no/en/>).

ITS Denmark and Norway are independent membership organizations representing ITS suppliers, authorities and research institutions working with intelligent transport systems and solutions, creating value for society and enabling the introduction of user-friendly smart mobility and logistics services.

ITS Denmark strive to close the gap between research and industry for a stronger synergy and the best possible solutions within ITS. With our expertise we contribute to the expansion of ITS in Denmark. This includes the benefits that ITS can provide in terms of traffic safety, economic efficiency, environmental advantages and legislation in the field of ITS.



The members of ITS Denmark are working with intelligent traffic solutions on different levels in different industries and public organizations. Members benefit from ITS Denmark activities such as seminars, webinars, professional networks and regular news updates.

Amobility of also member of YAGO, a cluster collaboration with central part an autonomous test centre.

YAGO has its origins in the interaction between different actors, who are genuinely interested new the development of new mobility solutions in Norway. Based on experience gained in the deployment of autonomous vehicles the YAGO cluster for autonomous technologies at Forus was established. YAGO aims to create growth with the help of local actors.



2.2.4 Luxembourg

Sales Lentz have been named as a contact entity for the participation in the study/project "CCAM Readiness Luxembourg", for the preparation of which the TÜV Rheinland Consulting GmbH has been commissioned by the Ministère de l'Économie Luxembourg. The aim of the *Study on cooperative, connected and automated mobility (CCAM) readiness Luxembourg*² is to record needs and jointly identify measures in order to promote automated driving in Luxembourg.

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<https://pmp.b2g.etat.lu/?page=entreprise.EntrepriseDetailsConsultation&id=519164&orgAcronyme=t5y&code=&echanges&clotures>

“The Partnership aims to harmonise European R&I efforts to accelerate the implementation of innovative CCAM technologies and services. It aims to exploit the full systemic benefits of new mobility solutions enabled by CCAM: increased safety, reduced environmental impacts, and inclusiveness. By bringing together the actors of the complex cross-sectoral value chain, the Partnership will work on a shared, coherent and long-term R&I agenda. The Vision of the Partnership is: European leadership in safe and sustainable road transport through automation” (source:

https://ec.europa.eu/info/sites/default/files/research_and_innovation/funding/documents/ec_rtd_he-partnerships-connected-and-automated-driving-ccam.pdf)

The participants of this working group are the key actors of mobility in Luxembourg: Ministère de l'économie, Ministère de la mobilité et travaux publics, SNCA (National Society of Automobile Traffic - <https://snca.public.lu>), TÜV Rheinland Consulting GmbH (<https://www.tuv.com>). Sales-Lentz participated in the study presenting the homologation-process for new and specialized vehicles in Luxembourg and proposing changes and requirements. The results of final study, were published in spring 2022. The report is available on demand (from SLA or the project coordinator).

The study results related to the AVENUE project can be summarized in the following:

The structures in Austria, France and Germany were examined and evaluated in order to draw suitable conclusions for Luxembourg. All the countries examined have a well-developed strategy for automated driving that is accompanied by legal measures. [...] The basis of the developments in the sample countries was, in particular, a great political will to deal with CCAM and to create the necessary framework conditions. This will has not yet been formally declared in Luxembourg.

The approval procedures based on international agreements have been described in detail for Luxembourg and show scope for action for the approval of experimental vehicles. [...] To increase the attractiveness of Luxembourg for automated driving, it is therefore of significant importance to ensure process reliability. This can be established through a comprehensible, reliable and consistent process flow as well as designated contact persons. One form of this contact can be a SPC, which supports Luxembourg in structuring and communicating its activities on CCAM.

Luxembourg's geographic location makes it dependent on European standards for infrastructure and data, which have not yet been entirely developed but are necessary for the long-term deployment of interoperable communication. Therefore, a unified concept for an extended Open Data Portal or Mobility Data Space offers benefits for local companies and creates economic value for Luxembourg. [...] As a fast follower, Luxembourg should monitor European research initiatives to be able to identify technological trends and evaluate them in advance for Luxembourg.

Overall, practical testing of use cases is always necessary in order to identify problems and get new insights into automated driving and to take them into account in development before the vehicle receives regular approval. While the aspect of extraordinary approval for test purposes has already been addressed, the practical use cases also play a major role in ascertaining the degree of technical maturity as well as acceptance by the future users. [...] Through this study, the necessary awareness for the topic of CCAM will be created among the active stakeholders at local and national level.

Based on examples from relevant reference countries of the European Union, administrative structures can be critically examined and necessary process improvements can be initiated. [...] Based on this study, a process may be initiated to develop a national strategy for CCAM that takes into account and recognises the interests of the various stakeholders at the administrative level as well as in research and development and in industry.

3 Conclusions

By the double action of participation in European Communities and initiating/joining national communities/groups in mobility, the project partners are able to not only promote the AVENUE results, but also influence the decisions and regulatory frameworks at national and international levels. The AVENUE project participation and its results give the project partners not only experience but also establish them as legitimate experts and actors in the Autonomous Mobility domain.

The work on the different communities will continue beyond the project termination, with the continuous active participation of the project partners in the existing and new communities that will be eventually created in different European countries.