AUTONOMOUS MOBILITY

FOR MORE PUBLIC TRANSPORT

KEOLIS

188 000+
km travelled.

40 000+
hours of opération.

57+
deployments woldwide.

227 000+
passengers carried.

From the first launch by Keolis in 2016 up to August 2024.

CONTENTS

AUTOMATED MOBILITY FOR LESS DENSELY POPULATED AREAS

Operational service pilots in pioneering areas, for a visibly enhanced public transport offer.

Autonomous mobility - now becoming automated mobility - is gradually moving from experimentations to pilot services. Keolis is developing it to address a concrete and essential use case in Europe : providing more multimodal alternatives to single occupancy car use in less densely populated areas (suburbs, business parks, cross-city services, etc.).

The partnership forged in 2021 between the start-up Urbanloop, the Saint-Quentin-en-Yvelines city association and Keolis has taken shape in the summer of 2024 with the opening to the public of the Urbanloop SQY rail capsule experiment.
The system welcomed more than 6,500 passengers during the two weeks of the Paris 2024 Olympic Games.

At the same time, automated road vehicles are beginning to circulate autonomously without an operator on board, moving from the various experiments conducted by Keolis since 2016 to 'No Op' services that will soon leave private sites to drive on public roads.

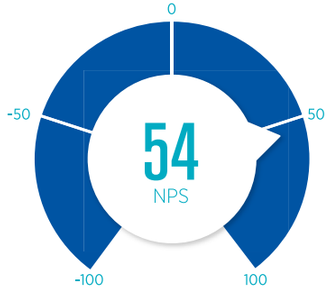
URBANLOOP SAINT-QUENTIN-EN-YVELINES – A PILOT SERVICE OPEN TO THE PUBLIC TO TEST THE SOLUTION

Saint-Quentin-en-Yvelines (SQY) city association took the initiative to gather Urbanloop and Keolis in a consortium that has obtained the financial support of French State public agency ADEME (future investments programme "PIA4") to install and operate an experimental 2 km-long line, from July 2024 to November 2025. The SQY fan zone site has been chosen to test this new mode of transport.

Under the impetus of Urbanloop and with the support of Keolis experts, the project has successfully completed all the technical and administrative stages required of any guided transport system. The project obtained the official State authorisation to open to the public on 24 July 2024.

Keolis played a decisive role thanks both to its expertise as a heavy modes operator and its leading position in automatic metro.

During the Paris 2024 Olympic Games, Urbanloop SQY has run over 6,800 km and carried more than 6,500 passengers. After the first month of operation, their feedback has been enthusiastic, as demonstrated by the very good NPS score collected. Regular surveys will enable the partners to consider the possibility of maintaining permanently the service tested in SQY.



NPS: Net Promoter Score, an indicator of customer loyalty and satisfaction

THE URBANLOOP SOLUTION, INDIVIDUAL SERVICE BY RAIL

In addition to its first public opening in 2024 as part of the Saint-Quentin-en-Yvelines experiment in Saint-Quentin-en-Yvelines until the end of 2025, Urbanloop has already received a firm order from Greater Nancy for the deployment of an operational line of 3.5 km and 5 stops that will serve the future Cité Judiciaire (city court) in Nancy, a project supported by Keolis Grand Nancy.

- **Individual capsules** for one or two people.
- **Urbanloop:** a French company created in 2019, producing in France
- Battery-free capsules **consuming very little energy**
- Traffic speeds of **up to 50 km/h**
- An **autonomous rail-based** solution based on GoA4 **automatic metro** standards (Lille, Dubai, etc.)
- Direct arrival at destination **without intermediate stops** thanks to stations branching off the main line
- A solution with a very **small environmental footprint**, a reduced ground surface area and a highly optimised total cost of ownership

THE CHALLENGES AHEAD FOR AUTONOMOUS ROAD MOBILITY

DRIVERLESS AUTONOMOUS VEHICLES

Since Keolis trialed the world's first-ever automated shuttle service in Lyon's Confluence eco-district in September 2016, we have continued to pioneer developments in this sector.
Under the impetus of former government minister Marie-Anne Idrac, France published its National Strategy for the Development of Autonomous Vehicles in 2018, strengthening the legal framework, setting priorities and establishing specific applications.

NEXT STEP: LEVEL 4 AUTONOMY

The large-scale deployment of fully autonomous vehicles (AVs) without an onboard driver is the current challenge. Changes in the regulatory landscape are paving the way for progress in this area. In France, the regulatory framework on sustainable mobility will allow fully AVs to operate in certain use-cases. And at European level, an amendment to the 1968 Vienna Convention recognises that, in certain cases, an 'automated driving system' may replace an on-board human operator.

The move to full autonomy is a step towards a more sustainable and strong business model, which will also influence volume production of vehicles and onboard equipment which may also drive costs down.

KEOLIS IS FOCUSING DEVELOPMENTS ON:

- **safety and cybersecurity**
- **progressive steps**
- **public acceptance**

KEOLIS' AUTONOMOUS MOBILITY TEST SITE (SEMA)

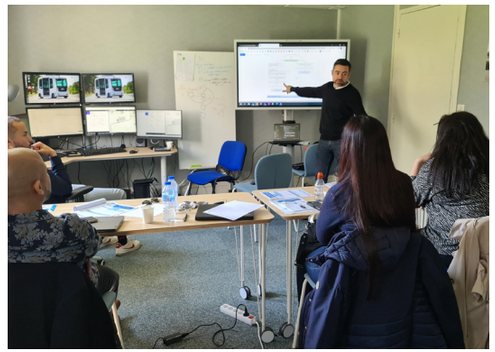
keolis
SITE D'ESSAI DES MOBILITÉS AUTONOMES

In 2020 Keolis began trialing vehicles without an onboard operator at its Autonomous Vehicle Test Site (SEMA) in Châteauroux. This privately owned 80-hectare site allows us to freely operate vehicles and thus build on our capabilities under real-life conditions and in a safe environment. The site has proven to welcome athletes and the public all year around.

Discover our test site here.

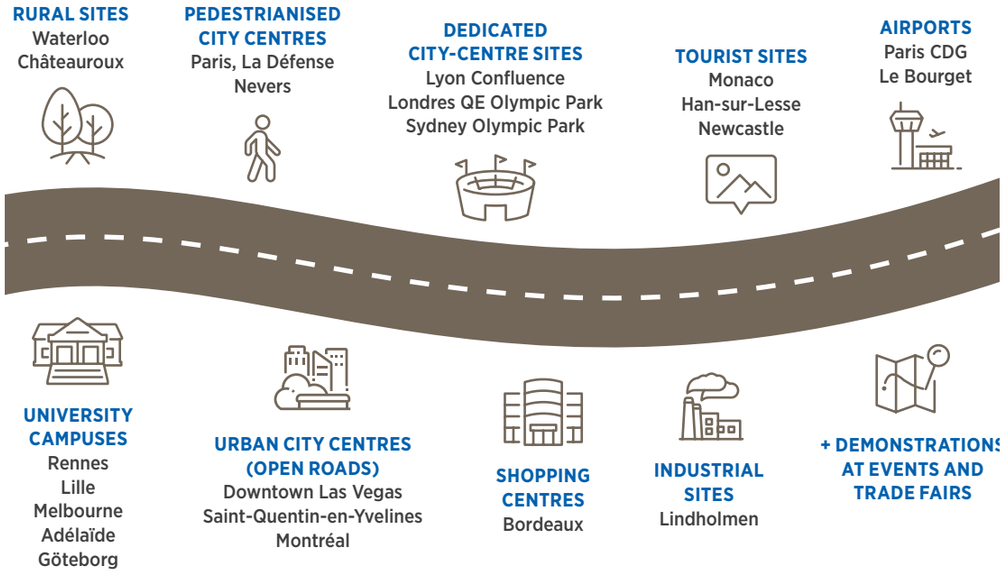
The SEMA test facility is the only one of its kind in the world. It is housed on the site of the National Shooting Sport center, where the French Sport Shooting Federation trains its Olympic and Paralympic teams. Our driverless vehicles are used to transport teams between the different shooting ranges.

Since its launch, the facility has pre-mapped more than 5 km of roads and the site has been developed to test different kinds of applications, such as crossing intersections with smart connected traffic lights.



The test site also provides ideal facilities for training the people who will operate and supervise Keolis autonomous vehicles, as well as future trainers. In a few years, the SEMA site has proved to be an invaluable resource for Keolis and vehicle manufacturers.

A VARIETY OF USE CASES



SAFETY

Keolis seeks to constantly enhance the technological capabilities of its services, while providing the highest levels of safety.
As a result, the so-called Operational Design Domain (ODD) is continuously improving.

OPEN ROADS	Dense traffic	left turn	On-street parking	Roundabout	Narrow street
TECHNOLOGY AND INTEROPERABILITY	V2X	5G	FMS	navya, Gama, easy MILE, ADASTEC, KARSAN, auvetech	
WEATHER CONDITIONS	Extreme cold	Snow	Light fog	Rain	Extreme Heat

HOLISTIC APPROACH TO SAFETY, SPECIFIC TO EACH SITE

With more than seven years of experience gained through operating autonomous vehicles around the world, Keolis has significant expertise across the entire project lifecycle – and especially safety.

THE 7 KEY STEPS IN OUR SAFETY STRATEGY

1. **Assess the technologies deployed by OEMs, such as Operational Design Domain (ODD),** object and event detection and response (OEDR), the functional capabilities of the vehicles (e.g. automatic obstacle avoidance, remote fleet management, etc.), along with their safety strategy, so as to define clear specifications tailored closely to each route, prior to deployment.
2. **Anticipate residual risks** and likely events, and adapt the system accordingly.
3. **Support the deployment of vehicles** to ensure compliance with specs; establish acceptance test criteria in accordance with the site; perform dry runs to ensure complete safety integrity.
4. **Adapt safety procedures** in accordance with specific on-site configurations.
5. **Train local teams** in line with the specific features of each site and vehicle.
6. **Communicate with other users** (pedestrians, cyclists, motorists).
7. **Ensure centralised supervision** much like a control tower – liaising with operators, OEMs and Keolis experts.

NEXT STEP: SEAMLESS INTEGRATION WITH EXISTING TRANSPORT NETWORKS

Autonomous mobility will not become an effective reality without close collaboration between private operators and public-sector authorities. As part of this process, Keolis will provide further support to regional authorities and stakeholders in their transformation.

AN INTEGRATED EXTENSION OF EXISTING NETWORKS

Autonomous mobility is an effective way of expanding an existing public transport network, especially in currently underserved areas or for the 'first and last mile' of the journey.
Autonomous vehicles are ideally suited for airports, university campuses, hospitals and tourist sites spread out over large areas.

Keolis has already integrated several such services into local networks, adapting passenger information in stations and onboard as well as on mobile apps and websites accordingly.
Driverless autonomous vehicles are also able to provide demand-responsive transport services.

Service 490 Saint-Quentin-en-Yvelines	île de France mobilités	490
Service N1 Lyon	TCL SYTRAL	Bus N1 - Décines Grand Large - Parc Olympique Lyonnais
Service 100 Rennes	Rennes Ville et Métropole	100 BEAULIEU Administration
Service 56 Lindhomen, Göteborg (Suède)	västtrafik	56 LINDHOLMEN SJÄLVKÖRANDE BUSS HUGHÅGSGATAN E HUGO HAMMARS KAJ
Service 68 Chalmers, Göteborg (Suède)	västtrafik	68 CHALMERS SJÄLVKÖRANDE BUSS CHALMERSPLATSEN KEMIGÅRDEN

FIRST SCHEDULED BUS SERVICE USING AUTONOMOUS SHUTTLES

In 2020, Keolis was chosen to operate France's scheduled first bus service using autonomous shuttles launched by Île-de-France Mobilités (IDFM), the public transport authority for the Paris Île-de-France region.
A significant contract win, since the PTA required that the chosen operator commit to delivering the same quality of service, punctuality and reporting levels as other regular bus services in the region. Between March 2021 and June 2022, three autonomous shuttles have run between a business park in Montigny-le-Bretonneux and Saint-Quentin-en-Yvelines/Montigny- le-Bretonneux train station (connecting with suburban trains). The autonomous vehicles have operated alongside regular traffic, over a 1.6 km route.
The service, free of charge for all passengers, was fully integrated to the network passenger information system, and users could check the shuttle timetable via the IDFM mobile app, alongside the regular bus services.

"IDFM has set key success factors for the service, which is a first in France. The evaluation of the quality of service is based on frequency, regularity, availibility and speed, similar to the quality delivered for a bus line. Moreover, the integration of the service in the network to complement other modes and real time information are key criteria for the service success."

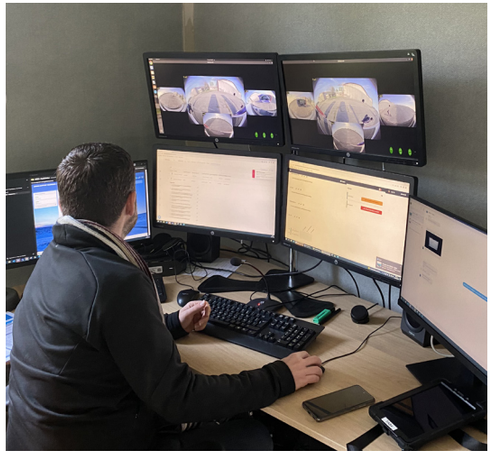
Estelle Chevalier,
Île-de-France Mobilités

LOCAL SUPERVISION AND TECHNICAL ASSISTANCE, TWO KEY AREAS OF EXPERTISE FOR FULL AUTONOMY

No matter how autonomous they may be, vehicles still depend greatly on human input!

As a transport operator, Keolis not only ensures the operational safety of the AVs it deploys worldwide, but also performs the vital role of monitoring fleets.

With the first fully autonomous mobility fleets (with no onboard operators) about to hit the roads, fleet monitoring is poised to become even more crucial, since supervisors can be called on to perform certain tasks with two key features : technical missions related to service supervision and fleet monitoring, as well as remote assistance for passengers.



Keolis fleet monitoring centre in Châteauroux.

AUTONOMOUS MOBILITY CONTROL TOWER

To this day, fleet monitoring has mainly been about providing support for onboard operators.

To adapt to full autonomy new challenges, Keolis chose to train local teams on fleet management, supported by remote cross-functional technical assistance.

Fleet management
Dedicated fleet management software (FMS) tools for scheduling vehicles, providing on-demand transport services, etc.

Supervise tactical maneuvers when technologically possible, as example: authorising a vehicle to bypass an obstacle or restart.

Managing interaction with passengers, for example if the vehicle is required to stop, and with support staff, if required to intervene on the vehicle.

Flawless understanding of the site so they can efficiently assess any issues and respond swiftly in case of service disruption.

Full cross-functional technical assistance (vehicles, connected infrastructure, technical tools and software...)

CREATING NEW JOB OPPORTUNITIES

As technological advances drive vehicle automation, new forms of autonomous mobility are emerging, offering ever improving levels of performance and safety. Keolis is gearing up for the rollout of fully autonomous services by preparing a new generation of operators and supervisors.
Onboard operators will progressively become remote operators, meaning that their day-to-day tasks are set to change. All Keolis automated vehicle operators are trained in the required technical skills and operational procedures, with safety being a priority. They are also trained to intervene manually and anticipate high-risk events.
In the years ahead, training will be adapted to reflect the changing role of operators.

Francis, operator in Saint-Quentin-en-Yvelines

MORE THAN 165 KEOLIS OPERATORS TRAINED IN REMOTE SUPERVISION

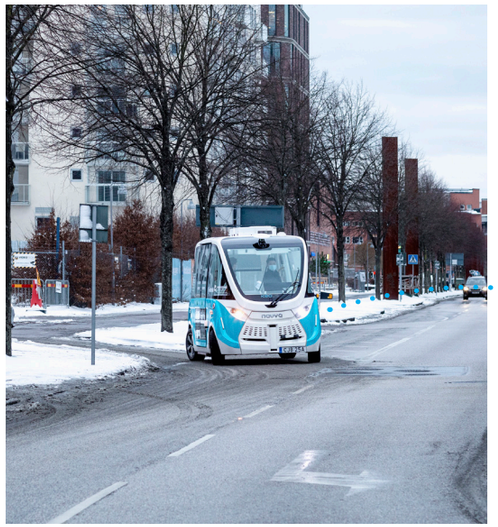
"I had the privilege of being Keolis' first-ever autonomous shuttle operator in 2016. So I've seen first-hand how both the technology and services have changed. I've also been given the opportunity to change, too, as I'm now a trainer."

Junior,
operator trainer in Lyon

"I feel like I'm taking part in the creation of a brand-new service, one that will grow to meet needs not covered by other modes, as it is the case here in the rural areas around Châteauroux."

Nordine,
Supervisor, local Automated Vehicle specialist operator and trainer in Châteauroux

TAILORING SERVICES TO THE NEEDS OF COMMUNITIES



INNOVATIVE, INTEGRATED MOBILITY FOR SMART CITIES

In Gothenburg, Sweden, Keolis has operated (from January to June 2021) autonomous electric shuttles that were fully integrated into the city's public transport network. The self-driving shuttles served business and residential areas, the university and car parks along a fixed 1.8 km route.

TECHNICAL HIGHLIGHTS

Can operate in extreme weather: cold, frost, snow, high winds.

PROVIDING THE ONLY PUBLIC TRANSPORT SERVICE IN RENMARK, AUSTRALIA

Operated in 2021 as a 12-month trial in partnership with the City Council and State Government, this autonomous electric shuttle was Renmark's only shared mode of transport.
It served several key locations including the main street shopping precinct, tourist centre and civic areas of the township along a 2.4 km loop.

TECHNICAL HIGHLIGHTS

Able to run in complex environments (cross a 4-lane highway) and operate in extreme heat (40°C and above).

PUBLIC ACCEPTANCE, A KEY CRITERION FOR DEVELOPING NEW MOBILITY SOLUTIONS

Keolis fosters relationships of trust with public partners based on listening and dialogue. We believe this is the best way to understand the needs and concerns of each local community and, in turn, implement the right transport solutions, such as autonomous mobility.

Several passenger surveys have been conducted to gauge how people perceive autonomous vehicles: do they trust them and would they consider using them in the future?

"In my opinion, autonomous shuttles can meet real needs in areas that are underserved by public transport."

Julie, passenger

"It's an innovative service."

Hélène, passenger

"The vehicles look futuristic. We're entering a new dimension!"

Thomas, passenger

PUBLIC SERVICE

Autonomous mobility will be provided first and foremost as a public service, in other words as public transport, so that it can remain affordable.

A FAIR TRANSPORT OFFERING

Autonomous mobility can improve accessibility and offer more inclusive transport solutions.

SUSTAINABILITY

All-electric autonomous vehicles support authorities in their shift to greener energies.

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