



The French network of
public and private stakeholders
for sustainable cities

Innovative solutions for sustainable cities

Mobility



URBAN INNOVATIONS IN THE FIELD OF SUSTAINABLE MOBILITIES

/// NEW MOBILITIES IN CITIES AND TERRITORIES

From long time, France has built up a tightly-meshed mass transit system, upgraded and adapted to new forms of mobility: coverage of mass transit in the Greater Paris Region, upgrading the tramway systems in metropolitan areas and the regional express trains (TER) that feed into cities from suburban and rural areas, etc. Alongside that, it has taken action to extend the range of mobility options available, with new services, such as self-service vehicles or the consolidated shared mobility services that have come up with the digital economy, including car-pooling, car-sharing, etc. This new era in mobility coincides with broader changes across society and in ways of life, included low-impact mobility and universal access to mobility. It changes the design and the use of urban spaces and the connection between urban development and transport is becoming even stronger, as can be seen in the more integrated planning documents being produced, the extended prerogative of transport authorities at the local level and urban projects with a broader range of social and functional uses. Innovating in the field of mobility also implies curbing demand; the local authorities and enterprises offer more and more ways of eliminating or significantly reducing transport, by facilitating tele-commuting, multiplying the number of co-working options available and adopting more mobility-friendly work tools.

/// WHAT ARE THE MAIN AREAS OF INNOVATION IN TRANSPORT AND MOBILITY?

Coordination, consistency and continuity of service are essential in guaranteeing the effectiveness of the overall mobility system and service quality to users. **We see three distinct avenues for action when it comes to innovation in mobility: Avoid, Shift, Improve (ASI)**

► **Avoid, Reduce (AVOID)** **Stepping up incentive policies**

Innovation in this regard means enabling mobility at the right time, via the most appropriate route. With the ever more intricate understanding of mobility demand and movement flows made possible by traffic management and regulation tools, public policies can be designed to act as incentives, fostering the use of infrastructures during non-peak times and optimising the infrastructures and services that already exist. Limiting peak times will require new incentives (loyalty and “rewards” systems, or positive tolls) and ongoing dialogue between transport sector players and major flow generators.

► **Changing, optimising and better integrating the city and mobilities (SHIFT) : guaranteeing accessibility and overall efficiency in the multimodal offer for all users**

While innovation in mobility is supported by technical and technological developments, one of the characteristics of French innovation is its endeavour to secure quality for all and intelligently integrate the urban area and mobility uses across all of neighbourhoods and territories. The result can be seen in the quality of the interchange hubs (physical and digital accessibility), accessibility for all user populations

and neighbourhoods, and more broadly speaking, quality all along the route from “door to door”.

Therefore, new mobility infrastructures are designed in connection with urban revival projects, to bring back to life older neighbourhoods and offer better accessibility to troubled neighbourhoods. Designing new neighbourhoods or re-developing neighbourhoods and public spaces are as many opportunities to integrate new mobility options into the landscape and come up with new multi-use systems that include low-impact mobility. An all-encompassing approach, embracing environmental, energy-related and digital factors, is now taken by many project teams, to ensure lower environmental impact in every step : design, construction and management. Fine-tuned management of intermodality within the larger interchange hubs makes it possible to guarantee service quality across the whole range, from traditional to low-impact and alternative forms.

The large-scale development of multi-modal integrated ticketing systems also offers the opportunity to develop new technologies, new services and a reorganisation of management and partnership methods. Work has been done on material and service design so that users can approach the mobility offer in metropolitan areas from a new angle.

► **Improve: Improving means going further : upgrading and embedding new technologies**

- **Working on existing infrastructures: French know-how makes it possible to upgrade infrastructures and services, without any break in service continuity.**

Cities today and transport and mobility services are transforming at ever-greater speeds. Our infrastructures need to be conducive to these changes, while also shifting themselves at an increasingly fast pace, so as to never hinder or hold up the service provision process. France has developed cutting-edge know-how that makes all the aforementioned developments possible while also maintaining service as usual throughout the duration of construction. Its accomplishments on the historical rail infrastructures have been particularly awe-inspiring (automation of metro lines).

- **Innovating in urban goods transport and urban logistics**
A radically different approach to distribution channels (shared distribution tools, newly-created “secondary” logistics centres, delivery points by neighbourhood, etc.), optimised third-party locations and interchange hubs, and capacity-sharing between different modes and infrastructures (using waterways or tramways to deliver merchandise during non-peak hours) are just some of the new practices that are opening the door to a new perspective on cities, city planning and city infrastructures.
- **Developing clean, autonomous, connected cars along with the related services**
With the major strides made in vehicle engine design (hybrid, electric, hydrogen, etc.), the infrastructures themselves will also need to change, to better

accommodate the new vehicles and maximise their potential, in particular when it comes to recharging infrastructures. The connected vehicle (implying vehicle-vehicle, vehicle-infrastructure, and vehicle-cloud communication) also opens up a new avenue for progress which has the potential to develop far more rapidly than those yet seen. It will enable a notable improvement in transport safety as well as new mobility usages. Autonomous cars (cars that are more or less “self-driving”, or autonomous driver-free shuttles) offer many new opportunities for progress: greater capacity to optimise vehicle flows, and more options for offering door-to-door mobility services, including in sparsely-populated urban zones.

/// **ACTION TAKEN IN FRANCE TO SUPPORT THIS INNOVATION**

For many years now, France has designed its public policy to support developing and experimenting with innovative ideas as applied to transport. The following programmes are of note:

- **The Investments for the Future Programme (PIA)** is working with 31 Eco-Cities on integrated urban projects aimed at building attractive and resilient cities that preserve the environment, social cohesion and quality of living for residents. Many project specifically focusing on transport are included (infrastructures, low-impact mobility, integrated ticketing, etc.) as part of this effort.
- **The Investments for the Future Programme - Vehicles and Transport for the Future** is facilitating the emergence of new technical and technological solutions by supporting projects around logistics, hybrid engines, vehicle weight reduction, rail transport, etc.
- **The “Industry Demonstrators of the Sustainable City” (DIVD)**, by the Ministry of Housing and Sustainable Housing and the Ministry of the Environment, Energy and Maritime Affairs, which are all championing one or more innovative products in the field of transport and energy, which promotes the exchange of flows between city stakeholders in order to cut back on the use of primary resources.

As you can see, to every mobility question... there is an answer! Whatever the need, audience or territory!

Work group run by **Caroline Maurand**,
Ministry of Housing and Sustainable Homes, with:
Camille Roccaserra-Vercelli, Fédération des EPL,
Christian Dubost, SNCF,
Annabelle Ferry, AREP,
Jean Bergounioux, ATEC ITS.



MULTIMODAL SPACE

WITH TRAMWAY, BUS, CAR SHARING, “VÉLOMAGG” BICYCLES, PARKING LOTS, AND COMBINED TICKETING SYSTEM FOR USERS

EMMA - MONTPELLIER

The EMMA mobility card, an “all-purpose” transit card, enables people to use the tramway, bus, downtown’s 7 parking lots, 10 tramway parking lots, VéloMagg bicycles, and car sharing with a single subscription.

It also features an itinerary and real-time schedule calculator covering all transportation modes.

Unique in France, EMMA is in production and continues to evolve. EMMA is a multimodal information service, universal and progressive, designed for travelers to help encourage environmentally friendly transportation modes.

Installed: phase 1 since 2014; phase 2 since May 2016.

INNOVATIONS

- ▶ EMMA innovation is simultaneously: technical, including the integration of cutting-edge technology systems; commercial, now taking into account users’ global needs; and managerial, leveraging structural realignment of organizations.
- ▶ Tools were completely redesigned, processes optimized, and sales spaces redefined and enhanced with an electronic client interface. Skills were decompartmentalized, while the sales approach was generalized.
- ▶ EMMA marks the arrival of a 360° vision of urban mobility that profoundly changes the operators’ organization and profession, now bringing better service to users than ever before.

KEY DATA

- Internet site with dedicated client space
- Mobility contract
- Single card
- Application for iOS and Android
- Interactive terminals
- Traffic, availability, and consumption alerts

STAKEHOLDERS

Cutting-edge technology partners!

- ▶ EMMA leverages cutting-edge technologies developed by recognized industry partners:
 - Micropole for developing the e-commerce platform and mobile applications,
 - Cityway for the information database and multimodal search engine,
 - Xerox for the ticket distribution and profile change solution,
 - Urban System for the back-office processing system,
 - Actool for writing on smart-cards,
 - Scheidt & Bachmann, Smoove, Metavera, and PayByPhone for webservice layers to interface with the sales system.
- ▶ The mixed economy company, TaM, is the EMMA project manager, with the Transdev group as chief project owner.

IMPLEMENTATION

- ▶ With the Internet platform, users can combine all of the transportation modes they wish to use, knowing service availability in real-time and subscribing to receive customized alerts. Mobility advisors at physical stations recommend specific monomodal or multimodal options adapted to their travel needs.
- ▶ A multimodal “Open Sesame” mobility contract gives users easy access to the entire transportation offering. Clients no longer need to purchase different transportation tickets from various operators in order to enjoy public transportation, bike sharing, car sharing, and parking services. They gain access to all service with a single ticket, available with a single card.



RESULTS



- /// Ridership was boosted for all transportation modes that are alternatives to cars. Commercial goals were exceeded with nearly 10,000 mobility contract subscriptions for active users in just two years, with 46% of active clients choosing the multimodal solution.
- /// The use of digital tools was also on the rise, with a 40% increase in visits from 2013 to 2015. The frequency of visits is expected to continue to increase in 2016 with the arrival of a commercial web-based platform, new applications, and interactive terminals.
- /// This project was recognized by the French professional community in 2014 and was awarded the:
 - Public Transportation Innovation Trophy 2014,
 - City Rail and Transportation Intermodality Trophy 2014.

FINANCIAL ASPECTS OF THE OPERATION

- /// The financial backing is sustainable, from multiple sources. Funding combines public-sector contributions from three entities, plus French and European subsidies and investment from three private companies.

KEY FIGURES

- Montpellier Méditerranée Métropole: €1,019,764
- City of Montpellier: €100,000
- French EcoCité: €1,552,950
- Europe: €959,918
- The mixed economy company, TaM, Transdev, and Modulauto (private car-sharing service): €908,158



Contact:

Hélène ROUSSEL, chef de projet Cité intelligente - Montpellier Méditerranée Métropole, h.rousseau@montpellier3m.fr



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FIRST PHASE OF NICE URBAN AREA RESERVED-LANE PUBLIC TRANSPORT NETWORK

LINE 1 OF THE NICE URBAN AREA TRAMWAY



Nice's first tram line was brought into service in 2007. Its aim was to enhance the city's public transport offering and improve access to central Nice from its northern and eastern districts.

The 22 stations on the 8.6 km-long line serve the key locations of the city centre including the railway station, the university, Place Garibaldi and Place Masséna. The services provided by Artelia covered the complete transport system and developments with the exception of the civil engineering works for the maintenance centre.

The tramway now carries nearly 105,000 passengers per day and is a key component of the urban area's public transport network.

INNOVATIONS

► **Invention of trams without wires:** The trams operate on batteries on the sections of line crossing two emblematic squares, Place Garibaldi and Place Masséna, to avoid disfiguring their remarkable architecture with unsightly overhead wires. The tramway blends in perfectly with its urban environment.

► **A transport project backed up by a large-scale development scheme:** The tramway project provided a backbone for other urban development and transformation schemes, rolled out by the Nice Côte d'Azur district authority and Nice city council.

► **The definition of an 8.5 km green grid** was innovative at a time when project objectives did not place a priority on environmental quality. The grid was geared to the specific features of each neighbourhood.

► **The Nice urban area authority used the inauguration of the tramway as a backdrop for the "l'Art dans la ville" cultural project**, one of the most ambitious open-air art galleries in Europe. The city council commissioned works from 13 international artists for this original project blending culture, heritage, art and tourism aspects.

KEY DATA

- A pioneer in the development of trams without wires
- A tramway with an overall "U" shape, to replace the former bus lines serving Nice city centre
- Serving the densest parts of Nice in terms of population, jobs, businesses and public amenities as well as the working-class neighbourhoods to the north-west and north-east, passing through the heart of the city

STAKEHOLDERS

- ▶ At the time this first tram line was designed, accessibility legislation did not exist. Subsequent developments to improve accessibility, especially for disabled users, were defined by a working group set up for this purpose bringing together representatives of all the disabled groups.
- ▶ Along with Bordeaux (another tramway to which Artelia contributed its expertise), Nice was a pioneer in the invention of trams without wires, by involving the manufacturers closely in the project.
- ▶ Artelia was commissioned to supervise construction of the complete transport system and developments. It worked in partnership with Ingerop and a consortium of architects: C. Vezzoni, A. Jolivet and M. Dalibard.

IMPLEMENTATION

- ▶ The inhabitants were consulted during the design stage, voting for the names of the stations along line T1 and selecting the trees along Avenue Jean Médecin, the city centre's main shopping street.



RESULTS

/// Enhanced eco-mobility for the wellbeing of Niçois and tourists alike

The tramway has made travel smoother, reduced private car use (thereby cutting greenhouse gas emissions), led to the development of cycle paths and given urban spaces back to pedestrians in the form of wider pavements. 40% of tram line 1 runs through pedestrianised areas.

/// A more attractive living environment

The developments carried out during construction of line T1 transformed the urban environment, thereby giving the city a highly positive image. They have improved living conditions for both inhabitants and tourists. For example, Nice's two main squares, Place Masséna and Place Garibaldi, were redesigned and transformed into attractive areas in which people can meet and relax, and where cars and buses no longer have a place.



FINANCIAL ASPECTS OF THE OPERATION

/// Nice Côte d'Azur district council, Alpes-Maritimes departmental council, Provence-Alpes-Côte-d'Azur regional council and the French government co-funded the 325 million-euro operation.

KEY FIGURES

- 150,000 passengers per day
- 6,500 inhabitants and over 42,000 jobs within 400 metres of the line
- 9.5 kilometres long
- 22 stations
- 20 trams each with a capacity of 200 people
- Trams every 4 minutes during peak times





ECO-MOBILITY AT THE HEART OF THE DESIGN OF THIS NEW DISTRICT



DANUBE ECO-DISTRICT IN STRASBOURG



In 2009 the Strasbourg Eurometropolis embarked on the city's biggest ever urban development project. The "ZAC Danube" eco-district is being built on the site of Strasbourg's former gas factory, in a strategic location at the heart of 250 hectares of dockside and industrial wasteland between the Heyritz district and Kehl in Germany that has been earmarked for regeneration. The operation is giving rise to a new, innovative "piece of city" in line with the principles of sustainable development.

The first installations were handed over in 2014.

INNOVATIONS

- ▶ **Placing priority on eco-mobility:** A policy encouraging eco-friendly transport modes has been introduced including a network of pedestrian routes, easy access to high-quality public transport, ample bicycle parking facilities, etc. On the other hand, car use is strongly discouraged, with parking only allowed in car parks and for dropping-off and delivery purposes.
- ▶ **A network of green and blue corridors:** Firstly, green spaces preserve the regional biodiversity. Secondly, water, as well as recalling the area's port heritage, is a key feature of the landscape in the form of features such as a river garden, swales, alleys, etc.
- ▶ **Inherent intergenerational and social diversity:** Building these links is very important for neighbourhood quality of life. The public spaces are designed to encourage people

to meet (e.g.: a large square next to the tram station) and enjoy shared activities (e.g.: allotments).

- ▶ **Very low energy consumption:** All buildings comply with the French "low-energy building" standard. The dwellings are passive, or even positive-energy.
- ▶ **Introduction of the "mobility pack":** A package of services designed in the early stages by Artelia rolls out actions to encourage inhabitants to use alternative modes of transport.

KEY DATA

- The first eco-district to win an award for mobility
- A 7-hectare eco-district project
- 7 years of works to transform an area of industrial wasteland into a modern neighbourhood
- The Danube project is both an ambitious urban sustainable development experiment and a showcase innovative eco-district

STAKEHOLDERS

- ▶ For this project the Strasbourg Eurometropolis authority was keen to set up a new form of shared governance involving public- and private-sector players.
- ▶ Future inhabitants, associations, socio-economic players, construction firms and local authorities were actively encouraged to participate and express their opinions throughout implementation of the project.
- ▶ To give this civic participation a formal framework, the developer (the Strasbourg public works and development agency - SERS) organised visits, round-table discussions and talks on various themes related to the operation.
- ▶ Devillers & Associés, a firm of architects, urban planners and landscape designers, was the lead firm in partnership with Artelia, Richter architects, technical design office LEA specialising in lighting and illumination, and botanist Philippe Obliger.

IMPLEMENTATION

- ▶ The operation successfully transformed a site with multiple constraints (divided by the river Rhine and an urban highway) into a strategic district close to Strasbourg city centre.
- ▶ At times the Danube eco-district project appeared to be in jeopardy due to issues relating to contaminated soils in the former dockland area, which placed severe restrictions on constructability.
- ▶ Eco-mobility was the number one condition for drawing up this programme.
- ▶ Construction of the eco-district is broken down into 3 phases, the last of which will be completed in 2020.
- ▶ In the early design phases, the inhabitants were offered an opportunity to submit a small number of projects on a co-housing basis. This initiative was sponsored by an association and backed by the city council. It has been built into the overall development strategy in order to better meet the needs of the future users.

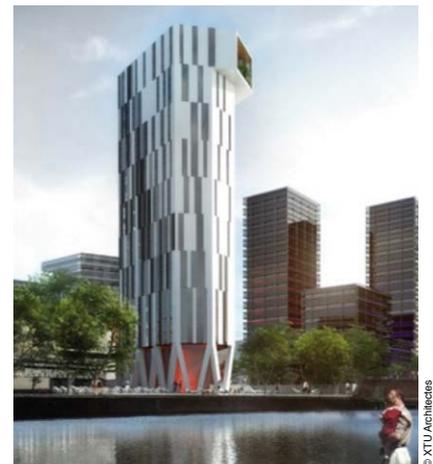
RESULTS

/// Eco-mobility in the Danube district strikes a balance between the interests of individuals and of the city community as a whole. The availability of public transport in close proximity offers the best compromise between speed, cost and convenience on one hand and air and noise pollution on the other hand, which is beneficial both for the environment and for human health.

/// As well as being innovative, the eco-district ties in with another area of Strasbourg – Neudorf – thanks to connections via the river garden, banks and bridges, fostering its integration into the city as a whole and promoting city-wide social cohesion.

/// In 2009, the Danube project was selected in the “mobility” category of the “Eco-district” call for projects launched by the French Ministry of Ecology, Energy, Sustainable Development and the Sea. In 2013, the French Ministry of Housing and Territorial Equality certified that it was “committed to obtaining eco-district status”.

/// The Elithis tower, a housing project forming part of the Danube eco-district, will be the world’s first positive-energy residential tower.



FINANCIAL ASPECTS OF THE OPERATION

KEY FIGURES

- 1,500 inhabitants
- 650-700 dwellings of which 50% social housing
- 84-bed nursing home
- A school complex
- 18,500m² of offices, services and businesses
- 10,000m² of green spaces of which 4,500m² of public spaces

/// The estimated cost of developing the Danube district is 24 million euros. SERS is the project concessionaire on behalf of the CUS; its aim for the operation to break even financially, in line with the objectives of the mixed development zone.

/// The Caisse des Dépôts et Consignations is backing the programme. It is contributing 1.3 million euros to help fund 15 eco-districts across France, including the Danube project.



Philippe Obliger





et associés



TRANSFORMED QUAYS

PROMOTING HUMAN INTERACTION THANKS TO ECO-MOBILITY

REDEVELOPMENT OF THE AREA AROUND THE OLD PORT IN PORNIC



Pornic is the main seaside resort along the “Jade coast” of western France, with more than 100,000 tourists strolling along the quays in the summer.

Continuing its efforts to upgrade the town centre, the municipal council appointed Artelia to implement a project to develop the quays (from “pont du 8 mai” bridge to the arches of the castle), which was completed in 2013.

This project to redevelop the quays of the old port focused on modernising the public spaces in order to enhance it with structures reflecting the remarkable history, architecture and landscape of the site. As a result, the municipality has a new, more attractive image and given its economy a new boost.

KEY DATA

- Redeveloping the quays of the old port is one of the largest projects undertaken by the town.
- The new experimental traffic flow system was based on a speed limit of 20 km/h.
- The new quays of the old port are one of Pornic’s showcase features, providing it with an image of a friendly and dynamic seaside resort.
- White, blue and grey are the main colours that have been made compulsory to unify the look of the businesses located on the quays.

INNOVATIONS

- ▶ **Adapting the use of the quays to suit demand:** From “Petit Nice” square to “pont du 8 Mai” bridge, the road has become a “modular area”. Depending on the time of year, it is possible to either encourage the use of eco-friendly means of transport or improve traffic flow by modulating the priorities given to pedestrians or cars in the old port sector. All the street furniture can be moved.
- ▶ **Developing complementarity between different forms of mobility in the “interaction area”:** the quays have become an area where the different modes of transport (vehicles, bicycles, pedestrians) coexist in harmony. They meet the objectives of the French environmental guidelines (Grenelle de l’Environnement). The entrances to and exits from this area are clearly indicated and the speed limit inside it is 20 km/h.
- ▶ **Enforcing a harmonious architectural charter for the quays:** the owners of buildings or establishments with terraces on the quays must meet the requirements laid down in a charter they have signed to ensure that any modification or development is in line with the marine atmosphere.
- ▶ **Enhancing the port with a “nautical theatre”:** at the tip of the old port, a gently sloping stepped area has been created for people to sit and look at the boats.

STAKEHOLDERS

- ▶ Pornic municipal council took on the role of project Owner for this operation. However, it also invited a group of about ten voluntary shop/restaurant owners to participate. It co-signed the documents to ensure there was a sole Owner. This operation associating an

Owner and a consortium of businesses is an innovative approach and the first of its kind in the area.

- ▶ In addition to the consortium of businesses associated with the Owner, the fifty or so businesses concerned by the redevelopment of the quays participated in the project by way of regular meetings (12 over 3 years).
- ▶ Local inhabitants were convened to many of these meetings to ensure they embraced the project.
- ▶ Architecture and town planning agency A.U.P. was the lead firm. Engineering consultancy Artelia was its only partner.

IMPLEMENTATION

- ▶ The configuration of the works site led to significant constraints in terms of traffic and cohabitation with maritime, business and tourist activities during a 7-month period. However, businesses stayed open throughout the works. In order to minimise the impact of the works, the contractors maintained pedestrian access and restored vehicle traffic at weekends.
- ▶ Pornic municipal council took steps to mitigate any financial losses suffered by businesses. It offered two different administrative support systems to help them keep afloat during the period of lower activity resulting from the

works: a single contact for tax and social security charges (with personalised debt repayment schedules) and a mediator to assist them with bank credit issues.

- ▶ A comprehensive communication campaign was launched to ensure local inhabitants embraced the project and enable them to follow the works progress in real time.

Yannick RANNOU, Project Manager in the Infrastructure, Energy & Development department at Artelia Ville & Transport

“ As the main seaside resort in the “Jade coast” area, close to Nantes, the town of Pornic has been making efforts for several years to enhance its public spaces, culminating in redeveloping the quays at the old port. In order to reduce the impact of through traffic and give priority to pedestrian areas and terraces for tourists, we created a long promenade from the arches of the castle to “pont du 8 mai 1945” bridge. To keep in line with the area’s seaside resort identity, we favoured light-coloured surfacing and white railings and installed palm tree planters along the entire length. **”**

RESULTS

- /// The roads have been reorganised to reduce the impact of through traffic and create public spaces, pedestrian areas and terraces for tourists. Redeveloping the quays has improved social cohesion in this popular meeting place.
- /// In addition to creating a pleasant atmosphere for pedestrians, the new promenade along the old port contributes to improving their well-being, safety and health. It also provides easier access for disabled people.
- /// The profound transformation of the quays has given the seaside resort a new lease of life. Its appeal, particularly with regard to tourists, has direct economic spin-offs for the town and for businesses’ turnover.



FINANCIAL ASPECTS OF THE OPERATION

KEY FIGURES

- €4m investment
- 4 years of preliminary studies
- 3 works phases from September 2012 to March 2013
- A common architectural charter for the façades and terraces in the old port

/// The project cost around 4 million euros and was funded directly by the city.

/// The city was granted subsidies by the FNADT (French fund for regional development). It also benefitted from support from the State via subsidies dedicated to improving the appeal of eight medium-sized tourist towns, Pornic being one of them.



© RATP - Eric Touze



AUTOMATING AN EXISTING METRO LINE WITHOUT SERVICE INTERRUPTIONS

LINE 1 OF THE PARIS METRO

Line 1 of the Paris Metro is the busiest in the metropolitan network transporting over 200 million passengers a year. The first line to be put into service in France in 1900, this historic line traverses the capital from east to west calling at 25 stations over 16 kilometres. In order to improve its performance, it was modernised and automated.

The work was carried out between 2005 and 2012 without any service interruptions. The stations were renovated, the rolling stock replaced, the tracks modernised and a control system installed, which allows a minimum interval of 85 seconds between trains during peak travel times.

KEY DATA

- A world first
- Complete automation [i.e. driverless trains] of an existing line with no service interruptions
- Usage: > 750,000 passenger/day
> 213 million/passengers/year
- Number of stations: 25
- Number of platform doors: 954
- Minimum interval: 85 seconds
- Maximum speed of MP05 trains: 80 km/h
- 4 million kilometres per year (100 times around the world)
- 7 November 2005: project launch
- 3 November, 2011: 1st automated trains on the line
- 22 December, 2012: Line 1 100 % automated
- 28 July, 2013: final SAET adjustments

INNOVATIONS

- ▶ The transition from a manual to a completely automated operating system is a world first on a line such as Line 1. The innovations concerned the operation of 56 trains using SAET technology (automatic train operating system), which was developed by Siemens for the CBTC system (Communication-based Train Control).
- ▶ In order to prevent intrusions on the line, the platforms are equipped with special doors. In total they number 954 and were installed on all 54 platforms between 2009 and 2011.
- ▶ The civil engineering phase was critical as the platforms had to be raised and the edges reinforced - all at night when the stations were closed.

STAKEHOLDERS

- ▶ **Public:**
 - RATP: Régie Autonome des Transports Parisiens (In English, Paris transit authority). In addition to the technical complexity of the operation, RATP also had to juggle organisational difficulties (e.g. integrating the work into its environment without service interruptions to the line, and coordinating the trades of the different industrial companies). RATP also managed the inherent social aspect of the project.
 - STIF: Syndicat des Transports d'Ile de France (the body responsible for coordinating the Paris region's transport).
- ▶ **Private:**
 - Alstom: MP 05 rolling stock (56 trains)
 - Siemens France: SAET and PCC
 - Kaba Gilgen: A Swiss company responsible for supplying the platform doors, which were chosen for their height and ease of installation
 - Vinci/Eiffage consortium: civil engineering of platforms
 - Créa2icom: treating the first trains

IMPLEMENTATION

- ▶ The majority of the civil engineering work in the stations and on the tracks was carried out at night i.e. between 2:00 a.m and 5:00 a.m. A disused right-of-way located at Porte Maillot was used as a maintenance workshop.
- ▶ The automation also provided an opportunity to upgrade the stations, renew the lighting, and install passenger facilities and information systems; the Franklin Roosevelt station benefited from a special make-over with the introduction of touch screens.
- ▶ The rolling stock was replaced with 56 MP 05 trains manufactured by Alstom able to accommodate 742 passengers maximum (i.e. 42 more than previously). The MP 89 trains have been transferred to Line 4, which will also be modernised in the near future.

→ With agreement from STIF, RATP has launched the automation works for Line 4 of the Paris Metro. Plans to automate Line 15 of the Grand Paris Metro are also in place.

→ **1 train every 85 seconds: this is the minimum interval between trains thanks to the automated system.**

Eric CAZEAUX, Siemens France

“ Successfully managing to automate a line which transports on average 725,000 passengers a day without service interruptions is a world first. ”

RESULTS

- /// The environmental benefit of Line 1 resides in the SAFT system's ability to manage train arrivals and departures in stations by economising on traction energy. The commercial speed has increased from 24.4 km/h to 30 km/h i.e. a gain of 2.5 million hours for the 213 million annual passengers (on the basis of 6 inter-stations on average).
- /// The efficiency and punctuality of the automated Metro 1 has improved (99.2% of trains on time in 2014); this makes public transport a more rapid and reliable alternative to private vehicles, which, in turn, contributes to a reduction in air pollution and greenhouse gas emissions. The quality of service has also improved thanks to better supply and demand ratios as well as brand new rolling stock and better station facilities.
- /// The new MP 05 trains are equipped with cooling units and have on-board information screens.



THE FINANCIAL ASPECT OF THE OPERATION

- /// The automation project was entirely funded by the RATP group. This project showcases SYSTRA's internal and external engineering expertise. The RATP group has also demonstrated its mastery of automated Metro systems.
- /// In addition to automating a traditional line, RATP also developed expertise in terms of modernising partial automation (as on Line 13), commissioning fully automated lines (Line 14), and automating a line in use (Line 1).

KEY FIGURES

- Cost of the operation: 700 million Euros
- MP 05 rolling stock: 549 million Euros
- Platform doors: 22.5 million Euros



SIEMENS

ALSTOM

KABA
BEYOND SECURITY





TRANSPORT INTEGRATED INTO A PROTECTED ENVIRONMENT

THE BORDEAUX TRAM NETWORK

Line A of the Bordeaux tram network opened to the public in December 2003 while Lines B and C were opened the following year; all three lines have been extended in successive phases. Adopted back in 1997, the tram project is part of the city's plan to renovate its historic center: restoring facades, widening and improving pavements, and creating cycle lanes. Today, the Bordeaux network covers 60 km, has 111 stations and transports over 280,000 passengers a day. A fourth line (Line D) is planned for 2019.

INNOVATIONS

► **The first tram network to be powered by ground-level power supply technology**

The advantage of this technology, notably used in the Dubai and Rio tram networks, is that it does not spoil the surrounding environment and historic architecture as there are no overhead contact lines.

► The Bordeaux tram network was the first network in the world to be powered using ground-level power supply technology (NB: in French, Alimentation Par le Sol (APS). Over 11 kilometres, a third rail replaces the overhead contact lines. Energy is supplied by a power collection shoe installed on the rail.

► **Other innovations:**

- 360-metre noise-reduction wall on the viaduc
- So-called «permeable» track
- Vibration damping system
- Guarded cycle parks
- 21 park and ride sites

KEY DATA

- First tram network to be powered by ground-level power supply technology
- Integrating the tram network into a city center development project
- Usage: > 430,000 passengers/day
> 65 million/passengers/year
- 3 lines (+1 under construction)
- 111 stations
- 58.9 km in the network:
- 11 km using ground-level power supply technology
- Maximum speed of the Citadis rolling stock: 60 km/h
- 1997: project launch
- December 2003: opening of Line A
- Spring 2004: opening of Lines B and C
- 2007-2008: Lines A, B and C extended
- 2015: Lines A and B extended
- 2016: Line C extended

STAKEHOLDERS

► **Public:**

- "Bordeaux Métropole", formerly known as CUB (Communauté Urbaine de Bordeaux), which is an area containing 28 communities within the Bordeaux conurbation and which has almost 750,000 inhabitants, is governed by the authority of transport of the metro-pole of Bordeaux (TBM)
- SYSTRA: prime contractor for the construction of the Bordeaux tram network

► **Private:**

- Alstom supplied the ground-level power supply technology via its subsidiary Innorail, and 105 Citadis 402 and 302 trams (750 VCC + APS)

► **Operator:**

Keolis Bordeaux Métropole is the company responsible for operating the TBM network (3 tram lines, 65 bus lines, 1 river taxi, etc.).

► The tram network is open from 5:00 a.m. to 12:30 a.m. on Thursdays, Fridays and Saturdays.

IMPLEMENTATION

► The start of the work in 2000 until completion of Line A three years later, were required to install the first tram line.

► In all tram projects, it is necessary to re-route existing distribution networks (e.g. water, gas, electricity, telecoms, sanitation, etc), adjust pavements and roads, construct tracks and concrete platforms, and lay the rails. Finally, the operating equipment was installed: electrical power supply using a catenary system, platforms and stations, signalling equipment, the maintenance and storage site, and passenger information and ticketing systems.

► At the end of the design and construction phases, trials were conducted prior to opening the network to the public.

Alain Juppé, Mayor of Bordeaux
22/12/2003

“ For a long time, Bordeaux dreamed to have a tram network: modern, silent, comfortable, non-polluting – it’s the public transport solution for the 21st century. This tram network responds to Bordeaux’s aspirations and perfectly showcases our magnificent stone architectural features. **”**

RESULTS

/// Part of the Bordeaux Urban Project, this tram network has been an integral aspect of renovating the historic city centre and improving the lives of Bordeaux’s residents.

/// The modal shift in terms of total circulation on the tramway has been achieved thanks to the 21 park and ride sites (with 5,000 spaces), the addition of cycle lanes, and guarded cycle parks. Preserving and improving the environment with the tram network meant that it was discreetly integrated into the historic architecture. Outside the city centre, the tram platforms are grassed and a vibration damping system is applied when the trams approach built-up areas.

/// During the work, the tightness of the famous Pont de Pierre, crossing the Garonne, was resumed and a special track was laid to not overload the bridge.



FINANCIAL ASPECT OF THE OPERATION

/// The Bordeaux Metropolitan tram network services an economic area of 340 000 salaried employees and a catchment area of 3.8 million people.

/// With almost 750,000 inhabitants and an expected demographic growth of 6.2%, this metropolitan area is set to reach 1 million inhabitants by 2030.

→ Overall cost of the project:
Phases 1 to 3, 1.65 billion Euros





A COMPREHENSIVE INNOVATIVE DESIGN APPROACH TO PUBLIC TRANSPORT

COMBINING PERFORMANCE, COMFORT AND ATTRACTIVENESS

METTIS, THE METZ METROPOLE BRT (BUS RAPID TRANSIT) NETWORK

Veritable backbone of the new Le Met transport network, the two METTIS Bus Rapid Transit lines are encouraging the city's inhabitants to see public transport in a new light thanks to the introduction of innovatively designed new vehicles (24-metre articulated buses powered by hybrid technology). Thanks to the completely overhauled lines, on-demand services, three park and ride facilities, and interoperable contactless ticketing with major transport authorities in Lorraine, the Metz Métropole public transport system has been totally redesigned in under five years.

INNOVATIONS

- ▶ These series hybrid vehicles operate like a generator
- ▶ There is no physical connection between the heat engine and the wheels
- ▶ No more gearboxes
- ▶ Adapted for circulation in busy urban environments
- ▶ Heat engine diesel generators operate in stable conditions
- ▶ 20% fuel savings
- ▶ Fewer CO₂ emissions and nitrogen oxide

KEY DATA

- 17.84 km on its own site of which 5.6 km is on a shared route
- 27 articulated vehicles (24 metres long), which are extremely easy to operate thanks to two steering axles (front and rear), plus an integrated low floor and special access equipment for riders with reduced mobility.
- There are four large double doors to ensure that passengers can get on and off the bus quickly; large panoramic windows keep passengers connected to the city
- 155 places per vehicle, 45 seated places and 2 places for wheelchair users
- 2,400 passenger/hour/direction in the morning rush-hour
- 635 P+R places

STAKEHOLDERS

- ▶ Metz Métropole launched a Public Service Concession tender for transport in order to achieve its objectives i.e. to transform its network in order to provide the community with a comprehensive mobility offer. The contract was awarded to the KEOLIS Group on 1 January 2012. It resulted in the creation of the Société Anonyme d'Economie Mixte Locale des Transports de l'Agglomération de Metz Métropole (SAEML TAMM).
- ▶ Metz Métropole holds 60 % of the capital, Keolis 25 % and SNCF 15 %.

IMPLEMENTATION

- ▶ **2009** • Application for the Declaration of Public Utility and public inquiry & Candidature selected for the METTIS project during the first Call for Public transport projects (on own site)
- ▶ **2010** • Start of preparatory work and network detours
 - Declaration of Public Utility Decree)
- ▶ **2011-2012** • Platform and surface work
 - Constructing the maintenance centre
 - Re-naming the network
- ▶ **2013** • Finishes and dry runs
- ▶ **7 octobre 2013** • Launch date

Jean-Luc BOHL,
CEO of Metz Métropole

Nouméa, Barcelona, Birmingham, Quebec and other cities have since expressed considerable interest in our concept. The advantages are multiple: in terms of design, the buses' lines are streamlined and elegant, and integrate perfectly into our urban environment without seeming out of place and adding a touch of modernity at the same time. The hybrid operating mode considerably reduces greenhouse gas emissions and noise pollution. The vehicles' lowered floors and visual and aural notifications inside the bus optimise accessibility for riders with reduced mobility.

RESULTS

/// Economic attractiveness

- 36,000 passengers/day
- A 40% growth in the number of journeys a day

/// Social cohesion

- 37 totally accessible stations (every 500 metres)
- The project included social clauses in the awarded contracts enabling 120 job seekers to secure employment for a total of 85,451 hours

/// Protecting and improving the environment

- A «façade à façade» urban planning approach along the entire route

/// Responsible use of resources

- Savings of 288,000 litres of diesel a year



THE FINANCIAL ASPECT OF THE OPERATION

- /// The investment budget for the Mettis project was €230 M. In order to balance the budget, it was necessary to form financial partnerships with a range of actors: The State, Lorraine Regional Council, European Union, the cities of Metz and Woippy, the Moselle General Council and ADEME.

KEY FIGURES

- Overall cost of METTIS: €230 M (excl. tax)
- Rolling stock: €29 M (excl. tax)
- Infrastructure and platforms: €145 M (excl. tax)
- Maintenance centre: €36 M (excl. tax)
- Surveys and project management: €20 M (excl. tax)

FRANCE
URBAINE
MÉTROPOLES, AGGLOS ET GRANDES VILLES

LE MET'
Metz Métropole vous transporte

Metz Métropole
COMMUNAUTÉ D'AGGLOMÉRATION

SYSTRA



CYCLING FACILITY IN CHARTRES

CONTRACTING AUTHORITY SUPPORT FOR THE CREATION OF AN INNOVATIVE BICYCLE FACILITY IN THE CHARTRES TRAIN STATION

As part of the modernization of the transportation hub of the Chartres train station, the agglomeration community wanted to integrate a dedicated space for a range of bicycle services: rental, parking, information, promotion... The assistance offered by INDDIGO led to the opening of a dedicated 150 m² area in Chartres Station.

INNOVATIONS

- ▶ In comparison with other cycling services that have been developing in France since the mid-2000s, the current project wanted to focus on the organizational and social aspects.
- ▶ This is why the project integrates different areas dedicated to welcoming local bicycle associations and others involved in the cycling community.
- ▶ A reading area with a range of books suitable for all ages (travel guides, travel stories, maintenance manuals, and children's books) is freely accessible to those in the train station.
- ▶ Also, since a number of routes dedicated to bicycle touring pass through the city ("Paris – Mont Saint Michel", for example), the service aims to address both the needs of daily users and tourists.

THE STAKEHOLDERS

- ▶ The management of the service is organized in-house with the agglomeration community staff. Communications, including visual identity and service promotion, were also driven internally by agglomeration community personnel.
- ▶ The management staff were given training sessions for bicycle mechanics and maintenance. Furthermore, local associations signed on to help ensure part of the maintenance of the bicycle fleet.
- ▶ Finally, the implementation of this bicycle facility in the heart of the train station would not have been possible without the provision of the premises by SNCF.

KEY FIGURES

- 100 bicycle parking spaces in the station
- 300 rental bikes including touring bikes, city bikes, tandems, children's bikes and electric bikes
- Approximately 150 m² including a reception area, a meeting room and a reading room

IMPLEMENTATION

- ▶ In the context of a framework agreement with the Centre region, Inddigo accompanied the agglomeration community of Chartres in the implementation of a cycling facility.
- ▶ The mission for the contracting authority involved detailing the technical specifications for the project: determining the quantity and types of equipment, contributing to the space layout and design, drafting the request for proposals, defining the visual identity of the service, etc.
- ▶ Cost estimations were also conducted in order to identify recurring costs for the community.
- ▶ The timeframe for this mission was rather constrained; it was carried out over less than three months.

The Bicycle facility is accessible from the railway station to fit the needs of residents and travelers and initiate a real complementarity between the train and the bicycle.

It reinforces the position of the city of Chartres as a step in the tour between Paris-Mont-Saint Michel and Saint-Jacques de Compostela. It also provides a starting point for bicycle routes of the Green Plan.

RESULTS

- /// As an average-sized agglomeration community, Chartres Métropole was able to offer a bicycle service to a wide group of users, all while taking care to limit the impacts on the territorial budget. For example, the bike facility has an operating cost 3 to 4 times less expensive than that for operating a bicycle-sharing system.
- /// The flexible mode of operation has allowed the facility to accommodate various additional functions. Since opening, the facility has added on a self-repair bike workshop.
- /// The agglomeration community has already received a trophy from the Club des Villes et Territoires Cyclables (the Club for cycling cities and territories).



FINANCIAL ASPECTS OF THE MISSION

- /// Approximately 70,000 € in initial investment.
- /// Around 80,000 € per year in operating costs for the cycling facility.

→ Chartres Metropole now offers a complete range of services while meeting its requirements on financial impact control for the community



CITYMOBIL 2

TRIALLING DRIVERLESS VEHICLES IN THE PUBLIC DOMAIN

For four and a half months, six 10-seat driverless vehicles circulated in the streets of La Rochelle. Over 15,000 people were transported in driverless vehicles as part of a large-scale autonomous public transit pilot scheme.

INNOVATIONS

- ▶ This demonstration was the first in the world in an open public domain.
- ▶ The innovations were numerous: driverless vehicles had to be developed and adapted to mass transit needs, the vehicles had to communicate with traffic signals and adapt to the practices of traditional drivers. This pilot scheme has also helped change the law as French ministries used this demonstration to draft new regulations.

STAKEHOLDERS

- ▶ **Steering the project:** Urban community of La Rochelle (public)
- ▶ **Partners:**
 - City of La Rochelle (public)
 - EIGSI (private)
 - Proxiway - Transdev (private)
 - Robosoft (private)

KEY DATA

- 6 autonomous vehicles
- 15,000 journeys on board
- 4 and a half months of daily operating

IMPLEMENTATION

► Over two and a half years of preparation to remove technical, regulatory and administrative hurdles in this world's first and convince the public of the relevancy of such a system.

Very well-received by all ages and has changed opinions about driverless vehicles.

RESULTS

- /// This project has enabled the manufacturer of autonomous vehicles to plan ahead and get to grips with commissioning issues; it has also shown other cities that this type of project is feasible. Similar projects have since been trialled in Europe and regulations have been relaxed.
- /// La Rochelle has received considerable attention in the field of innovation and has been visited by numerous delegations and countries in light of this initiative.
- /// Over 10,000 children have been made aware of eco-mobility and future mobility solutions thanks to this project.
- /// **Smart Cities Award for La Rochelle in 2015**



FINANCIAL ASPECT OF THE OPERATION

- /// €600,000 of partner contributions (not including the supply of the vehicles).
- /// Subsidised by 50% by the European Union.

KEY DATA

- A small-scale investment for a trial lasting under six months (€150 K)
- Benefits for the dynamics of such a large region



CONNECTED CARPOOLING STATIONS,

FUTHE FUTURE OF SUSTAINABLE MOBILITY
IN PERI-URBAN AND RURAL AREAS

COVOIT'ICI, THE CAR IS THE NEW PUBLIC TRANSPORT

The partnership of the ecov company, the LVMT Laboratory and 4 major Ile de France local authorities led to the COVOIT'ICI connected carpooling stations network commencing operations at the beginning of 2016 in the French Vexin area. Following the first 7 operational stations, 13 more stations are to be deployed in the Fall 2016.

INNOVATION

► If long-distance carpooling has seen exponential growth in recent years thanks to web platforms (Blablacar), the several local carpooling apps and websites created in the past few years have yet failed to mobilise a substantial number of drivers. Their digital-only approach is furthermore unsuitable for peri-urban and rural areas where the Digital Divide is a reality. Our solution is different from other carpooling services because it offers both digital and roadside physical interfaces. Using connected street furniture/roadside connected hardware, our carpooling stations enable drivers passing by to participate and offer their free seats with no effort. The presence of hardware also helps institutionalizing, organizing and securing the practice.

STAKEHOLDERS

► Members of the consortium behind the COVOIT'ICI experimentation are:

- **ecov**, startup developing the technology,
- **le Parc Naturel Régional du Vexin**,
- **the Regional Council of Ile-de-France**,
- **the Val d'Oise department**,
- **the Seine et Vexin community** (today Grand Paris Seine & Oise),
- **the LVMT laboratory.**

KEY FIGURES

- **7 stations running in September 2016, a total of 20 in late 2016**
- **Around 1,000 people signed up since service launch**
- **Affordable for the passenger: 1,20€ for a 10 km ride**

IMPLEMENTATION

- ecov takes care of station installation and maintenance, service operation and customer support. Station components can be installed (and moved if needed) in one day.
- Station placement is determined by preliminary studies of the local mobility needs and road network configuration. The inhabitants are encouraged to participate in the design of the service using surveys and presence on the ground.
- ecov also manages the drivers&passengers community management using both modern web tools, social networks and local events.
- Finally, a mobile app offers smartphone owners additional features making the experience easier and safer.

What do our customers have to say?



It works 24/7?

That's great, especially for the weekends!

I used to hitchhike when I was young so now I try to return the favour but times are changing and people are getting wary. The safety features brought by COVOIT'ICI are great news.

COVOIT'ICI is good for small towns, here we only have buses for the children going to school, two in the morning and two in the late afternoon, that's all!

I carpool with Blablacar for long-distances but it requires planning. COVOIT'ICI is a lot more flexible.



RESULTS



/// Increased mobility...

In rural towns like Chars, inhabitants need to travel several times a day to destinations that are not always easily reached by public transport. For a destination 17 kms away, a ride on the bus takes an hour whereas it only takes 20 minutes to reach it by car.

/// ... and rationalization of the transport system

People driving alone have empty seats they can offer to passengers making requests at the stations, thereby providing affordable transport solutions for both daily and occasional mobility needs.

/// In line with the 37101 ISO standard

COVOIT'ICI is a mean to reach the three main objectives of the 37101 ISO standard: economic efficiency, social cohesion and environment protection.



PROJECT ECONOMICS

/// ecov sells ridesharing stations to local authorities and then operates the service, debiting a fee on each transaction between passengers and drivers to cover the maintenance costs.

/// The ridesharing stations being a major innovation serving the general interest, local authorities willing to buy some can apply for regional, national (TEPCV in France) and European subsidies.

→ Ile-de-France region funds 50% of investment costs.

→ 3 €/km service fee

→ ridesharing station as affordable as a bike-share station





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MÉTROPOLE INTELLIGENTE



DECREASING HOME-WORK TRAJECTORIES

IN THE LYON METROPOLITAN AREA

CAR POOLS IN GREATER LYON

ONLYLYON 
LA MÉTROPOLE

Based on « employee habits and lifestyles », the approach aims to reach concerted actions amongst all users of public and private transportation to design the appropriate systems to « home-work and professional » travel.

To provide support in areas of employment, a travel management system has been implemented in partnership with companies. Currently, this new system is used by roughly 400 companies, employing over 60,000 employees.

Concerted actions will lead to the implementation of Inter-Company Travel Plans (ICTPs), as well as drafting of action plans that list multimodal possibilities to reduce the use of sole-occupant cars for home-work and professional itineraries, (better use of public transportation, car pooling, bikes, encouragement of remote working, etc.).

INNOVATIONS

- ▶ To provide local support for this system and to encourage changing travel habits, « travel leaders » have been assigned to the employment areas. They are sponsored by company associations, with the financial support of Lyon Métropole.
- ▶ A car pool portal has been created that enables any employee or resident to find a car pool for travel to work. Practices are currently being evaluated.
- ▶ For more information on the car pool portal, see: www.covoiturage-grandlyon.com

STAKEHOLDERS

- ▶ Management will be led and coordinated by Lyon Métropole with a specific approach for each type of use, through the Planning Department's « time » mission.
- ▶ Concerted action federates private and public partners: company associations, companies, transportation authorities, communities, ADEME and the Auvergne-Rhône-Alpes Region. These actions are beneficial and profitable for all partners.
- ▶ For more information, all actions are described on our site: www.temps.millenaire3.com

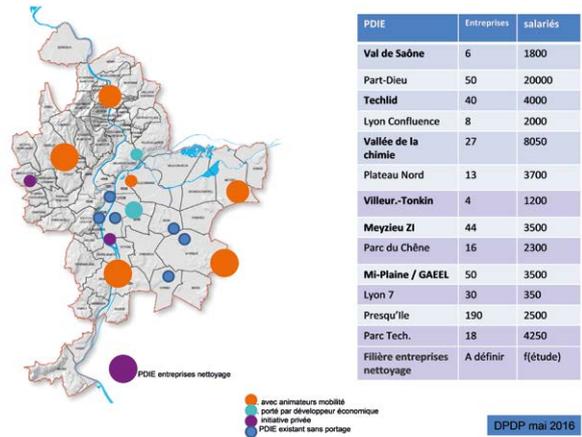
KEY FIGURES

- 14 ICTPs being developed and concern 400 companies employing 60,000 employees
- The proportion of sole-occupant cars has dropped by 7 points in certain areas (2014 evaluation)
- 19,500 people are registered on the car pool portal, including 24% who effectively share cars (2013 evaluation)

IMPLEMENTATION

- ▶ Action began in 2007 following requests from private companies seeking better and more sustainable means of professional travel.
- ▶ The specific approach based on user habits and local marketing provides a real advantage and guarantees successful action. Lyon Métropole's commitment to financially support this project also ensures its continuity. Nevertheless, the main difficulty stems from long term company participation.

14 ICTPs – 500 establishments and 60,000 employees



RESULTS

- /// 19,500 people were registered on the portal in the summer of 2016. Around 300 people sign up each month.
- /// Partner companies receive a stimulation pack that includes posters, a flyer, newsletter and games on social networks.
- /// Several communication campaigns have been implemented.
- /// 2013 evaluation: 24% of effective car sharing, generally by two people over an average itinerary of 28 km. This represents:
 - 1,500,000 km saved each month
 - 5,400 fewer tons of CO₂/year
 - €1,627 saved each year
- /// 2014 prize for the best communication.



FINANCIAL SCOPE OF THE OPERATION

- /// In proportion to the number of kilometers saved, the annual cost of the bid and community investment is very low.

→ Annual budget for the service provider bid, supervised by Lyon Métropole: €200,000



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REDEVELOPMENT OF “LES HALLES” DISTRICT IN PARIS

AN AMBITIOUS PROJECT WITH THE SITE KEPT IN OPERATION



Inaugurated in April 2016 following 5 years of works, the Canopy sits proudly on top of the second largest shopping centre in France, a range of cultural facilities and the busiest underground station in Europe.

Located right at the heart of Paris, this was one of the construction projects of the decade and a challenge from the technical, spatial and timing standpoints. To renovate and modernise this 6 ha aging site, Paris City Council commissioned Artelia with general coordination services and oversight of overall project technical coherence. The site and the public transport hub remained in operation throughout the works, representing a major innovation in construction site management.

KEY DATA

- Redevelopment of public spaces above ground: gardens, pedestrian square, etc.
- Redevelopment of underground public spaces: pedestrian malls in the “Forum”, staircases and lifts, etc.
- Construction of the Canopy: mixed programming of public facilities and shops
- Redevelopment and upgrading of underground roadways
- Redevelopment and extension of the Châtelet - Les Halles public transport hub

INNOVATIONS

- ▶ **A huge and complex project requiring excellent coordination:** about ten interconnected public space redevelopment operations carried out above ground and underground required the use of new architectural, construction and building site management methods.
- ▶ **Long-term works at a site kept in operation, without reducing its appeal:** in spite of the scope of the works, the “Forum” and the public transport hub remained in operation throughout the 5 years of works. This allowed 800,000 daily users to continue visiting the shopping centre, which lost none of its appeal.
- ▶ **Sustainable management of the works:** they were completed in compliance with the “low environmental impact and limited nuisance” works charter.
- ▶ **Model of the Canopy waterfall:** a scale model of the 10-metre high waterfall that flows from the roof of the Canopy was studied in Artelia’s hydraulics laboratory to make sure it would operate as planned.

STAKEHOLDERS

- ▶ When Paris City Council decided to launch a complete overhaul of “Les Halles” district in central Paris in 2002, a host of players became involved in the huge project.
- ▶ The Greater Paris regional council participated in the redevelopment of the district. The STIF and RATP (regional public transport operators) were in charge of renovating the enormous “Châtelet – Les Halles” station. Lastly, the SCFHP (authority in charge of managing the shopping centre) managed the transformation of the “Forum”. The works were broken down into several sub-projects managed by several project developers.
- ▶ Local inhabitants and business owners were able to contribute to the works through the “works steering committee”, which met once a month to draw up the works charter.
- ▶ Artelia was the lead firm for project management services concerning urban spatial coordination.

dination aspects, coherence of the overall urban planning project, and technical interfaces between projects. It was in charge of coordinating general scheduling and spatial aspects during all phases of the various projects, managing operation of the building site facilities, and overseeing overall coherence of safety measures applicable to public buildings.

IMPLEMENTATION

- ▶ Artelia was involved in the “Les Halles” project right from the start, providing project management services with a particular focus on sustainable development. It then assisted Paris City Council with the competitive tender process for the redevelopment of Les Halles district before being appointed to oversee the works.
- ▶ The complete overhaul started at the end of 2010: the building site facilities were installed and the Willerval pavilions were dismantled. Next, pollution remediation and asbestos removal operations were required on several installations prior to launching the works to build the new structures.

A working method combined with a digital tool to make the huge building site as inconspicuous as possible

GELITRA (a French acronym for management of deliveries and traffic) addresses a simple need: avoiding the need for any building site machinery to park or impede traffic on roads close to building site entrances at any time of day.

This application provides dynamic management of traffic in and around building sites. The regulation process is structured and optimised by a digital tool and a method developed by Artelia specifically for Les Halles project.

With this service, Artelia solved the usual headache represented by traffic on building sites located in dense urban environments.



RESULTS

/// Maintaining the appeal of the site by keeping it in operation during the works:

our building site management approach was based on our obsession of guaranteeing safety and keeping the businesses and public transport hub in operation throughout the huge construction works. As a result, the “Forum” retained its appeal as the second biggest shopping centre in France while the station remained the busiest in Europe. The economic prospects of the “Forum” have been boosted by the arrival of 35 new shops and 2 restaurants.

/// A site that is more accessible and better integrated into the district:

redeveloping the site made it possible to optimise this multimodal transport hub at the heart of Paris and make it safer and more modern. Today, it accommodates more than 800,000 people per day.

/// A new living environment:

the new cultural facilities offered on site improve the quality of life and the well-being of users. The wide range of services on offer gives the site an original identity.

/// Responsible use of rainwater:

a system recovers rainwater from the Canopy, which flows through the waterfall.



FINANCIAL ASPECTS OF THE OPERATION

/// The total cost of the “Les Halles” project amounts to about 918 million euros before tax; this amount may be higher than the initial estimate, but the increase was limited. All the partners involved in the programme contributed to its funding.

/// The economic spin-offs generated by the redevelopment project are going to be huge. Indeed, the number of visitors is expected to increase by several million per year, making the “Forum” the third largest shopping centre in Europe.

KEY FIGURES

- €918m: total cost of the redevelopment works
- 66,000 m² surface area
- 800,000 passengers in the hub every day
- 150,000 shoppers in the “Forum” every day
- 35 new shops
(150 shops predicted, compared with 115 currently)



FRANCE'S LARGEST BIKE STORAGE FACILITY LOCATED IN GRENOBLE RAILWAY STATION

MAKING URBAN GREEN MODES OF TRANSPORT EASIER TO USE AND MORE ACCESSIBLE

The Grenoble multimodal interchange hub occupies a strategic position in the city and is an important link between the city center, the Polygone Scientifique science district, the Europôle business district and the neighbourhood of Berriat. All the city's modes of transport are contained within the hub. One of the first objectives of this project was to un-clutter the station forecourt by freeing it of cars and creating a large area by pedestrians and greener modes of transport.

JOINING UP DIFFERENT MODES OF TRANSPORT

- ▶ The **Grenoble multimodal interchange hub** has been designed to operate as a **vital part** of the city. A new development policy has been devised to facilitate switching from one mode of transport to another, a phenomenon known as **intermodality**. Under this new scheme, **green modes of transport** have been given priority.
- ▶ The aim of the two bike garages and numerous cycle parking facilities (located within the boundaries of the multimodal interchange hub, near the station forecourt and around Place Schuman, on the other side of the platform area) is to **develop and promote cycle use in the city**.
- ▶ Three types of cycle parking are available on both sides of the station: bike lockers (pre-reserved enclosed boxes) for regular daily cyclists, temporary parking (exterior hoop stands) and communal secure parking for users of rail and suburban transit systems.

THE OBJECTIVE

The objective is to encourage green modes of transport with more than **1154** cycle spaces:

- An eastern garage with secure space for 552 bikes, by the pedestrian walkway between the passenger and coach station buildings.
- A western garage with secure space for 598 bikes on platform 4 in the northern extension of the new station entrance, along Rue de la frise.
- Parts of the garages have been planted to meet the objectives of the station hub in terms of urban integration.

MULTIPLE CLIENT TEAMS

- ▶ The eight partners of this ambitious, multi-component project have awarded its overall coordination to **Gares et Connexions**, a branch of **SNCF**, which has been named as sole client (following signature of an agreement). Design and construction was awarded to **AREP**, a multidisciplinary engineering consultancy and subsidiary of **SNCF**.
- ▶ **SNCF** is the client of the passenger services component and **SNCF Réseau** of the railway rights-of-way component. **Grenoble City Council** is the client of the urban works component (Schuman car park, access roads), **Isère General Council** owns the bus station component and **Grenoble-Alpes Métropole** is the client for the cycle component (cycle parking).

CYCLE GARAGES FOR A MORE ECO-FRIENDLY APPROACH...

- ▶ Using bicycles instead of cars to get around cities is currently very popular, and they are also used to access other modes of transport (interurban trains or coaches). The French government has also introduced an Active Mobility Action Plan (**PAMA**) to encourage cycle use in towns and cities.
- ▶ Following the government's lead, Grenoble city council took the decision to promote cycle use in the city from the area immediately around its railway station.
- ▶ Giving French citizens a choice of transport, and working towards more eco-friendly travel options were the key motivations behind the cycle garage project in Grenoble.

CYCLE GARAGES, A POWERFUL SYMBOL IN THE CREATION OF THE GRENOBLE INTERCHANGE...



The originality of the project meant that a new type of construction had to be included in legislation governing buildings open to the public i.e. structures used for cycle parking. Each of the garages took nine months to complete. The planned opening date is late September 2016.

A RESPONSIBLE PROJECT SITE...

/// Optimal management and social initiatives for the interchange works...

Throughout the construction project, environmental initiatives were implemented, such as water recycling, discharge filtering and reuse of some materials already present, thus guaranteeing sound site management.

Building works were only carried out during the day to limit noise pollution and minimise disturbance for users and local residents. Sound-insulating barriers were erected for noise control and the ground was watered to minimise dust generated by the site. In terms of social responsibility, companies working on the site and selected by works management guaranteed that 7% of their workforce were on employment integration programmes.

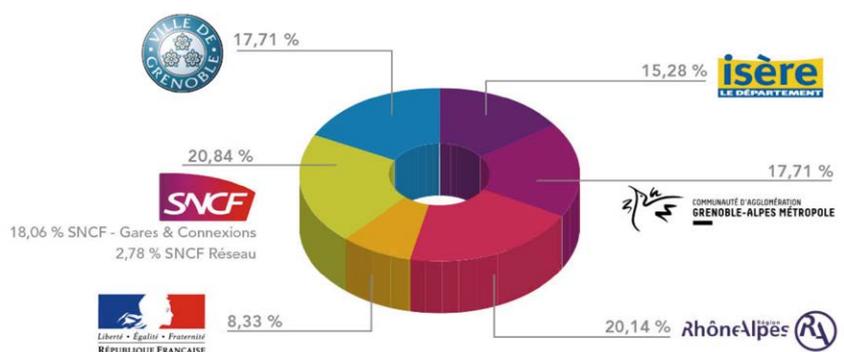
Building site cabins were decorated with a fresco depicting the history of Grenoble railway station by **ROCADE SUD**, a group of local artists.



A PARTNERSHIP PROJECT ...

/// 7 funding partners contributed to the refurbishment, development and modernisation of the Grenoble interchange hub.

- The Grenoble station interchange hub project required investment of almost €34.5m
- Tender for the metal components won by **CAMPENON BERNARD**: €3,456,133 ex. VAT, of which €2,642,000 for the 2 bike garages





AN ENVIRONMENTAL AND ARCHITECTURAL APPROACH TO INTERCHANGE HUBS

TRAM LINE 11, THE “TANGENTIELLE LÉGÈRE NORD” (TLN)

A new railway line known as “Tangentielle Légère Nord” (TLN) is a suburb to suburb tram-train link that will connect Epinay-sur-Seine to Le Bourget and is due for completion in 2017.

The first 11-kilometre section will serve seven stations and has required the creation of five passenger buildings and three additional access routes. The Tangentielle project will improve intermodality and promote the use of green modes of transport.

KEY DATA

- 15-minute travel time between Epinay-sur-Seine and Le Bourget.
- 60,000 passengers/day.
- 5 possible connections to date with other rail networks.
- Eco-designed buildings with innovations allowing:
- Savings in drinking water estimated at 700 m³ per year.
- Photovoltaic production of 43,000 kWh/year i.e. a CO₂ saving of 16 tonnes.

INNOVATIONS

The buildings of the TLN stations were designed to reduce their environmental impact.

- ▶ Advantages of a glass-metal construction system:
 - Factory prefabrication for a dry construction system on the site.
 - A modular design for easy adaptation to each site and given requirements.
 - An extendable modular frame for further expansion of the built area.
 - Demountability and separability for end-of-life environmental management of the building.
- ▶ The solutions deployed included: a rainwater harvesting system for watering and WCs, geothermal exchangers for heating and cooling, controlled natural ventilation and a photovoltaic.

STAKEHOLDERS

- ▶ The project method allowed effective management of subsequent developments in the initiative by involving a large number of stakeholders with overlapping areas of responsibility: SNCF Mobilités, SNCF Réseau, town councils, public development bodies, departments, municipality groupings, social landlords and the various transport companies involved (metro, RER, tram, bus, etc.).
- ▶ In particular, the regional transport authority (STIF) orchestrated the intermodal component which ensured standardised management of the respective urban challenges (integration of stations in each restricted site, interconnections).
- ▶ In terms of the buildings, innovations in environmental quality derived from the programme specifications were also jointly defined by the client teams and construction teams.

IMPLEMENTATION

- ▶ Creating the superstructure using a dry construction system limits the risks of pollution, environmental nuisance, and water and energy consumption, thus improving the environmental impact of the TLN project.
- ▶ Integration of an “environmental management” criterion for scoring companies and awarding tenders.
- ▶ Innovative photovoltaic panel assembly technique, permitted by an ATEX procedure (assembly process validated through expert technical assessment).



RESULTS

- /// The TLN improves intermodality by facilitating suburb to suburb travel without passing through Paris and its largely radial network. It connects with 10 other rail lines (existing and future) and promotes cycle use with the inclusion of secure bike shelters.
- /// All TLN stations are accessible to people with restricted mobility and the climatic comfort of semi-open public spaces is guaranteed through passive means.
- /// The TLN runs alongside the already existing Grande Ceinture freight line for optimal integration into the urban landscape.
- /// The TLN stations will make the areas around them more attractive and contribute to the development of suburban landscapes while ensuring respect for the environment, in particular the Georges-Valbon departmental park, classified as a Natura 2000 area (protection of species, conservation of groundwater bodies).



PROJECT FUNDING

KEY DATA

- Amount invested for development of the entire operation (rail lines, stations, access): €639m
- Cost of rolling stock: €51.9m

- /// Under client team SNCF Mobilités, the amount invested for the 7 stations totalled €35.66m, distributed as follows:
 - State: 34.19%
 - Ile-de-France Region: 58%
 - Seine-Saint-Denis Departmental Council: 6.77%
 - Val d'Oise Departmental Council: 1.04%



The Vivapolis network aims to federate French public and private stakeholders involved in conceiving, building and operating sustainable cities, in France or abroad, in order to improve synergy and help them be, individually and collectively, more efficient in their action.

www.cohesion-territoires.gouv.fr/vivapolis

These sheets have been produced by the Vivapolis network members, who attended 5 different work groups to promote examples of innovative solutions for sustainable cities.

Work groups jointly run by:

Circular economy:

**Alice Sarran, OREE / Jean-Christophe Daragon, EuroMéditerranée /
Nicolas Prego, Suez**

Citizen participation:

Marianne Malez, FNAU / Alain Renk, Urbanfab / Catherine Savart, Veolia

Energy:

**Maud Lelièvre, Eco Maires / Fabrice Bonnifet, Bouygues /
Claude Thouvenin and Franck Lesueur, Eneki**

Integrated urban utilities and digital platforms:

**Amandine Crambes, Ademe / Jacques Perrochat, Schneider Electric /
Adrien Ponrouch, TERA0**

Mobility:

**Camille Roccaserra-Vercelli, Fédération des EPL / Christian Dubost, SNCF /
Annabelle Ferry, AREP / Jean Bergounioux, ATEC ITS**

Each file focuses on a unique theme. Some solutions may address several themes, but they will appear in one file only.

Some of the solutions are also included in another file edited by France Urbaine together with Vivapolis: "A French Experience of Smart Cities" which presents a set of innovative solutions implemented in several French cities.