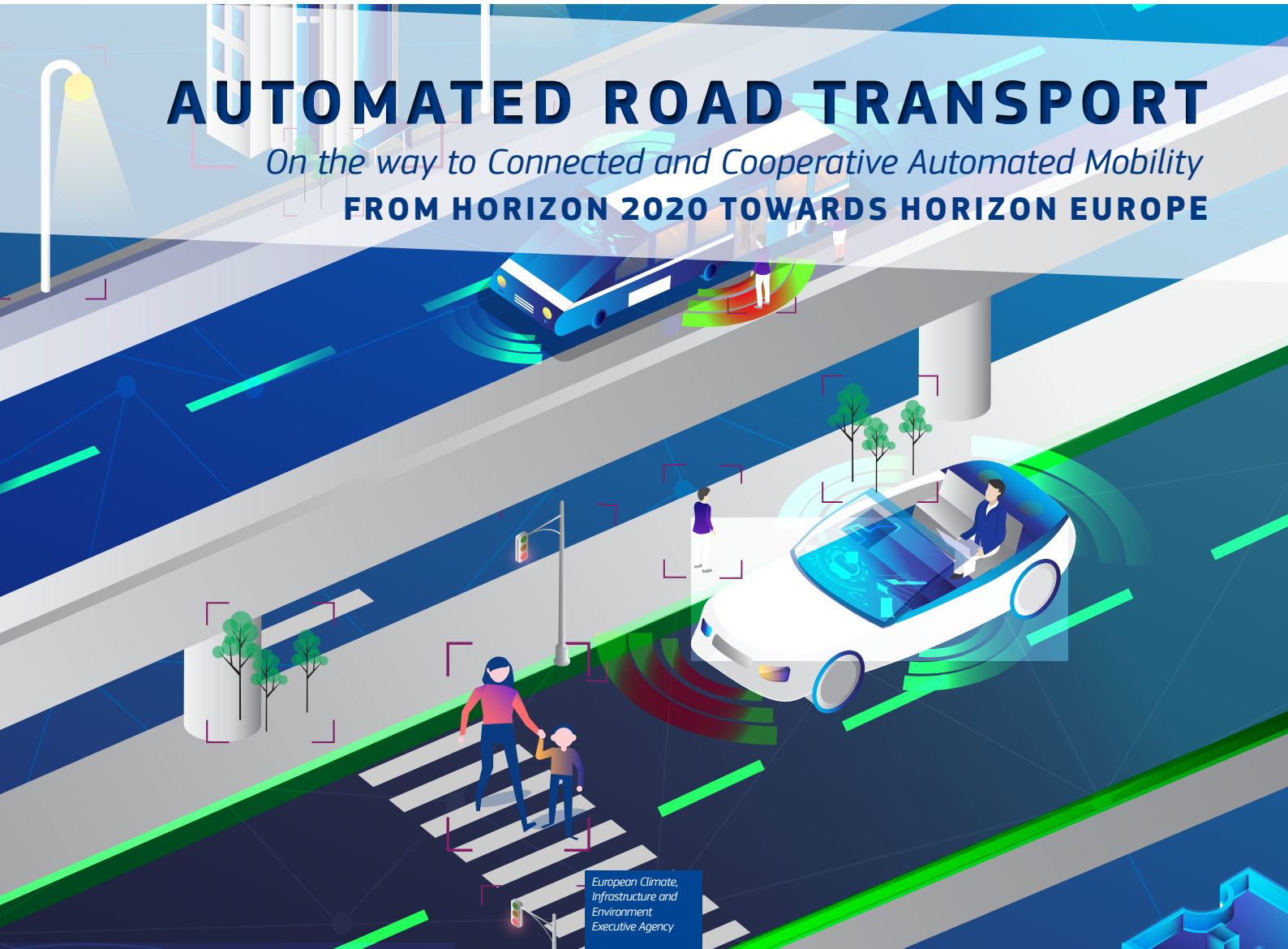# AUTOMATED ROAD TRANSPORT

On the way to Connected and Cooperative Automated Mobility

FROM HORIZON 2020 TOWARDS HORIZON EUROPE

CONTENTS

CINEA DIRECTOR
Dirk Beckers

FOREWORD

Europe has a long history of developing breakthrough innovations in various sectors including the automotive. The EU automotive industry invests more than EUR 60 billion in R&D annually. This contribution makes the automotive sector the largest R&D investor at EU level, representing 27 percent of the region's total R&D investments and one of the top world players in the field. The automotive sector provides direct and indirect jobs to 13.8 million EU citizens representing 6.1% of total EU employment. Regarding the EU economy, the turnover generated by the automotive industry represents over 7% of EU GDP.

In the context of a reduced dependency on fossil fuels, higher reliance on electrification, an aging population and the need for a revised urban planning policy, the road to automated mobility represents a key opportunity for Europe to retain its leadership and pave the way for a new mobility landscape for all of its citizens.

Automated Road Transport (ART) in Horizon 2020 programme is a growing part of Europe's effort towards highly automated and connected driving systems. The overall EU funding for research related to automated road transport and to 5G connectivity testing for automated vehicles exceeded 300 million euro in the period 2014-2020.

Many benefits from these investments are expected at technological, industrial and societal levels, such as more effective mobility, cleaner and safer vehicles and road infrastructure with improved connectivity for the population, especially in urban environments. More automated road transport is expected to decrease pollution, to foster new professional and personal skills, and to offer new mobility solutions for vulnerable road users (e.g. people with reduced mobility, elderly).

In order to address future challenges of the sector, a new European Partnership called Cooperative, Connected and Automated Mobility (CCAM) has been established under the Horizon Europe framework programme (2021-2027) bringing together all relevant stakeholders. This new partnership aims to accelerate the implementation of innovative CCAM technologies and services, harmonise European R&I effort and exploit the full systemic benefits of new mobility solutions enabled by automation. The European Commission envisages to dedicate up to 500 million euro to actions within the scope of the CCAM Partnership, to be matched with in-kind contributions by the other partners.

The European Climate, Infrastructure and Environment Executive Agency (CINEA) is managing most of the EU programmes' funding for automotive research and innovation.

This brochure provides a comprehensive overview of the automated road transport projects managed by CINEA within the Horizon 2020 Research and Innovation programme (2014-2020). I hope that you will find it informative and interesting.

CHALLENGES IN AUTOMATED ROAD TRANSPORT

TECHNOLOGY CHALLENGES

- Horizon 2020 Automated Road Transport aims to promote a wide market introduction of highly automated vehicles towards SAE level 4*.

- New technology development is essential to achieve the required improvements in connectivity, performance, productivity and efficiency of the overall transport system. These are to be tested in large-scale demonstrations, as a necessary step before market uptake.

- Digital technologies such as Big Data, the Internet of Things and Artificial Intelligence provide a great potential for developing innovative automated driving functions and mobility solutions for the future. Privacy, integrity and availability of the required data and communication systems will be ensured through cybersecurity solutions.

HUMAN-RELATED ASPECTS

- Interactions of automated vehicles with other vehicles, with the infrastructure and with other road users have to be addressed in the engineering process. Mixed traffic situations are critical in the transition period to the deployment of automated transport solutions.

- User acceptance will be only possible if a high level of safety is ensured and if the vehicles cover all user expectations, including comfort, connectivity and shared mobility solutions. The development of modern Human Machine Interfaces (HMI) will enable a quick adaptation to the new way of driving.

- Driver behaviour and response will drastically change with the introduction of automation. Socio-economic and human factors have to be considered in the design of human centred solutions.

REGULATORY FRAMEWORK

- Seamless and harmonised cross-border EU and national regulation is a key factor for market introduction of Automated Road Transport.

- Common procedures for testing, validation and certification will allow the standardisation of solutions. Standards should also apply to data exchange and communication solutions.

- Ethical, legal, environmental, safety aspects are to be regulated. The liability and responsibility of every actor in the road system has to be defined before introduction of automated driving.

* Classification system for automated driving published by the automotive standardisation body SAE International (formerly the Society of Automotive Engineers)

CEF | **H2020**

CINEA

CEF implementation

Targeted infrastructure investment at European level

Horizon 2020
implementation

Horizon Europe
implementation

Stakeholders

— Industry
— SMEs
— Academia
— Research Institutes
— Public Authorities
— Operators
— End-users and Citizens
— Standardisation bodies
— Insurance providers
— Telecommunication providers
— Suppliers

European Commission

DG RTD **DG MOVE**

— European Green Deal
— Sustainable and Smart Mobility strategy
— Communication on automated mobility
— Strategic Transport Research & Innovation Agenda (STRIA)

CCAM Partnership

Cooperative Connected and Automoted Mobility

— Strategic Research and Innovation Agenda (SRA)
— Multi-Annual Implementation Plan (MAP)
— Automated Driving Roadmap
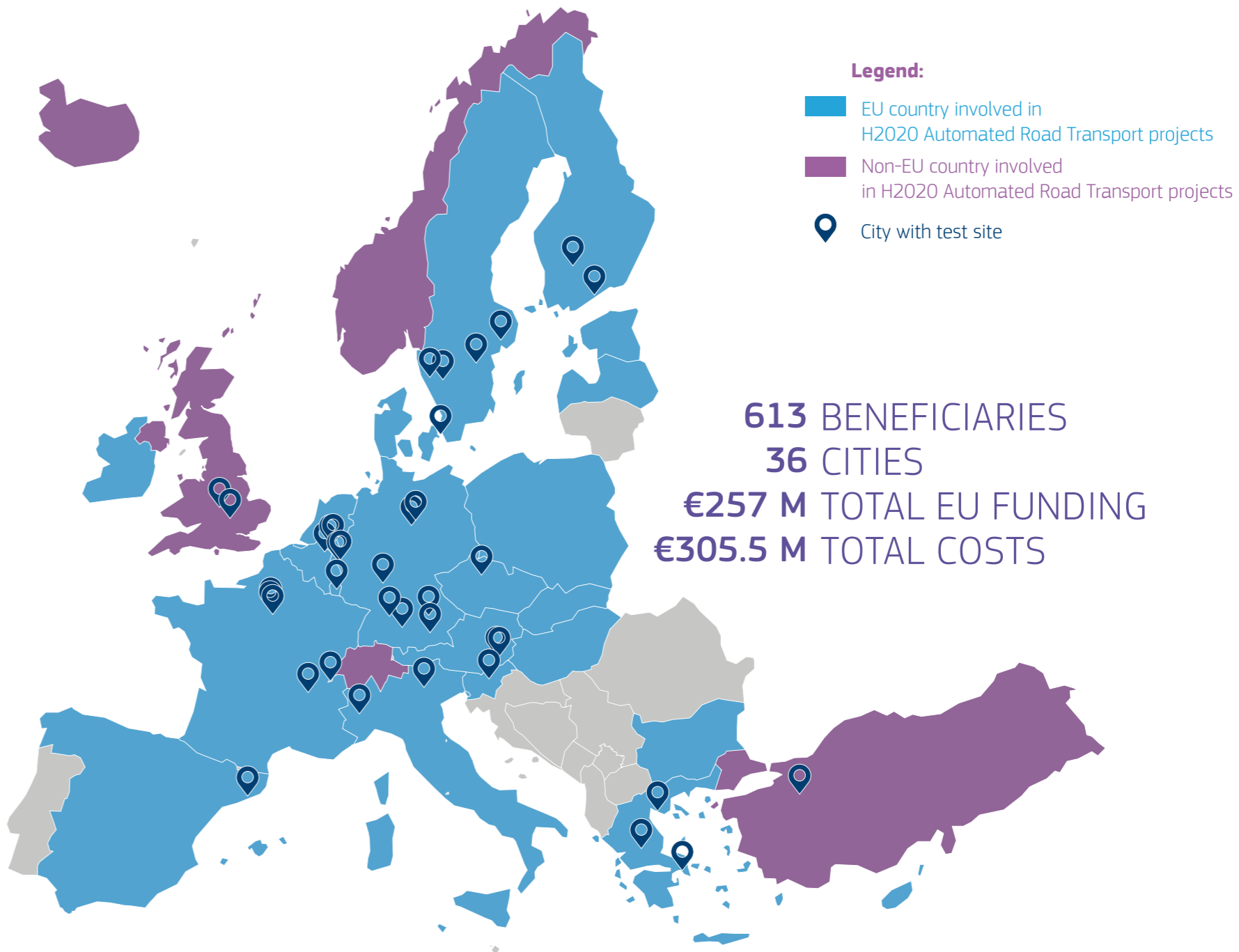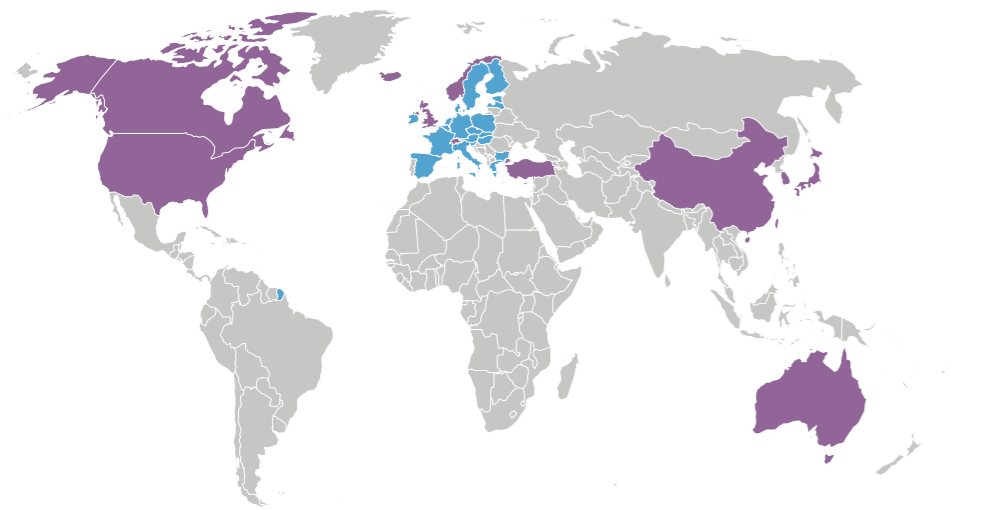
AUTOMATED ROAD TRANSPORT

OUTREACH OF PROJECTS FUNDED BY HORIZON 2020

PARTNERS FROM

22 *EU MEMBER STATES*
10 *NON-EU COUNTRIES*

613 BENEFICIARIES
36 CITIES
€257 M TOTAL EU FUNDING
€305.5 M TOTAL COSTS

ADAS & ME

ADAPTIVE ADAS TO SUPPORT INCAPACITATED DRIVERS MITIGATE RISKS EFFECTIVELY THROUGH TAILOR MADE HMI UNDER AUTOMATION

ADAS&ME

01/09/2016   29/02/2020

FUNDACION CENTRO DE TECNOLOGIAS DE INTERACCION VISUAL

STATENS VAG- OCH TRANSPORTFORSKNINGSINSTITUT

€ 8,998,950

www.adasandme.com

Coordinator   EU contribution   Website

ARCADE

ALIGNING RESEARCH & INNOVATION FOR CONNECTED AND AUTOMATED DRIVING IN EUROPE

connected automated driving.eu
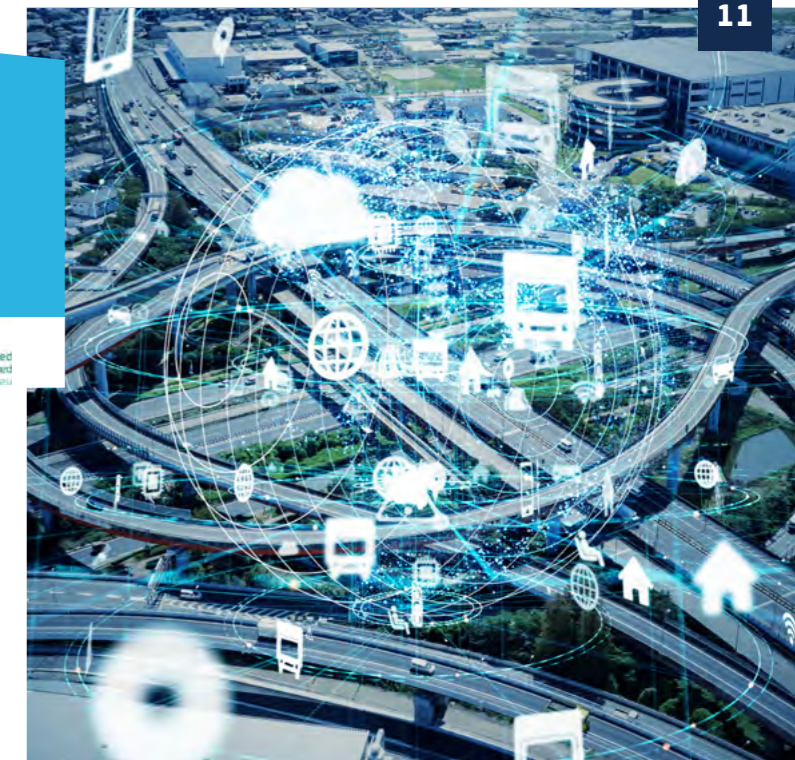
01/10/2018   31/07/2021

ERTICO

€ 3,000,000

www.connectedautomateddriving.eu

Coordinator   EU contribution   Website

The ADAS&ME project developed Advanced Driver Assistance Systems (ADAS) that incorporate driver/rider state, environmental context and adaptive interaction. The project aimed to automatically transfer the control between vehicle and user, thus improving efficiency, environmental impact and safety for all vehicle types: conventional and electric car, truck, bus and motorcycle.

The ADAS&ME approach was to develop driver/rider vehicle interactions that avoid critical scenarios by warning the users and automatically activating a support system. An adaptive architecture and technical implementation for all main systems and use cases have been developed and the data collection for all targeted driver states - including

sleepiness, visual distraction, rest, stress, emotions and fatigue – has been conducted successfully. A multimodal adaptive Human Machine Interface (HMI) framework and personalised user profiles that take into account inter-individual differences constitute a step toward the reduction of automated systems' development costs, better performance of sensor and data analysis systems, and optimised HMI strategies.

Test sites:_Barcelona (Spain), Lommel (Belgium), Versailles (France), Braunschweig (Germany); Södertälje (Sweden) to Wolfsburg (Germany)_

The ARCADE project aims to build consensus across stakeholders from all sectors on a sound and harmonized deployment of Connected, Cooperative and Automated Driving (CAD) in Europe and beyond.

ARCADE federates a CAD stakeholder network through the regular organisation of workshops and the co-organisation with the European Commission of the EUCAD Conferences and symposia. It also supports the Trilateral EU-US-Japan cooperation on ART. Through the joint CAD Network activities, experts exchange on best practices and lessons learnt, and build up synergies and a common approach to development, testing and validation of CAD. A major objective is the contribution to the definition of future

research and innovation priorities in Europe for the main thematic areas related to the deployment and adoption of CAD (e.g. STRIA CART and ERTRAC CAD Roadmaps).

ARCADE also consolidates an online Knowledge Base of reference information on CAD, including an overview of stakeholders, methodologies, regulations, standards, best practices, roadmaps analysis and public road test undertakings. ARCADE is open to Associated Partnerships for contributions.

AutoMate

AUTOMATION AS ACCEPTED AND TRUSTED TEAMMATE TO ENHANCE TRAFFIC SAFETY AND EFFICIENCY

01/09/2016 — 31/08/2019

OFFIS EV

€ 4,918,426

www.automate-project.eu

Coordinator   EU contribution   Website

© AutoMate

The success of future complex automated vehicles will depend on how they interact, communicate and cooperate with humans. For the design of an automated system, the overall driver-automation system should be considered, where driver and automation are considered as members of one team that share the driving task, who understand and support each other in pursuing cooperatively the goal of driving safely, efficiently and comfortably from A to B.

The overall objective of AutoMate was to develop, evaluate and demonstrate this «TeamMate Car» concept as a major enabler of highly automated vehicles.

To achieve this objective, AutoMate developed 9 technology enablers, including driver and environment modelling and

monitoring, V2X communications, planning and execution of human-like safe manoeuvres and the implementation of an innovative concept of human-machine interaction. These enablers were integrated into 6 demonstrators (3 vehicles and 3 simulators) to be evaluated in simulated and real environments to measure and quantify the benefit of the TeamMate concept.

AVENUE

AUTONOMOUS VEHICLES TO EVOLVE TO A NEW URBAN EXPERIENCE

01/05/2018 — 30/04/2022

UNIVERSITE DE GENEVE

€ 15,599,780

www.h2020-avenue.eu

Coordinator   EU contribution   Website

© AVENUE

The AVENUE project aims to demonstrate that autonomous vehicles will be a key element of the solution for the public transportation services of tomorrow. The project assesses the road behaviour and safety of the autonomous vehicles in public transportation and complex road situations. It will also demonstrate the economic, environmental and social advantages of autonomous vehicles for both the exploiting companies and the users, opening the way for their full scale adoption and integration in public transportation services.

AVENUE is organised around four major demonstration sites, where fleets of autonomous vehicles, providing door-to-door, free and dynamic routing will be integrated to existing public transportation services. The goal is to improve the service offerings for urban and sub-urban areas with low to medium service demand.

The demonstrator sites represent the most important models in public transport in Europe in terms of business organisation, service areas, social targets, and city and road layout. All four demonstrators operate autonomous vehicle transport services, collecting valuable information on the issues related to operation and integration within existing urban public transport services. At the same time they raise awareness among citizens and public authorities about the expected advantages of these new technologies.

Test sites: *Geneva (Switzerland), Lyon (France), Copenhagen (Denmark), Luxembourg*

AWARD

ALL WEATHER AUTONOMOUS
REAL LOGISTICS OPERATIONS AND
DEMONSTRATIONS

01/01/2021   31/12/2023

EASYMILE

€ 19,892,905.63

https://award-h2020.eu/

Coordinator   EU contribution   Website

BRAVE

BRIDGING GAPS FOR THE ADOPTION
OF AUTOMATED VEHICLES

01/06/2017   28/02/2021
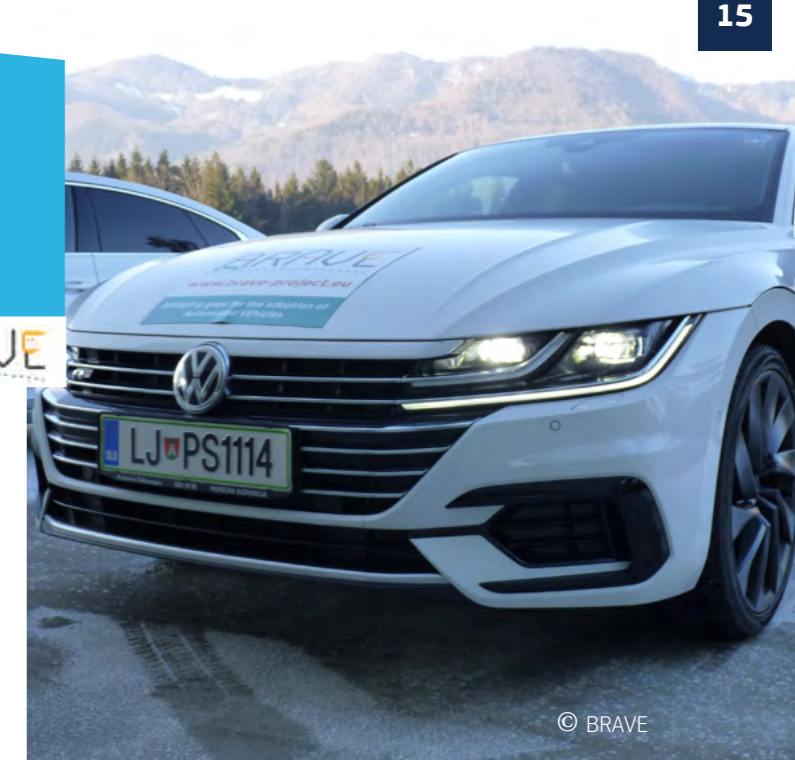
STATENS VAG- OCH TRANSPORTFORSKNINGSINSTITUT

€ 2,990,539

www.brave-project.eu

© BRAVE

Coordinator   EU contribution   Website

The main goal of AWARD project is to develop a harsh-weather proof autonomous driving system (ADS) for heavy duty vehicles, together with a fleet management system, that will enable 24/7 logistics operations.

AWARD aims to demonstrate the business model's viability of automated transport to optimise logistics operations and reduce operational costs. The project will ensure the scalability of the ADS through the development of standard interfaces and proper regulatory frameworks. The solutions developed will be deployed, integrated and validated in four real-life use cases:

» Forklift loading and unloading in warehouses and industrial plants.
» Hub-to-hub shuttle service on open road.
» Automated baggage dispatching in airports.
» Container transfer operations and vessels loading in ports.

Test sites: *Aschaffenburg (Germany), Oslo Airport (Norway), Rotterdam Port (The Netherlands), Gunskirchen (Austria), Hamburg (Germany)*

The BRAVE project aimed to improve safety and market adoption of automated vehicles. It took into consideration the needs and requirements of the users, other road users concerned (drivers and vulnerable road users) and relevant stakeholders (i.e. policy makers, standardization bodies, certifiers, insurance companies), assuring safe integration of key enabling technology advancements. The project issued an exhaustive Multidisciplinary study of the requirements and expectations of drivers and other stakeholders regarding the use of automated vehicles, including social, economic, security and ethical considerations. Focus groups, experts' interviews and population survey were conducted. These insights laid the foundation for the integration of innovative Advanced Driving Assistance Systems and Human Machine Interface concepts. These new concepts were validated back against the baseline requirements using an agile, iterative and incremental user-centric methodology. Propositions of advancements on the regulation will be made.

Test sites: *Vransko (Slovenia), Stuttgart (Germany), Linköping (Sweden), Linas-Montlhéry (France), Barcelona (Spain)*

CoEXist

'AV-READY' TRANSPORT MODELS AND ROAD
INFRASTRUCTURE FOR THE COEXISTENCE
OF AUTOMATED AND CONVENTIONAL VEHICLES

CoEXist

30/04/2020

01/05/2017

RUPPRECHT CONSULT-FORSCHUNG & BERATUNG GMBH

€ 3,474,068

www.h2020-coexist.eu

© CoExist

Coordinator   EU contribution   Website

Drive2TheFuture

NEEDS, WANTS AND BEHAVIOUR OF
'DRIVERS' AND AUTOMATED VEHICLE
USERS TODAY AND INTO THE FUTURE

DRIVE2 THE FUTURE

30/04/2022

01/05/2019

ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS

€ 3,998,612

http://www.drive2thefuture.eu/

© Drive2TheFuture

Coordinator   EU contribution   Website

CoEXist was systematically strengthening the capacities of road authorities and other urban mobility stakeholders in preparation for the transition towards a shared road network with an increasing share of connected and automated vehicles (CAV) at higher automation levels.

Following a trans-disciplinary approach, CoEXist has developed an automation-ready framework to support local authorities in reducing uncertainties and building up their capacity to make structured and informed decisions about CAV deployment in a mixed road environment. The project has further developed microscopic and macroscopic modelling tools to include different types of CAVs. Through their application in eight use cases in Helmond (NL), Milton Keynes (UK), Gothenburg (SE) and Stuttgart (DE), CoEXist will assess to what extent infrastructure is automation-ready and whether the introduction of CAVs improves traffic performance, space efficiency, and safety. This will help identifying needs for adaptation and design recommendations.

Test sites: *Milton Keynes (UK), Stuttgart (Germany), Gothenburg (Sweden), Helmond (The Netherlands)*

Drive2theFuture's mission is to prepare AV users (drivers, travelers, pilots, VRUs, fleet operators and other stakeholders) of all transport modes, and the industry of these technologies to acknowledge their needs and wants, in order to understand, simulate, regulate and optimize their sustainable market introduction; including societal awareness creation, acceptance enhancement and training on use. To do this it captures the feelings and attitudes of the different user groups towards AVs (via voice-of-customer surveys, acceptance risk assessment and sentiment analysis); develops an AV driver behavioral model, integrated in an AV developer's simulation suite (incorporating big data management, modelling & prediction tools, wearables detecting user reaction to AV functions, simulation platform); adapts and further improves Human-machine interface (HMI) good practices through iterative testing with real users; identifies new knowledge and skills required for increasing competences and competitiveness in the transport working ecosystem; investigates training needs and suggests programs, tools and curricula for all user clusters and modes; links AVs to Mobility ad a Service (MaaS); investigates business models and incentives strategies, policy schemes and measures; to conclude with an Automation User Acceptance Creation Roadmap for AV deployment. Tests and demonstrations are implemented in 12 pilot sites across Europe, by a consortium of 31 partners.

ENSEMBLE

MULTI-BRAND PLATOONING TO BECOME
A REALITY IN EUROPE

ENSEMBLE

31/11/2021

01/06/2018

NEDERLANDSE ORGANISATIE VOOR TOEGEPAST
NATUURWETENSCHAPPELIJK ONDERZOEK TNO

€ 19,802,512

www.platooningensemble.eu

© ENSEMBLE

Coordinator   EU contribution   Website

HADRIAN

HOLISTIC APPROACH FOR DRIVER ROLE
INTEGRATION AND AUTOMATION ALLOCATION
FOR EUROPEAN MOBILITY NEEDS

31/05/2023

01/12/2019

VIRTUAL VEHICLE RESEARCH GMBH

€ 7,995,988.75

https://hadrianproject.eu/

© HADRIAN

Coordinator   EU contribution   Website

Platooning technology has significantly advanced in the last decade; to move ahead towards deployment of truck platooning, though, an integral multi-brand approach is required.

In this framework, ENSEMBLE implements and demonstrates multi-brand truck platooning on European roads, enabling a single truck to platoon with any other truck.

ENSEMBLE aims at realising pre-standards for interoperability between trucks, platoons and logistics solution providers, to speed up market pick up of system development and implementation and harmonise legal frameworks in the member states.

During the first year, the consortium has concentrated on setting the specifications for the implementation of multi-brand platooning. Truck manufacturers and suppliers followed up for implementation on their own trucks during year 2, while the knowledge partners performed impact assessments. Year 3 focuses on testing the multi-brand platoons on test tracks and international public roads. The evaluation of technical results against the initial requirements will also include the impact on fuel consumption, drivers and other road users.

The HADRIAN project investigates three methodologies to improve safety and acceptance of human drivers interacting with automated driving vehicles.

First, the predictability and transparency of the automated driving functions is increased for the driver by communicating traffic, road, and environmental conditions directly to the vehicle. This is intended to avoid surprising the driver and facilitate guaranteed time-windows for the transition process.

Secondly, adaptive human-computer interactions are investigated that consider the driver's behavior to minimize information overload and as appropriate "scaffold" the driver's transitions back to manual driving.

Thirdly, the driver receives dynamic, adaptive tutoring about the automated driving system for better acceptance and use.

During the first period of the project, the user needs of three types of user populations (elderlies, truck drivers, and on-road office workers) were assessed and a holistic, human-centered operational concept was developed as well as implementation requirements were derived.

In the second period of the project, the effectiveness of the concept is investigated in driving simulators among partners. In the third project period, feasibility, acceptability, and safety of the solutions are demonstrated in a field-test.

HEADSTART

HARMONISED EUROPEAN SOLUTIONS
FOR TESTING AUTOMATED ROAD TRANSPORT
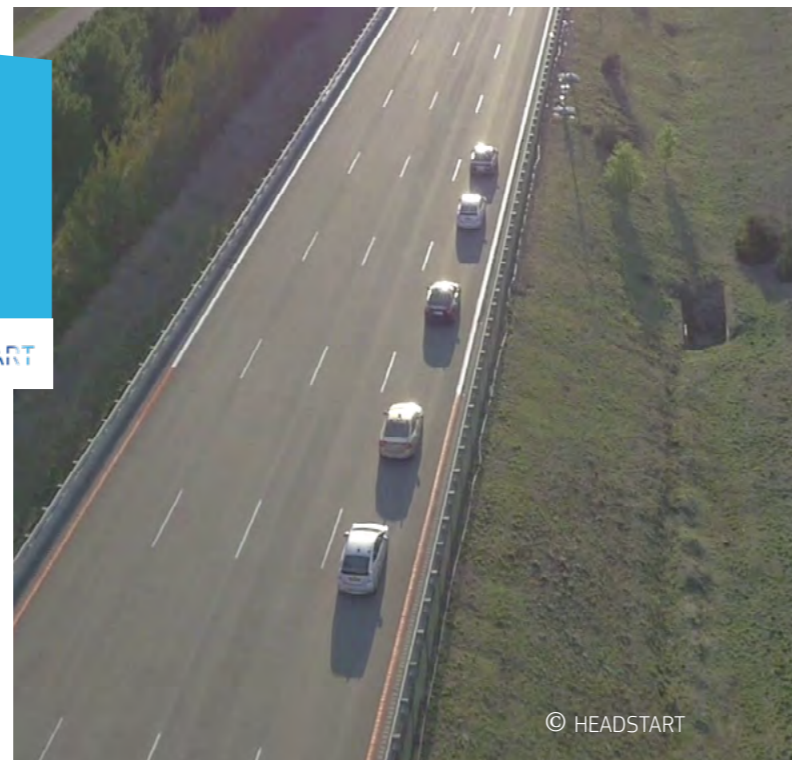
☑ HEADSTART

01/01/2019 — 31/12/2021

📍 IDIADA AUTOMOTIVE TECHNOLOGY SA

€ 5,999,028

🌐 www.headstart-project.eu

© HEADSTART

📍 Coordinator   € EU contribution   🌐 Website

HI-DRIVE

ADDRESSING CHALLENGES TOWARD THE
DEPLOYMENT OF HIGHER AUTOMATION

HI-DRIVE

01/07/2021 — 30/06/2025

📍 VOLKSWAGEN AG

€ 30,000,000

🌐 https://www.hi-drive.eu/

© HI-DRIVE

📍 Coordinator   € EU contribution   🌐 Website

HEADSTART aims to define testing and validation procedures on specific functionalities of Connected and Automated Driving (CAD) functions, including key technologies such as communications, cyber-security and positioning. The tests will be in both simulation and real-world fields to validate safety and security performance according to the key users' needs.

The project will bring together the consortium with European and national CAD stakeholders to cluster the most relevant existing initiatives, develop methodologies, procedures and tools and drive in a harmonised European solution for testing and validation of automated road vehicles. Within the lifetime of the project, relevant stakeholders will be able to join the experts' network to configure together the methodologies used and promote the project results' adoption. Ultimately, the project aims to facilitate consensus by creating and managing an expert network of CAD testing.

Test sites: *Sandhult (Sweden), Barcelona (Spain), Aldenhoven (Germany), Helmond (The Netherlands), Eindhoven (The Netherlands)*
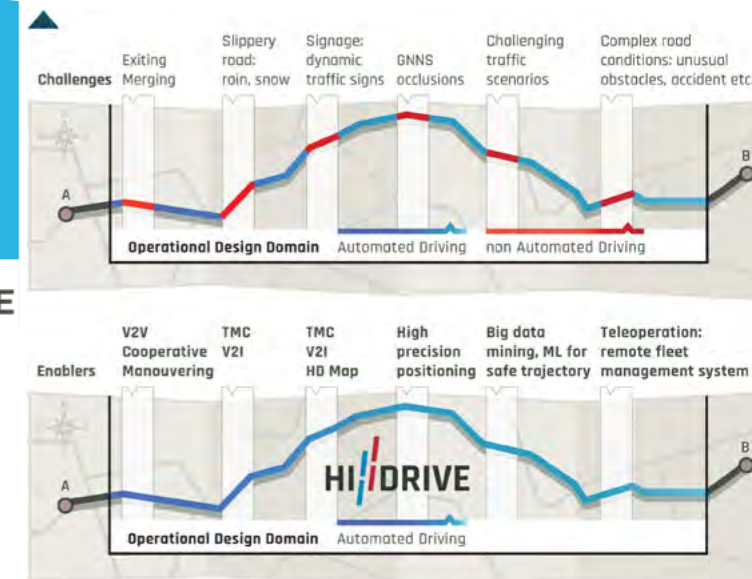
Hi-Drive addresses a number of key challenges which are currently hindering the progress of developments in vehicle automation. The key aim of the project is to focus on testing and demonstrating automated driving, by improving intelligent vehicle technologies, to cover a large set of traffic environments, not currently achievable.

Hi-Drive enables testing of a variety of functionalities, from motorway chauffeur to urban chauffeur, explored in diverse scenarios with heterogeneous driving cultures across Europe. In particular, the Hi-Drive trials will consider European Trans-European Transport Network (TEN-T) corridors and urban nodes in large and medium cities, with a specific attention to demanding, error-prone, conditions.

The project's ambition is to considerably extend the operational design domain (ODD) from the present situation, which frequently demands interventions from the human driver. Therefore, the project concept builds on reaching a widespread and continuous ODD, where automation can operate for longer periods and interoperability is assured across borders and brands. The removal of fragmentation in the ODD is expected to give rise to a gradual transition from a conditional operation towards higher levels of automated driving.

With these aims, Hi-Drive associates a consortium of 40 European partners with a wide range of interests and capabilities covering the main impact areas which affect users, the transport system, and enhance societal benefits.

ICT4CART

ICT INFRASTRUCTURE FOR CONNECTED
AND AUTOMATED ROAD TRANSPORT

01/09/2018

28/02/2022

INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS

€ 7,996,572

www. ict4cart.eu/

Coordinator *EU contribution* *Website*

INFRAMIX

ROAD INFRASTRUCTURE READY FOR
MIXED VEHICLE TRAFFIC FLOWS

01/06/2017

31/05/2020

AUSTRIATECH – GESELLSCHAFT DES BUNDES FUR
TECHNOLOGIEPOLITISCHE MASSNAHMEN GMBH

€ 4,899,404

https://www.inframix.eu/

Coordinator *EU contribution* *Website*

The ICT4CART project consists of 21 partners from 9 EU countries, united in their vision to build a sustainable future for connected and automated vehicles.

ICT4CART's goal is to provide an ICT infrastructure architecture to address existing gaps in the area of connected and automated driving. This high-level architecture will ensure performance and resilience for different groups of applications according to the needs of higher levels of automation (L3 & L4).

Through its architecture, by integrating a hybrid communications approach and mechanisms for seamless exchange of data, ICT4CART will address the challenges faced by the transition of advanced levels of road vehicle automation.

Instead of working on generic solutions, ICT4CART builds on four specific high-value use cases (urban and highway) which will be demonstrated and validated under real-life conditions at the project test sites in Austria, Germany, Italy and across the Italian-Austrian border.

Test sites: *Laßnitzhöhe area (Austria), Ulm (Germany), Verona (italy), Graz (Austria), Trento Centro (Italy)*

The INFRAMIX project aimed to design, upgrade and adapt both physical and digital elements of the road infrastructure, ensuring an uninterrupted, safe and efficient traffic in the transition period with automated and conventional vehicles. This also includes ways of informing all types of vehicles about the road operator's control commands and proposing new visual signs and electronic signals. INFRAMIX ensures that the proposed adaptations will not jeopardize safety, quality of service and efficiency.

In order to achieve this, INFRAMIX developed a co-simulation environment, combining the modelling of the vehicle behaviour with the traffic simulation to examine different mixed traffic scenarios.

It also designed and implemented novel traffic estimation, monitoring and control strategies.

The project developed hybrid testing systems, coupling infrastructure elements and vehicles on real roads with virtual traffic environment.

Lastly, it evaluated traffic safety and user's appreciation, and create a Road Infrastructure Classification Scheme.

Test sites: *Between Barcelona and the French border (Mediterranean Corridor), Between Laßnitzhöhe and City of Graz (Austria)*

interACT

DESIGNING COOPERATIVE INTERACTION OF AUTOMATED VEHICLES WITH OTHER ROAD USERS IN MIXED TRAFFIC ENVIRONMENTS

01/05/2017 — 30/09/2020

📍 DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV

€ 5,527,581

www.interact-roadautomation.eu

📍 Coordinator   € EU contribution   🌐 Website

© InterACT

L3Pilot

PILOTING AUTOMATED DRIVING ON EUROPEAN ROADS

01/09/2017 — 31/10/2021

📍 VOLKSWAGEN AG

€ 35,960,979

www.l3pilot.eu

📍 Coordinator   € EU contribution   🌐 Website

© L3Pilot

The interACT project developed novel, holistic interaction concepts for automated vehicles, that will enable their integration in mixed traffic environments in a safe and intuitive way.

interACT studied and substantially improved the communication and cooperation strategy between automated vehicles and other traffic participants. The project provided an overview of current human interactions in traffic and supported the safe deployment of automated vehicles. It did so by developing novel software and Human Machine Interface (HMI) hardware components for reliable and user-centric communication between automated vehicles and other traffic participants.

Concretely, interACT used social-psychological models to compile a catalogue of interactions, identifying the main communication needs of road users in current and future traffic scenarios. It contributed to improve software algorithms and sensor capabilities for assessing intention recognition and behaviour prediction of surrounding road users. It also developed a Cooperation and Communication Planning Unit to integrate planning algorithms, providing synchronised and integrated communication protocols. Last but not least, the project worked to ensure safety of road users by developing easy-to-verify software for a safety layer, as well as novel methods for fail-safe trajectory planning.

Test sites: *Munich (Germany), Turin (Italy), Braunschweig (Germany), Athens (Greece)*

The European research project L3Pilot tests the viability of automated driving as a safe and efficient means of transportation on public roads with 1,000 drivers across ten European countries, including cross-border routes. The project focuses on large-scale piloting of SAE Level 3 functions, with additional assessment of some Level 4 functions.

The tested technologies cover a wide range of driving situations, including parking, overtaking on highways and driving through urban intersections. L3Pilot covered the entire range of impact assessments, from the direct effects on driver behaviour to even the socio-economic impacts.

By the end of the project, L3Pilot has harmonised the various test sites as regards compliance with automated driving testing, thus creating a European-wide Automated Driving testing environment. To keep user desires in focus, L3Pilot collected data on user acceptance of vehicle automation in an annually published survey. The partners also involved various stakeholders to explore the trends and commercialisation potentials related to the L3Pilot functions.

Test sites: *Aachen (Germany), Barcelona (Spain), Brussels (Belgium), Coventry (UK), London (UK), Gothenburg (Sweden), Ingolstadt (Germany), Luxembourg, The Netherlands, Munich (Germany), Offenbach (Germany), Wolfsburg (Germany), Paris (France), Turin (Italy)*

Levitate

SOCIETAL LEVEL IMPACTS OF CONNECTED AND AUTOMATED VEHICLES

01/12/2018 — 31/05/2022

📍 LOUGHBOROUGH UNIVERSITY (UK)

€ € 5,022,215

🌐 www.levitate-project.eu

© Levitate

📍 Coordinator   € EU contribution   🌐 Website

MAVEN

MANAGING AUTOMATED VEHICLES ENHANCES NETWORK

01/09/2016 — 31/08/2019

📍 DEUTSCHES ZENTRUM FUER LUFT – UND RAUMFAHRT EV

€ € 3,149,661

🌐 www.maven-its.eu

© MAVEN

📍 Coordinator   € EU contribution   🌐 Website

LEVITATE is developing a wide-ranging evaluation framework to assess the impact of connected and automated transport (CAT) on all aspects of transport and individual mobility as well as at societal level. This framework will be used to evaluate the impacts of connected automated vehicles (CAVs) on individuals, the mobility system and society using a wide range of indicators.
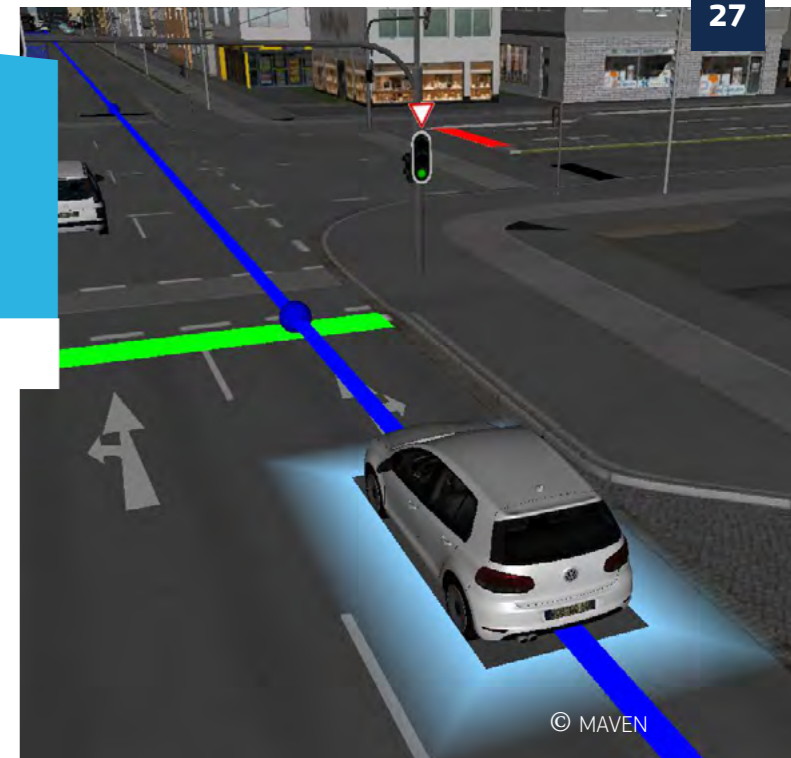
The project addresses the needs of municipalities, regional authorities and national governments that wish to prepare for the increasing prevalence of connected and automated systems, understand the implications for mobility policies and identify the most effective measures to achieve wider societal objectives. Time horizons cover short-term to long-term reflecting the progressive introduction of CAT technologies.

The framework is being applied to a wide range of use cases and scenarios to forecast expected impacts of CATs and develop a back-casting methodology that will enable cities to identify the most appropriate CATs interventions to enable them to achieve their policy objectives.

Cooperative automated vehicles and Cooperative infrastructure will get more and more present in the near future. The Managing Automated Vehicles Enhances Network (MAVEN) project aimed to improve traffic efficiency and safety with management functions at both vehicle and infrastructure level. The project has developed new solutions for platoon planning that also includes a tactical level. This is where platooning, lane changes and optimal speed for approaching an intersection are the main targets. The interactions with the infrastructure were organised as negotiations and supported by new and extended message sets, which are in the process of being standardised now. The project has developed a patented algorithm for dynamic traffic light controllers to support automated vehicles approaching an intersection with a predictable count-down, while maintaining high traffic efficiency. The combined use cases of platooning, speed advice and green wave have demonstrated during simulations that it is possible to eliminate stopping at intersections completely. This has a potential CO_2 reduction of 80 tons per year per intersection.

Test sites: *Helmond (The Netherlands), Braunschweig (Germany)*

PAsCAL
ENHANCE DRIVER BEHAVIOUR AND PUBLIC ACCEPTANCE OF CONNECTED AND AUTONOMOUS VEHICLES

01/06/2019

30/11/2022

HORIZON 2020

PAsCAL PROJECT

Enhance driver behaviour
and Public Acceptance
of Connected
and Autonomous vehicLes

WWW.PASCAL-PROJECT.EU

📍 LUXEMBOURG INSTITUTE OF SCIENCE AND TECHNOLOGY

€ 3,974,041.25

🌐 https://www.pascal-project.eu/

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📍 Coordinator   € EU contribution   🌐 Website

SHOW
SHARED AUTOMATION OPERATING MODELS FOR WORLDWIDE ADOPTION

01/01/2020

31/12/2023

📍 UNION INTERNATIONALE DES TRANSPORTS PUBLICS

€ 29,980,398.57

🌐 https://show-project.eu/

© SHOW

📍 Coordinator   € EU contribution   🌐 Website

PAsCAL will improve the understanding of the implications of connected and automated vehicles (CAVs) on society. The project will help decision-makers to move towards new forms of individual and collective mobility.

The project will examine the perceptions/expectations of citizens regarding CAV technologies and the behavior of their drivers and other road users, to provide safe solutions to address their fears or emotional/cultural gaps.

Surveys and behavioral analyses are being undertaken using simulators and virtual reality platforms. This will allow conclusions on vehicle design, human-machine interface layout and the holistic organization of the transport system to be drawn.

Five road-transport pilot projects are also ongoing, focusing on: autonomous buses; autonomous bus lines; user training; heterogeneous CAV usages; and applications allowing people with disabilities to travel on the network.

This new knowledge will be incorporated into the "Guide2Autonomy". Specific items for inclusion will be how best to train CAV users (the current "drivers"), the necessary certifications that must be obtained and any new traffic rules to be adopted.

A specific project focus will be for people who are currently unable to drive traditional vehicles e.g. blind or partially sighted citizens. Here CAVs offer numerous advantages in terms of freedom of movement and increased personal autonomy.

SHOW aims to advance sustainable urban mobility through the deployment of shared, connected, electrified fleets of Automated Vehicles (AVs). SHOW is the biggest and most holistic initiative ever piloting AVs in urban environments. It gathers a strong consortium (69 partners from 13 countries) and will pilot real-service seamless operation in 20 European cities for at least 12 months.

SHOW's partners defined use cases, the impact assessment framework, and new business and operating models. They also developed an open modular system architecture to integrate AVs in the existing Public Transport systems.

In 2022, SHOW will deploy a fleet of 70 AVs with different features: for passenger and cargo transport; to be deployed in dedicated lanes or mixed with traffic; to be connected to different supporting infrastructure (5G, G5, IoT); and operating at different speeds (from 18 to over 50km/h).

Finally, SHOW collaborates with organisations from the US and Asia Pacific. Collaboration agreements with China, Australia, Japan and Taiwan have been already signed.

Test sites: *Graz, Salzburg, Klagenfurt (Austria); Brussels (Belgium); Brno (Czech Republic); Copenhagen (Denmark); Tampere (Finland); Rouen, Veron-Giverny (France); Aachen, Karlsruhe, Monheim (Germany); Trikala, Thessaloniki (Greece); Turin (Italy); Madrid (Spain); Linköping, Gothenburg (Sweden); Geneva (Switzerland); Eindhoven (The Netherlands).*

SUaaVE

SUPPORTING ACCEPTANCE OF AUTOMATED VEHICLE

01/05/2019 — 31/10/2022

📍 INSTITUTO DE BIOMECANICA DE VALENCIA

€ 3,894.782.50

🌐 https://www.suaave.eu/

© SUaaVE

📍 *Coordinator*   € *EU contribution*   🌐 *Website*

TransAid

TRANSITION AREAS FOR INFRASTRUCTURE-ASSISTED DRIVING
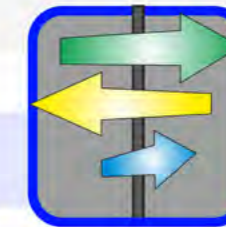
01/09/2017 — 28/02/2021

📍 DEUTSCHES ZENTRUM FUER LUFT – UND RAUMFAHRT EV

€ 3,836,354

🌐 www.transaid.eu

© TransAid

📍 *Coordinator*   € *EU contribution*   🌐 *Website*

SUaaVE aims to enhance the public acceptance of L4/L5 Connected and Automated Vehicles (CAVs) by combining synergies amongst social science, human factors research and automotive market. The main ambition in SUaaVE is the formulation of ALFRED, defined as a human centred artificial intelligence to humanize the vehicle actions by understanding the emotions of the passengers of the CAV and managing corrective actions in vehicle for enhancing trip experience. In this regard, the project has developed an emotional model (able to estimate the emotional state of the passengers from the analysis of their physiological response), a cognitive model (to characterise passengers from the perspective of situational awareness), an HMI display (to provide effective communication information about the current behaviour and future vehicle intentions), as well as ambient comfort and dynamic control algorithms to adjust vehicle behaviour. Furthermore, SUaaVE investigates the factors behind public acceptability of CAV in a holistic way (identifying fundamental insights on promoting acceptance) and generates a cross-cultural framework for ethical and legal issues emerging from CAV deployment. All these outcomes seek to establish trust between people and automated vehicles, as well as enhance the in-cabin and personalized experience.

TransAID was the first European project developing hierarchical traffic management procedures to allow the smooth integration of automated vehicles in traffic systems, especially around those areas of the road where vehicle automation reaches its limits.

TransAID looked into how future vehicle automation systems are going to act on the road. Special focus was put on the behaviour of the systems when reaching system limits, i.e. when facing a situation which cannot be handled by the systems without help – for example by starting a take-over request and giving control back to the driver. The project intended to simulate this behaviour, not only for single vehicles, but for the predicted market shares in the upcoming years. This would allow the assessment of the impact on traffic safety and efficiency. Based on this, hierarchical traffic management systems were developed, enabling a controlled movement of the vehicles by taking into account their abilities. The developed systems were prototypically implemented and the effects were assessed in simulation and real world tests. The findings have been aggregated to create guidelines and a roadmap for stakeholders.

Test sites: *Braunschweig (Germany)*

TrustVehicle

IMPROVED TRUSTWORTHINESS AND WEATHER-INDEPENDENCE OF CONDITIONAL AUTOMATED VEHICLES IN MIXED TRAFFIC SCENARIOS
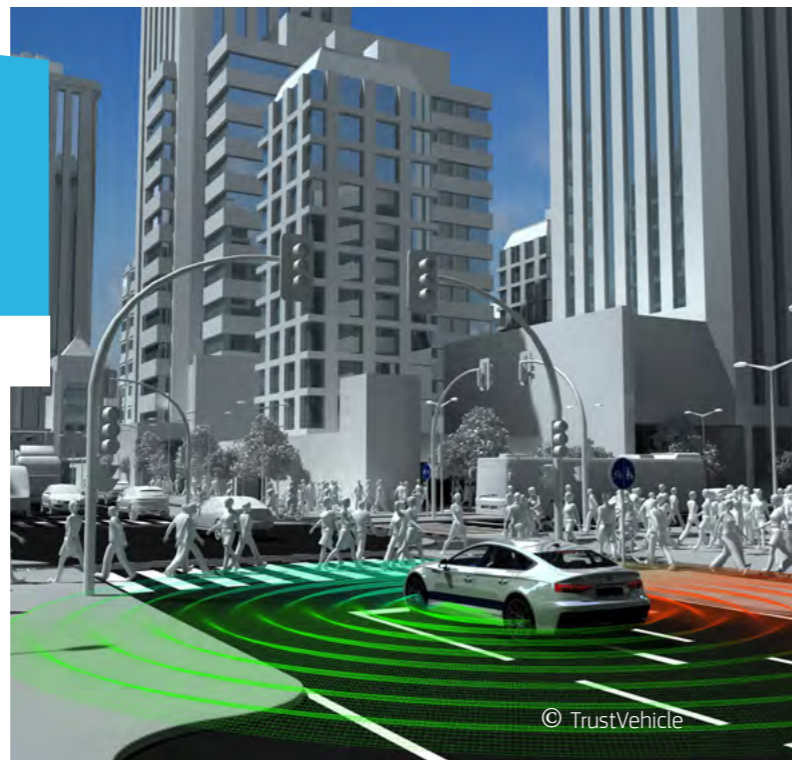
01/06/2017 — 31/10/2020

📍 VIRTUAL VEHICLE RESEARCH GMBH

€ 4,998,904

🌐 www.trustvehicle.eu

© TrustVehicle

📍 Coordinator   € EU contribution   🌐 Website

TRUSTONOMY

BUILDING ACCEPTANCE AND TRUST IN AUTONOMOUS MOBILITY

01/05/2019 — 30/04/2022

📍 ALGO WATT SPA

€ 3,920,000

🌐 https://h2020-trustonomy.eu/

© TRUSTONOMY

📍 Coordinator   € EU contribution   🌐 Website

The introduction of automated vehicles to the market raises various questions and problems. One of them is the trustworthiness of the automated systems and in this connection the user's perception and acceptance. The user's perception is especially important during SAE level 3 automated driving, where the driver must be able to resume vehicle control, and during the initial deployment of automated systems, where mixed traffic situations occur, in which automated and human-driven vehicles share the same road space. The project TrustVehicle investigated critical scenarios, especially in mixed traffic situations and under harsh weather conditions, and worked to improve trustworthiness.

For a user-centric approach, the driver's impressions and feelings are crucial for L3AD driving since he/she should be able to resume vehicle control if needed. Therefore, they are strongly considered in the whole development process of the different components that constitute the automated system. Questionnaires and tests on the driver simulator were some of the measures taken within TrustVehicle to assure the involvement of the user in the development process.

Test sites: *Tampere and Helsinki (Finland), Gothenburg (Sweden), Ford Otosan Inonu Proving Ground (Turkey)*

Automated driving raises several challenges, from evaluating the driver's ability to intervene in a driver-vehicle interaction, adequate driving training, ethical and legal perspectives up to properly designed Human-Machine Interfaces (HMI). All these factors encompass a trust dimension that is crucial for the successful interplay between human drivers and increasingly automated driving systems and vehicles. The TRUSTONOMY project aims at investigating relevant methodologies, approaches and technologies in autonomous driving and Request-to-Intervene scenarios, thus enabling and fostering increased safety, trust and acceptance of automated vehicles. More in detail, the project encompasses frameworks for the technical assessment of driver state monitoring systems and HMI designs, for automated decision support and for driver's intervention performance assessment. It also covers more human-centered aspects like the development of novel training tools and curricula for drivers and psychological studies around the experience of trust and its dynamic evolution while travelling and interacting with an automated vehicle. The research is carried out with driving simulators and real vehicles in 4 pilots across 5 countries and 7 locations, considering differentiated key aspects such as types of users, road transport modes (private cars, public transport and trucks), driving conditions and environments.

VI-DAS

VISION INSPIRED DRIVER ASSISTANCE SYSTEMS

31/08/2019

01/09/2016

📍 FUNDACION CENTRO DE TECNOLOGIAS DE INTERACCION VISUAL Y COMUNICACIONES VICOMTECH

€ 6,225,246

🌐 http://www.vi-das.eu/

📍 *Coordinator*   € *EU contribution*   🌐 *Website*

WE-TRANSFORM

WORKFORCE EUROPE - TRANSFORMATION AGENDA FOR TRANSPORT AUTOMATION

30/11/2023

01/12/2020

📍 POLITECNICO DE TORINO

€ 2,499,396.25

🌐 https://wetransform-project.eu/

📍 *Coordinator*   € *EU contribution*   🌐 *Website*

Road accidents, which are mainly caused by human error, are a major safety concern nowadays. Technologies have been developed to tackle this issue, but they are often limited to monitoring the exterior of the vehicle. However, for achieving automation, both the surrounding of the vehicle as well as the driver should be deeply analysed.

Unlike other existing solutions, VI-DAS proposed the next-generation 720º connected Advanced Driver Assistance Systems (ADAS), which monitors both the outside and the driver status based on non-invasive technologies. After capturing and analysing data, the system sends feedback real-time to better understand the driving context. As a result, VI-DAS keeps the driver in the loop during mode transitions in semi-automated driving or ADAS modes.

In short, VI-DAS contributed to take the automotive industry one step closer in the path towards autonomous driving. The main objective was to increase road safety and position Europe as the leader in the autonomous driving field. In order to reach this ambitious milestone, VI-DAS brought together leading international firms and institutions.

Test sites: *Milovice (Czech Republic), Eindhoven (The Netherlands)*

Automation in transport and digitalisation will affect both transport users and its workforce. Currently, there is a knowledge gap regarding the repercussions across the transport chain. The EU-funded WE-TRANSFORM project will combine expertise across all facets of transport and analytical tools and apply a participatory approach, using collective intelligence, to generate an evidence-based and action-oriented agenda to tackle the challenges connected to the effects of automation on the transport labour force, among other things. To do this, the project will establish a collaborative platform for stakeholders that will produce user-friendly and shareable knowledge on automation impacts on transport labour.

CINEA'S ROLE

The European Climate, Infrastructure and Environment Executive Agency has been established by the European Commission to implement parts of EU funding programmes for transport, energy, climate action, environment and maritime fisheries and aquaculture.

The Agency provides its stakeholders with expertise and high-level programme management. It fosters an efficient knowledge sharing, while at the same time promoting synergies among programmes, in order to contribute to economic growth and benefit EU citizens.

CINEA supports Road Transport research together with the European Commission's Directorates-General for Research & Innovation (DG RTD), and for Mobility and Transport (DG MOVE).

The Agency plays a crucial role in turning road transport policy set by the Directorates-Generals into successful implementation of research and innovation projects.

FROM HORIZON 2020 TO HORIZON EUROPE

Since January 2014, INEA has been the gateway to funding under the Horizon 2020 Societal Challenges 'Smart, Green and Integrated Transport' and 'Secure, Clean and Efficient Energy' with a total budget of €5.3 billion. CINEA (successor Agency of INEA) manages the portfolio of EU automated transport projects, with a budget of €250 million made available under the Automated Road Transport and Mobility for Growth calls in the period 2015-2020.

In the period 2021 – 2027 CINEA implements €9.6 billion from Horizon Europe programme's Cluster 5 on Climate, Energy and Mobility actions. In this new programme, the EU funding dedicated to Connected Cooperative and Automated Mobility (CCAM) amounts to €162 million already within the first calls of 2021 and 2022.

ADDITIONAL ROAD TRANSPORT RESEARCH, INNOVATION AND FUNDING OPPORTUNITIES

CINEA implements most of the **Connecting Europe Facility (CEF)** programme budget. In particular, CINEA manages the CEF Transport programme which invested around €23.2 billion from 2014 to 2020 to support the development of high performing, sustainable and efficiently interconnected Trans-European Transport Network (TEN-T) as well as €350 million for the priority "Innovation and New technologies" focused on alternative fuels infrastructure facilities. Moreover, between 2021 and 2027 CINEA will manage around €25.81 billion under the CEF2 Transport programme with the objectives to remove bottlenecks, provide missing links, and ensure sustainable, efficient and intelligent transport systems. The programme also promotes digital mobility solutions, integration and interconnection of transport modes as well as military mobility within the EU.

CINEA is also enabling and monitoring the CIVITAS initiative – the network of cities dedicated to cleaner, better transport in Europe and beyond. CIVITAS brings together cities developing and deploying innovative transport solutions. Over 800 measures and urban transport solutions have been tested and implemented as part of demonstration projects in more than 80 Living Lab cities Europe-wide.
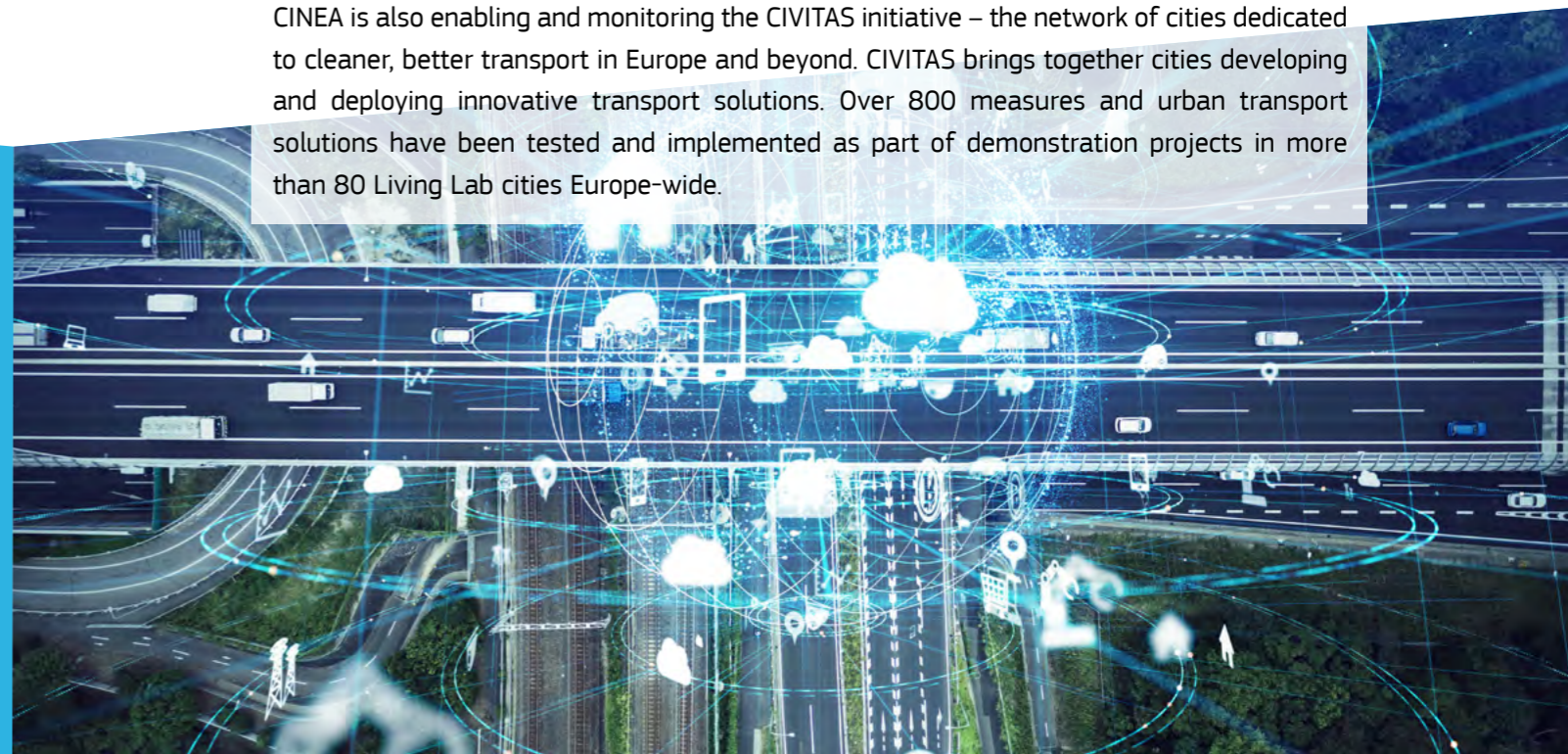
For a full list of CINEA-managed projects and to stay informed about upcoming funding opportunities, visit our website and follow the Climate, Infrastructure and Environment Executive Agency on LinkedIn and Twitter.

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