

setec

m a g a z i n e



in the headlines - p.10

An engineering commitment to the transport and mobility of tomorrow

in the headlines - p.2

The role of engineering and other key stakeholders on a major Eole-type project

features - p.23

The future of mobility: the emergence of connected and innovative transport

Editorial

Transport and mobility are at the heart of our daily activities and our economic and social lives. With 130.5 million tonnes of CO₂ emitted in 2022, the transport sector remains the largest source of greenhouse gas (GHG) emissions in France (32%), with car use accounting for 53% alone*.

One third of **setec**'s activities involve transport infrastructure. In order to meet the challenges of the French Low Carbon Strategy and in line with our Engineers & Citizens approach, the **setec** group has made low-carbon mobility one of the pillars of its social commitments. Fully aware of the impact of our activities in the field of mobility, we are committed to proposing alternatives and developing specific expertise to achieve the goal of decarbonisation. This year, 2024, highlights many transport projects that meet these objectives, some of which began more than a decade ago. Projects that have mobilised a large number of employees, all from different subsidiaries, committed to improving the daily lives of our fellow citizens, and ready to take on unprecedented technical challenges. Monumental projects, such as the Eole extension to the west, a key project for mobility in the Greater Paris region, which was awarded the National Engineering Grand Prix in 2019 and in 2023 by the International Tunnelling & Underground Space Association (ITA) prize. Since May 2024, it has been providing better service to the regions of the Greater Paris area, while complying with environmental standards; or the Greater Paris transport network, with the successful opening in June of the extension of line 14 south, ahead of the Olympic Games. Innovative projects, such as hydrogen-powered trains and planes, or new rail signalling systems, which combine a commitment to decarbonising transport and compliance with safety imperatives. Projects to improve travel for several million people, such as Bogotá's first metro line, one of the longest in South America, due to be in service in 2028. More than ever, let's continue our efforts to ensure that carbon-free transport is no longer the norm for tomorrow's mobility, but rather for today's, by committing ourselves to sustainable projects.

Enjoy your read.

Anne-Marie Choho, Michel Kahan

*Source: SDES, Annual transport report 2022 - Edition 2023
<https://www.notre-environnement.gouv.fr/actualites/breves/article/quel-est-le-niveau-des-emissions-de-gaz-a-effet-de-serre-denos-transport>

The role of engineering and other key stakeholders on a major Eole*-type project

... STAKEHOLDER PANEL



Guillaume LE RÉVEILLÉ
Project Director of construction
for VINCI SPIE Batignolles
consortium



Xavier GRUZ
Eole Project Director -
Nexteo / SNCF Réseau



Jean SOUSA
Project Director
setec tpi



Vincent DROUY
Project Director of the MOE SED
(consortium: **setec** – Egis –
Duthilleul) **setec tpi**



More than ten years of hard work and commitment were necessary to bring the Eole project, the new corner stone of low-carbon mobility in the Île-de-France region, to a successful conclusion. How do you succeed in mobilising teams over such a long period of time, overcoming technical challenges and sometimes doubts? How do you work together, as project owner, project manager, contractors and architect, to ensure the success of a project of this scale? We asked the people involved in this project, and more specifically those working on the new CNIT La Défense station, to share their thoughts on the success of the project and how they see the role of engineering in the completion of such a project.

In your opinion, what are the keys to the success of working together on a project of this technical and ambitious nature?

Jean Sousa: "You need to establish a genuine partnership between the client, the contractor and the project manager. And you must have a common interest: the interest of the project. It was a huge technical achievement, and without regular communication between everyone involved, it would have been impossible to complete the project."
Vincent Drouy: "In my opinion, the key to success is communication, and this is all the more important when you're in the construction phase, given the uncertainties that can arise

when managing a project of this complexity... Communication must be transparent and regular with regard to the various people involved in the project, in order to provide them with all the information they need on the progress of the project so that they can make the necessary decisions quickly and appropriately."

Guillaume Le Réveillé: "On a project of this scale, the role of each of the three main stakeholders is crucial: the client, who defines the programme; the project manager, who designs the project; and the construction contractor, who carries it out. For the success of such a complex project, it is important that these three main roles talk to each other frequently, and that each one fulfils that role effectively, fully aware of their responsibilities. The various stakeholders must be able to communicate, listen to and trust each other, and maintain a certain humility in the face of the work in progress, to make it all possible."

On this project, or any other of a similar scale, how do you define the role of engineering?

Xavier Gruz: "Engineering on such a complicated project is the technical expert. They are the people responsible for designing the work and guaranteeing that it can be built, that it will withstand the test of time and that it meets the challenges. Knowing exactly how to deal with all the issues that make up the complexity of these structures is fundamental, and the CNIT la Défense station is a good example of a project for which technical expertise was an essential element. The **setec** teams were able to understand the issues, make decisions and show considerable technical expertise."



For me, as project owner, the key to the success of a project of this scale is the trust we have in our project manager and contractors. The relationship must be forged and maintained throughout the project.

Xavier GRUZ
Project Director, Nexteo /
SNCF Réseau

front page

”

Organisation, discipline, perseverance and the ability to manage crisis situations are all essential qualities for good engineering on projects of this scale.

Vincent DROUY
Project Director of MOE SED
setec tpi



The Cnit La Défense train station project was completed in May 2024, after more than a decade of hard work by employees.

Looking back, what are you most proud of?

Jean Sousa: “Apart from the technical achievement represented by the underground works, my greatest pride lies in the human aspect. We all worked together to make this project a success. On Eole we were all part of the same family, all **setec** subsidiaries included. It's thanks to this understanding that we were able to put all our skills to good use.”

Vincent Drouy: “It's a source of personal pride to have been able to contribute to the project for so long (2015 to 2024). More collectively, I agree with Jean Sousa; I am delighted to have succeeded in working as an integrated team with members from diverse and varied backgrounds. We managed to overcome any difficulties that came our way”.

Guillaume Le Réveillé: “My proudest moment is to be standing in the middle of this station today and talking to you as an active participant and witness to this achievement. When you look back at what we did a few years ago, no one could have imagined that it was technically possible. We have succeeded in making this a reality thanks to a collective spirit. The station was built without any disruption to the CNIT, which remained open throughout the underground works. The other great success is, of course, the human adventure.”

Xavier Gruz: “This project has already won awards, and we may win more. But what I'm most proud of today is undoubtedly the way people perceive the stations now that they've been completed. At La Défense, when passengers get off the train, they are amazed by the grandeur of the station, and their first instinct is to take out their phones and take photos. It's the best reward of all”.

The architect's viewpoint

I've been working with **setec** for over thirty years on several projects, including stations in the centre of Paris. For the La Défense station, I knew that together we would build a creative team with the engineers who are inventors.

And although the final volume of the CNIT station project is very simple, it was undoubtedly very complex to build. Each engineer in his or her category had to be able to invent solutions to the problems that lay ahead, and everyone had a creative part to play. In my opinion, this is what characterises **setec**.

Creating and inventing a place to breathe and meet people, in the world of La Défense which can sometimes seem rather harsh and austere, is something that has motivated us all enormously. Today, seeing passengers in awe when they set foot on the central platform by the grandeur and sheer purity of the station is truly rewarding.

Jean-Marie DUTHILLEUL, architect of Eole stations



Decarbonised mobility by setec

We take a look at our decarbonised mobility challenge and setec's commitment to supporting projects that include proposals to decarbonise mobility, with Aurélien Bigo, associate researcher at the Energy and Prosperity Chair, and specialist in energy transition in transport, and Marc Ollivier, deputy general director of setec international and coordinator of the decarbonised mobility challenge.

... INTERVIEW



Aurélien BIGO
Transport Energy
Transition Researcher



Marc OLLIVIER
Deputy General Director,
setec inter

In 2021, when Aurélien Bigo was asked to participate in the elaboration of our **"Decarbonised Mobility Guide"**, he advised us on the different transition levers identified in his thesis (moderation of transport demand, modal shift, improvement of vehicle occupancy, reduction of vehicle energy consumption and decarbonisation of energy).

A brief background: the decline in greenhouse gas emissions from the transport sector is continuing, but it is not happening fast enough.

Aurélien Bigo: “Emissions from oil combustion are continuing to fall. However, according to the latest report from the French High Council for the Climate, we will need to “accelerate” this decline if we are to achieve our carbon neutrality targets by 2050. On a trend basis, we note that the fall in emissions is partly linked to the electrification of the vehicle fleet, but we must not forget the indirect emissions from the production of electricity and vehicles. However, this reduction has been slow to materialise in terms of sobriety. Certain economic factors may have contributed to limiting demand for transport, notably the Covid crisis and the subsequent rise in oil prices.

These factors were therefore endured rather than planned, but they did help to limit the rise in demand for transport. If we look at other levers, such as modal shift or vehicle occupancy rates, public policies are being put in place, but not enough to bring about significant reductions in emissions”.

Coming back to our guide on low-carbon mobility, it has been distributed to all our employees so that they have a clear and informative base...

Marc Ollivier: “Our guide is intended specifically for our engineers. It is based on Aurélien's work and starts by presenting the issues and the 5 levers for decarbonising mobility. It then details the energy challenges in France, from production to distribution, including uses and the adaptation of different types of energy to modes of transport. Finally, it gives our engineers the tools they need, with practical examples covering different types and phases of projects, to make the most of these levers for low-carbon mobility and apply them to our projects”.

AB: “This guide is very useful, particularly if it helps engineers take proactive action in advance of

projects and plan them with a clear and overall vision. Take the example of a new tramway. We can take into account its rebound effects or positive synergies, such as the reorganisation of the road network, the introduction of safe cycle lanes during the works, and the modal shift towards other modes of transport, such as walking or cycling. There are also energy aspects, in this case electricity consumption and the associated energy issues...

Our engineers are involved in all types of projects, at every stage, from design to operation. They are also interested in the functionalities and design of certain transport infrastructures such as roads.

MO: "Yes, we can activate decarbonisation levers on all transport infrastructures: for example, the development of dedicated lanes for public transport (VRTC in French) or for vehicles with a high occupancy rate (VR2+), (lane reserved for vehicles with 2 or more passengers). We can act as prime contractor or in a consultancy capacity for project owners in the planning and programming of future developments. When it comes to complex projects, the way we manage them is crucial, and we base our approach on the ten commitments set out in our manifesto.

As an independent engineering company, we also have control over the choice of projects we wish to work on.

MO: "These decisions are in line with **setec's**

Go / No Go policy. We have collectively decided not to accept projects that go against our choices in terms of decarbonising mobility. For airports, for example, there are still infrastructure needs, but we must avoid taking a position on developments that could lead to a significant increase in air traffic.

AB: "Certain trends, such as the increase in air transport or the rise in vehicle weight, are not sufficiently regulated by the public authorities. However, to make this transition a success, it is essential to align all levers in the right direction, and in particular that of moderating air and road traffic.

With this guide, it is also necessary to take into account the infrastructure and energy situations in each country.

MO: "In fact, we are adapting to different environments and developing our guide according to each context. In France, for example, we are seeking to readapt our roads to more low carbon uses, while in other countries it is still necessary to open up certain regions.

Different energy contexts can also lead to different recommendations in terms of mobility.

And if we could take a look at setec's work on the subject of carbon-free mobility.

AB: "I'm delighted to see an engineering company like **setec** tackling this issue. Highlighting this vision can have a domino

effect on all the stakeholders involved. It's a positive step to ensure that all **setec** projects are up to the challenge.

MO: "This guide and our manifesto for low-carbon mobility form the basis of our commitment, with a scientific and technical foundation and a solid general policy, which we are endeavouring to share with everyone through the training courses (the mobility frescoes) offered to our employees. It is now up to us to move forward to the next stage: proposing our range of low-carbon mobility services, which will be based in particular on an observation centre for our activities in this field.

Aurélien Bigo wrote his thesis, between 2017 and 2020, on transport and the challenge of energy transition.

Exploring past and future, technology and sobriety, acceleration and slowdown? "

The aim of this thesis was to explore how we can achieve carbon neutrality in France by 2050.

He then worked on ADEME's future scenarios. He is now a research associate at the Energy and Prosperity Chair, and in 2023 published "Cars, Fake or not?", a book explaining mobility transition.

#1 Inter-city

INTERVIEW



Caroline CAYZAC
Deputy Director of the Mobility
& Transport Department
setec international

Territories shaped by rail, carbon-free mobility

Rail has a central role to play in the National Low-Carbon Strategy, which aims to reduce greenhouse gas emissions over the short, medium and long term. The backbone of transport in France, train transport is a reliable, low-carbon, virtuous solution, already largely electrified and the most efficient for mass flows. By meeting the travel needs of the territories it serves, this capacity-enhancing form of transport also contributes to their development and continues to shape them.

In what way do high-speed rail lines affect the regions they cross?

setec has been involved in a number of high-speed rail projects, both in France and abroad. Among them, the LGV Bretagne - Pays de la Loire (BPL High-Speed Line: BPL HSL) project, where **setec** first conducted socio-economic studies as early as 2003. We were then involved in the design studies for 5 of the 7 work packages for Eiffage Rail Express (ERE).

setec also managed the BPL HSL Socio-Economic Observatory, in a consortium with the Espaces et Sociétés Laboratory (UMR CNRS 6590) and INRAE (UMR SMART). Established in 2012 and completed in 2023, this observatory brought together a large number of stakeholders: the government, regional representatives, SNCF Réseau, Eiffage Rail Express, economic operators, town-planning agencies, etc.

In particular, this has made it possible to assess the direct and indirect effects of the high-speed line (HSL) on the regions and territories concerned, both during the construction phase and the operating phase:

effects of the construction work and economic spin-offs, effects on employment, tourism, agriculture, modal shift and travel habits, attractiveness and territorial dynamics, etc. A summary of these ten years of observation was presented at the Observatory's closing ceremony.

Among the conclusions to be drawn, analyses have shown that the BPL HSL has been a major factor in the renewal of the territories it serves: railway station neighbourhoods have transformed and have once again become urban hubs, meeting places, commercial centres, multi-functional and multi-modal, etc.

The Trains d'Equilibre du Territoire (TET) provide a mainline service between main French towns that are not linked by a high-speed train. How do these areas benefit from the services offered?

setec is part of the group working with the Ministry of Transport on the development of TET lines and the redeployment of night trains, helping to identify potential additional rail lines, estimating traffic and

associated revenue, and adjusting the service in the light of traffic potential and operating and maintenance requirements. By providing passenger rail services of national interest, TET's help to open up regions on inter-regional routes and contribute to decarbonising transport by providing a real alternative to car and air travel on long-distance routes with night trains.

How can the French rail network adapt to changing mobility needs and meet the objectives of decarbonising transport?

setec is involved in discussions about the long-term future of the rail network. For example, we are currently working for SNCF Réseau on projections of mobility needs over the next 20 years. The aim is to translate these changes into train path requirements on both high-speed and conventional lines, and at different time periods. Several development scenarios are being studied, considering the potential arrival of new rail operators as well as changes in travel habits and modal shift.

setec's 10 COMMITMENTS to decarbonised mobility

- 1. Provide our clients, at each phase of our assignments, with a holistic vision that goes beyond organisational barriers** and includes the complete cycle of energy production and use, as well as mobility habits and behaviors
- 2. Focus our development** on activities where we have the greatest impact
- 3. Include the criterion of project relevance by analysing their functionality** and carbon footprint in our choice of assignments
- 4. Dare to challenge the program of our mobility projects** to accelerate their decarbonisation
- 5. Systematically propose the integration of carbon impact** in multi-criteria analyses
- 6. Continuously invest in research and innovation,** supporting the ideas of our employees and partners
- 7. Develop tools** for a strategic assessment of the impacts of our projects
- 8. Train all our employees** working in the field of transport and mobility
- 9. Promote our guide** to low-carbon mobility amongst our employees
- 10. Take action is to control** our own mobility



Ludovic ENGEL
Project Director
setec ferroviaire



Gilles FOUQUÉ
Project Director
setec ferroviaire

I HIGH-SPEED LINES: setec's STRATEGIC INVOLVEMENT

Since the early 2000s, setec has been working with the public contracting authority, Réseau Ferré de France (RFF), on high-speed rail projects in France. Historically inaccessible to private engineering companies outside the civil engineering sector, these projects have gradually enabled **setec** to consolidate its position in the rail sector and build up a comprehensive and exportable know-how. Gilles Fouqué and Ludovic Engel, Project Directors at **setec ferroviaire**, and Karim Amry, General Director of **setec technologies**, tell us more about this strategic move and its impact on the development of the group's activities.

How did setec get involved in HSL projects in France?

G. Fouqué: Historically, RFF (now SNCF Réseau) first developed the HSL network with the help of contractors such as Alstom. The first design tenders were for the first phase of the East HSL, and it was at this point that **setec** began to work on the civil engineering design. Our expertise was confirmed and extended with the Rhine-Rhone HSL, for which we won two of the three geographical civil engineering lots and were also awarded the railway system design in partnership with Egis.

What have been setec's most important HSL projects and what lessons have you learnt so far?

G. Fouqué: In addition to the East HSL and the Rhine-Rhone HSL, we played a key role in the Bretagne-Pays de la Loire (BPL) HSL, which was won by Eiffage under a public-private partnership contract. In addition to the traditional tasks of project management, lead designer and site supervisor (as part of the Eiffage teams), we had the opportunity to work on new subjects such as RAMS studies (Reliability, Availability,

Maintainability and Safety), the safety case documents, the management of the testing and commissioning of the railway interface tests with the SNCF, and the management of the interactions between the works and the testing and commissioning of the HSL, to name but a few and site supervisor alongside the Bouygues team as part (CNM-Contournement Nîmes - Montpellier), the first mixed freight and passenger line to be built under a public-private partnership contract, which also consolidated our growing expertise.



Each project has strengthened our expertise and enabled us to take on more and more responsibilities.

Can you tell us a little more about the development of setec's expertise on the CNM project?

L. Engel: On the East HSL, we were involved in the design of the catenary power supply system, but SNCF kept the responsibility for the integration testing and commissioning of the system integration. On the CNM, we supervised and took responsibility for all the

substation and catenary testing and commissioning. This demonstrates the trust we have gained from SNCF, who have monitored and supported the development of our expertise in these complex tasks. We have been able to systematically deliver fully operational installations on time, consolidating our relationship of trust with our client.

What value did setec add?

G. Fouqué: On the Rhine-Rhone HSL, we introduced a new construction method by incentivising companies to focus on results rather than resources. This innovation not only improved overall efficiency, but also reduced operating costs. It was a turning point for the SNCF, which at the time was usually in charge of its own construction sites. This approach has proved effective and is now used by SNCF Réseau.

How do you see the future of setec in the railway sector?

L. Engel: We intend to continue developing our skills in France and internationally. The experience we have gained on the major French high-speed lines enables us to tackle a wide range of projects, such as the High Speed 2 in the UK, the TER in Dakar and the extension of the Eole line. Our methodology is adaptable to other projects, giving us increasing legitimacy in new markets. The renewal of the existing network is also a real challenge. In 2017, we began work on the renovation of the RER C rail line in Paris and the Greater Paris Region, again on behalf of SNCF Réseau. The aim is to modernise the existing infrastructure and implement innovative solutions, while maintaining the safety and continuity of rail services. This is a major challenge, but it also opens up new opportunities to apply the expertise we have acquired on high-speed lines to dense urban environments.



I MOROCCO'S KENITRA - MARRAKECH HIGH-SPEED LINE



Karim AMRY
General Director
setec technologies

Following the success of Africa's first high-speed line linking Tangiers and Kenitra, Morocco is continuing to develop the high-speed rail network with the completion of the Kenitra-Marrakech line. This ambitious project involves the combined expertise of **setec Maroc**, **setec international**, **setec tpi** and **setec ferroviaire**.

Linking the cities of Kenitra and Marrakech, the Moroccan high-speed rail project has major ambitions in terms of mobility and connectivity between the country's main cities, as well as facilities for the football World Cup in 2030. **setec** is supporting the Office National des Chemins de Fer (ONCF) (Moroccan National Railways Office), in this project, by carrying out the complete technical studies for the second lot of the project, which concerns the 150-kilometer section between Ain Sebaa and Nouaceur. As Oussama Khomsi of **setec Maroc** explains, "The purpose of the Moroccan high-speed lines is to encourage a modal shift from road passenger transport to rail, thanks to a high-quality service that will drastically reduce journey times. In the long term, this

convergence between regions will change the face of Moroccan mobility by helping to reduce the carbon footprint of journeys thanks to greater intermodality, as well as encouraging residents to settle along the HSR axis". Youssef Kriem, General Director of **setec Maroc**, added: "The project is divided into 3 distinct lots. The challenge for the lot that concerns us is quite significant. It involves combining the challenges specific to this geographical area, with the challenge of constructing within running infrastructures in a dense urban environment marked by numerous interferences between passenger lines and freight lines, while ensuring overall and coherent optimisation of the network. We deliberately confirmed our desire to work on this project, because the combined expertise of all our experts means that we can fully manage this complexity. Today, we have almost completed the tender documents for the civil works. In parallel with these consultations, we will also be developing the detailed design and then the execution studies. Our assignment should therefore be completed in the first quarter of 2025.

setec technologies was created in 2022 in Rabat, Morocco. It provides assistance to subsidiaries, such as **setec Maroc** and **setec ferroviaire**, across all rail infrastructure markets, specialising in catenary and signalling design studies for both new lines and refurbishments.

We are working on the High-Speed Line between Kénitra and Marrakech, providing our expertise in catenary and innovative signalling technologies such as ERTMS (European Rail Traffic Management System) level 2. SNCF Réseau's "Qualification 13100" certifies that **setec** complies with quality and safety standards for railway infrastructures.

It is a difficult certification to obtain, and we are proud of this recognition, which confirms our ability to carry out rail projects in compliance with European standards.

I SUPPORTING DEUTSCHE BAHN

After a long and demanding pre-qualification process carried out in partnership with the Swiss company GESTE Engineering, **setec** has signed a framework signalling agreement with Deutsche Bahn to support the renovation and modernisation of its rail network. This marks the start of a particularly strategic collaboration for **setec**, which intends to put its railway expertise at the service of the decarbonisation of mobility in Germany. As Pierre-Edouard Tisserand, International Director of **setec ferroviaire**, explains, "Germany is investing massively to renovate, modernise and develop its rail network between now and 2030, and will need significant resources in rail systems engineering to carry out these investments. We therefore thought it would be

particularly interesting to contribute to this effort by combining all our expertise and resources and supporting this ambitious modernisation and renovation programme. Over the last twenty years, we have supported SNCF Réseau in renovating and modernising the French rail network, in particular by carrying out work on closed lines. We have the operational know-how to support Deutsche Bahn, which now has a similar approach. Antje Vogdt, head of development in Germany, adds: "Our partnership with GESTE Engineering enabled us to win a framework contract for signalling and telecommunications last March. Our aim now is to satisfy Deutsche Bahn by targeting the projects that best match our expertise, in order to offer the most relevant solutions for their network".

Behind these massive renovation projects for the German infrastructure network lies the key challenge of decarbonising transport, a subject to which **setec** is particularly committed.



I THE MONTPELLIER - PERPIGNAN NEW RAIL LINE

The Montpellier - Perpignan New Rail Line (LNMP) is an important element of the European rail network. It will initially link Montpellier to Béziers, then Béziers to Perpignan.

As Hugo Robles, Engineer with **setec organisation**, explains, "The project has multiple objectives: to complete the high-speed European infrastructure, to develop freight on the Mediterranean corridor with a new combined line, and to increase the range of daily transport services between Sète and Nîmes. On this last point, the project will "free up space" on the classic line, making it possible to increase the number of daily services, as part of the future SERM (Services Express Régionaux Métropolitains) in Montpellier".

Led by SNCF Réseau, supported by the **setec** group, the first 50 km phase (Montpellier-Béziers) is scheduled to come into service in 2034. Innovation and environmental protection are at the heart of the project. The line, which will follow the A9 motorway, will offer an alternative to the existing rail route,

which is very close to the coastal line. This double track will increase the resilience of the rail network in the face of climate change, particularly in the event of rising water levels impacting traffic. Guillaume Kpamegan, head of the eco-design approach, explains: "We have profoundly changed our methodological approach by integrating eco-design within the coordination team, which is completely new. We are also seeking to incorporate the project into local development. By planning to use local suppliers, and by working closely with them right from the start, we will anticipate the project's considerable needs. This approach is intended to be part of the HQE Infrastructures Durables environmental certification."

setec is playing a crucial role in the construction of the LNMP as owner's engineer for the programme. Under the guidance of Claire Defargues and Mathieu Papa, teams are analysing and updating previous studies. They are also identifying the need to acquire additional data in order

to draw up a techno-environmental performance programme. The aim of this programme is to encourage future bidders for the design-build contract to come up with high-performance, innovative and environmentally friendly solutions to make this new line a benchmark for major rail infrastructure.

”

We have profoundly changed our methodological approach by integrating eco-design within the coordination team, which is completely new.

Guillaume KPAMEGAN
setec inter

I HS2 RAIL PROJECT: FOCUS ON SECTIONS C2 AND C3

The High-Speed 2 (HS2) project is one of the UK's most ambitious infrastructure projects. The aim of the first phase is to improve connectivity between London and Birmingham and stimulate the economy between these two major cities. **setec** is acting as co-contractor within a dedicated design consortium (Arcadis, setec, Cowi) working for the Kier Ferrovial BAM construction consortium which is responsible for the 80 km long central sections C2 and C3 of the project.

As Stephen Leo, Business Development Manager at **setec consulting engineers**, explains, "The HS2 project, and in particular sections C2 and C3, will generate significant socio-economic and environmental benefits. It creates local jobs and helps regenerate towns it passes through. The client, HS2 Ltd, is also committed to responding to local needs, including improving public transport networks and access to essential services. Optimising connectivity between cities will therefore ultimately facilitate everyday transport, as well as boosting the attractiveness of cities and encouraging

commercial investment. In environmental terms, HS2 will reduce road traffic and carbon emissions by encouraging a modal shift. The space freed up for freight transport on the existing rail lines will improve road safety and reduce the maintenance costs of the road infrastructure, which is currently saturated.

The construction of HS2 is accompanied by a comprehensive environmental mitigation strategy. As part of this, **setec** has been involved in creating green corridors along the route to promote biodiversity and has been heavily involved in recycling and reusing materials to minimise the environmental impact of construction activities". Arnaud Giron, Project Director, **setec international**, adds to these comments by mentioning the multicultural and multi-site aspect of the project: "**setec's** tasks on HS2 include the coordination of geotechnical issues, project-level studies, participation in the optimisation team, external and internal controls of the studies and coordination between the various stakeholders. Working on such a vast and



complex project in English requires close collaboration with teams of different nationalities and cultures. This multicultural dimension not only enriches our exchange-based approach, but also brings with it a number of logistical and organisational challenges, not least because most of the **setec** teams are based in France. Electronic document management (EDM) obviously plays a crucial role in ensuring rigorous monitoring and fluid communication between the various project stakeholders.

#2 Urban and suburban, guided daily transport

...
INTERVIEW



Olivier NAU
Deputy General Director
setec its

Everyday rail services for local populations

In a context of urban growth and densification, urban and suburban transport infrastructure is essential to meet people's mobility needs. Olivier Nau reviews the current state of everyday transport and the challenges ahead.

What is the current need for transport infrastructure in major cities?

As cities grow and become increasingly dense, the need for heavy transport infrastructure becomes obvious. Mass public transport, combined with lighter solutions such as buses or cycle paths, is essential to offer an effective alternative to the car, which, although still necessary in some areas, is showing its limitations in densely populated areas. In France, the major city centres are already very well connected, but the suburbs continue to grow in population and require new infrastructures.

This is the case with the Greater Paris project. But the greatest needs will be internationally, such as with Bogotá, a city of 11 million inhabitants, which is currently building its very first metro line.

How can we improve links between less densely popu-

lated areas and public transport networks?

Once urban areas are well served, it is crucial to connect these networks to more remote areas.

We need to offer alternatives to car use for people living in less densely populated areas, which are often too far from urban transport networks.

Rail has a major role to play, often by building on existing infrastructure such as, in the French context, the future Metropolitan Regional Express Services.

What are the challenges and prospects for everyday transport in the coming years?

With the growth of urban areas and the challenges of decarbonisation, the need for transport infrastructure will continue to grow.

The number of automatic metros in service worldwide will have doubled by 2030 compared with 2020, and the

trend will continue, particularly in the many cities and countries that are under-equipped. This is obviously the case in Africa, where the stakes are enormous, with the excellent examples of the TER in Dakar and the metro in Abidjan. But it is also the case in certain industrialised countries such as Canada, where not all cities have yet achieved a sufficient level of mass transport coverage.

What are setec's commitments to promoting sustainable mobility solutions?

We are committed to directing our development towards more economical and sustainable mobility solutions, while integrating the societal challenges of access to mobility in all regions. Our priority is to develop capacity-enhancing public transport, linking it with other mobility solutions, with a view to the rational use of travel to serve the development of populations and regions.



Fabrice DROUIN

General Director, **setec ferroviaire**



Fabien Paszko

Operational studies coordinator,
setec ferroviaire

Metropolitan Regional Express Services (SERM) aim to strengthen public transport services in major French cities outside the Greater Paris region, by offering rapid and frequent mobility solutions to users in urban and suburban areas. The French law adopted in December 2023 has simplified the implementation of these projects, providing a legislative framework and tools to speed up their development.

As Fabien Paszko explains, "These services will enable a significant step forward in the quality of mobility services in more than 30 cities. The aim is to improve users' daily commuting and reduce their journey times,

I METROPOLITAN REGIONAL EXPRESS SERVICES (SERM - SERVICES EXPRESS RÉGIONAUX MÉTROPOLITAIN)

Boosting and decarbonising everyday mobility

Metropolitan Regional Express Services (SERM) represent a major initiative to improve mobility in French metropolitan regions. Often compared to the Île-de-France Regional Express Railway (RER) networks or S-bahn in Germany, these services aim to offer a fast, reliable alternative to car travel, particularly in dense suburban and urban areas. Here we take a closer look at these ambitious projects, which, although complex to implement, are essential for decarbonisation and the future of transport in France.

by allowing them to simply and quickly link their places of residence to their places of work". SERM should also help to reduce road congestion and promote sustainable mobility, based on a strengthened and optimised rail infrastructure. Finally, in addition to the ecological aspect, SERM also has a socio-economic virtue. "Their purpose is to bring people back to work via efficient services, so that they don't have to bear the high cost of petrol and car maintenance", adds Fabrice Drouin. However, the challenges involved in implementing SERM are numerous, including the need to review and improve passenger information and ticketing systems, and to promote strong intermodality around the rail network backbone. This rail infrastructure must be the structuring vector for low-carbon transport in the region, and form part of a wider, integrated network that promotes interconnection between different modes: bus, train, tram, bicycle, car-sharing, etc.". Technical expectations are high, and the deployment of SERM also requires a viable economic model and appropriate

governance to ensure efficiency and consistency. "The deployment of such transport services represents an extremely significant investment for the Government, and should be carried out in phases," adds Fabrice Drouin. For **setec**, the stakes involved in SERM are high. We will be working on projects that will draw on all the Group's skills, with service improvements to be made within a very short timeframe, taking into account the complexity of their implementation, their territorial and their long-term impact. It is a real challenge that requires all our rail expertise and an integrated approach that is both innovative and flexible," says Fabien Paszko. SERM projects are being developed simultaneously with other regeneration projects, and it is essential that they are coordinated with one another. Implementing SERM will therefore require detailed coordination to ensure the compatibility of these projects and the fluidity of the works. **setec's** role will also be to provide this insight to local authorities to avoid any potential deterioration in the quality of service.

I REGIONAL SERVICES: TER IN THE REGIONS



enough and is leading to a deterioration in the performance of this extensive network (delays or even complete closure of traffic). The decline of the rail network is inconsistent with the need to decarbonise mobility. Proactive public policies will be urgently needed, and these rail lines can help provide an alternative to individual car use and contribute to regional planning in sparsely populated suburban and rural areas.

The 4th European railway package and the French LOM Act (The Mobility Orientation Act) make it possible to consider a "regionalised" and "made-to-measure" model.

The main challenge in sustaining and developing an attractive service on these rail links lies in the complex economic balance that needs to be found between a service that is competitive with that offered by road and costs that are affordable for the public as a whole. The necessary transformation of the LDFT will require profound changes in terms of operations (services, infrastructure), technologies (signalling, energy carriers, axle loads), maintenance and even the contractual terms and conditions proposed for the competitive tendering of these services. All of these developments

will require a very high level of technical expertise over the coming years to allow a radical transformation of the existing system in line with new regional needs. Finally, while the long-term viability of a passenger service has already been established, freight transport remains a marginally addressed issue and is likely to benefit from a broader debate involving industrial and logistics stakeholders, in addition to the transport organising authorities.

In this context of technical, contractual and regulatory developments, the Greater East Region of France has awarded a public service rail transport concession contract, including the regeneration and maintenance of the Nancy-Contrexéville line, to the consortium of NGE (concessionaire, construction, maintenance) and Transdev concessionaire, (operation).

setec is involved in the 1st French competitive tender for the management of infrastructure and operations of rail services

setec has been chosen to provide design and maintenance engineering assistance, as a subcontractor to the TSO design-build consortium.

*International Union of Railways categories

THE CHARLES-DE-GAULLE EXPRESS: A MAJOR STEP TOWARDS IMPROVING MOBILITY IN PARIS

The Charles-de-Gaulle Express is a future 32-kilometre rail link between Gare de l'Est in the center of Paris and the Roissy Charles de Gaulle airport, scheduled for operation in 2027. The aim is to provide fast, reliable and comfortable transportation for air passengers, relieve congestion on existing public transport, particularly the RER B line, and reduce the use of private and commercial vehicles.

The Charles-de-Gaulle Express is a flagship project. By linking Paris' city centre and the main airport in just 20 minutes, every 15 minutes, from 5 a.m. to midnight, it is designed to improve people's mobility and encourage a modal shift from car to public transportation. The Group is involved in the project as design and construction supervision supplier of the railway infrastructure and equipment. The civil engineering works are now complete and works on the rail equipment started in May 2023. They are scheduled for completion in early 2025. The work has included the construction of a trench under the Cap 18 business area and

an engineering structure at the Porte de la Chapelle, which will contribute to the attractiveness of the new Arena district. The CDG Express is part of an approach that reuses existing infrastructure, with only 8 kilometres of new track, thus reducing the environmental impact. In addition, technological innovations, such as the installation of ballast-free tracks, will reduce noise and vibration pollution, as well as reduce maintenance operations thus maximising the availability of facilities.

With the CDG Express, the proportion of car travel will fall from 56 % to 40 % by 2027. This will prevent 330,000 tonnes of CO₂ emissions over 50 years for airport access. The CDG Express will therefore play a major role in transportation's ecological transition.

+ FOCUS ON

SERM in the Hauts-de-France region (North of France)

The **setec** group is assisting the Société des Grands Projets - formerly known as the Société du Grand Paris - in its mission to coordinate the phase of consolidating feasibility studies with a view to submitting them to the French National Commission for Public Debate (Commission nationale du débat public). An inventory of railway infrastructure studies was carried out in order to assess the maturity of the existing studies, identify any missing elements and formulate recommendations for

the future. **setec** is also carrying out an inventory of stations and multimodal interchange hubs in order to characterise the current offer, both from the point of view of mobility and urban dynamics, and to compare it with the future evolution of rail services and regional development. The mission includes a contextual study and support for territorial dialogue, carried out in conjunction with Stratéact, the partner in charge of consultation.

Eole

An extraordinary successful project story

There are certain projects that leave their mark on the careers of those involved, whether through their technical, organisational or human aspects. EOLE, the acronym for Est-Ouest Liaison Express, combines all three of these characteristics, making it an exceptional project.

For more than ten years, a number of **setec** subsidiaries have worked hand in hand to ensure the success of this major project for mobility in the Paris region, right up to the opening of service at the beginning of May 2024. Let's take a look back at the outstanding commitment of those who are part of the EOLE family.



setec provided both technical and human expertise. It was a real inter-generational experience.

The project gave the young engineers an opportunity to get to know setec as a whole. All of the group's entities worked on this project and have a share of responsibility in its success. The EOLE family is the greatest success of this project.

Jean SOUSA

Project Director, **setec tpi**



A technical achievement...

EOLE is an extension of the RER E from Saint-Lazare station to Mantes-la-Jolie, passing through Nanterre, La Défense and Poissy, the main aim of which is to improve daily transport for commuters in the Paris region. **setec** was involved in the project as leader of the design and construction supervision consortium with Egis Rail, the Jean-Marie Duthilleul architecture firm and AREP as subcontractor. The teams from **setec** were responsible for the La Défense sector (station and adjacent tunnels), the Nanterre sector (civil engineering for the rail lines, the station and the construction of the maintenance workshop) and the railway equipment for the entire project. This was a genuine technical challenge in itself for all involved: creating a station underneath a busy shopping centre! The EOLE La Défense station - which is 200 m long, 50 m wide and 20 m high - was designed so that the construction would in no way disrupt the commercial and business activities in the area.

The site was acoustically isolated to avoid disrupting surface commercial activity and the tranquillity of local residents. Existing underground roads were used for deliveries and removal of excavated materials. Under the large CNIT vaulted roof, the internal structures (hotel, shopping centre and car park), which are independent of the vaulted structure and weigh more than 100,000 tons, were temporarily supported by micropiles and then by a transfer slab (the future station ceiling) resting on the future station columns, which were themselves previously constructed in shafts. "This underpinning is the major technical innovation of this project, an achievement made possible thanks to the exceptional expertise of the team", says

Michel Pré, now an expert consultant for **setec tpi**, who led the design and tender procedure for the structural and civil works of La Défense station. "The most delicate part of the underpinning works was when we had to support the existing structure in order to cut out the foundations and replace them with new ones". This piece of technical bravery was awarded the National Engineering Award in 2019. The EOLE project then went on, as a whole, to win the 2023 Project of the Year award, presented by the International Tunneling and Underground Space Association.

...made possible by a unique human commitment

To achieve this technical challenge, the **setec** teams were mobilised day and night, sometimes seven days a week, for several years. "We worked non-stop, with flexible working hours, to ensure the safety and quality of the works. It was a unique experience, which has helped us to develop both professionally and as human beings," says Julie Pinto, engineer at **setec tpi**.

This major project for the group brought together a number of subsidiaries (**setec tpi**, **setec organisation**, **setec ferroviaire**, **setec bâtiment**, **setec opency**, **setec its**, **setec international**, **terrasol**, **setec als**).

One of the strengths of the group is the ability to work together and draw on each other's skills. "We were lucky to work with multi-disciplinary teams with complementary expertise who share the same vision when it comes to the project," points out Antoine Herlin, Project Director for track and catenary construction supervision at **setec ferroviaire**.

+ FOCUS

Focus on a deployment ground for the latest rail innovations

The 55 km extension of the RER E includes 8 km of new underground sections beneath Paris and the River Seine, as well as the creation of 3 stations at Porte Maillot, La Défense and Nanterre la Folie.

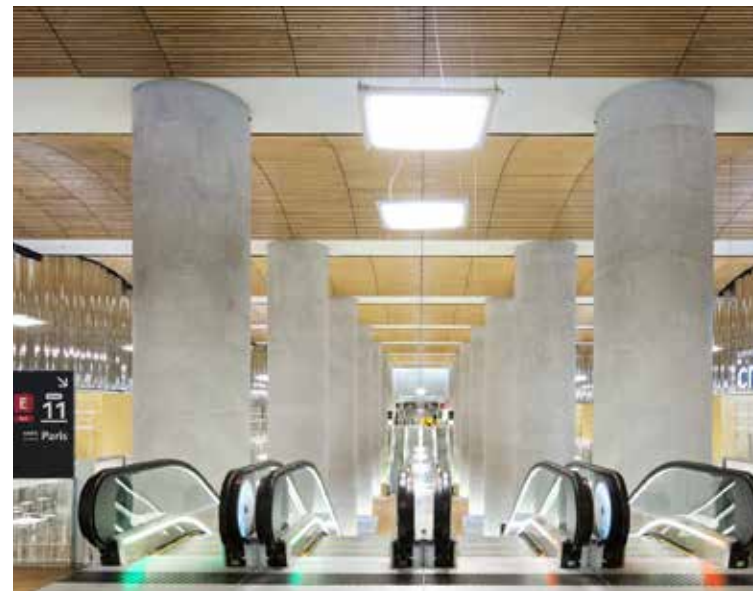
On this emblematic project, the teams opted for concrete track technology, which differs from ballasted track in that the track components, such as the cross-ties supporting the rails, are directly embedded in a concrete slab instead of ballast, and which offers a number of advantages. Innovative anti-vibration track technologies were used, particularly at La Défense station. "One of the challenges was the construction of 16 km concrete track and around twenty track switches in the tunnel, a real technical and logistical challenge at a depth of 40 m, pumping concrete over more than a kilometre through access shafts," says Sophie Benoist, principal engineer at **setec ferroviaire**. The rigid catenary solution was chosen for the tunnel, as this system takes up very little space and requires very little maintenance. Another challenge was to carry out works over 8 kilometres with access and delivery points limited to the shafts which are 800 m apart, and Porte Maillot and La Défense stations, and all of this during intense coactivity with the various civil engineering and rail equipment works. During the rail equipment phase, all three work shifts were in use, with the logistics team working through the night so that the installation teams could keep up the pace on the following morning. The teams had to demonstrate their agility and ingenuity to continually rethink logistic solutions in this changing environment. It was a complex task to coordinate, and that took the works scheduling and coordination teams to extremes prior to the opening of the line for testing, and which became even more complex with the trains running in pre-operational mode during the final year of the project. The success of this emblematic rail project demonstrates the strength of a collective effort, a value that is important to **setec**.



The Rigid Overhead Catenary System at Station La Défense was meticulously planned during the design and construction phases, with more than forty risers adapted to fit into the bamboo cladding on approximately 200m of each track surrounding the station

David HAYOUN

Catenary Work Package Manager, **setec ferroviaire**





I OPENING OF THE METRO LINE 14 SOUTH EXTENSION, A SUCCESSFUL GAMBLE IN TIME FOR THE OLYMPIC GAMES

25 years after it was first brought into service, the extension of line 14 to the south was officially opened on the 24th of June 2024. It is therefore fully functional for the Olympic Games, providing a direct link between the centre of Paris and Orly airport. The **setec** group, as part of the Elios⁽¹⁾ and Séléné⁽²⁾ consortium, took part in the works on the line extension to Orly Airport.

Benefits for users

The extension of metro line 14 will now, for the very first time, link the centre of Paris to Orly Airport in less than 30 minutes. **setec** was actively involved in the construction of the stations located at Hôpital Bicêtre, L'Haÿ-les-Roses and Chevilly-Larue the three stations just after the last stop in Paris. It also runs through a number of towns in the immediate southern suburbs of Paris, which were not particularly well connected until now (Villejuif, l'Hay-Les-Roses, Thiais, Chevilly-Larue in particular).

With these new extensions, Line 14 is now the longest line on the existing metro network, with 14km extension to the south doubling its initial length. It includes 7 new stations: in the north, Saint-Denis Pleyel, and in the south, Maison Blanche, Hôpital Bicêtre, L'Haÿ-les-Roses, Chevilly-Larue, Thiais-Orly and Orly Airport. The stations at Chevilly-Larue, Hôpital Bicêtre, Thiais-Orly, L'Hay-Les-Roses and Maison Blanche have been open to the public since June 2024.

A number of improvements have been made to cope with the increase in service due to the extended line: the number of carriages has been increased from 6 to 8, and the waiting time between 2 trains has been reduced (trains run every 1.5 minutes or even less during rush hour). The number of stations will be increased to 21, with the opening of the Villejuif - Gustave Roussy station scheduled for the end of the year. It will then be linked to the future line 15 South, scheduled to open at the end of 2025.

The key stakeholders

The Société des Grands Projets is financing the project to extend line 14 to Orly Airport. It has assigned the project management to RATP, except for two stations: Institut Gustave Roussy, built as part of the works on line 15 South and Orly Airport, (under contract by SGP). RATP is thus the project manager for the transport systems for the entire extension, including the line to Saint Denis Pleyel to the north. Several **setec** subsidiaries

are involved in the project: **setec tpi** is the civil design and construction supervision prime contractor for the entire project, in association with Systra and 5 architectural firms⁽³⁾ (one for each station), as part of the "ELIOS" consortium, as well as **setec bâtiment**, **setec opency**, **setec hydratec** and **terrasol**.

The project challenges

The extension of line 14 presented a number of technical and organisational challenges. The main challenge was, of course, keeping to the schedule, combined with architectural challenges (almost all the stations have an emblematic passenger building designed with an architectural company that is part of our project management team), as well as technical challenges to guarantee the safety and efficiency of the service, such as the construction of "full-height" platform façades (the first time this has been done on a Paris metro line).

+ FOCUS

I METRO LINES 15, 16 AND 17 OF THE GRAND PARIS EXPRESS

Since 2012, setec its has been working with Egis Rail on the design and construction supervision of the systems for metro lines 15, 16 and 17 of the Grand Paris Express, one of the world's largest infrastructure projects, with more than 125 km of automatic metro lines and 50 stations.

The systems' design and construction supervision mission is of exceptional scale, with the coordination of 38 work contracts involving more than 180 people. The consortium is assisting the client, Société

des Grands Projets in managing activities that are related to rail safety and preparation for commissioning. **setec** is also responsible for managing and coordinating organisational and technical aspects of the project that include quality, costs, deadlines and risks. The main systems are traction, high and low voltage, track, catenary, the multiservice network (RMS in French), ticketing and other systems that contribute to the safety of the infrastructure. A major challenge for this project is cyber security,

in order to achieve the required level of protection while guaranteeing the operation of the transport infrastructure.

The first station on line 16, Saint-Denis Pleyel, opened in June 2024, marking an important step in the deployment of the Grand Paris Express. Line 15 South is scheduled to open at the end of 2025, with test runs scheduled for 2024. Thereafter, lines 16 and 17, with their operational centre at Aulnay, will gradually be brought into service towards the end of 2026.

setec at the heart of the coordination of lines 15, 16 and 17 of the Grand Paris Express

The strategic mission of setec opency, as part of the KEIROS consortium, is to ensure that the Grand Paris Express lines 15, 16 and 17 are coordinated and on schedule.

setec is working as part of the KEIROS consortium, which includes Egis France and Ingérop, on a contract to manage the scheduling and general coordination" ("Ordonnancement, Pilotage et Coordination générale"-OPCG) of lines 15 South, 16 and 17 of the Grand Paris rail line projects. The aim is to guarantee the scheduled commissioning dates of the lines by coordinating and harmonising all the basic tasks of design, purchasing, works, testing

and commissioning. One of the first challenges is to manage an OPCG team of more than 90 people, including twenty from **setec**, an unusual number for OPCG assignments. The coordination and effective management of this team are crucial to ensuring the consistency and efficiency of operations.

Numerous in-house training modules have been used to enhance the skills of our employees. The installation of a project platform in the offices of Société des Grands Projets (SGP) at La Plaine Saint-Denis, (to the north of Paris), has also helped to create a relationship of trust with the client. This

trust has led to the implementation of a rigorous and comprehensive reporting tool, which has proved to be a valuable aid to decision-making and transparency on the project.

Another major challenge was to unite all those involved (project owner, design and construction supervision supplier, works contractors) around the need to respect the schedule. To make it easier to keep to the schedule, **setec** runs workshops to help find collective solutions to the problems encountered, so that deadlines can be met as effectively as possible, while at the same time encouraging the commitment of the teams.

Improving connections between Paris train stations and the Grand Paris Express

setec organisation is providing expertise in project management and operation management, to support the construction of the Grand Paris Express, a vast transport network essential to the future of mobility in the Paris region.

setec has assisted the "Grand Paris Agency", a dedicated unit managing SNCF Réseau's involvement in matters relating to the Grand Paris Express, since October 2023. This project management support mission consists of providing transversal support to the Agency to help implement the interconnections between the existing stations in the Paris region and the future

stations of the Grand Paris Express. The purpose is to support projects in meeting their objectives and improving their performance, whether in terms of managing costs, financing, schedules, risks, etc. **setec** is involved at every stage of project management and the production and circulation of information, with a view to keeping projects under control.

This close collaboration with the Agency Grand Paris aims to provide the appropriate resources for project managers, by coordinating these processes with a view to harmonising procedures, capitalising on experience and continuously improving, but

also by intervening directly in the management of certain projects and in reporting to financial partners, in particular the Société des Grands Projets and Ile-de-France Mobilités.



(1)Elios : Design joint venture lead by setec TPI, in partnership with SYSTRA - (2)Séléné : Joint venture of setec Opency (leader) and Egis to manage the scheduling and general coordination - (3) Groupe-6 for the Maison Blanche station in Paris ; Viguiet & associés for the Kremlin-Bicêtre Hospital ; Franklin Azzi Architecture for the Chevilly Trois Communes station ; Brunet Saunier for the MIN-Porte de Thiais station and Valode & Pistr Architecte for the Pont de Rungis station.



I BOGOTÁ'S FIRST METRO LINE

With a total length of 23.9 kilometres, Bogotá's first metro line (PLMB) will be one of the longest in South America and will be operational in 2028. **setec** is playing a crucial role in this ambitious and eagerly awaited project in Colombia, providing specialised project management consultancy (PMO) services to Empresa Metro Bogotá, S.A., the public company responsible for implementing the project. **setec** is also responsible for technical assistance and the review of critical elements of "the design of the system and operations aspects."

Following an international call for tenders, the concession contract for the construction of the PLMB was awarded to APCA Transmimetro, a consortium formed by China Harbour Engineering Company Limited and Xi'an Rail Transportation Group Company Limited. This consortium, under the name Metro Línea 1 S.A.S., is responsible for the investment, financing, design, construction, commissioning, operation and maintenance of the line.

This colossal project is financed by multiple international stakeholders, including the European Investment Bank, a feature that adds to the challenges of the project itself. Aimed at improving mobility for more than 8 million inhabitants, the PLMB will include 16 stations,

10 of which will be integrated into the TransMilenio bus rapid transit system. To limit the impact on the surrounding area, the metro will run on an elevated track stretching over 24 kilometres in the south-west of the capital, where demand for public transport is at its highest. The electric trains are designed to be energy efficient and environmentally friendly. The PLMB represents a major step forward for the city's infrastructure and will ultimately boost its economic and tourism development, while promoting intermodality and reducing pollutant emissions. Last May, Bogotá's Development and Regional Planning Commission approved a future 3.25-kilometre extension to the elevated roadway.

”

The Consorcio Consultores PMO consortium is made up of setec its, setec Gómez Cajiao, and CyD Ingeniería, a Chilean engineering company. setec plays a key role by providing its complete expertise in project planning, coordination, monitoring and control. Our joint ambition is to contribute to the sustainability, technical excellence and efficient management of this major project.

William G. Peñaloza Díaz,
Administrative Director,
Consorcio Consultores PMO Bogotá

TCSP (EXCLUSIVE RIGHT OF WAY PUBLIC TRANSPORT) IN MOROCCO: MODERNISING URBAN TRANSPORT



Rabat and Casablanca, two of Morocco's largest cities, are in the process of transforming their public transport systems. Rabat tramway, a major project designed to extend the existing network to meet the growing demand for mobility, and the development of a Bus Rapid Transit (BRT)

network in Casablanca, bear witness to the authorities' determination to implement a variety of exclusive right-of-way transport solutions. Officially opened in 2011, Rabat tramway was the first of its kind in Morocco, with two original lines covering around 20 km. Today, **setec** is working on the third phase of the network extension on behalf of Rabat Région Mobilité. This phase involves adding a further 45 km, of which **setec** is currently designing 20 km. These extensions are essential to serve the entire agglomeration and reduce dependence on individual cars. The services currently being finalised by **setec** include preliminary and pre-project design, with commissioning scheduled for 2030. This initiative is part of a global strategy to reduce greenhouse gas emissions and promote more environmentally friendly

modes of transport. At the same time, in Casablanca, the BHNS (Bus Rapid Transit) completes the city's public transport offer. Lines L5 and L6, in service since March 2024, extend over some 25 km. **setec** was prime contractor for the design and construction, once again demonstrating its expertise in the design and deployment of exclusive right-of-way public transport systems. BHNS represents a less costly alternative to tramways, while offering effective solutions for urban mobility. These projects illustrate the desire of the Moroccan authorities to modernise public transport, by focusing on innovative and sustainable solutions. **setec**, and in particular **setec Maroc**, as a trusted partner, continues to play a central role in the construction of these essential infrastructures for the future of Morocco's major cities.

I CYCLE PATHS IN LYON AND PARIS

setec is assisting the Lyon Metropolitan Authority in managing the Voies Lyonnaises project portfolio and coordinating the different stakeholders, in particular by using the Urban Set web-SIG solution. The group is also in charge of project management for several sections of the Voies Lyonnaises and is capitalising on the initial feedback from the design and construction supervision mission for the Paris cycle paths. This involvement reflects the Group's expertise in urban engineering and a strong commitment to sustainable, innovative solutions for cities.

The Voies Lyonnaises network is a major project under the Lyon Metropolitan Council's development plan. By 2030, it will consist of 13 safe, uninterrupted cycle paths, totalling 355 kilometres of facilities, with the aim of tripling the number of journeys made by bicycle by 2026. In addition to high-performance, attractive and safe cycling infrastructure, the network will include comfortable pedestrian facilities, with an emphasis on the environment and improving the quality of life through landscaping features that enhance user comfort in line with current climate



challenges. **setec** is assisting the Metropole with the management of projects to ensure the overall consistency of the portfolio, which is made up of a large number of distinct operations involving a large number of stakeholders throughout the region. Urban Set, the urban strategy planning and management software developed by **set by setec**, is being used to monitor these projects, and to ensure the reliability, synthesis and analysis of the territorial data required for the planning and implementation of the infrastructures. At the same time, **setec organisation** (along with **setec als** and **eocen**) is working in close collaboration with the city's project managers to manage operations on the different sections of the Voies Lyonnaises, providing expertise in both design and construction. To carry out

these tasks, the **setec** teams were able to benefit from initial feedback from the launch of the City of Paris' 2021-2026 Bicycle Plan. Aiming to make Paris a 100% cycle-friendly city, **setec** is in charge of design and construction supervision for the city's cycle facilities, which include 180 kilometres of new cycle paths, including the consolidation of 52 km of existing temporary paths created during the COVID pandemic and 130 kilometres of new cycle paths. **setec tpi** and **international** for the developments, along with **setec its** for the crossroads projects is working in collaboration with Atelier Nous, landscape architect, and Solcy, urban planning and cycling policy consultant, to ensure that the developments meet the challenges of making cycling safer through a complete cycling network in the capital.

I MONTREAL'S METROPOLITAN EXPRESS NETWORK (REM)

setec is actively participating in the construction of Montreal's REM (Réseau Express Métropolitain), the largest public transport project in Quebec in 50 years. This is an opportunity to gain greater visibility in a country where engineering needs are huge and to continue to work towards the implementation of sustainable mobility.

As Christophe Jehannin, Director of **setec Canada**, explains, "The REM is an automated light rail system that will include 26 stations covering 67 kilometres. It is designed to operate 20 hours a day, 7 days a week, and to provide reliable connections between the suburbs and downtown Montreal, as well as links to Pierre Elliott Trudeau International Airport. Added to the existing

public transport systems (underground metro, trains and buses), it opens up a new era of development for public transport in the region. By 2027, it will enable residents to benefit from an automated, reliable and high-frequency metro, which will relieve congestion in the Montreal metropolis on 2 of its major routes to the west and south." **setec** has been involved in this project from the beginning, in 2013, when the Metropolitan Transport Agency set up a project office to carry out studies for the implementation of a new public transport system between the South Shore and downtown Montreal. In 2015, the state-owned Caisse des Dépôts et Placements du Québec (CDPQ Infra), which is in charge of the development of this operation, once again awarded a contract to **setec** to carry

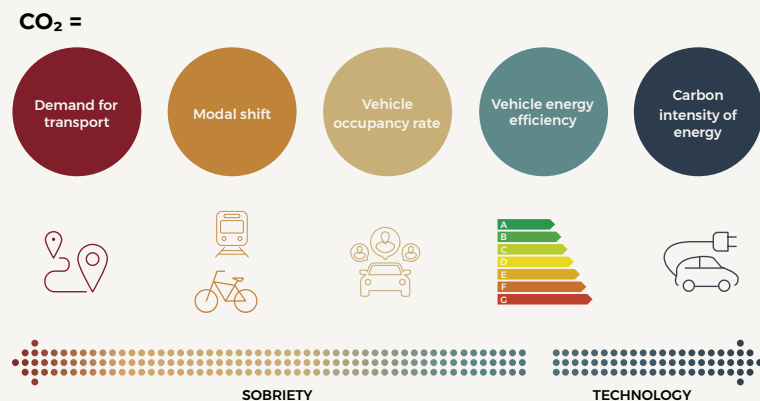
out the design studies in the field of systems and operations. Closely involved in the construction of the REM, **setec** additionally provided design and consulting services to the CDPQ Infra team during the bidding process for the engineering, procurement and construction (EPC) contracts for the rolling stock and operating and maintenance systems (RSSOM). **setec** provided meticulous monitoring of the design, construction, testing and commissioning of phase 1 of the REM, and assisted with the efficient integration of the various project components. **setec** is also supporting CDPQ Infra in supervising the operation and maintenance of the line segment in service and for the remainder of the project, since 80% of the REM is still to be commissioned in the next 3 years.

Auvergne-Rhône-Alpes Mobility Challenge

A renewed commitment by setec Lyon

On June the 4th, the **setec** teams in Lyon took part for the 5th consecutive year in the **Mobility Challenge Auvergne-Rhône-Alpes** region, encouraging employees to use an alternative mode of transport to the car for one day, either by travelling to work by public transport, by bike, on foot or other active modes, by carpooling or by remote working.

For **setec**, this action is part of the mobility plan and our Engineers & Citizens commitment to more sustainable mobility.



Promoted by the region, this challenge encourages participating companies to record the number of employees who use alternative modes of transport to get to work. To do this, they asked participants to complete an online survey or fill in forms provided by the region.

Each employee indicates the means of transport used, the number of kilometres travelled and their usual mode of transport to get to work on a daily basis, in order to measure the modal shift of this activity. Once all of the journeys made have been registered, the region announces the names of the winning companies, according to

their size and location. As Fabienne Bardin, in-house coordinator of the challenge, explains, "This initiative allows employees to try out other modes of transport and to commit themselves more easily to a daily modal shift". For **setec**, the challenge was also to maintain the top spot, as in previous years. Thanks to the strong commitment of its teams, the company won 2nd prize in the category for cities with more than 250 employees per company, with 90% of participants using alternative modes of transport, demonstrating once again the commitment of all involved to this annual event.

I CARBON-FREE MOBILITY CHALLENGE

Giving our employees the means and methods to understand the situation.

At the heart of all economic and social activities, mobility is a major challenge which, in order to tackle the climate crisis, requires rapid and ambitious changes to the way we travel. Decarbonised mobility is therefore one of the major issues that **setec** is committed to tackling, in particular by encouraging employees to develop their expertise in this field and by bringing our Decarbonised Mobility Guide to life.



Designed by and for the Group's employees, the guide to low-carbon mobility aims to give them a very practical understanding of the issues involved in low-carbon mobility and the overall levers for action, by phase and by type of project.

Since February 2023, a training course has been available on a monthly basis to introduce the guide to all **setec** companies and enable any employees who are interested to learn more about the subject. As Denis Seimille, training coordinator for the Group, explains, "The idea is to raise awareness and provide a shared method to encourage each company/engineer working in the mobility and transport sector to take action".

A genuine forum for exchanging and sharing experiences, the training course is organised into 3 stages. Firstly, a collaborative workshop based on the low-carbon mobility fresco. This is followed by an introduction to the guide to low-carbon mobility, setting out the major carbon emission perimeters of the transport sector, defining the levers for reducing CO₂ emissions and understanding the governance of mobility. Finally, there is a hands-on exercise, with an analysis of a project carried out by **setec** and the measures that can be applied to decarbonise mobility, depending on the type of project involved and the stage it has reached.

#3 Focus on Africa

INTERVIEW



Alain BLOCH
General Director
setec Afrique

setec's solution to population and urban growth in terms of mobility within and between African agglomerations

The group has been working in Africa for over 50 years, however, the setec Afrique structure was only created in 2020. What were the reasons for establishing this new setec organisation in Africa?

The creation of **setec Afrique** is the result of several factors. The first was that the needs of sub-Saharan Africa are enormous in areas that **setec** has expertise in, such as transport and water. We also want to create a high-level African engineering sector with local staff trained in the techniques we use. This ambition requires an appropriate organisation to generate work locally, which will be carried out entirely on site or in collaboration with the Group's French companies. Today, we have seven subsidiaries in Africa, in the Ivory Coast, Senegal, Cameroon, Gabon, Congo, Benin and Madagascar, as well as a branch in Guinea, employing nearly 200 people across all these entities.

What is the current state of transport infrastructure in sub-Saharan Africa? What are the issues involved?

Africa is a continent marked by rapid demographic growth and intense urbanisation, at the heart of which appropriate and efficient transport infrastructure is largely insufficient or non-existent. The vast majority of travel is made on foot (70% in Dakar), by motorbike in

some countries, and in collective taxis and buses that are often overcrowded and uncomfortable (25% in Dakar). The private car is still underdeveloped (5% of journeys in Dakar), but the growth in motorisation linked to economic development is hampered by frequent road congestion in major cities, which obviously causes pollution problems. Improving population mobility is all the more vital as it promotes access to education, health and the employment market, and therefore contributes to the economic and social development of the countries concerned. At the same time, there is the issue of energy transition.

If sub-Saharan Africa is to succeed in decarbonising its territories, it needs to have access to public transport that has the capacity, comfort and low hydrocarbon consumption to limit the growth in car traffic; active modes, which are widespread (especially walking), need to be made easier by creating secure, uninterrupted routes (pavements, cycle lanes).

What is setec's expertise in these areas?

The subsidiaries of **setec Afrique** and the French companies with expertise in mobility (**setec international**, **setec its** and **setec ferroviaire**) have acquired major references in Africa on these subjects, by combining their extensive know-how and

knowledge of the region and its particularities. **setec** is involved in sustainable urban mobility plans and therefore considers these issues of carbon-free mobility at a very early stage (planning). We are also closely involved, as design and construction supervision supplier or owner's engineer depending on the assignments, in a number of major projects, such as the RET, Regional Express Train and electric BRT, Bus Rapid Transit in Dakar, and the metro and BRT, Bus Rapid Transit in Abidjan. We are also working in Cameroon, Guinea and Benin.

We not only work on infrastructure, but also on rolling stock (comparing different types of bus engines) and on tools to facilitate operations, such as interoperability in Abidjan or the restructuring of the public transport network in Dakar, integrating ticketing and passenger information systems. In addition, our modelling tools are key assets at the planning stage, but also in terms of evaluating mobility policies. In Dakar, for example, we carried out a study on the evaluation of the negative externalities of transport, i.e. the quantification of the costs of air pollution, noise and transport-related accidents. This study has helped to inform decisions in favour of more carbon-free modes of transport and is of great interest to funding agencies.



This project illustrates the Group's approach to hybridisation of skills among subsidiaries within and outside France. It also strengthens setec Afrique's expertise in infrastructure and urban transport systems.

Joachim NALET
Deputy Director of Major Urban Transport Projects, Contractual Project Director setec its

I THE DAKAR REGIONAL EXPRESS TRAIN

The opening of a Regional Express Train (TER - Train Express Régional) line is a major step towards improving urban and suburban mobility for the 4 million inhabitants of Greater Dakar in Senegal.

This project is part of an overarching and comprehensive approach to improving mobility, begun at the turn of the new millennium, in a capital that is growing extremely fast (population doubled in 20 years) towards the east, from the tip of the Cap Vert peninsula where the historic centre and port are located.

Following the construction of the major roads needed to relieve congestion in the city, including the first urban toll motorway (where setec made a major contribution), the government has now undertaken to build the TER (55 km), the first state-of-the-art electric rail project in West Africa

I THE ABIDJAN METRO

The Abidjan metro line 1 project is one of the biggest infrastructure projects in the Ivory Coast in the last 50 years. It aims to significantly improve urban mobility, promote multimodality and improve traffic flow in the greater Abidjan region. The Abidjan metro is the first mass transit metro line in sub-Saharan West Africa. It will connect Anyama Centre to Félix Houphouët-Boigny international airport, passing through strategic areas such as Abobo, Adjamé and Plateau, and will generate a significant flow of passengers, similar to that of the RER A in Paris. The project also includes major infrastructures, including a viaduct over the Ebrié Lagoon, several rail and road bridges, footbridges and underground passages. The Group is involved as Technical Assistant to the Client (ATMO) in all stages of the project, from project management consultancy (in particular the implementation of the future Electronic Document Management System), to design and



construction supervision. setec's ability to take risks and support the Client over the long term, despite financial and contractual challenges, demonstrates a deep commitment to the development of the Ivorian capital. Several Group subsidiaries are involved in the project: setec Afrique and setec international for infrastructures control and monitoring, setec tpi for the bridges, terrasol for the geotechnical aspects and setec its for project management and the various transport systems. The ATMO team also includes Egis (as a subcontractor) and the Bureau National d'Études Techniques et de Développement (BNETD) (Ivory Coast's National Office for Technical Studies and Deveopment). The capacity building and knowledge transfer with the local setec Afrique and BNETD teams is also a key element of setec's strategy. Today, the project is both in the detailed design phase for the different transport systems and in the construction phase for the infrastructures.

(ERTMS 2 signalling system), to connect the suburbs, the new town of Diamniadio and the new Blaise Diagne international airport, which was built at the same time as the toll motorway. The aim of the TER is to reduce traffic congestion and improve the quality of life of inhabitants, by constituting a pioneering initiative to reduce the carbon footprint of transport in the region. The project is also part of the Senegal Emerging Plan (PSE or Plan Sénégal Émergent), which aims to modernise the country's infrastructure to support sustainable economic growth.

Once completed, this line will serve 14 stations and stops on the outskirts of the capital and will provide a service to the new international airport in less than an hour. The current project is divided into 2 phases: the first, covering 37 km from the centre of Dakar to Diamniadio, was opened to service

at the end of 2021, and the second, covering 18 km between Diamniadio and AIBD airport, will be completed in the 2nd half of 2025. Eventually, the TER line could be extended to Thiès and Mbour, two key cities which, along with Dakar, form the golden triangle of urban development in Senegal. Since 2017, setec has been the design and construction supervision within the contractor's consortium for the Eiffage-Yapi Merkezi-CSE consortium for civil engineering and the Equans-Thales consortium for rail systems. setec's main tasks include design studies (or their external supervision for those carried out by Equans-Thalès), site supervision, test management and coordination of interfaces between the various work packages. Several Group subsidiaries are involved in the project: setec ferroviaire, setec international, setec tpi and terrasol, and of course setec IA, our Senegalese subsidiary.

#4 Tomorrow

INTERVIEW



Anouchka HEBRARD
Deputy Director of Mobility Access Services and Marketing setec its

The future of mobility: the emergence of connected and innovative transport

Through its innovative solutions, connected and intelligent mobility represents the future of transport. Driving this transformation, setec has been involved in numerous projects from design to operation, integrating technical, governance and sustainability aspects. The aim is to create more efficient and environmentally friendly transport systems.

How can mobility be effectively managed by integrating connected technologies?

Unlike two decades ago, today's mobility offering are varied including individual options such as bicycles, scooters and e-scooters. It also involves semi-individual solutions such as car-sharing. Additionally, there are various public transport options such as buses, trams and underground trains.

This diverse range of mobility options requires sharing infrastructures which cannot be easily expanded, especially in urban areas. Connectivity plays a crucial role in this context, by integrating sensors and communication systems into vehicles and infrastructure to optimise the use and management of various modes of transport. Advanced technologies enable real-time data collection and analysis, leading to better data flow management and more efficient resources allocation.

For example, passenger information and operating assistance systems (SAEIV Système d'aide à l'exploitation et

d'information voyageur in French) provide users and operators with up-to-date information, improving the fluidity and punctuality of public transport. Furthermore, implementing contactless bankcard validation solutions streamlines access to mobility services.

This connected method also improves infrastructure and system maintenance management, allowing for preventive and adaptive interventions based on data analysis. By integrating these various technologies, we can create a smarter and more efficient mobility ecosystem.

Does the multiplication of connected systems in transport networks present any challenges? What measures can be taken to overcome them?

The abundance of data generated by connected systems offers opportunities to enhance our understanding of transport usage, adapt services and manage contracts. However, it also presents challenges regarding data security and infrastructure

resilience. The incident at a data centre in Strasbourg highlighted how a failure can impact the operation of many transport networks. In order to guarantee sustainable and efficient mobility, it is therefore essential to support local authorities from the design and contracting stages through to the transport systems operation and governance. This includes data management, cyber security and technological change adaptation.

Our role therefore is to provide a holistic response to the needs of projects, comprehending them from inception to completion, to ensure a comprehensive vision.

What about environmental issues?

It's obviously crucial to include them in the requirement specifications used in mobility projects. That's why we now systematically include requests for data on carbon consumption, lifespan and equipment life cycle, for example, in order to promote more virtuous and sustainable solutions.

I RAIL INFRASTRUCTURE BETTER ADAPTED TO CLIMATE CHANGE

Railway projects, by their nature, take a very long time to design, finance and then build. They are different from other modes of transport in that their lifespan must be optimised in relation to the investment required. The impact of climate change has already been identified, so clients have been looking at ways of consolidating and improving the resistance of the existing rail network and anticipating the design methods needed for the future. By combining the multi-disciplinary skills of its subsidiaries, setec is at the heart of sustainable engineering and offers a complete range of services, from analysing the vulnerabilities at stake to providing technical solutions to ensure that the design of projects meets the requirements of the principal risks posed by nature.

The increase in extreme weather conditions over the last few years has had a direct impact on rail infrastructures. While the diagnoses vary according to geographical zone or type of service (urban network, high-speed, mountainous areas, etc.), recurrent impacts on performance or regularity of service have already been observed on several routes.

The French government is currently drafting the third National Climate Change Adaptation Plan (PNACC 3), which will include specific measures for transport infrastructure operators.

Rail operators are committed to defining a targeted investment strategy to improve the resilience of the network, as they anticipate that the costs of inaction in the face of climate change will be greater than the preventive investments.

setec has assisted railway operators with a number of risk studies, including a macroscopic study of the national rail network and a regional study of the Arc Languedocien in the Occitanie region. In addition, **setec** has also studied the Paris-Lille high-speed line, a mixed line of the rail network in Colombia, and a section of line 15 of the Grand Paris Express to assess the risk of flooding.

The analysis of the impact on the rail network's infrastructure is carried out by cross-referencing the climatic hazards with

the physical impact (assessment of the damage caused) and functional impact (assessment of the capacity for use) of the rail infrastructure. To do this, **setec** combines the skills of specialist engineers (in hydraulics, geotechnics, railway systems, etc.) and university scientists (in climatology, the environment, etc.).

As the behaviour of the principal sub-components of a railway infrastructure are included in the physical scope of these studies, the expertise of railway engineers, and their feedback from network maintenance operations, are essential in proposing realistic scenarios of degradation, but also in designing adaptation solutions.



setec has carried out a study for SNCF Réseau examining the national railway network's vulnerability to five major climatic hazards (extreme heat, vegetation fires, soil shrinkage/swelling, runoff flooding and overflow flooding), using the IPCC's climate projections for 2050 and 2100 (RCP 4.5 and RCP 8.5).

This study was included in the latest report by the French Cour des Comptes, "L'adaptation du réseau ferroviaire national au changement climatique" (Adapting the national rail network to climate change). Using the #GIEC climate projections for 2050 and 2100 (RCP 4.5 and RCP 8.5), **setec** offers an analysis of the impact of climate change on the rail network's infrastructure. With the help of maps, figures and infographics directly quoted in the Cour des Comptes report, **setec** offers SNCF Réseau a global view of the main issues to be taken into account and further investigated.



hydrogeology and engineering, develop a statistical, analytical and cartographic approach to qualify, analyse and extract data (open data) both locally and globally.

setec also offers scientific and educational services concerning the nature and evolution of climatic risks and their multiple implications on a territory, an activity or a type of infrastructure.

The teams, made up of doctorates in hydrology, The teams, made up of doctorates in hydrology, develop a statistical, analytical and cartographic approach to qualify, analyse and extract data (open data) both locally and globally.

These experts are also involved in assessing the impact of climatic events on traffic and commercial services, thanks to their knowledge of the railway environment in operation and the restrictions on the maintenance process (impact of any speed restrictions on regularity, number of trains to be cancelled, etc.).

In addition to these analyses, it is now necessary to adapt the technical standards specific to the French system, which will require lengthy cooperation with the original operator SNCF Réseau in order to obtain safety approvals from the French authorities.



I MSF - MAINTENANCE AND STABLING FACILITIES (DEPOT)

Although invisible to the general public and yet essential to the functioning of the railway ecosystem, maintenance and stabling facilities (MSF) have opened up to major investments over the last decade to accommodate the arrival of new rolling stock.

Varying in size and with different functionalities depending on the type of maintenance required or the type of rail service, which may be intra-regional, intercity or high-speed (HSL), these depots require rare and specific skills: expertise in the requirements of rail operations, logistics flow management and industrial processes. In addition, there are a number of specific factors that could radically change the way they are designed, such as, in France, the increasing use of public service concessions contracts by the Regions, who can now challenge SNCF, the French historical national rail operator through a bidding process, and the arrival of new Open Access competitors on the French railway network. The strength of the rail service offer lies partly in the efficiency of the maintenance facilities, which must deliver rolling stock maintenance services, i.e. interior and exterior cleaning, refuelling with all types of fluid (water, sand, windscreen washer, oil, diesel, WC) and, of course, more or less heavy maintenance - preventive, predictive and corrective. Historically handled by SNCF Réseau's Regional Engineering Centres, design studies of these facilities (or studies

to adapt those facilities to new rolling stock entering into service) suffered from a triple disadvantage: chronic low investment with a very short-term vision, an almost systematic secondary priority compared with projects on the national rail network itself, and finally a lack of innovation in the specific domains of building and maintenance tools, often neglected because they are far from SNCF Réseau's main rail activities. Public project owners, railway companies (*) and major contractors - via design & build contracts - have therefore gradually called on private engineering companies to undertake multi-skilled studies of these complex depots, with the challenge of combining safety requirements of rail traffic with the performance of rolling stock maintenance, while reducing the environmental impact over the entire life cycle.

Today, **setec**, together with an architectural partner, manage and design all types of projects: from the first concept based on a functional design study of rail, road and logistics flows, to the design of rail equipment and facilities, right through to the supervision of works and the testing and commissioning. The company's references include both the creation of dedicated workshops and the rehabilitation of maintenance facilities that need to remain operational during the works, while managing the numerous technical interfaces and safety restrictions.

INNOVATION IN TRANSPORT INFRASTRUCTURE MAINTENANCE

The IDNT© method (Detailed Inspection New Technology), patented by **setec diadès** and currently in the process of obtaining CIRR certification (IDRRIM: The Institute for Roads, Streets and Infrastructures for Mobility), combines multiple sensors to carry out detailed inspections of tunnels in both the motorway and rail sectors, while minimising the impact on traffic. It features high-precision cameras, infrared sensors, profilometers and temperature and humidity probes, all controlled in real-time via a dedicated interface. This approach optimises surveys by limiting traffic disruptions, while guaranteeing an in-depth inspection that complies with section 40 of the French ITSEO (Technical Instruction for Monitoring and Maintaining Engineering Structures). The method combines advanced technology with human expertise for efficient infrastructure management.



Our feedback guarantees that the design meets the requirements of the maintainer, i.e. ensuring the smooth operation of the site while anticipating changes such as an increase of traffic; and focusing on the energy efficiency and resilience of the technical installations while guaranteeing optimum comfort for the maintenance staff.

Aurélien MARTEAU

Project Manager,
setec ferroviaire

(*) The main rail service providers in France: SNCF Voyageurs, Transdev, Keolis, RATP Dev...

I HYDROGEN TRAINS: A TRANSITION IN PROGRESS

Although the railway sector is already highly decarbonised (insofar as the electrical power mix is decarbonised) in industrialised countries, the fact remains that the vast majority of the secondary passenger networks are not (lines serving minor parts of the country, metropolitan terminals, etc.).

While electrification is undoubtedly the most efficient solution from an energy point of view (highest efficiency), this solution often does not allow an economic balance to be found on small rail lines.

Consequently, the necessary energy transition from thermal to electrical traction can only be achieved, at a reduced cost, by a battery option or a hydrogen option (via a fuel cell). Although the battery option is technically close to the catenary (or 3rd rail) option, it only allows non-electrified branch lines to be used over a few dozen kilometres (autonomy), unless cost-effective electrification is considered, which would involve significant costs for the electricity network (connection, transformation).

What's more, this option is rather at odds with the functionalities required for rail freight: the train's autonomy is linked to the mass of batteries transported, a non-commercial mass to be deducted from the train's useful load.

The hydrogen option, on the other hand, is fairly close to the combustion option in terms of transport functionalities: the range of several hundred kilometres is linked to the volume of the energy carrier transported, and refuelling involves little loss of time between two commercial missions (just a few minutes). This option also offers a number of indirect benefits for the area in which it is used: the construction of water electrolysis (hydrogen production) and distribution (service stations) facilities can be beneficial to a number of activities: both for the decarbonisation of bus or taxi fleets, or even "captive" logistics fleets, but also for the decarbonisation of certain industrial activities such as the steel industry (DRI, direct reduced iron process, for example) or cement works, or even certain chemical activities for agriculture (production of ammonia).

It is towards these territorial synergies, around a hydrogen-powered passenger train project in Uruguay, that **setec** is innovating both in terms of transport technologies and multi-vector / multi-activity energy study tools (Odyssey tool*).

Uruguay, which aims to become a major player in the sustainable hydrogen industry, has commissioned **setec** to study the opportunity, technical feasibility and implications (social, environmental, traffic) of introducing a passenger service using hydrogen-powered trains on the first 60 km of the freight line (in the suburban area of Montevideo).

*The Odyssey tool is a digital twin of energy systems developed as part of a thesis at the CEA (Atomic Energy Center). It enables both macroscopic and microscopic modelling of energy eco-systems, whether at the scale of a territory, a medium-scale site or an industrial process. This tool is particularly well suited to multi-vector energy and multi-use analyses.

I THE DEVELOPMENT OF THE FIRST HYDROGEN-POWERED AIRCRAFT



After 70 years of progressive improvements on aircrafts, the aeronautical sector is now stepping up its ecological transformation with the aim of achieving Zero Net Carbon Emissions by 2050.

As the world leader in this sector, Airbus is strongly committed to decarbonising its fleet. The company is aiming to bring the first hydrogen-powered commercial aircraft into service by 2035. To achieve this, the ZEROe programme aims to evaluate, develop and industrialise technologies, aircraft and the necessary ecosystem to supply hydrogen.

setec eocen is Airbus' project management partner for the ZEROe programme in Europe. The 20 **setec eocen** employees are working with the project team and each multi-functional team in charge of the different technological components. They deploy the latest project management processes and tools, and oversee the necessary planning, budgets, risks and financing. They support the development of new technologies and ensure the successful completion of the programme, in order to contribute to the development of low-carbon aviation.

I DIADIL: DIGITAL TRANSITION TO REVOLUTIONISE THE MAINTENANCE OF MAJOR ROAD NETWORKS

At a time when ageing road infrastructures require increasingly costly maintenance, setec international is offering innovative digital solutions such as DiaDIL (Diagnosis and Durability of Linear Infrastructures) to transform the traditional methods of managing road assets.

The origins of DiaDIL date back to 2022, when the digital innovation acceleration scheme supported by the Group was introduced. The support provided at that time enabled the foundations of a business model to be laid and potential clients to be identified. In May 2024, following funding obtained by **setec** from the BPI (French Public Investment Bank) as part of the "Automated Road Mobility, Connected and Low-Carbon Service Infrastructure" call for project, it finally took off, launching developments that will continue for over three years, with the ambition of rapidly introducing a first product onto the market. As Denis Le Roux, Project Manager at **setec international**, explains, "The DiaDIL platform is designed for road asset managers, offering them a tool for understanding the condition of their network and planning maintenance work

more effectively. It incorporates a range of technologies, including 3D point cloud scanning, image processing, integration of historical works data, and radar data analysis.

This unique multi-source combination enables in-depth analysis not only of the surface, but also of pavement structures. The DiaDIL solution is designed to meet a combination of challenges: the ageing of road infrastructure and the requirements of environmental transition. By optimising maintenance and associated works, DiaDIL helps to reduce the costs and environmental footprint of roadworks. This innovative approach is fully in line with the digital transformation dynamic that **setec** wants to encourage in the transport infrastructure sector. This national strategic project has been awarded a total of €2.1m in funding. It is being developed in collaboration with

three key partners: Logiroad, a company specialising in solutions to help analyse road assets and plan maintenance, The Cross Product (TCP), a specialist in the automated processing of 3D LIDAR data, and the École Spéciale des Travaux Publics (ESTP), (the School of Public Works) which will provide valuable academic expertise to the project, particularly in the field of the ageing laws of bitumen.

Such partnerships enhance the project by bringing varied and complementary skills, essential for a holistic approach to road infrastructure management.

Alongside DiaDIL, **setec** has also developed and operates another tool, called ARA (Automated Road Analysis), which is currently being deployed with several clients. ARA is designed to analyse motorway compliance with strict geometric and safety standards.

I MODERNISING TICKETING TECHNOLOGY THROUGHOUT THE PARIS REGION: **setec'** expertise at the service of innovation

With the help of setec, Île-de-France Mobilités is undertaking a major redesign of ticketing system to simplify and modernise access to public transport by integrating new technologies and services.

Modernising ticketing is a huge challenge for Île-de-France Mobilités. **setec** is playing a key role in this transformation, providing all its expertise in new technologies and project management. Already in place since 2019 for Android phones and since the spring of 2024 for iPhones, the dematerialisation of transport tickets means that users in the Paris region can use their smartphone as a transport card or as a ticket dispenser, making it easier to access mobility services. In 2020, a post-payment system was also introduced with the technical expertise of **setec**, to allow users to travel freely

throughout the metro and bus network, and to receive a monthly bill based on their actual journeys. This flexibility will be extended to the entire Île-de-France region from 2024, via a dedicated application offering fully digital management.

This will be integrated into the IDFM (Île-de-France Mobilités) application from 2025 to extend the service to all users. **setec** has also participated in the design of a major innovation: the development of a flexible, rechargeable smart card made of cardboard that can be dispensed from automatic ticket machines in the Île-de-France region, replacing the PET (polyethylene terephthalate) Navigo pass and magnetic cards. This technological breakthrough will help to reduce the region's ecological footprint and cut by ten the number of cards issued each year in the region. These

developments in services and technology have required the implementation of a centralised information system. This system simplifies competitive bidding processed of different railway lines' operation and will allow consistent and reactive management of fares and services throughout the network. **setec** brought extensive expertise for the creation of Île-de-France Mobilités' subsidiary dedicated to ticketing, a symbol of this new direction and a guarantee of total autonomy from the transport operators' legacy systems. Finally, **setec** is also supporting Île-de-France Mobilités in communicating about this project, by designing client journeys, developing communication support and drafting the general conditions of use. This support will ensure that the new functionalities are smoothly adopted by the public.



I setec AT THE CENTRE OF SIGNALLING TECHNOLOGY DEVELOPMENT

To meet the objectives of decarbonising transport, we need to improve the performance of the rail network, both in terms of capacity and traffic frequency, simplifying maintenance tasks and adapting to climate change.

While improving signalling is one of the most important levers for achieving this change, it is also one of the most delicate, given the safety imperatives involved. Initiated several years ago, the digitalisation of rail signalling and the development of cost-effective technologies will make it possible to intensify the service offering while maintaining the same safety guarantees for passengers.

setec's expertise in complex rail systems is recognised by both the French rail operator, SNCF and the major signalling industrial companies, and it is involved in the deployment of these technologies through a number of partnerships and R&D projects. Working with Alstom, **setec** has won the first contract for the deployment of ERTMS level 2 on a high-speed line already in service: Paris-Lyon, which has the highest passenger traffic in Europe. **setec** is providing design and construction supervision within the contractor's consortium, from design control to testing. Alongside Thalès, **setec** is also helping with the Azur+ High Performance project between Marseille and Ventimiglia, which involves deploying the ARGOS interlocking solution: fast, with lower energy and copper consumption. As part of a consortium led by Thalès, **setec** is developing a new cost-

effective rail signalling system (NS2F) for the secondary lines in France, which would be too costly to modernise with a conventional system given the level of use. The aim of the project is to replace all the signals and beacons along the tracks with an on-board system using cyber-secure public telecommunication networks. As well as reducing the use of materials that are critical to the ecological transition (copper), there are multiple benefits: the reduction in physical equipment reduces commissioning and operating costs, facilitates maintenance, and enables resources to be pooled because the geographical distance between substations is no longer a problem.

As part of the National Low Carbon Strategy, this project aims to support the Regions in the development of their territorial networks, while preparing for the arrival of SNCF's new "TELLi" train, expected in 2029. In the future, the rail network will need to accommodate more trains, improve passenger service and enhance safety, but this will not mean adding new infrastructure. The trajectory and objectives of low-carbon mobility are hardly compatible with the characteristics of a conventional signalling system, which is time-consuming and costly to implement. It is preferable to act, for example, by

reducing the distance between each train or increasing the operating radius of signalling stations. **setec** is committed to this process of change in the industry by proposing to re-examine the "just what's needed" of maintenance personnel and operators, and by challenging industrialists and manufacturers to find the best solutions. The expected leap in railway performance will come from signalling that is at the cutting edge of innovation.

OBJECTIVES IN NUMBERS

25%
CAPACITY INCREASE
ON THE PARIS-LYON LINE

REDUCE
INVESTMENT COSTS BY
30%