SHared automation **O**perating models for **W**orldwide adoption

Driving the future of mobility: key findings, impact, and legacy

SHOW
AUTOMATED URBAN MOBILITY

Author:
The SHOW Consortium

Funded by the European Union

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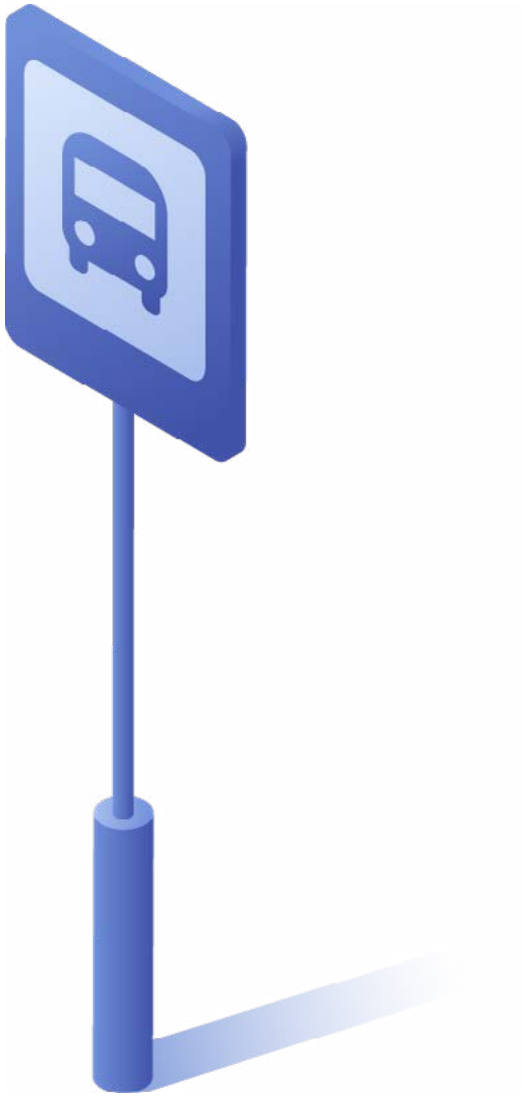


Foreword from **Project Coordinator**

John McSweeney
SHOW Project Coordinator
UITP

SHOW has been an enormous undertaking: more than 60 partners from 13 EU countries; the deployment of over 70 vehicles at sites across Europe; tens of thousands of passengers carried, and kilometres driven; and new knowledge generated on topics from technical development of vehicles to impact assessment, public acceptance, business models, regulations and more.

It is a testament to the efforts of the entire consortium that, despite some challenges, the project has produced such encouraging results for the entire CCAM ecosystem.

Most importantly, the project has proven that the benefits of automated mobility – providing affordable, sustainable and convenient mobility options to all citizens – can indeed be harnessed, and that it is best achieved by integrating automated mobility in public transport networks, ensuring less congestion and better service provision.

More work remains to be done. As vehicle technology continues to improve, policymakers, public transport operators, industry and service providers must work together to ensure we are ready for the mass deployment of automated vehicles.

SHOW has demonstrated that automated vehicles are not a future possibility, but a current reality. I thank all the partners for their incredible work in the project and look forward to seeing the fruits of that effort delivering sustainable mobility to all in the years to come.

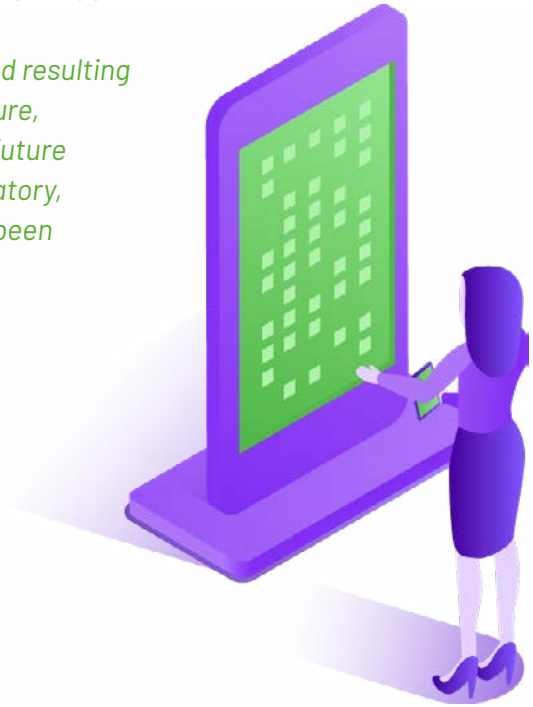
Foreword from **Technical Manager**

Evangelos Bekiaris
SHOW Technical Manager
HIT CERTH

Maria Gkemou
SHOW Technical Manager
HIT CERTH

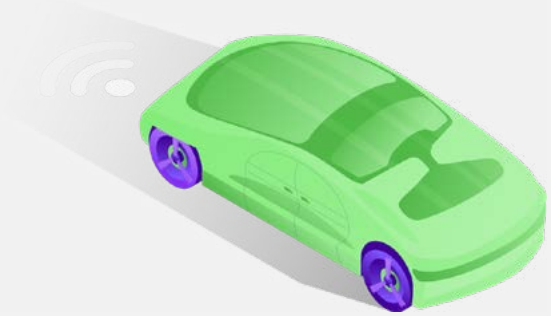
SHOW finally achieved to transfer thousands of passengers and hundreds of cargo units in the large scale field trials that were convened at its pilot cities across Europe deploying more than 70 automated vehicles of several types (buses, shuttles, passenger cars, delivery robots, specially designed vessels, some of which having been retrofitted in the project) in mixed traffic conditions and in the context of fixed, Demand Responsible Transport (DRT) and first/last mile, Mobility as a Service (MaaS) and Logistics as a Service (LaaS) schemes. Innovative vehicle concepts and CCAM (Cooperative Connected and Automated Mobility) services have been piloted resulting in large pools of data collected, performance and subjective both, paving the way for simulations and impact assessment studies with regard to safety, efficiency, environment,energy consumption and societal issues.

The experience in SHOW has been vast and multilayered resulting in a long list of data, results and projections for the future, lessons learned, guidelines and recommendations for future deployments, concerning technical, operational, regulatory, business and deployment aspects; all of which having been substantiated in its final public deliveries as an offer to the CCAM and road transport community.



SHOW project introduction

The arrival of automated vehicles (AVs) presents a transformative opportunity for urban mobility, particularly when integrated into public transport networks. By incorporating AVs into shared and connected fleets, cities can significantly reduce the number of cars on the road, improving access to previously hard-to-reach areas and enhancing first/last-mile connectivity.



Launched in January 2020, the SHOW project is Europe's most comprehensive real-life demonstration of Cooperative, Connected, and Automated Mobility (CCAM) in urban settings. Over nearly five years, SHOW has explored and implemented automated mobility solutions across various transport modes, including Public Transport (PT), Demand-Responsive Transport (DRT), Mobility as a Service (MaaS), and Logistics as a Service (LaaS).

The SHOW consortium has deployed shared, connected, and electrified AV fleets in urban settings, defined user-focused priority scenarios and built a global CCAM community, collaborating with international organizations.

Through extensive real-world operations, SHOW has collected invaluable insights into the practical deployment of AVs. Our pilots have covered hundreds of thousands of kilometres and safely completed countless passenger rides, providing crucial data on vehicle performance, user experience, and operational challenges.

Duration
1 January 2020
30 September 2024

Consortium
66 partners

22 pilot cities

13 European countries

A real-world revolution: **SHOW Pilots**

Imagine a city where automated vehicles seamlessly navigate streets, reducing congestion, improving air quality, and enhancing accessibility.

That's the vision behind SHOW.

Through a series of pilot sites across Europe, we have tested a diverse range of automated vehicles (AVs) in real-world environments. These pilots are crucial for understanding the true potential and challenges of connected, cooperative automated vehicles (CCAVs). By evaluating various business models and use cases, we have gathered invaluable insights to shape the future of urban transportation.

From analysing vehicle performance and user acceptance to developing a unified system architecture, SHOW has addressed the key factors influencing the successful integration of CCAVs to create a framework that helps cities worldwide replicate our successes and accelerate the transition to a more sustainable and efficient urban future.

SHOW provided us with a unique opportunity to better understand the future potential of large-scale shared CCAM deployment in complex urban environments. This includes not only technological maturity and user acceptance but also the interaction and complementarity with other transport modes. As the leader of the Demonstration Board, we closely followed each pilot site and its local partners through the various stages of the project—from securing permits for on-street testing to preparing vehicles and infrastructure, and finally to public demonstrations with users.

Together, we addressed common challenges and explored alternative solutions as the project progressed. Additionally, we had the pleasure of facilitating the transfer of knowledge and expertise between the project pilot sites and follower sites, hoping to create a lasting legacy beyond the project's duration.

More importantly, SHOW enabled us to delve deeper into how local authorities can prepare for a future where CCAM operators, both from within and outside Europe, will begin commercial operations in our cities. As legal and technical barriers are eventually removed, it will be essential for local practitioners and decision-makers cities to consider how they can maximize the benefits by adapting local regulations and concession procedures, building vertical and horizontal partnerships, and integrating new shared, on-demand mobility services into their sustainable mobility plans.

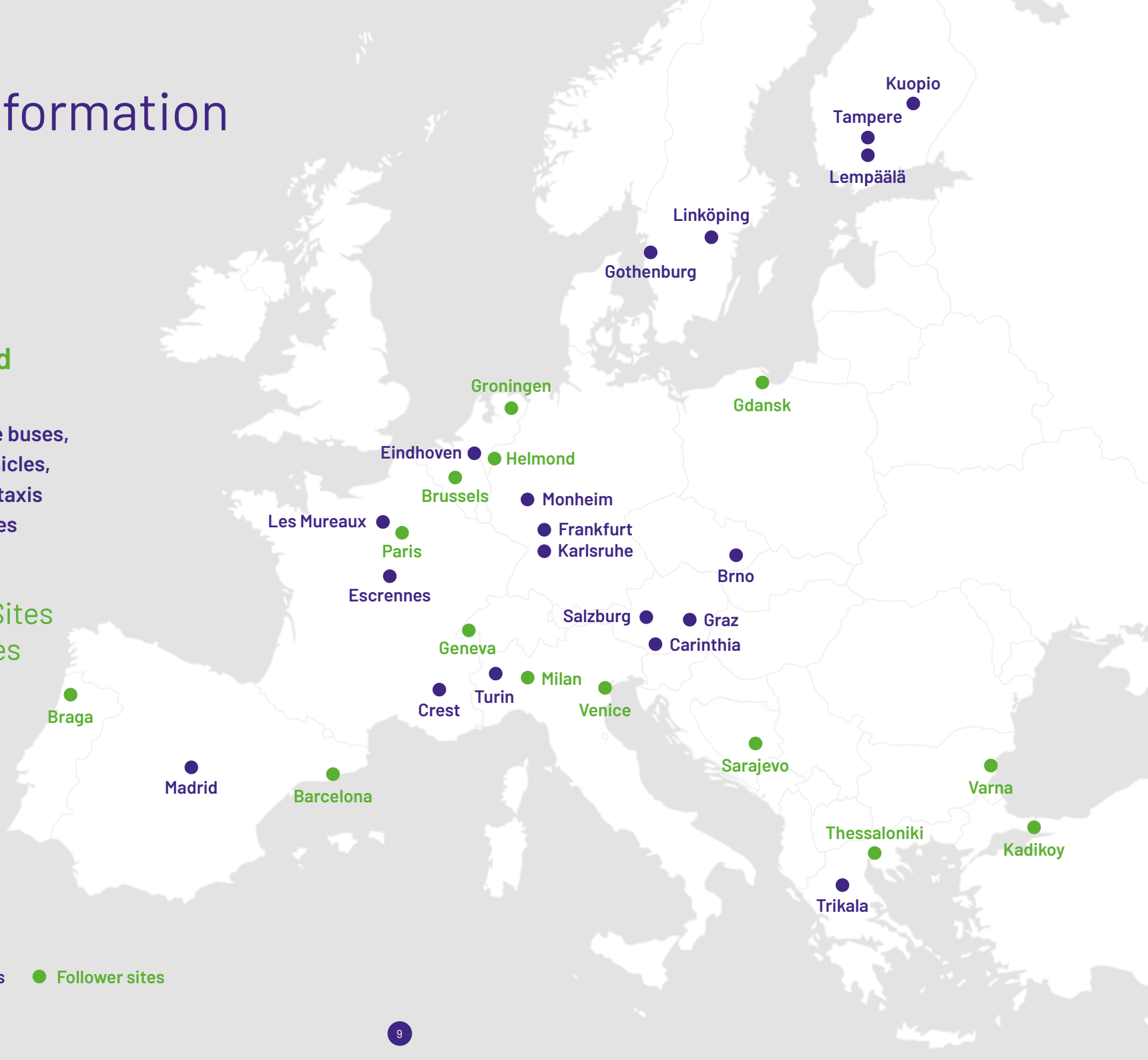
Peter Staelens
Eurocities

Pilot Site Information

More than
72 Automated vehicles

Shuttles, mid & large size buses, vans/pods, freight vehicles, delivery robots, robo-taxis and modular vehicles

5 Mega Sites
3 Core Satellite Sites
3 Follower Sites



Monheim am Rhein
Germany

AVs fully integrated into Public Transport since 2020

The service operates with a 10-minute interval from 9am to 9pm, seven days a week, connecting the old town with the central bus station. It is free of charge for Monheim residents with a "Monheim Pass," while the standard public transportation rate applies to other passengers. The service is supported by more than 50 trained Safety Operators, alongside 3 Designers responsible for deploying new routes and 3 Chief Operators who train new Safety Operators. Additionally, trained colleagues worked in a workshop focused on predictive maintenance of hardware components like steering and brakes for automated vehicles (AVs). The control centre oversees both regular buses and AVs in operation.

Challenge	Recommendation/Mitigation
High maintenance effort for AVs.	More / faster support from EasyMile, more In-house service.
If other vehicles are parked incorrectly, they are an obstacle for our AVs (safety stops, manual driving).	More awareness and support from the public order office: fines, less parking (possibilities) on the route; regular hecks how route can be optimised.
Operation of AVs is costly (Safety operators, high maintenance).	Driverless operations in the future.

Key feedback

- **From stakeholders:**
  The city of Monheim, the MonGuides and local businesses like the service as it attracts tourists and Monheim is perceived as an attractive and visionary city (positive city image).

- **From passengers:**
  Comfortable ride, easy to use for people with reduced mobility, convenient to step in and out, convenient to get connected to other buses, safety stops can be dangerous when standing in the AV.

- **From safety drivers:**
  Closer contact with passengers than in a standard bus, with occasional tips received; however, long periods of standing and occasional rude behavior from other road users were noted.

- **From other road users:**
  Especially car drivers perceive the AVs as an obstacle for traffic flow as the average speed is too low. Too many unforeseen hard braking events make the AV difficult to predict as a road user.

Route

Main route: 1.7 km long, serves 8 stops.
Alternative route: 2,7 km long, serves 8 stops.

Legacy

Following the pilot's success, operations will continue with a focus on advancing autonomous mobility. Participation in projects such as "Diversify CCAM" further supports these goals. Additionally, autonomous vehicle showcases are available for private events to promote individual events in other cities or at public transport operator premises.

Service started in **February 2020**, was endorsed in SHOW in **May 2022** and is **ongoing**

32,069 passengers

Fleet

- **5 Easy Mile Gen 2,**
  SAE Level: 3

Local Ecosystem

BAHNEN MONHEIM · DLR · MONHEIM AM RHEIN · easy MILE · T··Systems·

Karlsruhe
Germany

Shuttles operating freely without virtual rail

The Karlsruhe pilot activities aimed at improving the state-of-the-art in automated vehicles and to test the potential of innovative vehicle concepts. The vehicles collectively showcased a variety of applications, spanning from first and last-mile passenger transportation to cargo transport. This site deployed two modified shuttles for PT-oriented automated driving, which were developed by the FZI Research Institute and were modified to move freely according to traffic conditions, rather than adhering to a pre-defined virtual track. The modular U-Shift vehicle concept was put to the test at the Federal Garden Show. This DLR U-Shift modular vehicle consists of a drive board and different capsules (passenger capsule, cargo capsule, multi-use platform).

Challenge	Recommendation/Mitigation
Ride-pooling and dynamic routing. Driving around obstacles in mixed traffic.	Increased flow in mixed traffic through breaking free from virtual rail.
Intentionally provoked incidents by pedestrians.	Continuous software-update. Communication, driving cautious. Integrate feedback from safety operators.
Exploration of new mobility concepts.	Development of prototypes/software. Product development through industry partners.

Key feedback

- **From stakeholders:**
  Positive response to the U-Shift and FZI-Shuttle concepts, valuable knowledge exchange with industry partners, and strong student engagement in autonomous driving. PTO is interested in autonomous vehicles, but safety operator costs remain a challenge.

- **From passengers:**
  Vehicles received high ratings for their innovative design, with passengers feeling safe and highly satisfied with their rides. Downsides included low speed (limited to 20 km/h). Pedestrians appreciated the vehicles' cautious driving style.

- **From safety drivers:**
  They were highly committed, focusing on explaining vehicle functions and assisting passengers. A few incidents, where pedestrians intentionally triggered hard braking, proved psychologically challenging for them.

- **From other road users:**
  Pedestrians were mostly positive, open-minded, and curious. Car drivers, however, viewed the AVs as an obstacle to traffic flow.

Route

Route 1: 4.5 km public road route in KA Weiherfeld-Dammerstock encompassing various roads.

Route 2: 2 km track within a restricted area in the KIT Campus Ost

Legacy

Deploying the innovative vehicle concepts from DLR (U-Shift) and FZI within the SHOW project led to valuable insights for transferring research results into the real world with the goal of further adapting automated vehicles specifically designed for PT operations.

Development and research on these innovative vehicle concepts continue in various projects, and further applications in real-world environment are planned. Stakeholders, including the city and PT operators, are closely monitoring project results for potential future AV service implementations. Key research areas include teleoperation, smart infrastructure communication, fleet management, and multi-use vehicle development.

From **December 2022** to **November 2023** for the FZI Shuttles.
From **April** to **October 2023** for the U-Shift.

13,500 passengers
1,629 cargo deliveries

Fleet

- **2 modified EasyMile Gen 2**
- **Modified Audi Q5**
- **DLR-U-Shift** modular vehicle

Local Ecosystem

DLR FZI

External collaborators

Karlsruhe · Testfeld Autonomes Fahren Baden-Württemberg · VBK Bewegt alle.

Frankfurt
Germany

Automated On-Demand Service as a first-/ last-mile feeder

The Frankfurt pilot demonstrated the potential of automated, connected on-demand mobility as a future public transport component. By serving as a first/last-mile feeder to metro stops, the automated shuttles expanded public transportation's reach. The on-demand service, accessible via the RMV EASY app, offered flexible and convenient travel with virtual stops. The project involved testing advanced AI systems, including camera-based surveillance and voice-bot interaction, within the shuttles. Additionally, cooperative, coordinated driving manoeuvres were explored to optimize traffic flow and enhance safety. The integration of the shuttles with a control centre further demonstrated the feasibility of managing and monitoring autonomous vehicle operations.

Challenge	Recommendation/Mitigation
Complex connection between on-demand software and automated shuttles. For example, pick-up points and waiting positions after completing a task.	Optical marking of pick-up points and fixed waiting positions for shuttles after completing a task.
Smooth shuttle behaviour in challenging environments.	Adapting programmed routes before operation, considering speed, track position, and safety procedures.
Addressing the needs of elderly residents.	Simplifying product explanations and engaging with target groups through on-site communication.

Key feedback

- **From stakeholders:**
  Next step in the multi-year cooperation with local partners: Engaging in intensive discussions to apply learnings for future autonomous operations.

- **From passengers:**
  Very positive passenger feedback. Innovative character and mobility benefits are highly appreciated.

- **From safety drivers:**
  High commitment and interest in developing a better technical understanding, while effectively explaining automated driving and ensuring a greater sense of safety for passengers.

- **From other road users:**
  Shuttles were a traffic barrier due to the slow speeds.

Route

The service operated in Frankfurt's Riederwald district, a 2.7 km route with 30 virtual stops (including wheelchair-friendly ones) near metro stations, supermarkets, pharmacies, and a sports club.

Legacy

The RMV – as the regional PTA in the Rhine-Main-Region – has worked on automated PT systems since 2019. The SHOW site was one important step towards driverless on-demand services in the region. The next steps will mainly focus on enhancing the technical know-how and the integration into the existing (yet driver-based) on-demand services. Within the KIRA (German: AI-based regular operation of autonomous on-demand transport) project the RMV will take this new step together with Deutsche Bahn.

Service from
November 2022 until **October 2023**

3,051 passengers

Fleet

- **2 Easy Mile EZ10 Gen 3b,**
  L4, electric

Local Ecosystem

EASY MILE · fev · iokli DIGITAL PUBLIC TRANSPORT · rms · T··Systems·

External collaborators

fahma fahrzeugmanagement gmbh · RMV · traffiQ · VGF

Gothenburg
Sweden

Digital and physical connected Mobility for Public transport hub and Campus Mobility

The Gothenburg pilot site integrates automated mobility into the city's public transport system, covering a 1 x 0.7 km campus area. This free service is connected to the public transport hub and operates as part of Line 68, offering on-demand rides with no prior booking required. Passengers can track their trips via the ToGo app. A safety driver is always on board for added security, and remote supervision is managed from Paris. The system, powered by Autofleet's FMS, operates in both normal and complex conditions, ensuring seamless interaction with other road users and integrating with the operation center and automated bus depot.

Challenge	Recommendation/Mitigation
Authorization phase was long and hard to be provided, leading to a long time of operation without passengers.	Anticipation for the pilot phase, and final cancellation of the use of a third vehicle.
Economic difficulties on the shuttle supplier Navya side, creating issues for maintenance and support and additional authorization delay.	Very close relationship allowed to collect necessary spare parts and a minimal on-site support that eventually allowed starting the project in February.
Weather conditions especially from a hardware vehicle perspective.	After several difficulties in the pre-demo phase, a dedicated garage was rented for the pilot operation.

Key feedback

- **From stakeholders:**
  Such as the public transport company and the University of Chalmers welcomed the service. The Campus sees the service as a part of ongoing development in the area, including freight robots.
- **From passengers:**
  Thanks to integration in the transport network and the welcoming presence of safety drivers, ridership was high especially in the spring period.
- **From safety drivers:**
  A very different experience from driving a bus by itself, but keeping the direct connection to public, in a globally nice and friendly environment.
- **From other road users:**
  The speed of the shuttles was a constraint for some road users.

Route

Automated shuttles run between a hub in central Gothenburg (tram and bus) and a campus area. Roundtrip is 3,4 km and includes 5 stops.

Legacy

Following the project's conclusion, Level 4 autonomous mobility was successfully tested with Easymile, proving that services without a safety operator are feasible with the right training and operational setup, thanks to support from Keolis teams. While Keolis autonomous mobility initiatives in Sweden concluded at the end of 2023, the legacy continues, as Gothenburg's Public Transport Authority, Västtrafik, remains interested in exploring autonomous options, keeping the vision for driverless public transit alive in the region.

Testing from **October 2022** to **July 2023** (and 5 months of pre-demo)

3,278 passengers

Fleet

- **2 Navya Arma electric AVs (battery)**
  L3+

Local Ecosystem

ERICSSON · KEOLIS · RI.SE

External collaborators

autofleet · DRIVE SWEDEN · navya self-driving made real · VINNOVA

Linköping
Sweden

Automated mobility – the user in focus

The Linköping site successfully demonstrated the safe and reliable operation of three electrified automated vehicles in a mixed traffic environment, including shared spaces with vulnerable road users (VRUs) to improve the user experience for all end users. Transdev Sweden operated Navya and EasyMile shuttles for 23 months, providing a "first-mile, last-mile" service that complemented existing public transport. Passengers could track the shuttles via a mobile app and request pick-up or drop-off points. The service tested cooperation among multiple OEMs, PT providers, and operators.

Challenge	Recommendation/Mitigation
Certain weather conditions and their implications (such as leaves, snowbanks, etc.) can cause problems related to hard braking.	Shuttles were equipped with safety belts for the passengers and a safety arm as a support for the safety driver. Good maintenance help to reduce hard brakings.
The infrastructure along the route had to be adapted and navigation and positioning errors.	LiDAR markers, GNSS mast was installed for local mapping, and continuously updates of vehicle software.
Mix of road type.	Adapting the shuttles behaviour and driver training to different conditions.
Peak hours and campus crowded with pedestrians and cyclists.	Cameras to be used as mirrors were installed in the cabins to help the safety drivers. Instruction movies were developed and spread at Campus.
Majority of passengers normally walks or cycles. Only a few of them would have taken their car.	Visits at schools, University and public local events to promote usage of shuttles.

Key feedback

- **From stakeholders:**
  Highlighted the potential of shuttles as a complementary service to public transport, particularly as feeder traffic to trunk lines. However, improvements to the service, including booking and timetable, are necessary to enhance the passenger experience.

- **From passengers:**
  Most of the passengers were positive about the automated shuttle ride; it has been deemed important to attract more car users for which the ride is a positive experience.

- **From safety drivers:**
  The driver role was variant in the shuttles, i.e. they needed to support both the shuttle operation and the passengers, especially children, the elderly, and people with disabilities such as the visually impaired.

- **From other road users:**
  An increased focus is needed on how the vehicles should be able to interact with passengers on the shuttle, but also with those outside (pedestrians, cyclists, and other vehicle drivers).

Route

The route spanned 4.2 km and included 13 stops.

Legacy

Based on the successful demonstration, on-demand solutions have been implemented in the same area, expanding the service to more streets and enabling bidirectional operation. Preparation for this expansion occurred during spring 2024, and the service is now operational with downloadable apps. To support this expansion, new vehicles will be integrated, and regulations enabling remote operation will be established. A dedicated remote office will be set up to monitor and control the vehicles. Rigorous testing will be conducted to address latency and other technical challenges.

1 February 2022 to **31 December 2023**
(and two months of additional pre-demo)

17,638 passengers

Fleet

- **2 EasyMile Gen2**
- **1 Navya**

Local Ecosystem

COMBITECH · RI.SE · transdev the mobility company · vti

External collaborators

AKADEMISKA HUS · edeva · LINKÖPING UNIVERSITY · Linköping Där idéer blir verklighet · LINKÖPING SCIENCE PARK · ÖstgötaTrafiken

Crest
France

Integrated and automated Public Transport for passengers and goods

The Crest site offered a new public transport service, providing residents with a free, on-demand alternative to car travel, even in rural areas with mixed traffic and challenging road conditions. A fleet of autonomous vehicles (AVs) has been tested for both passenger and goods transport, operating regularly without heavy infrastructure for LiDAR detection. Shuttles with safety drivers navigate mixed traffic (including cars, cycles, pedestrians, and farm vehicles), while a droid operates on pedestrian paths. A remote hypervision centre, located 56 km away, managed operations, with local safety operators trained on-site. Maintenance is supported by a local garage.

Challenge	Recommendation/Mitigation
A lot of maintenance issues for AV shuttles.	Long discussion with NAVYA. Reco = A need for industrialization of AV shuttles and maintenance process
Overtaking of wildly parked vehicles Vegetation false detection.	Manual driving solves such issues. Technology needs advancement. Weeding should be done regularly. Usage of AI to advance such detections.
Operation of AVs is costly (amount of Safety Operators, vehicles, high maintenance).	Real driverless operations in the future, Higher quality of Avs in an industrial process.

Key feedback

- **From stakeholders:**
  City leaders supported the project from the start and now serve as national voices for automated mobility in rural areas, emphasizing the benefits of AVs for local public transport.

- **From passengers:**
  The service benefits elderly users by helping them leave their homes and meet up with friends, such as regular gatherings at Family Garden. However, there is a request for wider connections and a permanent service.

- **From safety drivers:**
  They discovered advanced technology and the future of transportation. However, some drivers feel there have been no major breakthroughs compared to other global technologies, particularly for those who worked on shuttles three years ago.

- **From other road users:**
  Reactions ranged from curiosity and hesitation to impatience and testing the shuttle's responses. Over time, interactions have become more cautious, with increasing acceptance as automated shuttles have become familiar on the roads.

Route

The route from Ecosite to the Malastre stop spans 2.1 km in mixed traffic, with 5 bus stops, 9 pedestrian crossings, a tunnel, 8 priority signs, and 1 major roundabout.

Legacy

The legacy of the SHOW pilot will continue with the RIMA project, which aims to expand the fleet to 7 automated vehicles and establish a consistent daily mobility service solely operated by shuttles. Additionally, beti will implement version 1.1 of its hypervisor for users and operators, applied across 4 controlled rural mobility services: daily, health, inclusive, and tourism.

Tests ran from
May 2024 to **September 2024**

992 passengers
1,410 packages

Fleet

- **3 NAVYA** (2 ARMA, 1 EVO), SAE-Level: 3+
- **1 Twinswheel "ciTHy M" model Droïd**

Local Ecosystem

beti
MOBILITÉ AUTOMATISÉE

External collaborators

biovallée · MOVIN'ON LAB · navya self-driving made real · VINCI FACILITIES · TwinswHeel

Les Mureaux
France

Operability of an autonomous shuttle fleet without on board operator for a large private site

Building on the Navetty project, the Les Mureaux site showcases a fully driverless shuttle service in an urban industrial setting without an onboard operator. This pilot advances regional goals in innovation, sustainable mobility, and infrastructure enhancement. Key focuses include remote supervision for centralized fleet management, connected infrastructure to improve safety and efficiency, and fully autonomous operations to develop expertise for future commercial services. This site is essential for demonstrating how autonomous shuttles can operate safely and efficiently, laying the groundwork for commercial deployment and sustainable urban mobility solutions.

Challenge	Recommendation/Mitigation
Safety case not completely defined for the particularities of the project.	At least 5 workshops took place between Transdev and EasyMile to define together the right safety levels (KPIs) and specific safety oncepts for the project.
Preparation of the shuttles delayed due to the shortage of electrical components (cameras for remote surveillance).	Replanning of no-op phase.
Surveillance cameras system (DriveU): video latency above 500 ms during peak hours.	Wired connectivity for the remote supervision station was replaced by a 4G modem solution.
EasyMile and DriveU uncoordinated updates caused operations interruptions.	All updates started to be coordinated by EasyMile and rescheduled to off-peak hours when possible.
Poor site lighting spots after sunset.	Specific operational procedures were defined if the shuttles needed assistance in one of these spots (roadside assistance intervention).

Key feedback

- **From stakeholders:**
  Emphasis on solving the "last mile" problem, a daily challenge for many residents in the region. The ArianeGroup expressed pride in contributing to autonomous urban vehicle development, while some stakeholders noted a need for additional funding.

- **From passengers:**
  Visitors and employees were positively surprised to get around in an autonomous shuttle. Open road passengers showed high demand for the trial, reflecting strong interest and engagement in the initiative.

- **From safety drivers:**
  Confidence in system safety grew as technical and operational improvements made shuttles more reliable and easier to operate, though bad weather demanded extra effort.

- **From other road users:**
  High acceptance from pedestrians, while other drivers showed lower acceptance due to the shuttles' low speed.

Route

3 EasyMile EZ10-G3b autonomous shuttles, full electric, 12 passengers

Legacy

The Les Mureaux project has successfully demonstrated the feasibility of SAE Level 4 operations for public transport, paving the way for future initiatives that can explore “eyes-off” remote operations and scalability with multiple shuttles. Consortium partners are eager to renew the project, highlighting the need for technology maturity and certification. Enhanced shuttles will aim for better performance on open roads, with higher speeds and reliability. Future expansions could connect key locations, such as the main train station to local recreation areas, while an Operation Command Center will support multi-site autonomous vehicle operations.

The Navetty project was launched in 2021.
Within SHOW, operations ran from
December 2022 to **November 2023**

2,623 passengers transported

Fleet

- **3 EasyMile EZ10-G3b** autonomous shuttles, full electric, 12 passengers

First project in Europe with 3 shuttles being operated without onboard operator in mixed traffic within a complex environment

Local Ecosystem

EASY MILE · INSTITUT VEDECOM · transdev the mobility company

External collaborators

ariane GROUP · Yvelines Le Département

Escrennes
France

Fully L4 automated shuttles for passenger transport with Hypervision center 400km away

The Escrennes pilot tested a fully autonomous L4 people mover service at an industrial site, operating without a safety operator or AV expert on-site, while being remotely managed from a hypervision centre 400 km away. The service was conducted in an off-road, closed industrial area with mixed traffic, enhancing employee wellbeing through smooth mobility services with minimal downtime or service interruptions. The shuttles were available free of charge, with no prior booking required. Safety operators and hypervision personnel were recruited and trained. After an initial phase with safety operators, the service transitioned to operating with safety drivers on board.

Challenge	Recommendation/Mitigation
A lot of maintenance issues for AV shuttles. Some tech issues when raining.	Intervention on all maintenance issues. Industrial process with automative OEM expert is needed to scale. For rain issues, reduce speed.
Wildly parked trucks were the main cause of disengagement.	Communication to truck drivers and manual driving solved such issues. A lot of communication for other road users. Tech should advance on overtaking long vehicles.
High cost of vehicles and maintenance issues.	Higher quality of Avs in an industrial process would reduce the price.

Key feedback

- **From stakeholders:**
  User engagement exceeded management expectations, and the project's communication significantly raised FM Logistics' profile. As a result, FM Logistic's top management invited family investors to test the service and requested a commercial proposal to sustain it.

- **From passengers:**
  Benefits included reduced walking distances (10-13 km daily) within the warehouse, improving wellbeing. Workers named the shuttles VOLT and ROBERTA. Downsides included requests for permanent service (5 AM to 10 PM) and solutions to tech issues related to rain.

- **From safety drivers:**
  Benefits included experiencing advanced technology and the future of transportation. Downsides included the uncertainty of the service potentially stopping.

- **From other road users:**
  Trucks, the most significant and frequent presence on-site and on the road, posed challenges for the AV shuttles. After a month of communication, truck driver acceptance was achieved. Pedestrians primarily consisted of employees using the shuttles.

Route

Two Easymile shuttles operated on a 1.6 km route with three stops (parking entry, building 5, building 11). Detection zones helped prevent interference with truck loading/unloading.

Legacy

Off-road sites like this—with controlled driving rules, low speeds, confined areas, and short ODDs of 1.5 to 5 km—are common in major industrial settings. The success in Escrennes demonstrates that similar setups could be replicated elsewhere.

Operations from
June to **October 2023**

3,133 passengers

Fleet

- **2 Easymile SAE**
  L4

Local Ecosystem

beti
MOBILITÉ AUTOMATISÉE

External collaborators

FM LOGISTIC

Carabanchel-Madrid
Spain

Automated bus depot and open traffic Public Transport service in Madrid

The Madrid demo showcases safe, sustainable, and integrated people mobility through a fleet of 5 automated vehicles navigating complex trajectories in diverse traffic conditions. It includes an Automated Bus Depot to optimize management and efficiency in a semi-controlled environment. The CCAM initiative fosters research and innovation in urban open traffic. The goal is to provide automated public transport in both scenarios, with the Carabanchel bus depot demonstrating the "5 stops service" to improve internal transport, reduce driving hours, and test teleoperation, auto parking, and platooning functions, showing significant operational benefits.

Challenge	Recommendation/Mitigation
Complexity of retrofitting processes.	Stay updated with OEM market developments.
Fear to unknown and overcoming initial reluctance from PTO employees.	Implement effective information and training sessions to build employee confidence.
Current legislation is not fully equipped to meet the expectations and demands of the autonomous mobility sector.	Enable the testing of these solutions without the current complex and costly procedures.

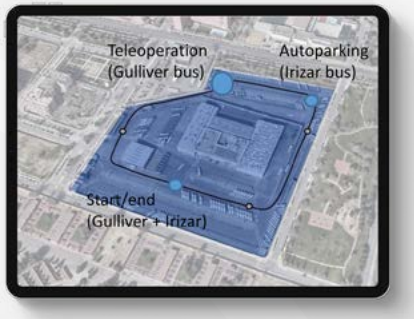
Key feedback

- **From stakeholders:**
  PTOs highlighted training, savings in non-productive hours, and the maturity of CCAM solutions in semi-controlled environments. However, open traffic uncertainties need further development. OEMs saw new business opportunities and called for easier field testing in Spain.

- **From passengers:**
  EMT employees enjoyed the automated service and showed no mistrust. School children questioned the need for a driver, and visitors at public events expressed strong interest in the deployment of automated services.

- **From safety driver:**
  IRIZAR and EMT drivers were cooperative during training and HMI development. They were confident in the 5-stop service but concerned about auto-parking due to localization errors. Overall, they accepted the autonomous services, viewing the slower speed as a safety feature.

Route



The routes have 800 meters (within the bus depot, circular, scenario 1) and 4.1 km, connecting Avenida de los Poblados area with the Islazul Mall (scenario 2)

Legacy

The Madrid pilot site has made significant strides in advancing CCAM through extensive awareness efforts. As a result, the City Board approved the Madrid Mobility Sandbox ordinance project on 3 October 2024, paving the way for CCAM testing and deployment. The initiative includes exploring automated charging processes using inverted pantographs and assessing the feasibility of an autonomous shuttle service in Casa de Campo park by the end of 2025. This progress fosters the development of the Madrid Mobility Sandbox, positioning Madrid as a leading Smart City in innovative mobility solutions.

From **November 2022** to **November 2023** (with 7 months of pre-demo from May 2022 until October 2022)

5,963 passengers

Fleet

- **2 Renault Twizzy** L4
- **2 Microbus Gulliver** L4
- **1 Irizar 12m i2ebus** L4

Local Ecosystem

EMT MADRID · indra · Irizar · tecnalia

External collaborators

AEVAC · DGT Dirección General de Tráfico · MADRID

Graz
Austria

Automated Mobility as a Complement of Public Transport in Graz

The Graz pilot focuses on integrating CCAM solutions to support the city's vision of minimizing individual car use. By implementing shared CCAM services, the project aims to enhance access to key destinations, including shopping centres. A key aspect of this pilot is the smart integration of infrastructure at the bus terminal, which facilitates seamless transfers between automated services and traditional public transport. Additionally, automated curb management systems are employed to optimize the use of bus bays, improving overall efficiency and user experience in the city's transport network.

Challenge	Recommendation/Mitigation
Users need more time to adapt to automated vehicles, as some still prefer conventional buses despite longer wait times.	Increased advertising and awareness to boost user engagement and enhance the experience.
At times, automated vehicles had to wait for bus bays to be freed.	With six bus bays and short bus standing times, the wait was brief (max 1-2 minutes).
The automated vehicle stopped behind an unplanned police vehicle in a bus lane, blocking operations.	The safety driver took control and steered the vehicle to an adjacent spot; in the future, a remote operator could take control.

Key feedback

- **From stakeholders:**
  Stakeholders, such as the public transport company, welcomed the service. Their main remark is the growing lack of bus drivers and how automated services would have a notorious positive impact respectively.

- **From passengers:**
  At first, people hesitated to go in an automated vehicle but were positively impressed and felt safe after being transported.

- **From safety drivers:**
  The feedback from the safety drivers was very positive overall, as there were only a few situations in which they had to take control due to special events.

- **From other road users:**
  People waiting at the bus stop were very interested in the vehicle and the service. Bus and Taxi drivers were a bit concerned about their jobs

Route

Two automated shuttles run between a suburban train station in Graz and a shopping centre, covering about 2 km to pick up passengers at the terminal.

Legacy

The legacy of the Graz pilot extends to Wörgl in Tyrol, where Virtual Vehicle has established another demo site to showcase automated passenger transportation between the train station and an industrial area. Leveraging knowledge gained from the SHOW pilot, the team efficiently transitioned from the preparation phase to the demo phase in a remarkably short time. With a strong focus on research and innovation, Virtual Vehicle Research GmbH aims to further enhance its software and hardware solutions in the field of automated driving through this project.

Tests ran from
October 2022 until **September 2023**

> 550 passengers

Fleet

- **1 Ford Fusion** (passenger car), L4, hybrid
- **1 Kia e-Soul** (passenger car), L4, electric

Local Ecosystem

austriatech · AVL · IESTA · virtual vehicle · YUNEX TRAFFIC

Salzburg
Austria

Automated passenger transport service on the first-/ last-mile in a peri-urban area

The Salzburg pilot deployed two autonomous vehicles—a prototype L4 passenger shuttle and a retrofitted L4 electric minivan—to connect the peri-urban village of Koppl to Salzburg's city centre, offering first- and last-mile transport that complemented existing public transit. Integrated with the local transit app, the free service ran five days a week, allowing residents, commuters, and tourists to plan trips and check schedules. Vital insights from the Koppl pilot support future autonomous transport deployment in Salzburg and strengthen the role of automated mobility as part of the public transport system. A trained safety operator provided assistance throughout the pilot

Challenge	Recommendation/Mitigation
Localization / positioning inaccuracy.	The safety operator manually took over and restarted the AD system at the next stop, increasing their awareness.
Object detection failures.	Manual takeover by the safety operator; restart of the AD system at the next stop.
Technical errors.	The automated shuttle was shut down and restarted, with error documentation consulted and technical support ensured.

Key feedback

- **From stakeholders:**
  First- and last-mile transport is a key priority for Salzburg, especially in rural areas. Insights from the SHOW project will guide future automated public transport options.

- **From passengers:**
  There is optimism about automated vehicles, with confidence in technology improvements. Passengers are interested in regular use but desire higher speeds and more flexibility for daily travel.

- **From safety drivers:**
  "Working with automated driving technology in real conditions is exciting, though it demands intense focus due to many procedures and full responsibility for vehicle and passenger safety. The role requires constant attentiveness, which can be mentally exhausting, but it's fulfilling to contribute to the future of transportation."

- **From other road users:**
  Reactions were mostly positive, though some were uncertain due to the shuttle's slow speed. While some drivers were considerate, others grew impatient and attempted risky overtakes, especially during peak hours.

Route

7 stops along a 2.8 km fixed track between Koppl Sperrbrücke and Koppl Am Weberbach.

Legacy

The Salzburg pilot aligned with the province's mobility and Science and Innovation Strategy 2025. Continued testing of automated vehicles was key to raising public awareness and confidence, demonstrating that automated shuttles are a reality. However, the pilot highlighted the technology's current limitations, as fully autonomous first-/last-mile services are not yet feasible. As technology matures, it could improve public transport coverage and reduce private car use, but integration into transport systems and fare models is essential. First-/last-mile transport, especially in rural areas, remains a priority, with lessons from the SHOW project guiding future options.

May 2023 until **June 2023**

711 passengers

The Digibus® 2.0 (eVAN) was involved in an accident on August 2, 2023, leading to the revocation of its test permit by the Austrian Federal Ministry of Climate Action. As a result, piloting on the Koppl track was suspended after two days and could not resume until the end of the project.

Fleet

- **1 autonomous shuttle** (HEAT) L4
- **1 VW e-Crafter** (automated, fully electric) L4

Local Ecosystem

austriatech Mobility in motion · kapsch challenging limits · salzburgresearch

External collaborators

Digitrans · Salzburg Verkehr verbindet

Carinthia
Austria

Automated shuttles for passenger and cargo transport in a complex traffic environment

The Carinthia pilot offers a first and last-mile solution to enhance existing public transport through automated shuttles, integrating Cooperative, Connected, and Automated Mobility (CCAM) to reduce individual car use. The project features an on-demand service that boosts operational efficiency while combining passenger and cargo transport. It focuses on optimizing the passenger experience in automated shuttles and enhancing the safety of vulnerable road users (VRUs) using V2X technology (C-ITS). Two key locations are included in the pilot, Pörtschach and Klagenfurt providing essential connectivity and accessibility within the region's transport network.

Challenge	Recommendation/Mitigation
Vegetation and parked vehicles next to the road caused issues with lidars.	Cooperation with the municipality regarding green maintenance and parking rules.
Cyclists and car drivers coming too close to the shuttle.	Sign on the shuttle: "Keep distance of 3 meters".
Crossing unregulated intersection.	Implementing "Operator-GO".
The low operating speed results in reduced acceptance among passengers.	Increase operating speed of automated shuttle.

Key feedback

- **From stakeholders:**
  Stakeholders are generally positive toward automated vehicles. They emphasize that teleoperation will be essential for reducing operating costs in the future.

- **From passengers:**
  Particularly tourists, young individuals, and elderly or handicapped people, expressed strong interest in the automated shuttle service. Additionally, residents of Pörtschach requested an extension of the existing route.

- **From safety drivers:**
  Safety drivers find their role demanding due to frequent software error messages that necessitate intervention. However, they appreciate the interaction with passengers, who are often very interested in the technology and eager to ask questions.

- **From other road users:**
  They have mixed feelings about the shuttle's slow speed, which is limited to 20 km/h by law; passing drivers do not appreciate this speed. Conversely, some residents welcome the reduction as a measure to calm traffic.

Route

The Pörtschach route is a 2.7 km connection with 8 bus stops linking the train station to the lake, hotels, and town centre, featuring no traffic lights and two left turns.

The Klagenfurt route is 4 km long with 18 bus stops, connecting the train station to the university and key destinations

Legacy

The Carinthia pilot leaves a valuable legacy, as the C-ITS infrastructure developed will be utilized by KMG, the public transport provider, to prioritize public bus operations effectively. With an increasing workforce shortage, transportation companies recognize the necessity of automated vehicles. Plans for expansion into other regions are underway, accompanied by ongoing development of functionalities. This initiative not only enhances business models but also facilitates the transfer of knowledge and expertise, paving the way for a more efficient and sustainable public transport system.

September 2021 to **September 2022** (and 3 months of pre-demo) for **Pörtschach**.
June 2024 to **September 2024** for **Klagenfurt**.

6,600 passengers (Pörtschach)
3,300 passengers (Klagenfurt)

Fleet

- **1 Navya Arma DL4 shuttle**
- **2 more Navya Arma DL4 shuttles 2024**

Local Ecosystem

AIT Austrian Institute of Technology – Tomorrow Today · austriatech – Mobility in motion · ioki – inspiring smart mobility · navya – self-driving made real · SURAAA · YUNEX TRAFFIC

External collaborators

IAM – Institut für Technologie und Alternative Mobilität

Tampere
Finland

Automated Feeder Transport Services in Finland

The Finnish Satellite Site project started in Tampere, piloting automated feeder services to the new tram line in Hervanta under harsh northern weather. As the project expanded, new pilot sites were added in Lahti, Kuopio, and Lempäälä, integrating automated mobility with public transport and offering unique services on public streets. Focused on advancing Cooperative, Connected, and Automated Mobility (CCAM), the Finnish pilots test automated transport in mixed traffic along light rail/tram corridors, tackling the challenges of Finland's diverse seasons. These real-world trials, across rain, snow, and sun, have provided valuable data and driven the development of resilient automated solutions.

Challenge	Recommendation/Mitigation
Requirement of onboard safety supervisor delays realization of cost benefits.	Activation of the Remote Control Center from which an operator can operate multiple vehicles, reducing the need of safety drivers in vehicles.
Harmonised legislation is needed to guide automated vehicle operations and services.	The Finnish Ministry of Transport has established an automated road legislation working group, including SHOW partners.
Technology is still under active development and poses multiple challenges.	Sharing key feedback to vehicle manufacturers on how to improve the vehicles.

Key feedback

- **From stakeholders:**
  The Mayor of Tampere and others welcomed the service as the future of mobility and key to public transport. The Local Accessibility Working Group is pleased to be involved, with the SHOW demonstration's real-world application and strong winter performance as key advantages.

- **From passengers:**
  "Good drive, will come again," "Very good," "The vehicle drives well, and it was interesting to be onboard," "I am excited and pleased".

- **From safety drivers:**
  They enjoyed the service and asked many questions, praising the vehicle's performance and finding the experience interesting. The use of the automated vehicle allows the driver to focus more on other operational tasks and customer service.

- **From other road users:**
  There have been no major complaints, though the slower speed of the vehicles occasionally causes congestion, which has affected some drivers. Overall, the experience has been neutral.

Route

- Three routes in Tampere, in the suburb of Hervanta. All feeding to the tram line.
- Pilot route in Lahti, feeder service connecting the city centre to elderly care house.
- Pilot route in Kuopio. Shuttle going through a campus and business area.
- Pilot route in Lempäälä, automated bus connecting a neighborhood to the train station.

Legacy

The SHOW project has been highly successful in Finland, starting in Tampere and expanding to other cities. Users have embraced automated shuttles and buses, prompting discussions with PTOs for integration into public transport. The pilots have significantly advanced Finland's automated mobility sector, leaving a lasting legacy. The EU-funded metaCCAZE project will build on SHOW's results, aiming to deploy automated services across Tampere and other pilot sites, integrating them as feeder services into the public transport system.

From **January 2022** to **January 2024**

18,301 passengers

Fleet

- **2 Toyota ProAce vans**
- **1 VTT's AuveTech-based research shuttle, Aune**
- **3 AuveTech ISEAUTO shuttles**
- **3 Easymile EZ10 gen3 shuttle**
- **1 OHMIO Lift**
- **1 Karsan e-ATAK**

Local Ecosystem

TAMPERE · REMOTED · sensible4 · SITOWISE · VTT

External collaborators

KUOPIO · Lahti · LEMPÄÄLÄ · NYSSE · VILKKU · VR

Brno
Czech Republic

Automated scheduled and on-demand mobility as a complement to public transport

The Brno pilot integrates automated mobility with public transport, expanding services in mixed traffic and adverse weather. It uses two shuttles and one robotaxi, testing vehicle configurations for user acceptance. Rides are requested via QR codes, with vehicles operating on a fixed timetable. Each vehicle has a safety driver, and a remote operator ensures safety and compliance. Operating in a semi-open area, the pilot aims to integrate automated vehicles into the broader transport network through remote supervision.

Challenge	Recommendation/Mitigation
The autonomous vehicle struggled to move smoothly due to the disorderly movement of people.	At least partial corridor reservation and occasional manual remote driving.
Change in environment after route mapping.	Precise route planning, communication with the road manager, occasional remote control.
Technology is still under active development and poses multiple challenges.	Sharing key feedback to vehicle manufacturers on how to improve the vehicles.

Key feedback

- **From stakeholders:**
  The Czech transport minister liked the minibus, although expected it to travel higher speeds akin to motorway conditions. Automated transport isn't yet a priority for Brno, but the city sees its future potential. Stakeholders noted SHOW's main advantage as its real-world operation.

- **From passengers:**
  Passenger feedback was positive, with comments like "Good drive, will come again" and "Very good." Many were impressed, noting it was "interesting to be onboard" and expressed excitement and pleasure.

- **From safety drivers:**
  Safety drivers praised the service and vehicle performance, noting that automation allows them to focus more on operations and customer service.

- **From other road users:**
  No major complaints and were mostly curious, often taking photos, riding, and responding positively.

Route

The 3 km route connects passengers to various transport modes and adjusts for safety during special events.

Legacy

Currently, documents are being prepared for the representatives of the city of Brno for the downstream operation. The operation of the autonomous minibus should be maintained in the same mode, supplemented by possible demonstration rides at special events (fairs, conferences, etc.) Furthermore, the autonomous transport can be used for needs depending on the season, e.g. providing transport near swimming pools or zoos in summer, transport near cemeteries in autumn and transport near Christmas fairs in winter.

Operations from **September 2022** to **June 2024** (+ 2 months of pre-demo)

41,308 passengers

Fleet

- **1 Esagono shuttle**
  L4, electric
- **1 Hyundai i40**
  L4 diesel
- **Ford Tourneo Custim,**
  L4, diesel

Local Ecosystem

ARTIN · BRNO · CDV Centrum dopravního výzkumu · roboauto

External collaborators

DPMB Dopravní podnik města Brna a.s. · Czech Republic Ministry of Transport · BVV Veletrhy Brno

Trikala
Greece

On-demand Automated Mobility as a complement of Public Transport in suburban areas and Delivery services in pedestrian areas

The overall goal is to provide on-demand automated mobility as a complement to public transport in underserved suburban areas and delivery services within pedestrian zones in Trikala. This approach aims to reduce the reliance on internal combustion engine (ICE) vehicles, promoting a healthier, safer, more affordable, and sustainable multimodal mobility system. The site focuses on integrating CCAM to enhance access to the city centre and minimize ICE vehicle usage. It includes demonstrating the integration of autonomous vehicles (AVs) into public transportation and connecting them to key locations like the railway station and university. Additionally, a fleet of delivery robots address local delivery needs in pedestrian areas.

Challenge	Recommendation/Mitigation
Drivers parking on both sides of the road created narrow, high-speed traffic conditions, complicating automated operation.	Tested a new feature where one van acted as a leader to assist in overtaking, supported by lower-than-expected demand, preventing service interruption.
The PT operator was hesitant to integrate the service, affecting logistics and supply chain integration.	Several meetings with local stakeholders in Trikala raised awareness, preparing for future integration through projects like IN2CCAM.
Current legislation restricted public access, leading to lower-than-expected demand and underuse of the AV fleet.	Vehicles operated daily at varied hours, and different user groups were recruited to test functionalities.

Key feedback

- **From stakeholders:**
  They welcomed the service. Municipal authorities emphasized the need for CCAM last-mile services in suburbs. The youth council viewed CCAM as a safer travel option, while GISEMI innovation hub and CitiesNet saw potential for 24-hour routes. Coffee shop owners appreciated the service and the Yape booking system.

- **From passengers:**
  Most passengers were aware of and positive about the AV service, showing willingness to pay the same as for PT. The safety driver on board improved their sense of security, and surveillance systems eliminated safety concerns.

- **From the public:**
  Trikala citizens are willing to use and integrate to their daily activities innovative services that promote sustainability via the established technological culture through numerous past innovative projects.

Route

The 9.6 km van route connects the city centre to Trikala University with on-demand stops and smart traffic lights. The pilot also includes autonomous delivery robots in the pedestrian centre, offering free parcel delivery with remote monitoring.

Legacy

The Trikala pilot has demonstrated the transformative potential of AVs for urban transport and logistics, integrating them into on-demand services that complement public transport in suburban and pedestrian areas. Key achievements include testing AV applications, advancing V2X integration, securing research funding, and developing a novel noise pollution monitoring system. Findings from Trikala can inform similar projects in other cities, supporting the deployment of larger AV fleets and exploring higher-speed AV applications without disrupting the road network.

The minivans operated from **January** to **September 2024**
The retrofitted passenger operated from **August** to **September 2024**
The robot taxis operated from **December 2022** to **February 2023**

8,598 passengers
2,215 delivery trips

Fleet

- **5 delivery robots (droids) YAPES** for small freight distribution, L4, electric
- **2 L4 automated 6-7 seats mini vans** (Peugeot e-Traveller retrofitted by SuburVAN) for passenger transportation
- **1 Robo-taxi passenger vehicle** (Ford Mustang Mach-E), retrofitted by VIF & CERTH, L4, electric
- **Second vehicle following the lead retrofitted vehicle and** (belongs to CERTH existing fleet)

Local Ecosystem

e-trikala · Università di Genova

External collaborators

SuburVAN · vodafone · yape

Global Collaboration

SHOW's impact beyond borders

International cooperation has been key to advancing automated urban mobility, allowing SHOW to exchange ideas and solutions globally. SHOW's collaborations with partners in Australia, Japan, the United States, China and South Korea have enriched its solutions through mutual learning and comparative analysis. Key partnerships, such as with BJTU in China, the University of San Francisco or ITS Japan have fostered dialogue and explored innovative business models in CCAM. These global efforts highlight the value of cross-border cooperation in creating smarter urban mobility solutions.

Connecting global insights with local stakeholder involvement

SHOW's global collaborations have enriched mobility solutions, while the project focus on local communities ensures seamless integration of automated mobility in transport systems and ecosystems. By engaging stakeholders and citizens at the grassroots level, the project connects global insights with local actions to foster acceptance and create a positive impact at its pilot sites.

"SHOW has been at the forefront of disseminating knowledge and transferring expertise in the realm of automated mobility. Over the past four years, we have actively participated in prestigious events like the ITS Congresses, TRB, TRA, and EUCAD.

Our commitment to sharing our insights and fostering collaboration has extended beyond the global stage, as we've engaged with local stakeholders at our pilot sites through innovative initiatives such as hackathons and training programs. By bridging the gap between research and real-world applications, SHOW has played a vital role in shaping the future of urban transportation."

Nikolaos Tsampieris
SHOW Dissemination Leader
ERTICO

Engaging communities, shaping the future

SHOW partners have actively sought input and feedback from local stakeholders and end-users. Through a variety of engagement activities, we've been able to gather valuable insights and ensure that our automated mobility solutions align with community needs and preferences.

From showcasing our vehicles in action to organizing dedicated workshops, we've created opportunities for open dialogue and collaboration, fostering a deeper understanding of the challenges and opportunities presented by automated mobility.

Here are some examples:

SHOW Pan-European Workshops

The annual SHOW Pan-European workshops brought together stakeholders from across the automated mobility sector for collaboration and knowledge exchange.

With keynote speakers and panel discussions, the workshops addressed key topics like vehicle integration, regulatory frameworks, and urban mobility solutions.

Policymakers, industry leaders, and researchers joined to foster innovation and strategies for sustainable automated mobility across Europe.

MAMCA workshops

The Multi-Actor Multi-Criteria Analysis (MAMCA) methodology in SHOW's pilot sites—Frankfurt, Linkoping, Gothenburg, Tampere, Portschach, Brno, and Madrid—enabled stakeholders to assess autonomous mobility scenarios, focusing on road safety, traffic efficiency, and environmental impact. Results revealed diverse perspectives but highlighted an overall positive view of automation, with road safety as the top priority.

SHOW Hackathons

SHOW organized a series of Ideathons and Hackathons to spur innovation in automated mobility. Three Ideathons, including two on-site in Carinthia and San Francisco, allowed participants to explore solutions for user acceptance and accessible mobility. A three-day Hackathon in Thessaloniki in 2022 challenged teams to address safety, demand optimization, and accessibility. Additionally, in 2024, SHOW collaborated with Open Summer of Code (OSoC) in Brussels, where students developed a visionary "mobility hub of the future," integrating micromobility and automated vehicles for sustainable, user-centered urban transport solutions.

AustriaTech supertester

This three-day event allowed participants to experience automated driving firsthand in various settings, from urban environments to suburban areas. By collecting feedback on factors like safety, comfort, and usability, these events helped us refine our automated mobility solutions and ensure they meet the needs of diverse communities.

Transformative results

SHOW highlighted milestones

The SHOW project has reached significant milestones. These outcomes illustrate the project's progress in advancing and assessing automated mobility, fostering innovation across pilot sites and beyond and paving the way for a sustainable future that will be CCAM aware.

Logistics:

The SHOW project is revolutionizing road transport together with including also urban logistics through the innovative Automated Logistics as a Service (ALaaS) framework. By deploying shared, connected, and electrified fleets of autonomous vehicles for logistics operations in real-life pilots across Carinthia, Karlsruhe, Trikala, and Crest, and testing scenarios at our simulation site in Rome, we have redefined logistics operations in urban environments. Our comprehensive impact assessment methodology rigorously evaluated the sustainability, maturity, innovation, transferability, and scalability of such ALaaS solutions in real-life, setting new standards for efficient and effective urban logistics.

Simulations:

Over the course of the SHOW project, the role of simulations evolved significantly. Initially, they focused on the basic functionality of AVs, passenger capacity estimates, and timetabling. Later, simulations shifted to assessing the impact of AVs on surrounding traffic and scaling up the use of multiple AVs across pilot sites. Impact analyses revealed that using AVs on multi-lane roads was often more beneficial than expected by many city planners. Simulations also highlighted issues like setting AV speeds below the legal limit and the need to adapt road infrastructure, including separate lanes and spaces for idle AVs, to achieve optimal outcomes.

A web-based Simulation Suite was developed to consolidate data from different simulation environments used in SHOW. It allows users—researchers, practitioners, and city planners—to conduct traffic and environmental impact assessments, simulate CCAM, and analyse traffic flow across pilot sites, offering accessible insights for informed decision-making.

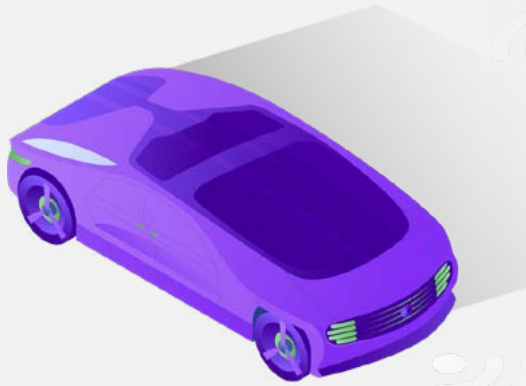
AI & Big Data:

Several AI-based services have been developed to support CCAM operations and planning decisions. These services enhance operations by providing critical information to users, improving their travel experience, and assisting operators in coordinating services.

AI-based tools include estimated time of arrival prediction for both scheduled and demand-responsive transportation, passenger and cargo demand prediction, and accident detection. CCAM planning is also improved through AI-based mobility pattern identification, enabling service planners to design tailored services using Big Data collected by operators. In the SHOW project, advanced machine learning methods such as Gradient Boosting, Graph Neural Networks, Random Forest, Principal Components Analysis, Density-Based Spatial Clustering, and K-means clustering were used. These services were tested across various pilot sites, showcasing the potential of Big Data and AI in future mobility services.

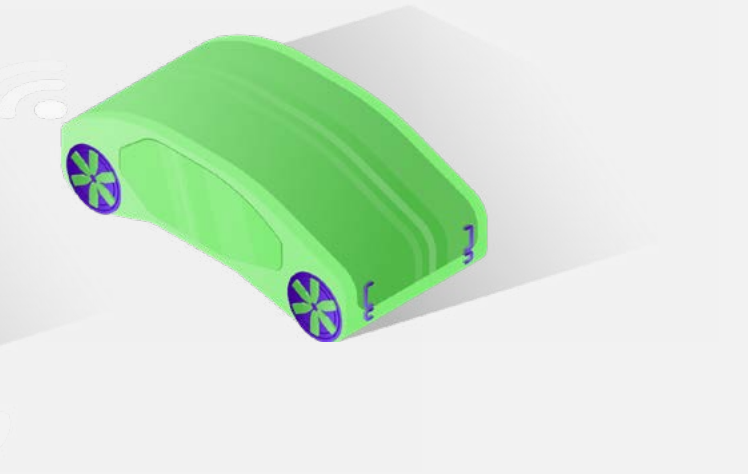
Additionally, two software applications—the SHOW Dashboard and the SHOW Data Management Platform (DMP)—were developed to manage and visualize data from the SHOW fleets' automated vehicles operation. The DMP collects all relevant data, supporting AI-based CCAM servicesas well as the simulation and impact assessment analyses of the project.

The Dashboard of the project is public (https://show-project.eu/show-dashboard/) and is populating data from the pilot sites continuously, aiming at the end to visualize all verified Key Performance Indicators (KPIs) of each pilot site.



User acceptance:

The assessment of the acceptance, perceptions, needs and expectations of the ecosystem in terms of automated services was carried out throughout the project on the various pilot sites. The various studies carried out (surveys, user reviews on social networks, interviews) highlight a good *a priori* perception of automated services. These studies also show shared expectations in terms of punctuality, security, and reliability of automated mobility services, even if some specificities appear according to the country where certain criteria are assessed as more important than others depending on the population.



The acceptance of automated mobility solutions among users who experienced the deployed services appears to be promising. Averaged across all the pilot activities, crucial factors such as perceived usefulness, punctuality, comfort, and safety were rated positively, with scores above 7 on a 9-point Likert scale. Similarly, participants reported promising feedback regarding their intention to use the service again and recommend it to a friend or colleague. However, there is still room for improvement, particularly in areas like avoiding hard braking and increasing vehicle travel speed. While these issues were raised by many passengers, their frequency varies depending on the specific AV service deployment across differing traffic contexts of SHOW pilot cities.

Traffic efficiency, energy and environmental impacts:

Data from pilot and simulation sites were used to assess the impact of automated vehicles on traffic flow, energy consumption, and environmental factors. Pilot sites provided data on AV speed, acceleration, and harsh braking, while simulation sites contributed additional data on emissions and average network-wide vehicle speeds. Specifically, for energy use estimation of AVs, a model was developed that used individual vehicle speed profiles as inputs. This impact assessment reveals that individual AVs have low average speeds (2-8 km/h), with higher speeds in suburban areas, linked to cautious driving. Increased average speeds correlated with more acceleration variance and harsh braking.

Energy use per km varied between two pilot sites, likely due to higher speeds and acceleration variance at one site. The simulation sites showed no significant difference of the energy use per km when comparing scenarios with, and without AVs. Finally, the environmental impact was determined using emissions calculated at the simulation sites. A considerable reduction in emissions was found at the city-level simulation due to a decreased share of private cars with the introduction of AVs. However, street-level simulations showed marginal changes in emissions since the simulated AVs did not substantially improve traffic flow performance.

Societal impacts:

The societal impact has been addressed by integrating the findings from existing literature, combined with the results from a modified Delphi study run by the pilot sites and other experts' interviews. The main societal impacts addressed are accessibility to public transport, equity, housing prices, perceived safety, and impact on jobs.

These impacts have been addressed by the different scenarios tested in SHOW:

1. Automated shuttle(s) for first/last mile,

2. Door-to-door delivery of persons and goods,

3. Mass transit AV services,

4. Shared Robotaxis.

Our findings suggest that while CCAV holds promise for enhancing accessibility to public transport, challenges persist, particularly regarding affordability and inclusivity, notably with regard to the deployment of shared robotaxi services.

The perceived safety by passengers is also expected to increase as the penetration of the services increases. Moreover, the transition to automated services presents both opportunities and challenges for employment, emphasising the importance of proactive measures in workforce planning. This will come along with a clear trend towards re-skilling across all services, which will increase as adoption increases. However, as penetration rates increase, the overall employment landscape is expected to stabilise, reflecting the current scenario of the number of workers, but performing different tasks.

Business models & exploitation

The SHOW project focused on developing a sustainable exploitation strategy for its results. Key business models were created with test sites to ensure continued operation and scalability post-project. A total of 91 key exploitable results (KERs) were identified, paving the way for commercialization and further development. The project also outlined a roadmap for continued deployment, with 33 vehicles remaining in service after the project ends.

19 Memorandums of Understanding (MoUs) have been signed to extend use cases and build new business models. Eight business models were implemented at test sites, relying on strategic partnerships across multiple stakeholders. Additionally, 53% of the use cases will continue with further funding, ensuring long-term impact and the integration of automated mobility into real-world applications.

Recommendations to cities, authorities & operators

The deployment of shared CCAM services in Europe provides key lessons for cities, public transport authorities (PTAs), and operators (PTOs). Integrating CCAM into Sustainable Urban Mobility Plans (SUMPs) ensures alignment with existing systems, while local partnerships and stakeholder collaboration help address technical challenges like digital infrastructure and data sharing. Prioritizing accessibility encourages expanding services to underserved areas and ensuring inclusivity. Cities should adopt a learning-by-doing approach, starting with small-scale pilots to build expertise. Scaling up services requires adapting physical and digital infrastructure, such as pick-up/drop-off points for automated vehicle fleets. Public engagement and continuous feedback are vital for building trust and ensuring safety. By working with local stakeholders, cities can create efficient, user-friendly mobility solutions.

Further details on these strategies and practical recommendations are collected on the **SHOW booklet on CCAM services**.[1]

[1] SHOW (2023). D17.4: CCAV integration in SUMP. Deliverable of the Horizon-2020 SHOW project, Grant Agreement No. 875530

Replication

The follower cities involved in the SHOW project included Thessaloniki, Geneva, Brussels, Helmond, Kadiköy, Sarajevo, Venice, Barcelona, Braga, Varna, Gdansk, Groningen, Paris, and Milan, selected for their readiness to adopt CCAM and integrate automated vehicle systems into Public Transport, Demand Responsive Transport (DRT), and logistics services.

SHOW supported these cities by developing tailored roadmaps suited to their infrastructure and mobility needs. Through Memorandums of Understanding (MoUs), site visits, and workshops, cities gained insights from SHOW pilot sites. Thessaloniki, Geneva, and Brussels contributed directly by sharing data and running operations in the course of the project in selected Use Cases, while Helmond, Sarajevo, Venice, and Kadiköy advanced replication roadmaps for automated public transport, after exchanging with the project.

The project fostered collaboration, enabling cities to enhance their urban mobility with sustainable, automated transport solutions.[2]

[2] SHOW (2023). D12.8: Follower sites multiplication plans and actions. Deliverable of the Horizon-2020 SHOW project, Grant Agreement No. 875530

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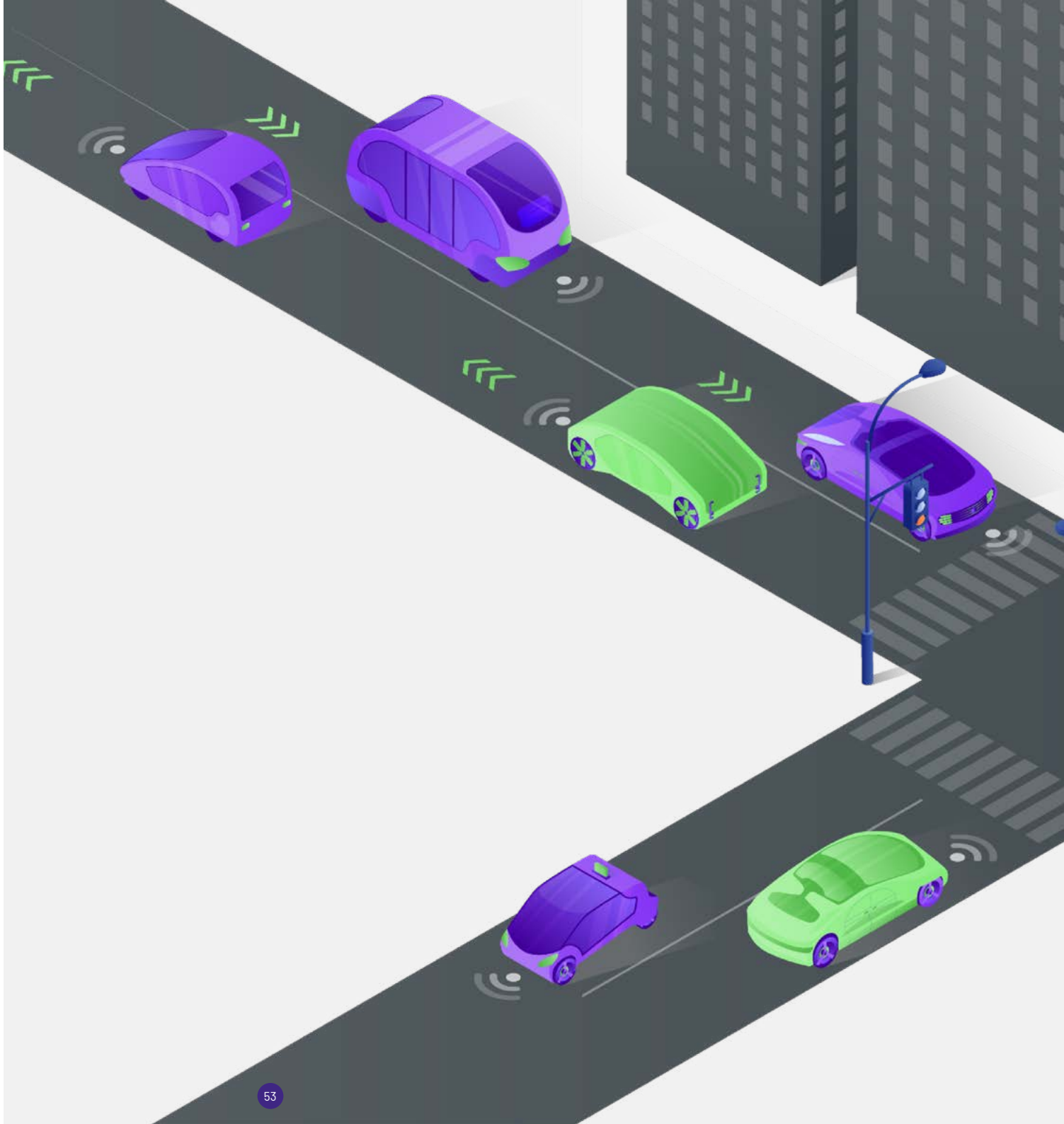

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