“Developing answers for the mobility of tomorrow”

Since it got under way on 19 September, IFSTTAR has been providing input for the discussions at the Assises nationales de la mobilité – a broadly-based consultation exercise on transport - which is due to run until the end of the year. Its purpose is to draw up the next Framework Law on Transport. This is much-awaited and the Government would like to bring it before parliament in 2018. This special issue presents the goals and challenges which feature in IFSTTAR’s contribution.

Sharing everything we know, but also what we don’t: the Assises de la mobilité present IFSTTAR with a wonderful opportunity. This national consultation exercise calls on us to take stock of our knowledge, in particular what we have learnt when working with our European partners. It demonstrates a desire to generate a new momentum for progress on problems we will be facing ten or twenty years from now and which we are already trying to solve.

The Institute is making a very concrete contribution to the attempt to construct this new policy for the transport of passengers and goods. Our researchers are taking part in the working groups for each of the six thematic workshops as well as the innovation workshops. The latter prefigure an innovation and transport committee which it is hoped will become permanent.

The multidisciplinary aspect of the Assises means we sometimes express original views in order to shed light on the complex societal issues involved in transport: lifestyles, energy, digital technology, developments in urban and rural areas, what the impacts will be on the aspirations and interactions of every man and every woman... without losing sight of social acceptability. Our teams propose an analysis of transport and its stakes by placing the user within a triad consisting of “infrastructure, vehicles and services”. In short, this consultation sets out to boost innovation. Let’s hope we can all benefit from transport which is cleaner, safer, better shared and more reliable.
**DIARY 2018**

**JANUARY TO MAY**

- "Can digital technology make cities more sustainable, socially just and supportive to citizens?"

- **30-31 JANUARY**
  Think Education & research
  Two days dedicated to innovation in higher education and research
  Find out more at: [https://education.newstank.fr/fr/thinkER2018/](https://education.newstank.fr/fr/thinkER2018/)

- **15 MARCH**
  1st SHM-France study day
  Testing and monitoring of structures.

- **22-23 MARCH**
  JNM2018
  The second national masonry days to be held at IFSTTAR’s Marne-la-Vallée site.

- **26-28 MARCH**
  PPRS2018

- **23-28 APRIL**
  INTERMAT, the international exhibition for construction and infrastructure.
  Find out more at: [https://paris.intermatconstruction.com](https://paris.intermatconstruction.com)

**IN BRIEF**

**BETTER UNDERSTANDING AND BETTER SERVING MOBILITY**

The Intelligent Mobility Encounters will take place in the Beffroi de Montrouge just outside Paris on 24 and 25 January 2018. The theme will be “Better understanding and better serving mobility” These annual encounters, which are honoured to have as their patron the Minister with responsibility for Transport under the Ministry for an Ecological and Solidary Transition, bring together more than a thousand participants around the topic of intelligent transport. This is a genuine forum for exchanges of view and debates with exhibitions and meetings, and an unmissable event for French and European stakeholders in the sector.

Our experts will be on hand to lead meetings:

- Patrick NIERAT: Operation in a road freight transport company: what changes in the last 25 years?
- Martine CARUSO: Our knowledge about Urban Public Transport supply and mobility services: a knowledge gap or a technology gap?
- Christine BUISSON: Effects of traffic on measured nitrogen dioxide concentration: showing the impact of mean speed using data collected over a 30 month period
- Hasnaâ ANISS: Cooperative ITS can supplement mobility systems at urban nodes: the example of the Bordeaux pilot site
- Lucas RIVOIRARD: Proposal for the dynamic structuring of an inter-vehicle communication network for ITS

Find the full programme in French on-line at: [http://www.congres-atecitsfrance.fr/le-congres/13246](http://www.congres-atecitsfrance.fr/le-congres/13246)
The work at the Assises will provide researchers with a survey of the question of transport with all the stakeholders”, explains the IFSTTAR research officer Guillaume Uster. “We have a number of simultaneous aims: to reduce fuel consumption by 2 litres per 100 km, to bring about shared transport with two persons per vehicle, and to increase bicycle use. Limiting transport demand also requires regional planning measures. Combining all these is not straightforward as the ultimate aim is to draft a very pragmatic law”.

The researchers propose to adopt a systemic approach around the “vehicle, infrastructure, practices” triad instead of silo thinking. “With regard to vehicles, we are working on consumption and different types of energy, electricity, hydrogen, liquid gas...” Guillaume Uster explains. But a car’s lifetime is 19.7 years, so today’s new cars will still be here almost until the year 2040. With regard to infrastructures, if we want to develop electric transport, we need to increase the number of charging points, and the same applies in the case of hydrogen vehicles. We need to apply all the levers simultaneously, and the last lever consists of practices, that is to say the acceptability of electric cars with relation to their range, and the acceptability of transport sharing, i.e. how to make the transition from an owned vehicle to a shared vehicle, etc.”

Cleaner transport

A TRIAD: “VEHICLE, INFRASTRUCTURE, PRACTICES”

The issue of “cleaner” transport raises three interacting topics for discussion: vehicles and their consumption; active or green transport, and urban planning. Another stated goal is to give a status to new shared forms of transport.

“The work at the Assises will provide researchers with a survey of the question of transport with all the stakeholders”, explains the IFSTTAR research officer Guillaume Uster. “We have a number of simultaneous aims: to reduce fuel consumption by 2 litres per 100 km, to bring about shared transport with two persons per vehicle, and to increase bicycle use. Limiting transport demand also requires regional planning measures. Combining all these is not straightforward as the ultimate aim is to draft a very pragmatic law”.

2NEMO: NEW TYPES OF ENERGY AND NEW SERVICES FOR TRANSPORT

Funded by the Thematic Development Consortium (CVT) of the French National Agency for the Coordination of Energy Research (ANCRE), the 2NEMO project is founded on this systems approach to transportation and energy. The project starts with a conventional approach focused on the components of transport systems, mainly vehicles, which it sets out to extend to create a comprehensive vision which considers the vehicle in its environment based on the “vehicle – infrastructure – practices” triad. Digital technology plays a pivotal role and the industrial ecosystem provided by Intelligent Transportation Systems (ITS) is the digital melting pot that provides services in the areas of security, operation optimisation and energy savings. 2NEMO also involves research into the concept of “dedicated vehicles” for private or public use and passenger and goods transport, in order to gain a better understanding of their social, economic dimensions. Studies have focused on the business world – which has done little to take on board the potential of these innovations in economic, social, and image terms – especially firms that are located in peri-urban and rural zones.

The car is still indispensable in peri-urban and rural areas. The researcher goes on to say “it would be interesting if this law could try to achieve a new balance between public transport and new shared forms of transport, by giving the latter a real status. Long-distance car sharing is on the increase and short-distance car sharing is beginning to take shape. We therefore need to bring this third transport mode into the public sphere, after the private car and public transport".
More connected transport

THE CHALLENGES FACING THE DIGITAL REVOLUTION IN TRANSPORT

New connected transport services and transport assistance services, which are being developed as a result of the mobile Internet, could transform travel practices. Integrating them within transport systems and policies nevertheless poses major challenges for the public authorities.

The penetration of the mobile Internet in the sphere of passenger transport has the potential to bring about enormous and potentially profound changes which will affect not only tomorrow’s stakeholders and transport modes but also the travel practices of connected persons. The latter can access new sources of information about their trips and new services in real time, for example for the sharing of journeys and vehicles: car sharing, self-service bicycles, etc. The smartphone plays a central role in this process, both as a data collection device and in order to host applications that permit the deployment and use of such services. “The stakes are considerable for the public authorities,” explains Anne Aguiléra, the Deputy Director of the Planning, Mobilities and Environment Department (AME) who is an expert in the links between transport and the use of ICTs (Information and Communication Technologies). “It is a question not only of adapting to this digital revolution in transportation at a time when new entrants are already exploiting the opportunities provided by platform services, but also making sure that it operates in a way which fosters more sustainable transport, in particular transport which is more multimodal and intermodal (the Mobility-as-a-Service concept)”. However, so far the impact of the new services on travel practices is still minor and unclear. They also seem to be heightening socio-spatial inequalities between the centres of major cities, where such services are primarily developing, and rural and peri-urban areas. These questions are central to CISMO², one of the research projects on this topic. The project is being conducted in Loos-en-Gohelle (in the Département of Pas-de-Calais), and sets out to work with residents to develop innovative bespoke transport solutions for low-density areas.

1. Co-building of innovations for transport services services in peri-urban areas.

SO FAR THE IMPACT OF THE NEW SERVICES ON TRAVEL PRACTICES HAS BEEN LIMITED

GEOLYTICS: ANALYSING DATA FOR BETTER MANAGEMENT OF PASSENGER AND GOODS TRANSPORT

The aim of the GEOlytics project is to become the benchmark platform for the analysis and forecasting of multimodal transportation requirements. The project is being managed by the start-up Geo4Cast, the LVMT², and TélécomParisTech and is funded in the framework of the Fonds Unique Interministériel (FUI). Its goal is to enhance the automated analysis of millions of fine-grained digital traces generated by smartphones. The project is aimed at potential clients among local authorities, network managers, service and transport firms as well as sites that receive large volumes of flows (hospitals, airports…). GEOlytics will provide assistance for managing passenger and freight transport. By performing massive data analysis both in real time and in the long term, the platform will, for example, play a part in setting up short distance carsharing services or the acquisition of data on the behaviours of users who are difficult to interview such as tourists.

2. City, Mobility and Transport Laboratory.
More socially supportive transport

ADDRESSING THE NEEDS OF DEPRIVED AREAS AND THE MOST VULNERABLE SOCIAL GROUPS

What are the main needs of the most vulnerable areas? Which social groups are the least well catered for? Is it possible to transpose any existing remedies? These are some of the issues which are raised around the theme of “more socially supportive transport”.

“The goal is clear,” explains the geographer Olivier Bonin, who is the Deputy Director of the Cities, Mobility and Transport Laboratory. “We need to reduce social and geographical divisions, and doing this also entails reducing travel inequalities.

THE FRENCH ARE NOT EQUAL WITH REGARD TO TRANSPORT

How can we ensure that everybody has access to education, jobs, culture, training, healthcare, etc.? The French are not equal with regard to transport, either, for example, because they live in an area which is deprived in terms of services, or because they belong to a social group which, for various reasons, has greater difficulty accessing transport in the broad sense of the term”. Starting from this basis, vital questions are raised about areas and infrastructure, the most vulnerable social groups and the concept of geographical equity. With regard to areas, is the distinction between urban, peri-urban and rural areas still relevant today in relation to transport? As far as the most vulnerable members of the public are concerned, we need to seek different solutions for disabled persons, the unemployed and single-parent families.

“Our working group brings together elected representatives, groupings of municipalities, representatives of transport undertakings, federations of taxi drivers and other groups”, Olivier Bonin explains. “And we are also examining locally-developed initiatives, observing which work well and seeing if they can be encouraged, irrespective of whether they have been developed by citizens or institutions”. Transport takes place in a general context of urban planning and regional development. France has a preference for heavy transport modes (train, tramway, métro) “but they are costly and do they really provide the services we expect of them?” Olivier Bonin wonders. The issue of funding is central, and citizen initiatives receive no subsidies from the employers’ payroll tax.

SOFT: ACHIEVING ENERGY SOBRIETY THROUGH URBAN FORMS AND TRANSPORT

In the Est-Ensemble urban community in the Greater Paris Region (which brings together nine municipalities and contains 400,000 inhabitants), the project consists of proposing realistic scenarios that aim to improve energy efficiency, in accordance with the expectations and practices of the inhabitants, as well as the projects developed by planners. This area is emblematic of the challenges which are currently facing most suburban districts in large conurbations. Emphasis is placed on how higher density residential and business zones can be integrated without impacting green or blue corridors and creating a variety of dense and less dense zones. Residential development is taken into account when dealing with transport issues, and priority is given to local options rather than comprehensive modifications to transport supply: traffic in new districts, improving the safety of pedestrian and cycle routes, accentuating the role of railway stations as centres and fostering functional polycentrism in order to limit needs for medium distance transport.
More intermodal transport

“INTERMODALITY IS NOT JUST A QUESTION OF INFRASTRUCTURE”

Using several transport modes and linking them together involves a large number of topics for consideration and research: infrastructure, planning, forms of production and delivery, etc. An illustration, taking freight transport as an example.

“The question of intermodality is more complex than it seems, as it is not just a question of infrastructure”, points out Corinne Blanquart, Director of the AME Department (Planning, Mobilities and Environment). In the case of freight transport, for example, we often feel that there are too many trucks on the roads and all we need to do is to provide more efficient rail transport with infrastructure such as loading and unloading platforms, etc. But we must take account of firms’ delivery constraints, in terms of deadlines and types of product”. Rail transport is not an obvious solution for a firm that has to make small volume “just-in-time” deliveries, but it is of interest for large volumes such as for the metallurgical and chemical industries or for cereals. “In the past rail transport was dominant because the Fordist production model required it for large volume production, which was stored before leaving the factory”, Corinne Blanquart explains. “But road transport has gradually become necessary due to today’s more flexible production mode which requires smaller consignments to be sent more frequently.”

ALLOCIRCO: LOGISTICAL ALTERNATIVES FOR SHORT SUPPLY CHAINS

The ALLOCIRCO project which ran in the Nord-Pas-de-Calais region between 2013 and 2015, focused on one question: what logistics and transport organisations should be put in place in order for supply chains to be efficient economically, socially and environmentally, both for producers and local authorities? The project showed that logistical considerations are an essential lever for improving the efficiency of short supply chains, on condition that solutions reflect the diversity of the rounds. The research demonstrates the benefits of logistical organisation, and describes the forms of optimisation which are the most appropriate for pre-identified supply chains. Several optimisation approaches have been identified: the organisation of rounds, the pooling of resources, the use of transport service providers, the application of ICTs and the need to take account of the specific characteristics of the area. One of the project partners, CEREMA¹, has developed a tool for calculating the costs, transport times and environmental costs of deliveries.

WE ARE FAR FROM HAVING OPTIMISED THE LOGISTICS OF SHORT SUPPLY CHAINS

Another preconceived idea is that short supply chains are good by their very nature. However, “We are far from having optimised the logistics of short supply chains,” observes Corinne Blanquart. “For example, transport and logistics are not part of farmers’ know-how and we often see vans with very low loading rates, empty return runs, single-delivery runs, etc., in situations where an organised transport undertaking would make rounds with well-loaded vehicles.” In addition, pooling is not necessarily the answer as farmers want to maintain their personal contacts with the end user. Finally, with regard to planning, short supply chains mean it is necessary to set aside farming land in the outskirts of conurbations.

¹. Centre for studies and expertise on risks, the environment, mobility, and urban and county planning.
Safer transport

DOES THE ADVENT OF THE DRIVERLESS CAR SPELL AN END TO ACCIDENTS?

Safety is the primary concern of the French in the area of transport, and one of the major issues for the transport of the future. However, the impacts on the health of the users of innovations such as the driverless car or new urban developments to improve the sustainability of transport have received little study.

Driverless cars: two words which frequently crop up in discussions about the transport of the future. These vehicles are synonymous for some people with better road safety, or even the complete end of accidents. Dominique Mignot, the director of IFSTTAR’s TS2 Department (Transport Health Safety) qualifies this view: “In 100 years’ time this will certainly be true, but in the near future when driverless cars first begin to be used under real conditions, there will be nothing to prevent a pedestrian from stepping out in front of the vehicle or the driver of a conventional vehicle from making an error”. In addition the arrival of a new technology generates new behaviours and situations that need to be studied: in the event of an impact, what happens if the passenger is sitting sideways or with their back to the road? How can a person take control of the wheel in an emergency? Should the car give priority to protecting its passengers? “There is a great deal of work to be done on the impact of driverless cars on passengers and other road users. A joint research programme is due to get under way next year, involving laboratories from IFSTTAR, the LAB1 at Renault and PSA, Ceesar² and CEREMA”, Dominique Mignot mentions. Driverless cars aside, some other technologies can already reduce accident risk: devices that detect road edges or fatigue, cameras to eliminate blind spots, anticollision radars... But here too caution is required: “The cost is high. It will take some time for them to be fitted to all vehicles. In addition, they have no impact on the state of drivers, whether they have consumed alcohol or not, for example.” While waiting for the automation of the vehicle fleet, safer travel still requires compliance with the rules of road safety.

STUDYING THE IMPACT OF DRIVERLESS VEHICLES ON ITS PASSENGERS AND OTHER ROAD USERS

RED: MANAGING RISKS ASSOCIATED WITH SUSTAINABLE TRANSPORT

Most European cities have implemented policies to foster sustainable urban transport, and there is now a consensus in favour of these as a means of achieving the necessary environmental transition. But what happens in the event of a malfunction? This is the central question posed by the ANR RED project that brings together some 30 researchers from IFSTTAR and the Universities of Aix-Marseille, Caen and Strasbourg. Three groups of problems are being investigated with in the framework of this project: the risks related to transport safety, spatial selectivity and social inequality. The researchers have mainly been concerned with the first group. For example, they have carried out research into the integration of tramways within the public space. This has shown that the impacts on safety are not always positive – for example installing a tramway may make spatial design more complex and more difficult to interpret.

1. Laboratory of Accidentology, Biomechanics and the Study of Human Behavior.
2. European Centre for Safety Studies and Risk analysis.
More sustainable transport
TOWARDS SUSTAINABLE ROADS

Imagining the uses of tomorrow’s road. This was the task IFSTTAR set itself for the 5th Generation Road (R5G). As it is to have low consumption, be connected and produce energy, it could provide its own economic resources in order to optimize its operation and maintenance.

What financial resources will be available tomorrow for maintaining and developing infrastructure? At the Assises de la mobilité, this question is of central importance for the working group on “More sustainable transport”. Solutions under discussion include: urban tolls or a new environmental tax “but they do not take account of the future uses of the road”, explains Nicolas Hautière, the assistant to the director of IFSTTAR’s Components and Systems (COSYS). “IFSTTAR’s thinking about transport is based on one question: what should the road of the future be like in order to provide a support for new forms of transport?” This question has many answers: it will generate heat or electricity and permit energy exchange between the infrastructure, the vehicle and the network manager...; it will be able to carry out self-diagnosis and self-repair; it will collect and send data... Each of these functions make it possible to develop new economic approaches. “The data which is collected and the energy which is produced could be used to optimise maintenance of the road” Nicolas Hautière explains.

“In addition, although designing R5G with materials that are capable of self-repair represents a greater investment, the life cycle costs of the infrastructure will be reduced.” Last, a new legal instrument known as a comprehensive performance contract, is currently opening up interesting perspectives for a more effective partnership between public purchasers and contractors with regard to the maintenance and operation of the road of the future. In the framework of this contract, the public purchaser uses numerical indicators to lay down the performance which the road must achieve in terms of quality of service, energy efficiency and environmental impact. This gives firms providing services more freedom to innovate in order to find low-cost solutions.

R5G@MLV: A DEMONSTRATOR FOR THE ROAD OF THE FUTURE’S INNOVATIONS

Due to urban sprawl, several motorways, such as the A7 through Lyon or the A35 in Strasbourg, are now near dwellings. These roads are congested and a source of pollution and noise. The R5G@MLV project aims to transform one of these urban motorways, the former A199 in Champs-sur-Marne, into an urban Boulevard which will conserve transport flows but also improve the quality of life enjoyed by residents. This flagship IFSTTAR project will trial a large number of innovations: depolluting materials, supplying residents with energy, free access to information about the weather, the state of the road, air quality etc. R5G@MLV is one of the 6 development operations in the Ecocité programme in Marne-la-Vallée, which is a project for a city of the future financed by the Future Investments Programme “The city of Tomorrow.”
Statements for researchers

A joint interview with Thomas Robert and Fabien Menant. These IFSTTAR researchers have each spent a year collaborating with two of IFSTTAR’s partners: the Imaging and Orthopedics Research Laboratory (LIO) at the École de Technologie Supérieure in Montréal and the Pavements Laboratory at the Quebec Ministry of Transport (MTQ).

What was the purpose of your collaboration with the Quebec-based laboratories?

Thomas Robert: At LIO, I was involved in developing a new device for simulating natural gait. This consisted of a two-strip treadmill with a feature that allows it to adapt to the subject’s speed. This means we can investigate how certain diseases affect walking, re-education and how urban spaces should be designed. I brought my expertise on human gait to the project, particularly in relation to balance control and variations between individuals in terms of anthropometric dimensions and physical capacities.

Fabien Menant: The Pavements Laboratory gave me the opportunity to promote and test some non-destructive pavement testing devices developed at LAMES'. This enabled us to deploy the Miranda system which uses on-board sensors installed in a vehicle fleet to detect pavement defects at the scale of the road network. The MTQ is interested in its real-time detection and characterisation capabilities. Its intention is to use it to help its operational departments organise and prioritise maintenance activities. Miranda has also been used to evaluate the riding quality of landing strips at Nunavik airport.

How did you benefit from this contact?

T. R.: Going abroad allows you to extend one’s network, to learn how to use new tools and discover different working methods, in order to supervise students for example. Apart from my involvement in the design of the natural gait simulator, I learned how to use it. It will give us a more detailed view of the biomechanical phenomena that take place during walking and be a valuable tool for my next ANR project on modelling balance.

F. M.: Testing our devices under extremely demanding measurement conditions enabled me to identify new perspectives for research and development. This is interesting with a view to distributing our devices in similar countries. This also gave me the opportunity to work alongside experts in pavement management and learn more about this topic.

The opportunity to promote and test our tools

Thomas Robert’s biography

Thomas Robert has a degree in mechanical engineering and completed his thesis on passenger falls in public transport at IFSTTAR in 2008 before becoming a researcher at the Biomechanics and Impact Mechanics Laboratory (LBMC). His research is concerned with the ergonomics of vehicles and the risks of falling.

Fabien Menant’s biography

Fabien Menant is an optoelectronics, signalling and imaging engineer who joined the Road Testing and Management section at IFSTTAR’s Nantes centre in 2004. He has been a researcher at LAMES for 5 years, focusing on the design and development of innovative testing and monitoring equipment for the non-destructive testing of roads.
A new approach to modelling urban traffic
Towards improved mobility with ERC MAGnUM

The team led by Ludovic Leclercq at LICIT (a laboratory that is jointly managed by IFSTTAR and ENTPE) is engaged in research of excellence. In 2015, this research received a five-year grant of 2 million from the European Research Council, which is the maximum possible amount. Half way through, let’s turn a spotlight on the MAGnUM project.

Imagine a digital model of the city of Lyon in which more than 50 players can simultaneously decide to make a trip, choosing a departure time, a route and a transport mode. This “simulation game” approach is one of the innovations provided by the ERC MAGnUM project. Ludovic Leclercq explains how this enables us to achieve a better understanding of the dynamics of traffic: “Unlike conventional research based on field observations in which surveys can only take in a few routes and a few individuals at the same time and cannot provide a comprehensive view of traffic, this simulation allows us to watch a large number of players modify their decisions in real time.” But ERC MAGnUM does not intend to stop here: The project research team is working to produce a dynamic aggregate platform by 2020 that is able to rapidly simulate any urban transport network at the metropolitan scale. This work has a dual goal: creating a new tool and using it to improve our understanding of the links between the trips made by individuals and the fluidity of transport systems. Ludovic Leclercq sees this project as a recasting of methodological frameworks: “until now, in order to model the transport system we often had to choose between a large-scale static model and a dynamic model which although very detailed was accurate only at the district scale. Our platform is accurate at a large scale.”

Our platform provides a new large-scale perception of transport systems

Imagine a digital model of the city of Lyon in which more than 50 players can simultaneously decide to make a trip, choosing a departure time, a route and a transport mode. This “simulation game” approach is one of the innovations provided by the ERC MAGnUM project. Ludovic Leclercq explains how this enables us to achieve a better understanding of the dynamics of traffic: “Unlike conventional research based on field observations in which surveys can only take in a few routes and a few individuals at the same time and cannot provide a comprehensive view of traffic, this simulation allows us to watch a large number of players modify their decisions in real time.” But ERC MAGnUM does not intend to stop here: The project research team is working to produce a dynamic aggregate platform by 2020 that is able to rapidly simulate any urban transport network at the metropolitan scale. This work has a dual goal: creating a new tool and using it to improve our understanding of the links between the trips made by individuals and the fluidity of transport systems. Ludovic Leclercq sees this project as a recasting of methodological frameworks: “until now, in order to model the transport system we often had to choose between a large-scale static model and a dynamic model which although very detailed was accurate only at the district scale. Our platform is accurate at a large scale.”

1. This project is financed by the European Research Council (ERC) in the framework of the H2020 programme for research and innovation in the European Union (Agreement number: 646592).

Transport in Scientific Reports

It is rare for this highly selective journal which is part of the “Nature” group to publish papers on this area of research. As part of ERC MAGnUM, a paper describing research carried out with the University of Delft was published in Scientific Reports. In this case too, Ludovic Leclercq’s team has shown its ability to change existing methods. In this case, what was involved was mapping traffic congestion. ERC MAGnUM replaces the conventional two-dimensional zoning of urban areas with a 3D congestion map in which volumes represent spatial and temporal zones with similar traffic speeds. With this new mapping technique they found it was possible to characterise day-to-day changes in congestion with only four standard maps containing just 9 zones. Depending on the time of day and traffic conditions, it is possible to apply one of these profiles to a given situation and then forecast journey times for the rest of the day. When deployed in the city of Amsterdam, these dynamic congestion maps predicted journey times for 84% of urban trips with a margin of error of less than 25%.

Lopez C, Leclercq L, Krishnakumari P, Chiabaut N, van Lint H. (2017). Revealing the day-to-day regularity of urban congestion patterns with 3D speed maps. Scientific Reports. 7, 14029. 10.1038/s41598-017-14237-8
“Meeting today’s needs and foreseeing tomorrow’s”

Day-to-day, for everyone, in every kind of zone... Tomorrow’s mobility has always been in the front line of IFSTTAR’s research. The Institute helps provide solutions to meet immediate needs and looks ahead to future solutions, which may include completely new types of technology and services. Antoine Frémont, IFSTTAR’s Deputy Scientific Director, explains.

Promoting types of mobility which are hoped for and desired rather than endured and forced is one of the flagship principles that underpins IFSTTAR’s research strategy. But how can we meet the diversity of needs and situations, from urban mosaics to rural areas? How can we reduce the environmental impact of transport, noise, congestion and journey times? The answer is by exploring all the potential solutions. This is the Institute’s role. In particular, we should foster a complementary relationship between the different transport modes to be able to create mobility “packages” that include cars, public transport, bicycles, etc. This means we must use all the approaches at our disposal - technology, the development of innovative services and planning measures.

There are still some stumbling blocks which prevent us from improving the present-day situation and meeting immediate needs, in particular in the area of transport infrastructure. How can we assess its condition in order to make it “last” without unnecessary expenditure? In order to make sure an engineering structure is perfectly safe, what repair works should we perform, and when? How can we make it more resilient to exceptional situations such as extreme weather events? The answers should be found through technological innovation and the development of new materials. Another topic that is very much in the news is the development of driverless vehicles. This raises technical, social and ethical questions which are being tackled by researchers and industry. But what will these vehicles really be used for, and under what terms? Will they be more appropriate for very dense areas or isolated zones? A large number of issues linked to their use must also be examined.

In order to develop new services we need to understand mobility. Through the surveys it conducts on both passengers and freight - potentially using digital sources such as smartphone data and big mobility data - IFSTTAR contributes to an understanding of new practices and new services. This research plays a major role in supporting public policy. It interprets technological, social, and policy aspects with a view to informing decision-making in ministries and firms regarding the development of new mobility services.

The Institute is also closely involved in mobility-related planning activities, at all scales. It encourages open spaces to be designed in a way that guarantees not only free traffic flow and intermodality but also the safety of all users: motorists, pedestrians, two-wheeled vehicles, persons with disabilities... And it also helps to foster links between urban planning and transportation in order to limit disamenities and soil sealing. In this context, IFSTTAR provides input to the debate on urban sprawl.

Providing practical rapid solutions in a constrained financial framework and remaining open to all possibilities when envisioning the future: this is the aim of our interdisciplinary research for the benefit of “mobile” citizens.
Improved simulation of crowd movements

Interview with Bachar Kabalan

Bachar Kabalan is a post-doctoral researcher at the ENPC, UPEM and IFSTTAR’s City Mobility Transport Laboratory (LVMT). His doctoral research involved studying crowd dynamics and his work on modelling pedestrian movements and interactions in public spaces has improved our understanding of passenger flows in railway stations.

WHAT IS CROWD DYNAMICS?

We speak about crowd dynamics when a group of pedestrians with a density of more than one person per square metre is formed and moves. Under these circumstances we can observe collective phenomena which range from self-organisation to turbulence when the density exceeds five persons per square metre. In the latter case, the consequences may be drastic, as was the case in 2015 during the Hajj pilgrimage (Saudi Arabia) when a crowd stampede killed 769 people and injured 934. My research is concerned with crowd dynamics in mass transit stations, by which I mean stations through which a very large volume of users pass every day.

WHAT DID YOUR THESIS SET OUT TO DO?

It is difficult to investigate crowd dynamics under real conditions. You need a large number of people and we cannot put them at risk. To solve this problem, we use computer models. The work for my thesis involved perfecting a discrete, or microscopic, model, developed by the Navier laboratory1. Unlike macroscopic models which only represent flows, discrete models simulate the trajectory and behaviour of each individual in the crowd. But human interactions are complex: in order to reach our destination we can, depending on the situation, change our behaviour, speed or path... For example, to reach point B, individuals generally adopt the shortest path strategy. But, in the event of congestion, they prefer the quickest path. Our model includes three types of behaviour: aggressive (forcing one’s way through the crowd), avoidance and, an original feature of my work, pushing. This behaviour, which is based on the collision strategy, is adopted during periods of competition in which the concept of personal space disappears, as when a train arrives at the platform and it is necessary to push through the crowd to get on board.

WHAT CAN WE HOPE TO GAIN FROM A BETTER UNDERSTANDING OF THESE PHENOMENA?

With regard to the transport of the future, simulating crowd movements helps us find practical solutions for building and designing public spaces which provide users with improved safety and better quality of service. Our research at the LVMT aims, for example, to better manage pedestrian flows in order to improve traffic conditions in stations. Personally, I worked recently on the platforms of the Bibliothèque François Mitterrand station on line C of the Paris Express Rail Network (RER). The severe congestion which occurs in this area affects both train stopping times and user safety. In order to solve this problem we recommended, in particular, removing a number of badly placed advertising panels and encouraging passengers to wait in the amply-sized station hall by providing free Wi-Fi.

1. Laboratory jointly managed by Ecole des Ponts ParisTech, IFSTTAR and CNRS.
A QUESTION FOR JEAN-JACQUES MOGORO, leader of SNCF Réseau’s DIGITAL project, who is also in charge of technology watch in the signalling department

WHAT IS YOUR ATTITUDE TOWARDS THE ADVENT OF THE INDUSTRIAL INTERNET?

J-J. M.: For the SNCF, the aim is to enhance the resilience of the historic railway network which we must keep running. The Industrial Internet allows us to explore every possibility. As engineers, we have the impression that there are no longer any limits, whether for data storage, price or data management. A consequence of this is we have to be careful that we are not pursuing illusions. This is what we value in our work with IFSTTAR: the capacity to carry out rapid prototyping and a genuine grasp of practical realities. We understand each other. With IFSTTAR, the business plan is not the prior condition for all collaboration: scientific work comes before and it is this which allows us to address a real technical need. We share these values.

The French railway network is almost 200 years old, during which time it has been through some major changes. The next technological transformation it is due to undergo is the Internet of Things (IoT). IFSTTAR is working with SNCF to manage this move towards an “intelligent communicating” railway network. It is to be covered by a forthcoming framework agreement between these two major bodies.

WHAT THE SNCF WANTS FROM US IS A GENUINE SCIENTIFIC CULTURE

than just capture and transmit information. The strength of our laboratory is its ability to integrate algorithms which translate a database containing physical data into a genuine report on the health of the structures in question. Put another way, the algorithms developed by SII which are undergoing testing on the SNCF network can digest data and provide staff with real-time monitoring of all the facilities. They then provide the appropriate diagnosis for each situation. This represents a cultural revolution for the railway network. “The IoT is completely new for the SNCF, but working with us enables it to make this fundamental change at its own pace. The SNCF is not only looking for a technical solution, what it wants from us is a genuine scientific culture”. A framework agreement between the two bodies is soon to be signed which will formalize IFSTTAR’s commitment to working with the SNCF for the next four years.

Keeping railway facilities running when they have been through every major technological change is an exacting task. One major worry in the case of French railways is the ageing of the network. In the near future, the technologies known as the Internet of Things will make it possible to envisage a new monitoring approach for maintenance purposes. “It’s a question of changing from set maintenance procedures to predictive maintenance which is more targeted and responsive” details Vincent Le Cam, the director of the SII (Structures and Integrated Instrumentation) laboratory at IFSTTAR’s Nantes site. He is managing a number of projects with SNCF Réseau which aim to develop predictive measurement systems: “The challenge is to install sensors on the network which do more
Automatic speed control: 4 countries under scrutiny

In his latest book, IFSTTAR senior researcher Laurent Carnis gives readers the chance to discover, analyse and compare four research programmes on automatic speed control.

What does your book set out to do?
It performs an international comparison between four research programmes on automatic speed control, in Norway, France, the Australian state of Queensland and a number of cantons in French-speaking Switzerland. I interviewed representatives from the Transport Ministries, the police, insurance companies and associations of road users in the four administrations. Each case study was accompanied by a painstaking field survey. The book consists of a systematic comparison and analysis of these surveys. Each programme is presented with reference to three interdependent levels - institutional, organisational and operational - which allows readers to understand their governance. The approach is scientific and follows a precise analysis framework. None of the programmes is given benchmark status.

What readership are you targeting?
Public decision-makers will find useful information for implementing good practice. Members of the public will benefit from an accessible document which will satisfy their curiosity. How is an automatic speed control system embedded within policy? How is it organised? What stakeholders are associated with it? What use is made of the revenue? The book describes the principal features of each system in order to make understanding and comparisons easier. It is a scientific publication which road safety researchers or researchers who analyse public policy will be able to refer to in order to understand the nature of public intervention in the sphere of road traffic speed control.

What are its original features?
Few books deal with automatic speed control. Those intended for the general public usually approach the topic from a perspective of contestation and provide little basic knowledge. The scientific publications are generally concerned with just one country, and are therefore not very comprehensive. This publication is the first to present an international comparison conducted on a systematic basis with a common analysis framework. It is also the only one that provides an analysis that is based on results that go back such a long way. The first data were collected in France as early as 2003.

Les politiques d’automatisation des contrôles de vitesse : Entre logiques institutionnelles, formes organisationnelles et contraintes opérationnelles, In the series Ouvrages scientifiques de l’Ifsttar, April 2017

Laurent Carnis
laurent.carnis@ifsttar.fr
Philippe Duron was a Deputy for Calvados until 2017, and during his career has also been a mayor (of Caen) and the President of a Region (Basse-Normandie). In 2003 he presided over the Mobilité 21 Commission which was tasked with ranking major transport infrastructure projects. As a expert in infrastructure issues, Philippe Duron is also the President of the Association Transport Développement Intermodalité Environnement (TDIE).

**Philippe Duron, Chair of the Infrastructure Policy Committee in the framework of the Assises nationales de la mobilité**

**WHAT ARE THE CHALLENGES IN THE SPHERE OF MOBILITY AT THE NATIONAL LEVEL?**

Philippe Duron: Mobility is a constitutional right and French people travel a great deal – to get to work, for educational purposes and, of course, for leisure purposes and to access market services and public services. These go under the name of daily transport. Young people and seniors, who have time at their disposal, travel a great deal and over greater and greater distances. The freedom to travel is at the heart of the major challenges facing society. Greenhouse gas emissions from transport are still rising, while the proportion resulting from industry and housing is falling very significantly.

Decarbonising transport has today assumed as much importance as the accessibility and competitiveness of areas which has long been a concern of elected representatives and business circles. The digital revolution is the other major challenge which is disrupting the economics of transport. The development of digital platforms redefines the relationships between operators and their clients/users, and inevitably replaces the sectoral and modal approaches which have hitherto dominated the world by the concept of overall mobility. The arrival of connected vehicles followed by driverless vehicles is a challenge to everybody involved in mobility, and calls into question, in particular, the traditional boundaries between private vehicles and public transport. All this raises a simple question: will every area, whether urban, peri-urban or will rural benefit in a fair manner from the progress generated by collective action in response to these challenges?

**DECARBONISING TRANSPORT HAS TODAY ASSUMED AS MUCH IMPORTANCE AS THE ACCESSIBILITY AND COMPETITIVENESS OF AREAS**

**WHAT ROLE CAN IFSTTAR PLAY IN THESE DEBATES?**

It is impossible to make a correct decision in the general interest without analysing the outlook. Understanding and foreseeing future needs is both complex and risky. It requires a thought process which is methodological, documented and well-argued. It is here where IFSTTAR and its proven research teams can make a remarkable contribution. With its research programmes that investigate vital technological issues for advances in transport, research into transport economics and changing practices, IFSTTAR’s contribution is a genuine asset for decision-makers.