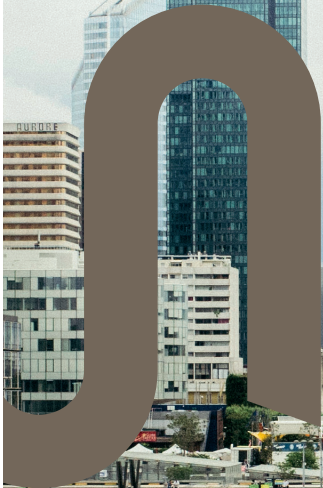


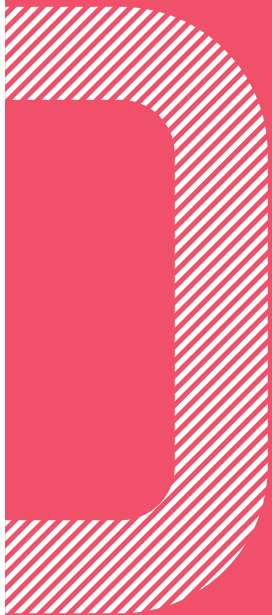


UNLIMITED MOBILITY

→ AUTONOMOUS SHUTTLES



keolis



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The urban challenges ahead

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A growing success story

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Keolis, driving transformation

LYON

1st

city in the world to operate a driverless shuttle bus for public transport, launched in September 2016.

18,300

passengers in 1 year.

LAS VEGAS

1st

autonomous shuttle bus on a public road in the USA, launched in January 2017.

3,250

passengers over the first 11 days of operation.

LONDON

19-day

trial at Olympic Park.

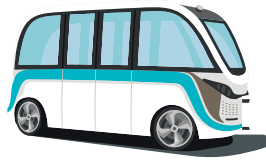
PARIS LA DÉFENSE

3

separate routes.

22,000

passengers in 2 months.



Autonomous vehicles constitute a technological revolution, taking urban mobility to a new level.

Used to complement traditional transport modes, autonomous vehicles offer a mobility solution that is accessible, environmentally friendly, flexible and cost-efficient.

Keolis is pioneering these developments, with the successful rollout of driverless services in partnership with Navya, and sees autonomous mobility as a seamlessly integrated component of transport networks.

THE URBAN CHALLENGES AHEAD

A NEW DEVELOPMENT MODEL

The exponential growth of cities worldwide calls for a rethink of urban development and everyday transport.

Autonomous mobility solutions can make a credible and sustainable contribution to this new model for cities.

→ **2.4 billion**
private cars worldwide by 2050 – up from 1 billion today⁽¹⁾.

→ **x2**
Urban transport demand will double by 2050⁽¹⁾.

→ **67%**
of the world's population will live in urban areas by 2050 – compared with 54% today⁽²⁾.

→ **41 megacities**
with more than 10 million inhabitants by 2030⁽²⁾.

(1) Source: ITF Transport Outlook 2017.

(2) Source: United Nations Department of Economic and Social Affairs – 2014.

MEETING THE CHALLENGES OF THE FUTURE

With rapid urban growth and increasing demand for public transport, the challenge in the years to come is to develop new mobility solutions that are efficient, sustainable and tailored to passenger needs.

As a world leader in shared multimodal transport, Keolis has put this challenge at the heart of its strategy.

ACCELERATING URBAN TRANSFORMATION

Autonomous vehicles (AVs) constitute a technological revolution.

Incorporated into urban transport networks, they provide passengers with more seamless, efficient and comfortable journeys, combined with cost savings and a lower environmental impact. AVs are a new way to travel and represent a significant opportunity to accelerate the development of public transport networks.

ANTICIPATING THE TRANSITION

To reap the full benefits of autonomous mobility, local transport authorities need to adopt a holistic approach to anticipating and managing this transition. An ideal scenario makes optimal use of all forms of mobility, and features close collaboration between public transport authorities, transport operators and other relevant stakeholders. Keolis is actively engaged as a key partner in this process in order to provide mobility services that are carefully tailored to the needs and expectations of citizens.

The introduction of autonomous vehicles can help solve the issue of providing first and last mile connections in under-served suburbs, for example, as well as encourage the shift from private vehicles to shared-ride services.





A STRATEGIC PARTNERSHIP

Sharing the same culture of innovation, Keolis and French start-up Navya have formed a partnership to develop the use of autonomous electric shuttle buses in urban environments. Under this agreement, the two companies are studying opportunities for joint autonomous electric vehicle projects in countries where Keolis is already established.

SEAMLESSLY INTEGRATED INTO SMART CITIES

In the smart, sustainable cities of the future, transport will be shared, personalised and multimodal. Autonomous mobility solutions are the perfect match for these requirements.



ON-DEMAND

Autonomous mobility provides efficient on-demand transport for people currently in areas which are currently under-served or not serviced at all, especially for first and last mile connections.



FOR EVERYONE

Autonomous mobility offers transport solutions for all: passengers with reduced mobility, children, urban and suburban populations, and people without a car.



INTEGRATED

Whether by shuttle bus or car, shared autonomous mobility supplements existing transport networks and alleviates traffic congestion. Passengers can choose their preferred means of transport from the wide range on offer.



24/7

Autonomous vehicles can provide a continuous service at any time of day or night.



ENVIRONMENTALLY FRIENDLY

Electrically powered autonomous vehicles are cleaner and quieter.



COMPLETELY SAFE

Autonomous vehicles help to significantly reduce the number of road accident, as research shows that 90% of these are currently caused by human error.

A WIDER CHOICE OF SHARED MOBILITY

Autonomous vehicles integrate seamlessly into a comprehensive multimodal transport offer that combines public and individual mobility solutions, improving the efficiency of transport networks and transforming public spaces.



MORE ATTRACTIVE PUBLIC SPACES

By making public spaces more accessible, autonomous vehicles (AVs) will enhance the appeal of our towns and cities. And by allowing local authorities to tailor transport services to the needs of citizens, AVs will reduce congestion, pollution and noise.

“We’re building on successful trials around the world to develop the expertise for operating fleets that will be mass-produced from 2020.”

Schéhérazade Zekri,
Director of New Mobility,
Keolis

AN INTEGRATED EXTENSION OF EXISTING NETWORKS

Autonomous mobility is an effective way of expanding an existing public transport network, especially in currently under-served areas or for the first and last mile of the journey. They are well suited to airports, university campuses, hospital complexes and tourist attractions which are spread over a large area.

TAILORED MULTIMODAL EXPERTISE

To develop its multimodal offering, including AVs, Keolis draws on its leadership in the operation and integration of traditional transport systems, combined with experience gained through the successful rollout of autonomous vehicle solutions in urban environments, in partnership with the high-tech leader, Navya (see pages 14-17, “Keolis, Pioneer in new mobility solutions”).

POISED FOR DEPLOYMENT

Discussions are currently underway at a national, European and international level to establish the necessary legal framework that will allow driverless vehicles to operate on public roads. Automotive manufacturers have announced that we can expect to see fleets of mass-produced driverless vehicles on the market from 2019 onwards, making autonomous mobility a reality for people everywhere.

2016-2018

Cities test driverless shuttle buses under real conditions and prepare to integrate them into their local transport networks.

2019-2021

Mass-produced autonomous vehicles will start entering the market.

2021

Cities will rollout their first fleets of AVs.

A GROWING SUCCESS STORY

MOBILITY AT THE FOREFRONT OF INNOVATION

As technological advances drive progress in vehicle automation, new experiences in autonomous mobility are emerging, with ever-improving levels of performance and safety.

THE INDUSTRY EXPERTISE OF KEOLIS

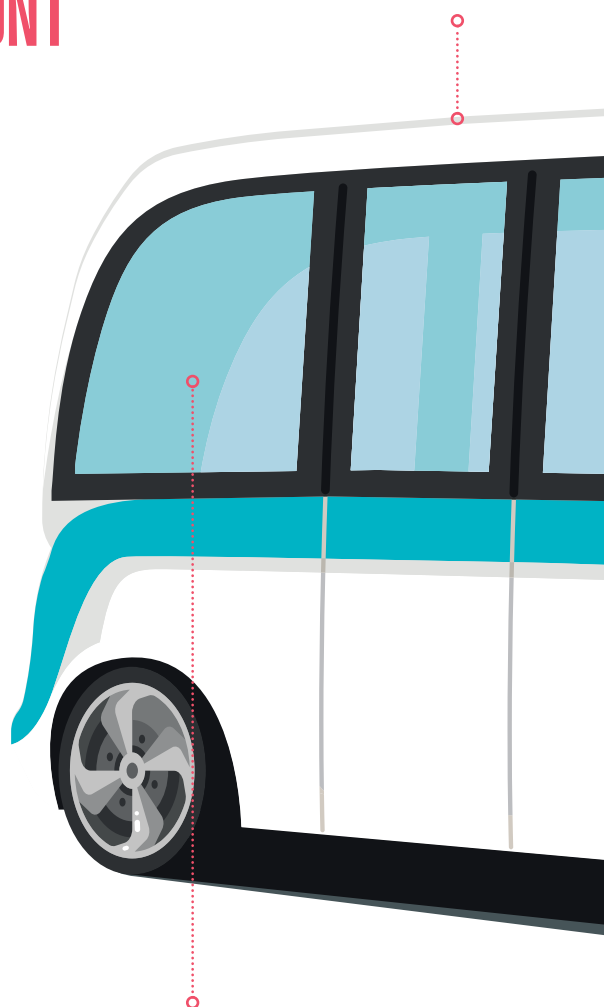
As a leader in driverless automatic metros and tram networks, Keolis identifies the key benefits of technological developments to offer the best service for all modes of transport. Keolis also draws on its industry expertise to manage complex transport systems, while providing the highest levels of performance and safety to its customers.

AUTONOMOUS OPERATION GAINING MOMENTUM

The connected vehicle, with increasingly sophisticated driver aids on board, is already a reality today. This is the starting point for the autonomous vehicle, which handles all driving functions. Between the two, there are various degrees of automation (see illustration below).

GNSS ANTENNA

to relay the vehicle's exact position in real-time.



DIGITAL SCREENS

allow communication with passengers.

LEVEL 0



No autonomy.

LEVEL 1



Occasional assistance.

LEVEL 2



Partly autonomous vehicle.

LIDAR RADARS

provide 2D/3D perception to detect obstacles even in the dark.

SELF-LEARNING ARTIFICIAL INTELLIGENCE

In 2017, vehicles with built-in artificial intelligence, enabling them to learn routes as they drive, are not yet commercially available. The autonomous shuttle buses already on the market, such as Navya's shuttle bus described here, are pre-programmed to operate in a specific area and use real-time sensors to compare what they see with their onboard mapping system, enabling them to detect and avoid obstacles in their path.

ENHANCING THE PASSENGER EXPERIENCE

Convenience, comfort and safety – the three keywords that are defining the mobility experience of the future. Onboard, passengers can spend their time reading, chatting, working, or simply relaxing and enjoying the ride. In addition, environmentally friendly technology keeps air pollution and traffic noise to a minimum. And finally, the artificial intelligence systems in place ensure a smooth and safe journey.

COMPACT DESIGN

offering maximum space for passengers.

ODOMETER

to analyse the vehicle's position and speed.

STEREOVISION CAMERAS

at the front and rear of the vehicle to detect obstacles and analyse the vehicle's position.

LEVEL 3

Largely autonomous vehicle.

LEVEL 4

Fully autonomous vehicle under specific circumstances

LEVEL 5

Fully autonomous vehicle in all circumstances.

A NEW MOBILITY EXPERIENCE FOR PASSENGERS

Autonomous mobility caters to the growing demand for smarter, more accessible and integrated transport. Built around passenger expectations, it allows operators to create personalised travel solutions.

THINKING LIKE A PASSENGER

There is no such thing as a typical passenger: people using transport networks may be young or old, residents or visitors to the city, technologically savvy or unfamiliar with technology. Profiles vary depending on the person, the time of day and travelling conditions. Keolis' autonomous mobility solutions reflect our commitment to 'Thinking like a passenger', which means taking account of this inherent diversity to best meet the needs and expectations of each individual.

A MORE INTUITIVE JOURNEY

Autonomous mobility will result in a simpler, intuitive and more enjoyable travel experience at every stage of the journey. Thanks to digital innovations, it will eventually be possible to offer personalised door-to-door journeys, perfectly suited to all needs.

ALEX

For Alex, multimodal travel is second nature – helping him live student life to the full.

The key is a mobile app that helps him choose the best option depending on where he's heading.



07:30

As soon as he's awake, Alex receives a notification from his transport app, reminding him to book his journey with the AV service.



17:30

After lectures, Alex might join his friends in the city, go to work, the library or the gym. Whether it's by automated metro, bus, tram, bicycle or a shared AV, flexibility regarding his transport options is key.



09:00

The shared AV drops Alex and other users at the station, where he takes the train to university.



10:00

On campus, an AV takes Alex to his lecture theatre, then later drops him at the cafeteria for lunch.

ANNA

«Retired but always on the go!» is how Anna describes her life.
Managing her busy schedule is made easy thanks to the simple and convenient local transport solutions available.



10:00

Anna books her AV for the day. Not entirely comfortable with smartphones, she has personalised her passenger profile on the city's online portal. This means that she only has access to the services she uses most and her favourite journeys are saved on the system.



14:00

The AV she ordered drops her at the doctor's surgery for her check-up.



15:30

An AV then takes Anna to the supermarket. When she's finished shopping, it will take her back home.



FRED

With a busy working and social life,
Fred needs transport solutions that help him get around quickly and comfortably.
His main priority is having travel options that fit in smoothly with his hectic schedule.



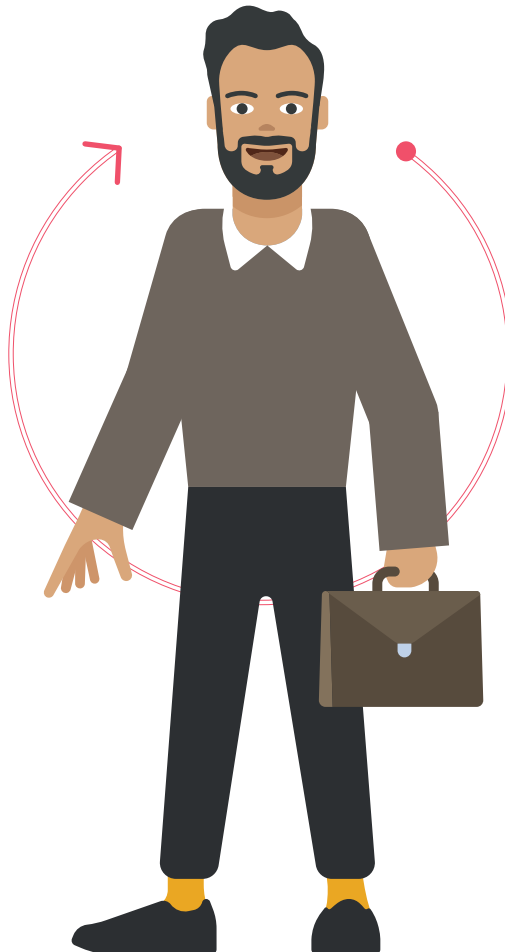
07:00

First thing in the morning, Fred texts his transport operator to order an AV, which takes him and his neighbour to the nearest metro station for their journey to work.



23:00

Fred joins friends for an evening drink in the city. There are no buses this late, so he uses the app to book an AV to take him home.



08:30

Fred is able to enjoy a coffee with his neighbour while travelling in the AV.



12:30

An AV takes Fred and his co-workers to the staff canteen, which is on another site.

KEOLIS, DRIVING TRANSFORMATION PIONEER IN NEW MOBILITY SOLUTIONS

Autonomous mobility is becoming an everyday reality and Keolis has strategically positioned itself as a partner of choice for the rollout of these new transport solutions.

«The autonomous shuttle trial has been underway for a year now in Lyon, giving us lots of insight. We've been able to clearly identify passenger profiles to improve the service. For example, we soon intend to develop a real-time information system at stops allowing passengers to accurately estimate how long they have to wait for the next shuttle.»

Pascal Jacquesson,
Managing Director, Keolis Lyon

A WORLD FIRST IN LYON
In September 2016, Keolis, in partnership with SYTRAL (Lyon's public transport authority), the local government and Navya, launched the world's first autonomous shuttle bus service for public transport. This free service uses two driverless shuttle buses, each carrying up to 15 passengers. In the heart of Confluence, the city's environmentally friendly district, these fully electric vehicles service five stops along a 1,350m route, and connect with two existing tram stops. In total, 18,300 passengers have used the service during the first year.

14,000
km traveled
in 1 year

5
stops
served

18,300
passengers
carried over
1 year

2
tram stops
900m apart

SUCCESS IN THE UNITED STATES

From 11-20 January 2017, people in Las Vegas were also able to take free test rides on an autonomous, driverless shuttle bus along a busy stretch, 460m stretch of road open to traffic between Las Vegas Boulevard and Eighth Street. This was a first for the United States and a total of 3,250 people used the shuttle service over the 11 days of operation, accompanied, as in Lyon, by a Keolis operator in the vehicle. The trial was hailed a resounding success by local government representatives and passengers.

"The city of Las Vegas is making major investments to improve mobility and safety and provide reliable transportation choices to residents and visitors through the use of new technologies."

Carolyn Goodman,
Mayor of Las Vegas, Nevada, USA

"This contract is a decisive step for Keolis' expansion in the United States and will serve as a benchmark when we bid for future business in urban transit, paratransit, shuttles and on-demand transport."

Bernard Tabary,
Chief Executive Officer, International

KEOLIS. DRIVING TRANSFORMATION

AN INNOVATIVE NEW WAY TO EXPLORE QUEEN ELIZABETH OLYMPIC PARK

Throughout September 2017, visitors to the Queen Elizabeth Olympic Park, one of London's most popular urban parks, were able to ride on a free shuttle bus service which used autonomous, fully electric vehicles. The trial service covered a 1km stretch in the north of the park, allowing people to hop aboard to reach favourite venues and attractions such as the VeloPark and Timber Lodge Café.

1 km route

4 pick-up points

8 passengers per shuttle bus



“These vehicles are the first to meet emerging mobility needs. By the end of 2017, the aim is for them to run in full autonomous mode on public roads, with no operators onboard!”

Valérie Péresse,

Head of the Greater Paris regional authority and of Île-de-France Mobilité public transport authority.

AN AUTONOMOUS SERVICE FOR EUROPE'S LARGEST BUSINESS DISTRICT

From June to December 2017, La Défense, in the west of Paris, is witnessing a small revolution with the trial of an autonomous, fully electric shuttle bus service.

The innovative service has already attracted 22,000 passengers in the first two months of operation. The shuttles can seat up to 11 passengers with a further four standing, and can also carry passengers with reduced mobility.

The free shuttle service stops at nine pick-up points on three different routes (two during the week, and one on the weekend for tourists).

The innovative new service facilitates first and last mile connections in and around the 400-acre business district, for the half a million people who come to La Défense every day.

TAILORED SUPPORT FOR LOCAL TRANSPORT AUTHORITIES

Autonomous mobility will not become a reality without close collaboration between private operators and local transport authorities. As part of this process, Keolis is ready to go that step further in supporting local authorities in their transition towards these new mobility solutions.

AN APPROACH BASED ON LISTENING

From the outset, Keolis has fostered relationships of trust with public authorities based on listening and dialogue. We believe this is the best way to understand the needs and concerns of the local community and, in turn, implement the right transport solutions, such as autonomous mobility. Listening is also the basis for understanding the needs and expectations of customers. The studies conducted by Keoscopie, our research observatory for new mobility trends, are a perfect illustration of this approach.

GOING FURTHER TOGETHER

Keolis is leading the field in autonomous mobility, drawing on our 35 years of

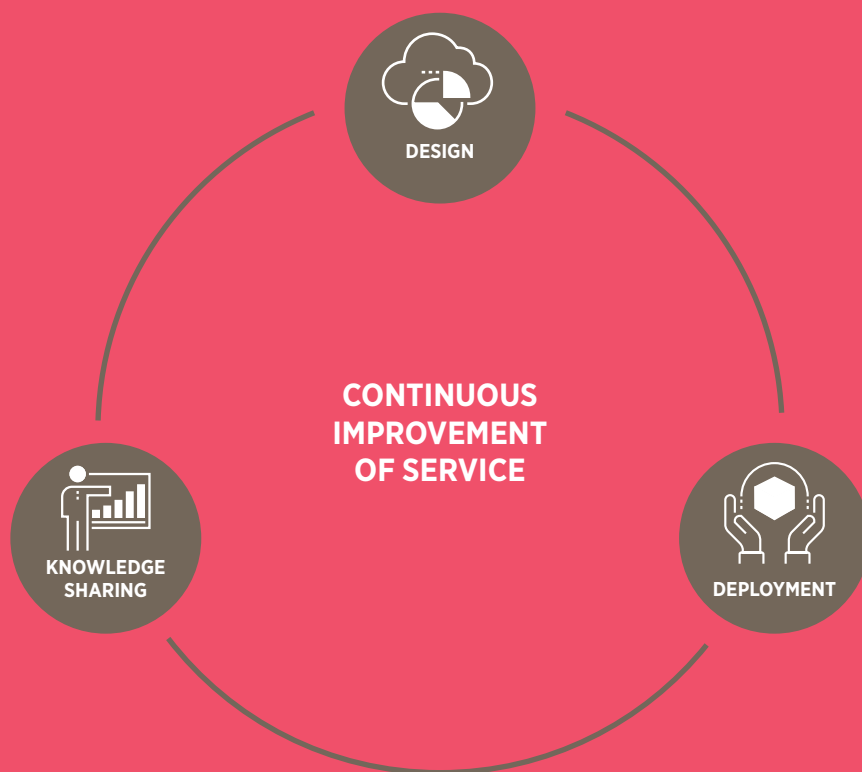
expertise in automated driverless metro systems and our pilot projects worldwide. And we are ready to take the next step

with local authorities to make autonomous mobility a seamless extension of their existing transport networks.

“Terrebonne has given the green light to a year-long pilot project for self-driving electric shuttles. We are now waiting for the state government's agreement before starting. The shuttles would transport passengers in the tourist area of Old Terrebonne. With room for 15 passengers per shuttle and travelling at about 15kph, this new service would enrich the public transport offer, especially for the first and last mile. This would optimise travel time for passengers and would reduce traffic jams and pollution.”

Stéphane Berthe,
Mayor of Terrebonne, Quebec, Canada

A TAILORED SERVICE



DESIGN

- Site analysis
- Design of the most appropriate solution, in light of the existing network and planned budget

DEPLOYMENT

- Legal support
- Integration with the local environment
- Assistance for passengers
- Network operation and comprehensive maintenance

CONTINUOUS IMPROVEMENT

- Based on passenger feedback
- Driving technological improvements

Design : MEANINGS

Keolis – Executive editor: Thomas Barbelet – Photo credits: Denis Paillard, Navya, Keolis, Vincent Pedoussat, Julien Goldstein, Victoria Viennet et Alisa Gill – Illustrations: Creamcrackers



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