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The report for 2011 – the first year the fledgling Institute properly got up and running – revealed that there was still much to be built and consolidated beyond the mutual knowledge of staff and their activities, and the identification of courses of action for the years to come. In 2012, Ifsttar continued to progress as planned with willingness and determination, and we are especially proud to be presenting you with the report for this year, which has been enormously productive as you will find out.

In scientific terms, we developed our first ten-year scientific strategy after closely heeding our partners’ and supervising ministries’ wishes. We then redefined our organisation to make it clearer and more effective and to facilitate interdisciplinary approaches.

Our new goals and performance contract with the State was drawn up in less than a year – for the 2013/2016 period.

We began to settle into the Cité Descartes, in Marne-la-Vallée, joining a thriving science and technology cluster that promises much potential.

During this time, our research and expert appraisal activities continued and developed, with an ever greater quality requirement and constant focus on getting our research findings utilised by the business community, particularly with the launch of the first actions of the future investments programme.

On top of all that, we have maintained our quality certifications and shown determination in our European and international involvements, particularly with the setup of the European Transport Research Alliance (ETRA). As a result, the Institute was, once again, very busy. Above all, the first foundational building blocks outlining the future of the Institute were laid collectively, thus ensuring internal cohesion and external visibility. As such, it is clear for all to see that Ifsttar is a well-founded Institute.

The scientific strategy has shown us the direction to take, the contract with the State lays down a four-year road map for us and the new organisation gives us the appropriate means of action. The long-haul journey may now commence!

We would once again like to thank everyone working at Ifsttar for their commitment, involvement and efforts in this collective building process.

This year, we have continued to work towards a common ambition and shared vision of our new purpose.
LET’S HEAR FROM...

Prof. Dr. George. A. Giannopoulos
Director of the Greek Transport Institute (HIT)

The Director of the Hellenic Institute of Transport (HIT) multiplies the exception caps on the international and European scene, including the presidency of the new ETRA, European Transport Research Alliance, and of ECTRI, European Conference of Transport Research Institutes. He is also the author of 10 books and more than 200 scientific papers.

What are the challenges that Europe faces in terms of mobility?

George Giannopoulos: An equal mobility for all people, combining the requirements of a sustainable and highly secure development counts among one of the societal challenges that Europe intends to meet in the medium term, as specified by “Horizon 2020” the new ambitious EU framework program for research and innovation. Regarding the challenges for European mobility, I believe that we must concentrate our efforts and focus on a few priority issues to navigate a realist realm and achieve concrete results. I mention especially the following:

► Defining a core network of strategic European infrastructures in the frame of the European Mobility Network;
► Providing a coherent funding framework for transport infrastructures;
► Defining and demonstrating an efficient and integrated mobility system for our urban areas;
► Enabling true multimodality in the European freight transport system.

Is the launch of ETRA in 2012 one of the notable events of the year in regards to transport?

G.G.: Yes, because it is crucial to act collectively. The launch of the European Transport Research Alliance ETRA in Brussels is the culmination of a long process to achieve synergy and promote the ERA (European Research Area) in the field of Transport, that started by the signatories of the Declaration of Lyon in 2008. This strategic move, crucial in my opinion, demonstrates the willingness of European Transport research “actors” to coordinate their efforts to confront and solve challenges together, each bringing its added value. The Alliance should provide more integrated, more scientific and more multimodal input to important debates on the future of European transportation and is expected to help materialize the future ERA Transport.

Another most notable event in European Transport, of the year 2012, was in my opinion the creation of Ifsttar from two world known pillars of French transport research. I congratulate Ifsttar on its creation and wish the French transport researchers the best of luck in their work.

What are the advantages of Ifsttar in the European level of research?

G.G.: The new French Transport research institute through its responsiveness and its crucible of scientific excellence is definitely cut out for being a leading protagonist for transport research at both national and European levels. It has already demonstrated the ability to unite the major research programs and is active in most networks and associations on European and global transports. In addition, it ranks among the leaders in most of the partner associations of ETRA, namely ECTRI which was created by an initiative of the former Inrets and is fully supported by Ifsttar today. I am sure that Ifsttar will have the opportunity to further expand its influence in the future and demonstrate its skills on the international and European scenes since it will host the TRA in 2014, which over time became the leading global event for transport research.

1 / European Conference of Transport Research Institutes founded in April 2003 and based in Brussels. It has around 20 members among the major European transport research institutes or universities and brings together over 3,000 scientists.
2 / Transport Research Arena.
Jean-Louis Marchand
President of the French Union of Road Industry Associations (Usirf).

Usirf is a veritable old lady still young at heart...

Jean-Louis Marchand: Usirf brings together 1,500 road building companies via 20 regional associations. Our activities are changing in step with the environmental and social challenges, users’ expectations – especially in terms of mobility – and innovations. Laid down progressively over time, the one million kilometres of our road network are today some of the highest-performing in the world – but this strategic asset is anything but sustainable. The road must be projected in the future – become a 5th generation road – and this calls for greater consideration to be given to the existing heritage and its capitalisation. The deterioration in the condition of many road networks is hugely regrettable: this negligence will require major expenditure in the future if we are to maintain the level of service.

Let’s not forget that, beyond the different types of mobility, the road and road infrastructure support all the other networks – electricity, communication, water supply, drainage – and ultimately all of the systems making up the intelligent road. By all means let’s dream about the roads of tomorrow, but let’s not leave to perish the ones we already use today.

What ties do you have with Ifsttar and how are you working together to take up the challenges of the road?

J.-L.M.: Our traditionally strong ties with the LCPC are boosted by its merger with Inrets, which positions Ifsttar in a mindset of use and system, while we will be concentrating on structure. We are developing this approach (which we are raising the profession’s awareness about), and carrying it out together at the French Institute for Roads, Streets and Infrastructure for Mobility (Idrrim). This new partnership arrangement is a core feature of the voluntary undertaking agreement signed in March 2009, which commits the profession to the ecological perspective. The Ifsttar/Usirf partnership can also be appreciated by the joint research being conducted: Optimirr, which looked at structuring aggregate emulsion, is just one such example. Moreover, we should be actively developing exchanges between Ifsttar researchers and companies.

What are you expecting from Ifsttar?

J.-L.M.: The current “industrial” model for road maintenance needs changing urgently in favour of service contracts; this is the only way to optimise the means that local authorities will devote to their networks and enable them to determine their priorities. For that, we need to define performance indicators, develop measuring and diagnostic tools and design systems for modelling, simulating and visualising the evolution of infrastructure and its use; with new technologies this is now possible. Who better than Ifsttar to do and oversee this – thereby contributing to the renewal of a tradition of excellence?
INDICATORS

63 European projects
18 future investment projects
16 distinguished researchers
The pages that follow show that the Institute has continued to thrive in close association with its environment. Four foundational building blocks have been laid down to form the new Institute: the first concerns the validation of the first ten-year scientific strategy and the second, the drafting of the first goals and performance contract between the State and the Institute for a four-year period. The third involved the creation of five departments to ensure external visibility and clarity of the Institute’s scope on the one hand, and to federate the laboratories internally to enable cross-fertilisation on the other. Last but not least, the fourth building block was the headquarters’ move from the historical site on boulevard Lefebvre in Paris to Cité Descartes in Marne-la-Vallée to shore up the Paris-Est cluster. The Institute’s partnerships and collaboration remain a priority, whether at regional, national or international level, despite all of the efforts being made in-house to ensure we are a well-founded Institute. As such, in 2012 it is worth noting: the corresponding close involvement in the start-up of future investment projects Railenium (the scientific cooperation foundation (FCS) came about by decree on 26 October 2012) and Sense-City (the financing agreement with Ademe was signed right at the start of the year) as well as in obtaining the Vedecom and Efficacity the latest being a major research & development institute on the energy efficiency of the sustainable city; the follow-up of 63 European projects, defence of 89 theses and 10 Research Supervision Accreditations (HDR), maintenance of ISO and Cofrac certifications despite such notable changes as the move of the Paris site and internal reshuffling, 16 awards for researchers and participation in 11 new projects under the 2012 call for the 7th FP. Ifsttar’s foundations are definitely firmly in place!
2012 will go down in Ifsttar’s history thanks to three landmark events: its new headquarters moved to Marne-la-Vallée, its 1st goals and performance contract was drawn up and its ten-year scientific strategy was finalised.

Bienvenüe building, a new headquarters in Marne-la-Vallée for Ifsttar

Over the last quarter of 2012, Ifsttar’s 480 employees across the Paris and Marne-la-Vallée sites moved into the premises of the Bienvenüe building at the Cité Descartes, the headquarters of the Paris-Est University Research and Higher Education Cluster (PRES UPE) in Champs-sur-Marne. Covering over 26,000 sq.m., Bienvenüe is a low-energy building certified to be of “high environmental quality”. These new premises in the Paris-Est Science and Technology Centre dedicated to sustainable cities also houses the teams of the École des Ponts Paris Tech, CSTB, Sétra and École d’urbanisme overseen by the Universities of Paris-Est Marne-la-Vallée and Créteil, with which Ifsttar has many research priorities in common. Thanks to this move, the mutual knowledge of the new campus’s stakeholders will increase and the whole will form an undeniable centre of reference in the field of construction and sustainable cities. At the same time, this strategic location on the campus will further improve Ifsttar’s visibility and appeal to foreign researchers and students. Once the disruptions caused by the move – hardly helped by the delays in the building’s delivery – are out the way, this change in setting will also prove beneficial in terms of working comfort, particularly with more spacious, modern and ergonomic laboratories.
2012, the year in which Ifsttar’s 1st Goals and Performance Contract was drawn up

The 2013-2016 Goals and Performance Contract has been signed between the French Institute of Science and Technology for Transport, Development and Networks (Ifsttar) and its supervising ministries: the French Ministries of Ecology (MEDDE) and Research (MESR). This defines the courses of action to take with regard to research, expertise and management. Its final version defines five main strategic guidelines, and was drawn up over four main stages. Conducted in March and April 2012, the first stage took stock of the situation, identified the contextual elements to be taken into account and sketched out the strategic guidelines. Four main activities were identified at the end of this first stage: “Research and education”, “Expertise, services and assistance for public authorities”, “Support” and “Management”.

From May to September, the second stage entailed discussions about the goals, the activity and performance indicators and the targets to be met ... for each of the four main activities. For that, the project team, which included representatives of research structures and functional directorates alike, held consultations both internally and externally with the MEDDE general directorates in particular to find out what their expectations were.

From October to December, the third stage involved checking over the written draft at the end of stage 2 with the MEDDE Directorate for Research and Innovation (DRI) and MESR General Directorate for Research and Innovation (DGRI), as well as Ifsttar’s Scientific Board and Board of Directors. On 4 December, a more or less definitive version was approved by the Ifsttar Board of Directors.

The final adjustment stage is still going on in 2013 until it has been signed by the supervising ministries. This will then give rise to an annual written report produced no later than the end of the first half of the following year. These annual reports will also be presented to the Board of Directors.

Finalisation of the scientific strategy

In June 2012, Ifsttar approved its ten-year scientific strategy. This document sets out four priorities on which Ifsttar will be focusing its efforts. This initiative follows on from five “mutual knowledge” seminars that were organised in 2011 and proved invaluable for creating a knowledge base on which teams could then agree with regards to common priorities.

Some 80 representatives of research units got their teams involved and worked for about a year on defining these priorities. Successive synopses were then disseminated and widely discussed in each research structure before finally being officially defined as Ifsttar’s four challenges:

- Invent sustainable mobility
- Adapt infrastructure
- Control natural hazards and our environmental impacts
- Thinking up and planning cities and regions

At the same time, nine cross-disciplinary groups looked into how to organise the research tasks and assess researchers and which academic partnerships to encourage, etc.

Ifsttar also wished to validate and build on its ideas by hearing from academic partners, companies and users’ associations…

Four meetings were held (one per challenge) at which some 40 French experts were able to give their reactions per theme.

Concerning research policy and after an initial preparatory stage, some cross-disciplinary groups got back to work on drawing up lists of journals in which it would be worth the researchers publishing and ensuring that the scientific facilities are shared as effectively as possible and made the very best use of. Other groups are due to be launched to put the Ifsttar’s scientific strategy into practice in every possible way on a daily basis.
2012 STRIKING FACTS

30 JANUARY

7 & 8 FEBRUARY
► Technical Road Days in Nantes.

15 & 16 MARCH
► Concrack 3 (CONtrol of CRACKing in concrete structures), joint seminar between Ifsttar and Japan Concrete Institute.

8 MARCH
► Signature of the GIS Lirgec Pays de la Loire Agreement (Ifsttar, ECN, CSTB and University of Nantes).

23 TO 26 APRIL
► TRA in Athens.

23 TO 27 APRIL
► Acoustics 2012.

9 TO 11 MAY
► 36th civil engineering structure days in Sourdun.

JUNE
► Imagine Ifsttar General Assemblies across Ifsttar’s sites.

5, 6 & 7 JUNE
► Transports Publics, European Mobility Exhibition, Ifsttar joint stand with Predit.

13 & 14 JUNE
► Ifsttar ICST and metrology doctoral days in Villeneuve d’Ascq.

18 JUNE
► Visit from Dr Ashich Verma from the IISc Bangalore (India).

6 JULY
► Launch meeting of Sense-City.

10 & 12 JULY
► LCA and Construction in Nantes, 1st international symposium on life cycle analysis in the construction sector.
**27 TO 31 AUGUST** 06
- ICSE-6 (sixth International Conference on Scour and Erosion) in Paris, in partnership with EDF, the SHF, Cetmef and ESTP under the auspices of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE).

**4 SEPTEMBER**
- Visit from the President of BAST.

**10 TO 13 SEPTEMBER**
- EWGT 2012: 15th European Working Group on Transport organised by the LVMT at the Cité Descartes, Marne-la-Vallée.

**20 SEPTEMBER** 07
- Signature for creating the European Research Alliance.

**2 TO 4 OCTOBER**
- Geotechnics Days in Autrans.
- Interoute & Ville exhibition and 1st Congress of the IDRRIM in Lyons.

**10 & 11 OCTOBER**
- Technical Acoustics and Vibration Days in Autun.

**10 TO 14 OCTOBER** 08
- Ifsttar laboratories took part in the 21st Festival of Science.

**6 NOVEMBER**
- PLInfra closing seminar, project aimed at forging closer heavy goods and infrastructure interactions.

**26 NOVEMBER** 09
- Inauguration of the DECID2 Bridge.

**26 & 27 NOVEMBER**
- Participation in the Assises de la Recherche Research Conference in the regions where Ifsttar has a base.

**6 DECEMBER** 10
- Farewell ceremony at the historical Boulevard Lefebvre site.

**14 DECEMBER** 11
- Managers meeting (Committee of the 100), on management training.
Future Investment Programme (Pia)

Picking up pace

After Ifsttar’s numerous successes (18 projects) in 2011, intense work was undertaken in 2012 to describe the scientific content of these new tools, finalise the financial and administrative agreements and explain how they work. 6 July, launch of Sense-City

All of the projects made significant headway, with the following happening in particular:
- Setup of the Railenium and Jules Verne French Technological Research Institutes (IRTs).
- Signature of the Sense-City financing agreement.
- Signature of the MMCD Futurs Urbains financing agreement.

In financial terms, the first revenue was recorded in 2012, mainly for the Laboratories of Excellence (Labex) and Sense-City, as well as the funding of several theses (Vedecom & Railenium).

These dynamics are also reflected by research programmes with clear specifications, in which Ifsttar often plays a leading role.

All of this progress confirms the business community’s interest in the Institute’s research fields, and its high expectations as regards our achievements.

The 18 projects forming part of the future investments programme

**EQUIPEX**
Facilities of Excellence
- SENSE-CITY
  Nano-sensors for the city and the environment Île-de-France
- IVTV
  Engineering of ageing and living tissue Rhône-Alpes
- RESIF-CORE
  French seismological and geodesic network Rhône-Alpes
- NANOIMAGEX
  Nanotomography Île-de-France

**LABEX**
Laboratories of Excellence
- FUTURS URBAINS
  Planning, architecture, environment and transport Île-de-France
- CELYA
  Acoustics, health, cognitive sciences, etc. Rhône-Alpes
- OSUG@2020
  Climatology, hydrology, seismology, etc. Rhône-Alpes
- MMCD
  Materials for sustainable construction Île-de-France
- PRIMES
  Physics, radiobiology, medical imaging and simulation Rhône-Alpes

**IRT**
Technological Research Institutes
- RAILENIUM
  Rail infrastructure and its interfaces Nord-Pas de Calais
- JULES VERNE
  Composite materials, metals and hybrid structures Pays-de-la-Loire
- MMCD
  Materials for sustainable construction Île-de-France
- PRIMEs
  Physics, radiobiology, medical imaging and simulation Rhône-Alpes

**SATT**
Transfer of Technology Acceleration Company
- ÎLE-DE-FRANCE INNOV
  Île-de-France
- PACA-CORSICA
  PACA

**IEED**
Institutes of Excellence on Zero Carbon Energy
- FRANCE ÉNERGIE MARINE
  Marine energy Pays-de-la-Loire & PACA
- GÉODÉNERGIES
  Geothermal energy, CO2 storage Centre
- VEDECOM
  Vehicles and transport services Île-de-France
- EFFICACITY
  Sustainable cities Île-de-France
COMMUNICATION

One year after it was founded, Ifsttar is making its mark, and its name known, through a whole host of internal and external communication actions.

Press relations

- Ifsttar is drawing attention to itself
  Press events have increased by 9.43%, all media taken together, compared with 2011. The most notable increases concern requests from TV (+84%) and radio (+55%). We can particularly owe this growing reputation to the wide range of actions taken through 2012, starting with the annual press lunch of the General Management that drew 20 journalists from the general and specialist press, including Le Monde, les Échos, Radio France, Auto-Moto for the former and RGRA le Moniteur, la Vie du Rail and Béton(s) le Magazine for the latter.

- A high-impact communication format
  Press releases play a part in the Institute’s visibility and active promotion of its research. In 2012, there were 10 press releases on topical subjects or focusing on the Institute’s leading areas of work.

Magazine

- New content has been added to Trajectoire to shed clearer light on Ifsttar’s action
  “Trajectoire, le Magazine” is the quarterly newsletter presenting the very latest in terms of research, expertise and professional fields at Ifsttar for its institutional and economic partners. In 2012, Ifsttar reviewed the magazine’s format by adding four new pages. The three issues published in 2012 particularly included special theme articles on research on pedestrians, the safety of engineering structures and the electric vehicle. As well as demonstrating the wealth of research fields in which Ifsttar is involved, these articles above all highlight the diversity of approaches as well as the multidisciplinary nature of teams and shed additional light on each theme.

Events

- Ifsttar makes its presence known
  The Institute took part in countless national and international events in 2012: 34 conferences or seminars and 8 exhibitions including 3 for the general public. The Institute’s research teams also got involved in the 21st Festival of Science, a national event that ran from 10 to 14 October 2012 throughout France. In Bron, 3 presentations touched on eco-driving and kinetic energy in the event of impact, while in the Science Village in Nantes, researchers unravelled for the general public the ins and outs of high-speed line energy consumption and the propagation of seismic waves.

In Paris, researchers endeavoured to explain the topic of the drinking water cycle in plain language (Espace Pierre-Gille de Gennes) as well as that of the virtual pathway in eco-driving (Cité des sciences et de l’industrie). Last but not least, in Salon-de-Provence, a focus on the behaviour of road vehicles (Espace Charles Trenet) raised awareness among a great many visitors.

Web

- A new intranet is boosting in-house communication
  In January 2012, production of a new intranet website got underway on Ifsttar’s in-house network. Participatory, customisable, user-friendly and upgradeable, this intranet has a wide range of functions facilitating the circulation of information within the Institute. Content publication is now decentralised. The Ifsttar web team assists with the Institute’s support roles and services in structuring and populating their sections, and manages the validation circuit. This new operating method is boosting the dissemination of information and helping to improve in-house communication.

- The future website is getting its bearings
  2012 was also the year in which the design and production project of the Ifsttar website was launched. A project group was formed to accomplish this mission, supervised by an in-house steering committee. In a context where communication actions must be directed externally to present the Institute’s ambitions, the setup of a user-friendly website with just the right density of information is proving to be particularly strategic for Ifsttar.
Ifsttar's 3 quality qualifications

1 - Ifsttar has ISO 9001 since October 2002
A certification which was renewed in 2005, 2008 and 2011, for its quality management system of the five activities involving research, development, studies and expert appraisals, certification and testing for civil engineering structures and materials, geotechnics and natural hazards, the environment and operation of transport infrastructure.

2 - Ifsttar is “COFRAC Essais” accredited as per ISO 17025...
... for the seven following test programmes:
- Prog. no.3: tests on hydraulic concrete and its constituents (CPDM/Paris).
- Prog. no.5: concrete reinforcement tests (SMC/Nantes).
- Prog. no.29-1: metal material tests, mechanical tests (SMC/Nantes).
- Prog. no.8: tests on asphalt mixes and their components (MIT/Nantes).
- Prog. no.23: tests on rocks and aggregate (MIT/Nantes).
- Prog. no.86: tests on bitumen and derived binders (MIT/Nantes).
- Prog. no.105: tests of special products intended for hydraulic concrete structures (CPDM/Paris).
- Off the programme: mechanical strength tests of structures in a crash STAT ROUTE (Unex/Bron).

3 - Ifsttar is “COFRAC Certification de Produits Industriels” accredited as per EN 45011 (since 1 May 2006)
For the CE marking of aggregates (Directive 89/106/EEC Construction Products), notified body no. 1165 according to the “2+” system for in-factory production control audits in aggregate production quarries.

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The different “quality” audits in 2012

For over 20 in-house audits performed in 2012 by a group of 25 highly motivated “house” auditors, Ifsttar hosted auditors from the LNE (for ISO 9001) and COFRAC (for ISO 17025 and EN 45011).

The surveillance audit, as per ISO 9001, was conducted on the Paris, Satory and Nantes sites by the LNE over five days from 10 to 14 September 2012. This proved to be wholly conclusive, with certification of the quality management system being maintained.

The COFRAC “Product certification” surveillance audit at the “Certification Unit” of the Department of Partnerships and Resources in Nantes took place from 4 to 6 September 2012 (as per EN 45011). The “CE marking of aggregates” accreditation was maintained.

The COFRAC “tests” surveillance audit of the “Physico-chemical Behaviour and Durability of Materials” group in the “Materials” Department in Paris took place on 22 June 2012. This accreditation was consequently maintained on the Paris site.

The COFRAC “tests” surveillance audit for the Unex (Experimental Tests Unit) research unit on the Lyons-Bron site took place on 15 and 16 November 2012. This was the 1st surveillance audit after initial accreditation in 2011. Unex’s accreditation was maintained.

The most important challenge for 2012 was the “COFRAC test” renewal audit on the Nantes site for the “Metal and Cable Structures” research unit in the “Civil Engineering and Structures” Department and “Materials for Transport Infrastructure” Group in the “Materials” Department. Their accreditation was renewed for five years, until February 2018.

OTHER STRIKING FACTS

• In 2012, Corinne Husson, Assistant Quality Manager, left Ifsttar for a metrologist position in a French Ministry of Defence laboratory in Orléans. Her replacement, Charles Quesada, who joins Ifsttar from the MEDE central departments, took up his former position in June 2012.

• During the management review in June, the Ifsttar Executive Committee approved the new process mapping which will be applied from January 2013.
PARTNERSHIPS AND ALLIANCES

Via the ties forged with major stakeholders, across all of the fields of mobility expertise, the Institute is committed to holding effective collective discussions as closely in line with citizens’ and manufacturers’ expectations as possible. In this way we have the opportunity of putting our knowledge to use and passing on our visibility and action.

IN THE FIELD OF ROAD INFRASTRUCTURES

Roads and streets still in focus

Ifsttar has been an active member of Idrrim since the latter was founded in January 2010. Idrrim is an association bringing together all of the French public and private stakeholders working in the transport infrastructure, construction, maintenance and management sectors. Ifsttar performs the administrative duties of the association’s board, oversees the “qualification-certification” operational committee and various Ifsttar researchers and engineers contribute to the work of different committees and working groups set up by Idrrim. Ifsttar made a substantial contribution to Idrrim’s first congress, which was held in connection with the Interoute&Ville 2012 exhibition in early October in Lyons. Five of the congress’s fifteen sessions were taken in hand by the Institute’s researchers, as well as some dozen conferences. The presentations on the 5th generation road, contribution of transport infrastructure to the energy transition and technical breakthroughs in terms of understanding the degradation mechanisms of highways proved immensely popular with the congress’s 700 participants.

In July 2012, Ifsttar became even more resolutely committed to supporting Idrrim by signing a collaboration agreement according to which the Institute provides the association with human resources for helping it to successfully complete its missions. Since October 2012, Philippe Tamagny, deputy-director of the Materials and Structures Department, joined Idrrim on a part-time basis as Technical Affairs Manager, supporting the Institute’s Managing Director, Marc Tassone.

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IN SUSTAINABLE CITY PLANNING

Thinking up the city together

Cities now cover 2% of the world’s surface, are home to 50% of the world’s population, consume 75% of the energy generated and produce 80% of all CO2 emissions. The sustainable development of our societies depends, in practice, on the choices of cities for all their components – both structural and functional.

Ifsttar boasts unique skills and experience in France for thinking up and building the cities of tomorrow – particularly by calling on the resources of the French Urban Scientific and Technical Research Institute (IRSTV) in which it is closely involved. This CNRS research federation brings together some twenty laboratories in West France with the aim of coming up with methods and tools that contribute to sustainable city planning. Researchers and engineers from Ifsttar departments take part in all sorts of IRSTV federative research projects and oversee some of them. These include the Nantes Observatory of Urban Environments (Onenvu) dedicated to long-term monitoring of water, pollutant and energy flows in different environments (air, water, soil) and to urban remote sensing on several catchment areas and neighbourhoods of the Nantes urban area, Micro Climatologie Urbaine et Energie (MUE), Sols Urbains (SOLURB) as well as Environnement Sonore Urbain (ESU).

A deeply informative year

2012 was marked by the final seminar of the EVALPDU project (Environmental Evaluation of Urban Journey Plans and their socio-economic consequences) of the ANR Sustainable City programme. This found that the environmental effects of such plans undoubtedly remain limited, but can be quantified, with a clear influence on the perceived well-being of inhabitants. For their part, the effects of public transport accessibility on real estate have been confirmed.

The EM2PAU project (Influence of micro-meterological effects on noise propagation in the urban environment, funded by the Pays de Loire Region), which involved Ifsttar’s acoustic team, ended in 2012. The work on this theme is due to be continued in the federative framework of the IRSTV.

Gardens have a future

The organisation of a second FluxSAP urban climatology measurement campaign on the ground and by airborne remote sensing brought together a dozen or so teams from different institutes. The data collected should enable micro-climatic models to be validated (transfers of heat and steam) in disparate urban sites, by identifying their sources and separating the bare and occupied soil, building and planted surface contributions.

Two new projects involving Ifsttar have got under way, including the ANR sustainable city project and JASSUR Buildings project on urban associative gardens from the perspective of practices, functions and risks. For its part, the INSU-EC2CO ROSHENY project looks at the role of soil cover with regard to the modelling of energy and water flows in the urban and suburban environment.

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IN THE FIELD OF ENERGY AND TRANSPORT

Transport, a major parameter of the global energy equation

The French National Alliance for Coordinating Energy Research (Ancre) brings together, around its founding members (CEA, CNRS, Ifpen and CPU), those French public research bodies concerned by energy problems with a view to identifying and resolving their main scientific, technological, economic and social obstacles.

Since 2010 Ifsttar has been running the “Transport” usage group (GP6). The GP6’s work took an approach that was both sectoral and cross-cutting to this field. Precedence was mainly given to road transport.

In 2012, the skills of French laboratories in the field of thermal, hybrid and electric vehicles, of the fuel cell, rail and energy efficiency were mapped. What’s more, a report entitled “Identifier les verrous pour accélérer les développements industriels indispensables à la transition écologique” (Identifying the obstacles to speeding up the industrial developments necessary for ecological transition) was published. The different energy sources from biomass, fossil fuels, geothermal energy, nuclear, solar, hydraulic marine and wind energy – as well as the use of energies (in buildings, industries, agriculture and transport) – were also analysed.

The total or partial electrification of vehicles in the road transport sector holds considerable potential for improving consumption and emissions, but is hampered by several obstacles: architecture, hybrid and electric engines, optimisation of heat engines, conventional and alternative fuels, electricity storage, strategies for controlling and managing energy and so on.

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The electric vehicle, a major stake in the energy transition
Regional footholds are part of a process reflected in a collective and individual gain in terms of visibility, performance and innovation. Ifsttar thus intends to contribute to overall discussions that are useful to the development of regions on all mobility fields and with decisive public policies for the future. They also show that we consider our desire to forge a link between research and industry as one of our priorities.

Marne-la-Vallée & Satory/Île-de-France

Ifsttar’s Headquartes; Part of Our Research Teams Are Also Moving to Marne-la-Vallée

벽 Marne-la-Vallée is becoming one of the world’s major centres for education and research on all urban-related themes

At the end of 2012, Ifsttar’s headquarters and the teams at Boulevard Lefebvre in Paris moved into the Bienvenüe building. Other teams already based in Cité Descartes are due to join them shortly. The Bienvenüe site forms part of the Paris-Est science and technology cluster within the University of Paris-Est Marne-la-Vallée.

Cité Descartes, which boasts a high potential of researchers, engineers and doctoral students from research bodies, graduate schools, institutes and the University of Paris-Est Marne-la-Vallée, is now becoming a cluster of excellence and innovation to meet the challenges of the sustainable city. This grouping, in synergy with the Advancity competitiveness cluster, will thus be one of the world’s major multidisciplinary centres of education, research and innovation on the themes of the city of tomorrow.

벽 Satory is making headway

The Vedecom Institute of Excellence on Zero Carbon Energy (IEED) proposal, reworked in 2011 by all of the 42 partners (including Renault, PSA, Valéo and Ifsttar), was selected by the French General Commission for Investment (CGI). Thanks to State funding of up to €53 M, Vedecom will conduct research on the electrification of vehicles, delegation of driving as far as automation and new mobility systems and services. As a result, a new 300-strong research centre will eventually set up shop at Satory alongside Ifsttar, at 25 avenue des Marronniers, in a specially designed building. This building will also house Ifsttar’s laboratory on assisted and automated driving, Livic.

벽 New platform, new projects

Currently being built in Satory, Mov’éo TREVE, the platform for the “Vehicles of the Future” programme supported and accredited by the Mov’éo competitiveness cluster, will focus on testing and assessing charging systems for rechargeable...
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annual report 2012

nantes-Bouguenais / pays de la loire

SUPPORTING ALL CIVIL ENGINEERING, INFRASTRUCTURE AND URBAN INITIATIVES

Staff at Ifsttar’s Nantes centre sought in 2012 to strengthen their local presence in West France – obviously Pays de la Loire, but also Brittany, Lower Normandy and Poitou-Charentes. This has been manifested in our participation in all the research partner organisations (at academic and industrial level), as well as resource centres (Novabuild, which has replaced the PGCE competitiveness cluster) or clusters (such as the one on marine renewable energies in the Pays de la Loire region). In addition to regional participation in the French National Research Conference, preparatory work for drawing up the future regional plan (Pays de la Loire Region) of higher education, research and innovation (ESRI) for the 2014-2020 period involved a great many academic institutions. Under the auspices of the Unam Research and Higher Education Cluster and regional advisory committee of research and technological development (CCRRDT), Ifsttar made a particular contribution to the work of the “materials, engineering” thematic commission (including acoustic, energy and civil engineering aspects) and of the “towns and territories” cross-disciplinary cluster.

Strong involvement in competitiveness clusters
Ifsttar’s centres in the Parisian region have built on their ties with the Advancity, Mov’eo and Systématic competitiveness clusters.

Materials, civil engineering and cities
Alongside aeronautical and shipbuilding activities, civil engineering and non-destructive control (NDC) methods are reputed as leading activities in the Pays de la Loire region – for which Ifsttar is one of the main standard-bearers, particularly our Nantes site. Civil engineering in the Pays de la Loire accounts for 25% of French academic research potential in the sector: the LIRGeC (Loire Institute for Construction and Civil Engineering Research) GIS (scientific consortium), founded in March 2012 and jointly managed by Ifsttar, is the “tool” for the territorial coordination of civil engineering research. Ifsttar’s teams are helping to diversify civil engineering and NDC applications, from the traditional sector of transport infrastructure (roads, bridges, ports), housing, aerial shot of Nantes, including the test track surrounding the centre and energy generation (dams, nuclear power plants) to new energy sources (especially onshore or offshore wind energy: Fondeol 2 project, or binders from biomass energy: Algoroute project). The Institute remains closely involved in governing the Advancity cluster on the sustainable city by chairing the scientific advisory board and the Mobility accreditation committee and running the four strategic guidance committees. The teams are continuing to take part in putting together and coordinating projects accredited by this cluster, including the GERFAUT II project which is developing new equipment for regulating travel in dense urban zones across Seine-Saint-Denis. We could also mention the TRAFIPOLLU project for multi-scale modelling of pollution caused by traffic in an urban environment.

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Nantes-Bouguenais/Pays de la Loire
SUPPORTING ALL CIVIL ENGINEERING, INFRASTRUCTURE AND URBAN INITIATIVES

Helping to structure regional research
Staff at Ifsttar’s Nantes centre sought in 2012 to strengthen their local presence in West France – obviously Pays de la Loire, but also Brittany, Lower Normandy and Poitou-Charentes. This has been manifested in our participation in all the research partner organisations (at academic and industrial level), as well as resource centres (Novabuild, which has replaced the PGCE competitiveness cluster) or clusters (such as the one on marine renewable energies in the Pays de la Loire region). In addition to regional participation in the French National Research Conference, preparatory work for drawing up the future regional plan (Pays de la Loire Region) of higher education, research and innovation (ESRI) for the 2014-2020 period involved a great many academic institutions. Under the auspices of the Unam Research and Higher Education Cluster and regional advisory committee of research and technological development (CCRRDT), Ifsttar made a particular contribution to the work of the “materials, engineering” thematic commission (including acoustic, energy and civil engineering aspects) and of the “towns and territories” cross-disciplinary cluster.

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Contributing to regional scientific reputation
The organisation of national and international technical or scientific events in the regions is one of the ways in which Ifsttar is contributing to the visibility and reputation of the regions in which we have a centre. Beyond the usual national technical road days (JTR) organised every year in early February in Nantes, Ifsttar was the main organiser
and facilitator of the international congress Acoustics 2012 (www.acoustics2012-nantes.org) in partnership with the French Acoustics Society, and the first international seminar on consideration of the analysis of the materials and structures life cycle in the field of civil engineering and construction, LCA 2012 (www.lca-construction2012.ifsttar.fr), in partnership with the Rilem. Both of these events were, moreover, distinguished by Métropole and the Nantes Cité de Congrès as one of the most significant scientific events in 2012 – with Acoustics 2012 scooping the congress’s most important award of the year (for its duration, the number of participants and where they came from).

To increase the visibility of research teams in the Nord-Pas de Calais, in 2012 the Region drew up two strategic documents for 2013: the Regional Plan for Higher Education and Research and the SRI-SI (Regional Innovation Strategy for Intelligent Specialisation). Transport and mobility have been identified as one of the 6 strategic activity areas, and rail infrastructure should logically be one of the main specialisation areas. It is worth pointing out that although Nord-Pas de Calais is the 4th French region in terms of population and GDP, it is only 11th for the number of research & development jobs (8th for public research positions). Ifsttar is the only organisation to be set up in the region with a proportion of our national workforce exceeding 10%.

The rail sector – a highly formative symbolic activity

Ifsttar has chosen to play a very active part in Railenium, a federative project of the Future Investments Programme (PIA) and taking the form of an IRT devoted to research on rail infrastructure1.

Main objectives of Railenium: increase the life cycle of rail infrastructure (30% increase in the life cycle of tracks and 20% in traffic capacities) and focus on a swift international development of its new products. This challenge is crucial for the future of the rail industry.

1 / Selected on 9 May 2011, the Railenium IRT is situated on a site in Valenciennes, with three other sites in Villeneuve d’Ascq, Aulnoye-Aymeries and Compiègne: It brings together public and private applied research laboratories as well as some twenty industrial stakeholders.

Lille-Villeneuve d’Ascq/Nord-Pas de Calais
TRANSPORT, A STRATEGIC LINE OF RESEARCH IN THE NORD-PAS DE CALAIS REGION

The rail industry, a major theme for this site in North France
The Railenium IRT relies on 2 operational units. The first, a Scientific Cooperation Foundation launched after the approval of its articles of association by Decree of 26 October 2012. The second, a European Rail Testing Centre, based in Aulnoye-Bachant (Nord), is still to be launched. Following 8 Work Programmes determined in the spring of 2012, the Railenium board defined a programme of 15 research projects along with five thesis projects – two of which are hosted by Ifsttar and two by the universities of Lille 1 and UVHC, but jointly managed with the Institute. Involved in 7 of these Work Programmes, Ifsttar oversees two of them: WP2 (Mechanical and Civil Engineering of Soils) and WP4 (Intelligent vehicle-infrastructure interactions). The Railenium teams will get to work in 2013 with the Institute’s support. For, as a founding member of the IRT, Ifsttar has undertaken to provide staff according to arrangements that still need defining.

► Cisit is readying its assets for the challenge of sustainable mobility

Ifsttar has partnered up with the Cisit (International Campus on Transport Safety and Intermodality) since it was founded in 2007, under the State-Region Project Contract 2007-2013. As part of the Cisit’s 2014-2020 future strategy, launched in mid 2012, Ifsttar has got involved to produce a shared perspective and joint scientific objectives, with the ambition of projecting the Cisit as a European stakeholder on the theme of the sustainable mobility of people and property by 2020 – renowned for its original approach, research excellence and ties with the industry.

► The i-Trans competitiveness cluster moves up a gear

Ifsttar has stepped up its collaboration with regional economic stakeholders, particularly through the i-Trans competitiveness cluster where representatives of the Institute run the “Research” and “Intelligent Mobility” programme committees. The “i-viaTIC” platform on the intelligent mobility of people was launched in December 2012, with a view to offering leaders of public and private projects in Nord-Pas-de-Calais, Picardy and the Eurométropole Lille-Kortrijk-Tournai services provided by a dedicated team, assisted by the i-Trans cluster and a network of expertise. Featuring amongst the 15 “highly effective” clusters following the 2012 national evaluation, at the end of the year i-Trans drew up its strategic road map 3.0, which focuses on stepping up the call for scientific and technological resources in its territory. Along with the UVHC, Ifsttar is the main academic partner of the cluster in terms of our involvement in its innovation and research projects (Ifsttar is running some twenty of the 165 projects set up since 2005). One of the cluster’s newly declared ambitions is to develop social sciences in association with some of its future projects. To round off this regional round-up, Ifsttar’s expertise activities should also be built on in 2013, especially with such partners as Certifer.

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Lyon-Bron/Rhône-Alpes

A COMPREHENSIVE, COHERENT AND PARTICIPATORY APPROACH

Through a rich catalogue of innovative initiatives giving precedence to partnerships, the involvement of civilians and the visibility of the centre within local bodies, the Bron site is making a long-term commitment to the mobility of citizens.

► Mobility and inequality

Ifsttar has been closely involved in the Rhône-Alpes science and technology cluster (PST) since it was set up by the French Ministry for Ecology, Sustainable Development and Energy (MEDDE) to enable the emergence, testing and assessment of sustainable and safe mobility solutions. Through its 10 members’, the Rhône-Alpes PST more than amply covers the theme of mobility according to four work strands. The Institute, which helped to create strand 2, Mobility and inequality, is tasked with running and steering the projects under way. Two research projects began for this work strand in 2012. A review of the current situation with regard to mobility inequalities, conducted as part of a one-year post-doc contract hosted by the ENTPE-LET and jointly supervised by Ifsttar/ Lescot, will provide local stakeholders with an exhaustive list of the problems of mobility inequalities and their possible interactions.

The second project, conducted by the Lyons Public Works Design and Research Office (Cete) and jointly run by Ifsttar/ Lescot, the Certu and ENTPE-LET, looks at mapping tools and information systems describing the local access possibilities. An initial assignment to assess the territory’s public transport accessibility for people with reduced mobility is under way. This is based on the adjustment of a tool producing isochronous access maps for the territory.

► Thinking up and building the city of tomorrow: inhabitants and researchers are joining forces

A major project of the town of Bron, the national scientific encounters “sustainable and social city for citizens” were initiated on 13 July 2012. Ifsttar and the town of Bron are the co-founders of this national and local event which puts into practice the “Charter to open research up to society” signed by Ifsttar and Irstéa among other organisations.
Innovative and participatory
The first stage involved launching four “Citizen workshops” jointly run by researchers-in-residence around Bron. The three themes selected for 2012/2013 are urban planning, road safety and electric vehicles. A cycle of five “Knowledge encounters” began in October 2012 at the Médiathèque Jean Prévoast. Along the lines of open universities, this intends to share scientific questions and not limit itself to painting a picture of current knowledge. The theme selected for the 2012/2013 academic year – Energy transition and transport – ties in with the theme of the 2012 Festival of Science.

Democratising research
Lastly, in-depth discussions launched by Ifsttar’s Scientific Directorate and the CPSN³, overseen by Dominique Mignot, Deputy Scientific Director of Ifsttar, will result in a “Scientific Seminar” scheduled from 6 to 8 June 2013 in Bron. Thematic and multidisciplinary, it is aimed at progressing knowledge in the research fields at the interface between urban governance and social concerns, the social consequences of environmental policies, the economic crisis and social transformations of the city. Presentations will be made at this seminar of the progress made in thoughts given to the Encounters theme. After three annual seminars, an international scientific symposium will be held for the 4th year in Bron. This will produce scientific findings and breakthroughs. At the same time, on 7 and 8 June 2013, the work and discussions will be presented in plain language during the “General Public Days”. Free and open to everyone, these will be held in a symbolic venue – Collège Théodore Monod – located right in the popular Bron-Parilly neighbourhood.

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Disseminating scientific culture: active participation
The dissemination of scientific culture is a strategic political objective for the foundation of a democratic society and shared knowledge. Ifsttar’s participation in the annual meetings of the Archimède committee on this very theme, as a representative of the research organisations in PACA (CORPACA, coordination of research organisations in PACA), makes us a vital force for research federation and dialogue in the region, in light of the rising social concerns about mobility and safety. For the record, the State-Region Coordination for the development of scientific culture in Provence-Alpes-Côte d’Azur is placed under the authority of a steering committee made up of regional council elected members and State representatives. Regarding scientific culture dissemination strategy, the steering committee can call on the advice of an advisory committee, the Scientific Culture Action and Project Guidance Committee known as the Archimède Committee. This has 19 members – experts appointed jointly by the State and Region, as well as representatives of universities and research organisations.

The synergy between the territorial stakeholders is materialising
The actions to consolidate the centre’s territorial presence are continuing. In particular, Ifsttar submitted its application in 2012 to join the FCC structure (Flying Capabilities Campus) as an associate member. Launched in 2011 and set up in the Salon-de-Provence region, FCC is a new kind of campus project devoted to the space and aerospace systems of tomorrow. We are offering to share our expertise in accident analysis with this campus, as well as our knowledge about the impact of human factors on the analysis of the malfunction of occupant protection and transport systems. Indeed, our teams in Salon-de-Provence and Aix-Marseille have strong skills as well as considerable test means for conducting complementary and cross-cutting research in the land transport field, dedicated to accident analysis from its occurrence to its rectification. Our Institute thus intends to increase our contribution to the synergy between education, research, industry and local authorities. For this collaboration is sure to positively impact training and growth for all of the stakeholders in these various research fields.

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Salon/Marseille Provence-Alpes-Côte d’Azur
A FORCE FOR RESEARCH FEDERATION AND DIALOGUE ON RISING SOCIAL CONCERNS ABOUT MOBILITY

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Notable involvement in the Regional Conference for Higher Education and Research
In 2012, it is worth mentioning the Institute’s active contribution to the Regional Conference for Higher Education and Research through the CORPACA. It particularly posted a regional contribution to the Conference website and took part in the event on 13 October 2012 organised by the coordination at the Hôtel de la Région in Marseilles.
A structured strategy

By increasing our scientific reputation, Ifsttar is lending a hand in constructing the European Research Area, forging partnerships with institutes of excellence, actively participating in international networks and featuring on the emerging country scene; these are the objectives of Ifsttar's international strategy.

In 2012, as part of the Institute’s project, a collective thought process got under way, identifying five key objectives for Ifsttar: fully integrate the international component, look for formative partnerships, develop the European priority, work together with French economic stakeholders and continue to take action in emerging countries.

These objectives will be set out in more detail in operational plans in 2013. This strategy must help to improve the Institute’s scientific excellence on the international stage in line with the national research priorities.

In this context of international policy, Ifsttar is continuing to play an active part in the World Road Association (PIARC), which represents a vast forum of information and knowledge exchange on all sorts of themes associated with the road.

We have stepped up our involvement, especially in the technical committees set up in 2012. Beyond performing the general secretariat duties of its French committee, Ifsttar also chairs the technical committee “Road Network Operations” and carries out the secretariat roles of the three committees: “Freight Transport”, “Management of Road Assets” and “Earthworks and Unpaved Roads”. The Institute is also represented in six other committees.

In Europe, organisation of the 2014 Transport Research Arena conference by Ifsttar can now get under way after the success of the 2012 conference. TRA 2014 will be held at the Cnit in Paris La Défense from 14 to 17 April and is designed, by the MEDDE and Ifsttar, as a formative event forming a fully-fledged exchange platform on the priorities of transport research in Europe and its implementation.

Dynamic bilateral cooperation

The operational development of bilateral cooperation projects launched by Ifsttar teams could also take place in 2012. In Tokyo, Japan, the Institute took part in a symposium in September, “Natural disasters and railways”, with the RTRI1, SNCF and RFF; the Institute also jointly organised a symposium with the University of Kyoto on reducing the carbon footprint, and hosted a joint seminar with the Japan Concrete Institute in March entitled “Concrack 3” (CONtrol of CRACKing in concrete structures).

What’s more, Ifsttar has got involved in fund-raising efforts to support our cooperation with three projects selected by the Franco-Quebecker standing cooperation commission, several projects with Brazil on civil engineering themes adopted by the French Committee for Assessing University and Scientific Cooperation with Brazil (Cofecub) and two Franco-Australian projects with grants under the “France-Australia Science Innovation Collaboration” programme (Fasic).

1 / Railway Transport Research Institute.
2012, launch of ETRA

The European Transport Research Alliance (ETRA) was officially launched on 20 September 2012 in Brussels. This alliance has come about following the Lyons declaration signed in 2008 between five associations that work in the transport sector: ECTRI, FEHRL, FERSI, EURNEX and HUMANIST, of which Ifsttar is a member. Indeed, the signatories of this declaration undertook to work together on strengthening the European Research Area in the transport field so as to take up the major challenges associated. The Alliance’s priorities are to examine the strengths, weaknesses, opportunities and threats of the transport sector and to develop a joint vision of the actions to be taken to reduce research fragmentation and overcome the integration barriers.

The Alliance rounds off the work of existing organisations in the field of transport research and innovation in Europe, particularly by making a more multimodal contribution to important debates on the future of transport.

Ifsttar and our European networks

Ifsttar has also continued to play an active part in several European associations and European networks.

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<th>EUROPEAN ASSOCIATIONS AND NETWORKS IN WHICH IFSTTAR PARTICIPATES</th>
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This participation played a major role in the success of the 7th FP 2012 call for projects and in ensuring that the Institute’s messages are clearly passed on in the future European research programme Horizon 2020.
We have shored up our position in the European Research Area. Thanks to Ifsttar's unflagging participation in European associations and ties with the European Commission, we have been able to initiate new European projects and receive funding. We can thus be proud of the fact that we have submitted high-quality projects to European bodies, with 34 projects submitted in total and 11 selected out of the 16 submitted in the Transport theme of the 7th FP. With a success rate of around 30% on average over the whole of the 7th FP by the end of 2012, Ifsttar is thus participating in 55 ongoing projects – 8 of which we oversee. Moreover, in 2012 European contracts brought in around €2.1M. In 2012, the Institute also put a lot of effort into responding to the Marie Curie calls for researcher mobility (8 projects submitted) as well as those of the European Research Council (1 project submitted) with a view to boosting international renowned careers.

This performance rewards the Institute’s unwavering efforts in terms of keeping an eye out for opportunities and of operational support for researchers. It is also the fruit of targeted collective dialogue upstream and validated the strategy to participate in European associations and networks of excellence, including ECTRI² and FERSI³, on the boards of which Jean-Paul Mizzi, Deputy Managing Director, and Dominique Mignot, Deputy Scientific Director, have been elected respectively. Likewise, Ifsttar is closely involved in several of the FEHRL’s ⁴ bodies, and this forum’s particularly active role in setting up European projects in which our researchers play a large part should be highlighted.

> **Steering policies and programmes, a priority**

Also worth highlighting is the commitment of the Directorate of European and International Affairs to supporting the Institute’s researchers’ participation in European projects, particularly via the organisation of workshops and exchange and information seminars. The ERT subsidiary has supported several project setups and performs the administrative management duties of some European projects.

Ifsttar provides ample food for thought in the MESR’s, MEDDE’s and European Commission’s discussions on drafting the Horizon 2020 programme, particularly by contributing to specific and thematic working groups. Through in-house brainstorming workshops, papers have been written that clearly describe the role of transport infrastructures in the Horizon 2020 programme.

Lastly, commissioned by the Allenvi alliance since 2010 to oversee the French participation in the joint programming initiative “Urban Europe” on sustainable cities, Ifsttar is still playing a key role in this initiative’s Governing Board and running a mirror French group made up of the MESR, MEDDE, ANR, Ademe and CNRS.

Ifsttar has provided considerable food for thought in the discussions about the future European research programme “Horizon 2020” via specific working groups and bodies drawing up strategic agendas for giving content to the programme, which is due to be launched at the end of 2013. In this respect, as a member of the European Construction Technological Platform (ECTP), Ifsttar has made a significant contribution to its initiative “Research for Future Infrastructure Networks in Europe”; and taken part in the working groups of the European technological road transport (ERTRAC/ European Road ⁵) platforms. Lastly, Ifsttar has directly contributed to the work of the inter-platform group created in 2012 by the European Commission, bringing together the platforms of the four transport means (road, rail, maritime/fluvial and air) with the construction platform. On a different note, Ifsttar has continued to chair the “research” sub-group of the CEDR (Conference of European Directors of Roads) on behalf of the MEDDE.

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2 / European Conference of Transport Research Institutes.
3 / Forum of European Road Safety Research Institutes.
4 / Forum of European National Highway Research Laboratories.

The members of the Directorate of European and International Affairs take regular action within the Commission Transport Research Advisory Council) and rail transport (ERTRAC/ European Rail Research Advisory Council) platforms. Lastly, Ifsttar has directly contributed to the work of the inter-platform group created in 2012 by the European Commission, bringing together the platforms of the four transport means (road, rail, maritime/fluvial and air) with the construction platform. On a different note, Ifsttar has continued to chair the “research” sub-group of the CEDR (Conference of European Directors of Roads) on behalf of the MEDDE.
Transport Research Arena Conference: from Athens to Paris!

Organised in Athens in April, the TRA 2012 conference was a hit. A major innovation for this 4th edition: the combination of all road, maritime/fluvial and rail surface transport means. As a member of the programme and management committees, Ifsttar featured prominently, organising two guest sessions, presenting a dozen communication documents and posters and facilitating several sessions during the conference. The France Pavilion, which Ifsttar organised jointly with the MEDDE, proved to be an effective meeting point for researchers and practitioners.

After this success in 2012, the 2014 edition is already being planned, for the MEDDE had expressed its interest in 2010 in hosting the TRA 2014 and delegated its organisation to Ifsttar. In 2012, Ifsttar therefore set up the management committee, the vice-chair of which is Hélène Jacquot-Guimbal; the programme committee and the organisation committee. Come to Paris La Défense in 2014 for the 5th edition!

Researcher mobility ever encouraged

The mobility of Ifsttar’s researchers is part of our influence strategy, for this contributes both to our reputation and the advancement of the researchers’ careers. In 2012, Ifsttar therefore continued with our policy supporting researchers’ scientific residences in foreign research institutes. Worthy of mention are five long-term residences in Europe (École Polytechnique de Lausanne in Switzerland, national aeronautics and space research centre of the Federal Republic of Germany (DLR) in Berlin) as well as across the Atlantic in the States (USC-University of Southern California and UCLA-University of California, Los Angeles) and Canada-Quebec (INRS, institut national de la recherche scientifique).

Franco-German friendship: continuing scientific cooperation

In anticipation of the Franco-German year 2013, celebrating fifty years since the signature of the Elysée Treaty, in 2012 Ifsttar continued to strengthen our ties with our German partners. Ifsttar organised a seminar in Berlin that brought together some thirty researchers from the Transport Institute of the Deutsches Zentrum für Luft-und Raumfahrt and Ifsttar on the theme “Sustainable transport: definition, assessment, tools and public policy”. Workshops on various themes to do with sustainable transport, mobility and freight pinpointed the two institutes’ mutual interests for sketching out future targeted cooperation.

Ifsttar also strengthened our ties with the Bundesanstalt für Strassenwesen. In this way, our Institute helped to write an article co-signed by the Transport Infrastructure Directors of the French and German Ministries, which was published in the PIARC’s magazine “Routes/Roads”.

The two French “5th generation roads” and German “Road of the 21st century” programmes highlighted the two institutes’ mutual interests in the theme of the road of the future. Ifsttar is also continuing to collaborate in the Franco-German Cooperation research programme on transport, Deufaro, with a second project on quiet road surfaces. Two other projects were completed in 2012: ICADAC on camera detection in deteriorated weather conditions for cars and PLATA/PROTON which developed a multistandard telematic platform for vehicle-to-vehicle communication.

focus on...
Expert services

Promote research through high-quality expert services

These include the appraisal conducted on a railway in Saudi Arabia for the civil engineering sector and the detailed inspection of the Radès La Goulette bridge in Tunisia, conducted jointly with Sites. This service also included training in bridge pathology and inspection for managers of engineering structures at the Tunisian Equipment Ministry.

In China, at the request of the JSTRI (the largest test bureau and laboratory in China) and RIOH (Research Institute On Highways), Ifsttar experts organised training in the use and interpretation of highway fatigue testing.

Furthermore, the Institute’s experts have been providing their expertise for several years – at the request of the European Union Delegation in Haiti – on the new construction site for the main road RN6, between Cap Haitien and the Dominican Republic border. The renovation of slip roads and construction of the main road has been funded by the European Union. In addition to this expertise for the RN6 road, a second mission on the RN3 road between Mirebalais and Hinche has been conducted to try and determine what caused a major crack in the road surface.

In the field of road safety, Ifsttar has lent our support to the road safety policy of the Comoros Republic, with the organisation of a seminar at which the strategic priorities could be defined. Four Ifsttar experts continued their consultancy and Radès La Goulette bridge in Tunisia assistance missions with the Vietnamese road safety authorities under a contract of the World Bank and in partnership with Egis. Lastly, several expert missions were completed in Columbia in liaison with Corasfalto, a Columbian public research institute, and the Universities of the Andes and Javeriana in Bogota, particularly to promote French road technologies.

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Let's hear from...

Corinne Blanquart
From the summer of 2011 to the summer of 2012, at the DLR, Berlin

MORE THAN JUST
A PERSONAL EXPERIENCE...

When I had plans to join the Transport Research Institute (IVF) at the DLR for a year, I never dreamt that the adventure would be so rich and productive – proving to be so much more than just a personal experience. The Splott unit and the IVF have been sharing ideas for many years now, and conduct fairly similar work in freight transport and logistics. That said, few studies had looked at the very last links in the chain – shops – and the flow of goods they generate. I therefore put together a specific research project on how commercial distribution is organised. For this major project, I had the chance to coordinate a dedicated team of four young researchers. We were able to hold 120 qualitative interviews, which is no mean feat!

The idea was also to give fresh scope to these exchanges, and even to institutionalise them. I hope to have successfully transformed the test, first of all by organising a Franco-German seminar in September 2012, at which other collaboration possibilities could be identified. But among the most significant outcomes of my time in Berlin was the creation of an international associate team on the theme commerce and transport – a first for Ifsttar. This should be set up in late 2013/early 2014 between the DLR IVF and Splott. It will explore other issues, including the influence of the location of distribution centres and sales outlets or developments such as e-commerce on transport practices, etc. The adventure is still going on!

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7 / National aeronautics and space research centre.
DOCTORAL TRAINING

For doctoral training, Ifsttar’s second year of activities in this area has focused on bringing recruitment methods and thesis supervision into line. The Future Investments Programme (PIA) schemes provide a fresh source of funding.

The doctoral dynamic is picking up pace

With 106 new theses getting under way, there’s no doubt that the 2012 recruitment campaign has been a success. Overseen by the Scientific Directorate, the stage for selecting subjects for Ifsttar funding ended at the beginning of the year with 75 subjects being launched. The application portal then made it possible to submit no fewer than 420 applications. In the end, the Commission placed 41 students in a primary list and 34 in an additional list after interviewing the candidates. On top of these theses funded entirely or jointly by Ifsttar are those theses funded externally (Cifre, Ademe, Region, through contracts, etc.). Note also that new PIA schemes were implemented in 2012. As partner of several laboratories of excellence (Labex) and technological research institutes (IRT), Ifsttar has thus been able to help recruit 4 theses with Railenium, 4 with VedeCom, 2 with the MMCD Labex and 1 with the Lyons St Etienne initiative of excellence (IDEX). Ties with the main doctoral schools have been strengthened thanks to the participation of several doctoral school heads in the Ifsttar interviewing commission. Their membership has been appreciated both for their scientific expert appraisal of applications and the mutual knowledge of recruitment methods. For all of our sites, the number of defences is 89 with a median duration of 3.3 years – which places Ifsttar in an excellent position as regards national doctoral training indicators.

A bright future

Concerning the fate of doctors, follow-up of the 2011 cohort (68 doctors) lends credence to the sense that Ifsttar’s doctoral training puts our doctors in a very favourable position. At the turn of 2013 (so a little over a year after their defence), 95% of 2011 doctors have found a job – 2/3 of which a permanent one. These jobs are spread between the private (company, agency, etc.) and public sectors (university, institute, school, ministry, etc.) at the respective rates of 38% and 62%.
106 new arrivals, including 39 Ifsttar doctoral contracts, 11 under joint funding, 5 under an Ifsttar research contract, 5 theses under joint supervision, 55 under external funding, including 15 CIFRE.

34 education missions took place in 2012, in the 2011-2012 or 2012-2013 academic year.

16 prizes and awards have been received at national and international conferences.
As they are every year, many Ifsttar researchers were rewarded for their research work in 2012.

**Dest**
- The article: Participation, urbanisme et études urbaines. Quatre décennies de débat et d'expériences depuis “A Ladder of Citizen Participation by S. R. Arnstein” won the APERAU 2012 prize for reference scientific article in urban and town planning.

**IM1**
- Doctoral prize at the Ifsttar ICST doctoral students day.

**IM2**
- TRA Year 2012 prize won by Cindy Andrieux.
- Académie des sciences morales et politiques prize awarded to Jacques Ehrlich.

**LBA**
- ACFAS 1st prize for an international jointly supervised thesis awarded to Eric Wagnac.
- Polytechnique de Montréal 2nd prize for a research doctorate awarded to Rohan Bianco.
- POES 1st prize for fundamental research awarded to Léo Fradet.

**Leost**
- Best presentation prize awarded to Stephen Dudoyer at the CEM2012 symposium in Rouen in April 2012.

**LVM**
- Nicolas Oppenchaïm won the thesis prize of the École des ponts ParisTech and Université Paris-Est.

**Macs**
- Best poster prize at the International Conference Fatigue Design.

**Lemco**
- TRA 2012 “Best paper” prize in Pilar Safety and Security awarded to Mélanie Grapinet et al.

**Mat**
- Carlota Pons won the student award at the International Geosynthetic Society 2012; Sandrine Marceau, Laetitia Van Schoors, Andy Andriamandraina and Anne Ventura were awarded the Best Oral Presentation prize at the Ecobat 2012 Congress in Paris; Nicolas Roussel, jointly with the GEPEA and in partnership with the Polytechnic School of the University of São Paulo, won the AFGC prize.

**SOA**
- François Toutlemonde and Renaud-Pierre Martin received the Best paper award at the 14th International Conference on Alkali Aggregate Reaction in 2012.

**Umrestte**
- Martine Hours was awarded the NIOSH USA prize, as part of the previous participation in the interphone study.
Ifsttar’s editorial activity helps to disseminate knowledge, utilise research findings and capitalise on scientific production. Through a variety of editorial products, Ifsttar can pass on the knowledge acquired from its different research and expertise fields.

2012 was marked by the creation of a new Editorial Committee, set up on 22 June 2012. Discussions are under way concerning the creation of new collections specific to the Institute. In 2012, Ifsttar published 17 works in its various collections. Seven of these are part of the former French National Institute for Transport and Safety Research (Inrets) collections and ten of the former French Central Civil Engineering Laboratory (LCPC) collections. These two institutions have since been merged to found Ifsttar. On top of this are four issues of the RTS journal.

The turnover generated amounted to around €60,000, 35% of which was made abroad.

The catalogue of Ifsttar publications is available by request or can be viewed on the website. The collections’ publications are available for sale at: diffusion-publications@ifsttar.fr or by faxing +33(0)1 81 66 89 93.
The three new focuses of the Images Centre

To promote its productions, the Centre now boasts new tools for showcasing and disseminating its audiovisual material for the general public.

► With Pictolab, the image of research is going online
Promoting the Armadillo tool and base which existed before 2011, the Images Centre has undertaken a reindexing project. A joint system of the two former institutes’ historical collections has been implemented: classification, storage, digitisation and utilisation. As such, the digital photo/video library Pictolab will open up access to audiovisual production in 2013, for consulting and downloading, from the Ifsttar website.

► Fips, the advantages of a very real “resource centre”
The complementary Scientific Heritage Image Collection (FIPS) will form the physical photo/video library, meeting the legal obligation to preserve archives since digital storage does not offer any guarantee.
In 2012, the Images Centre team collected audiovisual archives from Paris and Bron and conducted technical studies to adapt a physical centre for the historical audiovisual collection, in line with the standards in force. Rounded off and supported by photo and video equipment, Ifsttar will thus provide an “image resource centre” on transport, urban planning and networks. An open and living archive collection, this will be accessible to researchers and experts – in-house and external alike – for consulting and promoting the material.

► Collective promotion strategy
With a view to showcasing Ifsttar’s sites, the Scientific Directorate is getting involved in preparing dissemination events. The editorial policy department will present its publications and multimedia material, while documentation will put its collections and journals on display. To back up these actions, the Images Centre is participating in making all of these resources available in clear, easy-to-understand language. In 2012, it thus launched the production of films and photo exhibitions, jointly produced with the ENTPE and National Scientific Encounters of Bron, “sustainable and social city for citizens”.

IMAGES CENTRE
Audiovisual material for the general public.

Project for accessing Pictolab from Ifsttar’s website
With synergy being the key word

For Ifsttar’s scientific and technical multimedia documentation department (DMST), 2012 was all about synergy, with the grouping together of its documentary bases Cassis and Callistée within the new portal Madis, after defining and adjusting the settings of this portal.

The products of the Institute’s researchers and their backgrounds have been repatriated according to how they had been submitted by the researchers. Their full text versions will be stored and made available to staff from 1 January 2013, in keeping with confidentiality and copyright, dissemination and uploading laws. Notices describing the collections of all Ifsttar’s libraries have also been brought together in a common catalogue, fed into Madis by the Institute’s research officers.

> Submission to HAL and TRID

In 2012 the department continued its policy to submit publications to the open archive HAL (http://hal.archives-ouvertes.fr), and, as an active member of TRID, also submitted the productions of the Institute’s researchers to the international database (http://trid.trb.org). With two research officers joining the Bron site, progress could be made in mapping the local collection and integrating it in the common classification plan, as a first stage before the complete assimilation of the historical documentary collections. The Paris and Marne departments have merged and prepared for their move to the Bienvenüe building in 2013.

The PRES Paris Est’s participation in the documentary portal project crystallised: choice of service provider and definition of partnerships. The department continues to contribute to various networks and think-tanks at national level in particular (ISTEX¹, BSN², Couperin).

> Facts & figures

The DMST department responded to 2,200 documentary requests, including 260 public requests. It provided almost 900 article searches in-house and exchanged around 150 loans of works with different university libraries. Over 8,000 search sessions were carried out on the main electronic resources (databases or journal bundles) to which the department is subscribed, for more than 10,000 searches carried out and more than 40,000 documents downloaded.

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1 / Initiative of excellence of Scientific and Technical Information, which is part of the “Future Investments” Programme initiated by the French Ministry for Higher Education and Research (MESR). The ISTEX project is a vast scientific resource acquisition programme aimed at creating a digital library.

2 / Digital Scientific Library initiated by the MESR.
INDICATORS

89 theses defended
151 research contracts
389 articles published in journals with national or international editorial committees
2012 is an important milestone for Ifsttar. It saw the collective thought process culminate in a “ten-year” scientific strategy for the fledgling Institute – a long enough view for overcoming the economic priorities and emergencies, but short enough not to risk divergence with regard to actual needs. The four priorities that have been defined – in a nutshell: “Invent sustainable mobility”; “Adapt infrastructure”; “Control natural hazards and our environmental impacts”; “Thinking up and planning cities and territories” - build on the previous priorities which were used, for the last time, to programme our actions in 2012. Some striking examples of these are illustrated in this report. 2012 also saw the reorganisation of Ifsttar’s laboratories into five main departments, which form the skills and knowledge base necessary for what we do. The balance and complementary nature of engineering sciences and human and social sciences are now necessary more than ever to take a comprehensive approach to tackling the problems posed by a mobile, and for the most part urban, society – whether in terms of safety, accessibility, sustainability or impacts on health and the environment.
The themes broached in research area W help to encourage the construction sector to make sparing use of natural and energy resources for the sake of striking the best balance between technique and savings and reducing the environmental impact of solutions looked into.

The objectives of cutting greenhouse gas emissions and making energy savings particularly call for the development of new construction processes and materials. So-called “warm” road materials (on which Ifsttar has conducted characterisation work) would enable substantial energy savings to be made as regards higher temperature asphalt. In connection with the Ecole des Ponts ParisTech and CNRS, the Institute has also begun modelling the behaviour of aerated materials. This research is a first step towards controlling the production processes of these materials with worthwhile insulating properties.

In terms of resource preservation, Ifsttar is studying, in practice, the possibility of making material and water savings in earthworks. Moreover, the conclusion of a European project has put forward solutions for recycling road materials in transport infrastructure which factor in health and environmental concerns.

The objective of taking environmental criteria on board in the construction phase of infrastructure is achieved using the Ecorce eco-comparison tool, the new 2.0 version of which can now be downloaded from Ifsttar’s website.

Lastly, an ecological transition overseen coherently by all public stakeholders implies stronger continuing education among senior managers into its challenges and new decision-aiding tools. In this context, in liaison with Idririm and Ponts Formation, in 2012 Ifsttar set up a continuing education programme on the themes of eco-comparison tools and life cycle analysis.
SOIL TREATMENT
TWO BIRDS WITH ONE STONE...

Cutting costs in the construction and civil engineering sector whilst complying with the requirements of protecting natural resources and the environment: soil treatment used increasingly in earthmoving meets this twofold challenge.

This is because the simple addition of a few percent of lime and/or cement improves the properties of soil with mediocre geotechnical characteristics, enabling it to be reused reliably and in an integrated manner. The use of local soils thus reduces the use of natural resources and the bill.

Experimental studies have been carried out with a view to validating the possibilities of treating mica-rich soil from Brittany and Pays de Loire and assessing the behaviour of materials when water is circulating.

A multi-scale and multidisciplinary approach combined with monitoring of the mechanical performances of the treated soil and its physicochemical change over time has demonstrated that the effects of the treatment and benefit gained by the initial soil depend on the materials’ microstructure, which itself depends on the initial mineralogy of the soils. This soil process then determines the material’s response to the water circulating and mica soil presents a microstructure that is not conducive to maintaining mechanical performances while water is circulating.

Examples of watering systems used in earthworks

EARTHMOVING SITE ROADS
SIMPLER WATERING

Earthmoving operations are undeniable water-guzzlers in dry weather – particularly in the summer, but even in the spring.

Water is used to optimise the workability and foster soil compacting so as to guarantee the durability of earth structures (embankment, dikes), but also, when necessary, to hydrate the treatment products (hydraulic binders) of fine soils. Moreover, for the purposes of safety and reducing pollution, water is also used to reduce dust spray over worksite roads.

Reducing the amount of water used to water roads is part of the voluntary undertaking agreement for energy and consumable savings in the earthmoving sector signed in 2009. The Syndicat Professionnel des Terrassiers de France (SPTF), which initiated the project, has also committed to halving the amount of water used on worksites by 2020. A new Ifsttar laboratory, the “GERS - Terrassements et Centrifugeuse”, is helping the SPTF to carry out this project.

The first work stage focuses on updating knowledge on dust so as to understand the production mechanisms and their behaviour. Different points will be addressed: regulations, measurement and characterisation methodology, treatment. A second stage will identify guidelines for reducing water use. At the same time, exploratory trials will identify the different parameters influencing dust spray.

Last of all, this work will lead to a pilot device being produced. There are plans to recruit a master’s student to do a CIFRE thesis.

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Detection of porosity (C) and distribution of lime and cement (Calcium and Silicon) in soil
ECO-COMPARISON TOOLS
ECORCE 2 IS PUT ONLINE
http://ecorce2.ifsttar.fr

Head construction contractors are increasingly including environmental assessment in their infrastructure projects.

Ifsttar has set the pace for several years already by providing them with an initial version of a decision-aiding tool - Ecorce1, an eco-comparison tool that determines environmental indicators from specific data obtained from the road building, maintenance and recycling stages.

In 2012, Ecorce offered new simulation prospects. User feedback was used from 2009 to draw up the specifications of a completely renovated version 2.0 of Ecorce. Developed in liaison with the Public Works Design and Research Offices (Cetes), it went through a technical approval procedure with the IDRRIM conducted by the “approval” operational committee for uploading on the Ifsttar’s website as freeware in the 1st quarter of 2013. With a view to reaching as many people as possible, the Ecorce project team provided widespread training in the tool while the RST set up a users’ group, establishing a useful and relevant exchange framework for practitioners.

Ecorce tasks now include the environmental assessment of roads, earthmoving work, recycling materials and different means for transporting materials. The environmental systems for taking the procedures into account are similar, integrating the impacts upstream of energy generation. To implement life cycle inventories using a compatible format in Europe and further afield, the version 2.0 has seen input from external experts from the University of Orléans and the MTQ (Quebec Transport Ministry).

This version of the software, founded on life cycle analysis and its application in the road sector, fits into the methodological framework of the OEET (Energy, Environment and Transport Observatory). This new version is very flexible to use, in terms of ergonomics, integration of innovative technological solutions and processing of results. Its scope covers several levels. At the call for tenders stage or after the work, the tool will be able to be used to analyse solutions undertaken with different indicators. At the design or programming stages, it helps to define the best solutions in environmental terms.

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1 / Road eco-comparison tool: building and maintenance.

RE-ROAD
RECYCLING ROADS IN ALL ITS FACETS

Making more sparing use of natural resources by increasingly recycling used materials is a widely shared objective at European level.

Making more sparing use of natural resources by increasingly recycling used materials is a widely shared objective at European level.

Launched in 2009 and completed in 2012, the European project Re-Road fits within this line of thinking. It brought together 15 European laboratories and closely involved Ifsttar.

Funded by the European Commission, this collaborative programme tackled recycling from a comprehensive perspective by incorporating both technical and environmental aspects. Its objective was to maximise road recycling by limiting the introduction of new materials in mixtures. It focused on hot-mix recycling in plants, which currently accounts for most recycling work.

Several aspects of recycling were broached: sampling and characterisation of reclaimed asphalt pavement (RAP), production of RAP and its management in plants and lastly the assessment and modelling of the performances of asphalt containing RAP. The environmental characterisation of recycling was paid particular attention from a health point of view, with potentially hazardous materials like tar being factored in especially, as well as from a point of view of “lifecycle analysis”. At the same time, a wide range of laboratory studies were performed along with monitoring of worksites and current recycling practices.

The major advantage of such a project is to have enabled collaboration at European level, revealing both the limits and great potential of asphalt recycling. All of the work carried out is available on the Re-Road website: http://re-road.fehrl.org/

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“AERATED” CONSTRUCTION MATERIALS
MATERIALS THAT ARE NOT SHORT OF AIR

Incorporating bubbles of air in a construction material might appear to be simple, economical and lasting, increasing its insulating properties, but poor understanding of the effects the added air has on the material’s properties makes it very difficult to manufacture large quantities of these aerated construction materials.

To move forward on these questions, the Rhéophysique team from the Navier laboratory (jointly managed research unit between ENPC, Ifsttar and CNRS) has been developing experimental and theoretical work on model aerated materials. The materials studied are made by mixing bubbles of controlled size into a model fluid (an emulsion) of known characteristics. By measuring the rheological behaviour of materials depending on their composition, it has been possible to identify the parameters describing the impact bubbles have on the different rheological properties of aerated material. At the same time, theoretical work has put forward a predictive model of the characteristics of a suspension of bubbles depending on the fluid and bubble characteristics. Although fundamental by nature, these findings, published in scientific journals and presented at diverse congresses, represent a key stage for controlling aerated material development processes. Diverse developments are currently being conducted through partnerships inside and outside Ifsttar.

Ifsttar has developed an experimental device for assessing the quality of bonding between the bitumen and the aggregate under warm-mix asphalt manufacturing conditions by an original thermal method. The device developed involves bringing hot bitumen into contact with a cylindrical sample of rock that has also been heated and equipped with thermocouples. This contact induces a heat transfer between the two surfaces of different temperatures. On the basis of the theoretical information gained during the partnership (thanks to which the problem of inverse conduction resulting from the contact can be formulated and resolved), it is possible to estimate the thermal contact resistance (TCR) at the interface. This TCR is used as an indicator of the bitumen-aggregate bonding quality.

The TCR values obtained depending on different parameters have been compared successfully with the findings of standardised tests on asphalt.

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BITUMEN-AGGREGATE STUCK LIKE GLUE!

Given the recent emergence of new road practices in favour of the careful use of energy in the development of so-called warm materials, several questions come to mind.

These primarily concern understanding the behaviour of these materials and the sustainability of the bitumen-aggregate interface, which are key factors for predicting road damage.

In partnership with the École Polytechnique in Nantes, as part of Cyril Some’s PhD thesis, these studies have been conducted in Nantes, as part of Cyril Some’s PhD thesis, in partnership with the École Polytechnique (jointly managed research unit between ENPC, Ifsttar and CNRS) has been developing experimental and theoretical work on model aerated materials. The materials studied are made by mixing bubbles of controlled size into a model fluid (an emulsion) of known characteristics. By measuring the rheological behaviour of materials depending on their composition, it has been possible to identify the parameters describing the impact bubbles have on the different rheological properties of aerated material. At the same time, theoretical work has put forward a predictive model of the characteristics of a suspension of bubbles depending on the fluid and bubble characteristics. Although fundamental by nature, these findings, published in scientific journals and presented at diverse congresses, represent a key stage for controlling aerated material development processes. Diverse developments are currently being conducted through partnerships inside and outside Ifsttar.

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Systematic approaches and eco-design — Thoughts on the conceptual basis and applications of Life Cycle Analysis (02/04/12)
Research Area 1

Mobility, Environment, Energy

Contributing to the sustainability of travel practices, transport systems, urban planning policies and territorial systems

Research area 1 groups together the activities of four research units (Dest, LTE, LTN-Satory and Splott) and one jointly managed unit (LVMT). Firmly cross-disciplinary, these studies fall into both the category of Human and Social Sciences and that of Engineering Sciences. They are based on quantitative data produced by the research units or taken from national and local surveys, and also make use of more qualitative data, gathered from interviews with people (users, inhabitants), companies, private urban planners and local and national public authorities.

The research undertaken for this area focuses on analysing and modelling the links between transport systems, production systems, travel practices, urban planning strategies and territorial dynamics, as well as on their impacts in energy and environmental terms. The joint objective is to provide food for thought about how to evolve towards more sustainable lifestyles, transport systems and territorial systems.

Three objectives of the 2010-2013 four-year contract refer to activities covered by research area 1: observe and analyse mobilities and territories; assess transport systems and their organisation; reduce energy consumption and the environmental impacts of vehicles.
PRESENTATION OF THE MOCA RESEARCH
HOW CAN THE UNPREDICTABLE BE MANAGED?

During a catastrophe, the uncertainty over how victims and operators in the field will react makes it difficult for the crisis management and safety authorities to control the situation completely.

The objective of the MOCA research is to develop an innovative analysis tool aimed at understanding and predicting the behaviour of individuals, populations and institutions in the event of a catastrophe – particularly if a terrorist attack strikes. It is intended to train decision-makers and operators in the field and inform the various political and operational stakeholders involved in crisis management.

The MOCA research has been funded by the French National Research Agency (ANR) through the CSOSG programme. It brought together researchers of social psychology and sociology from the Dest (Economic and Social Dynamics of Transport) laboratory, LVMT (City, mobility, transport laboratory) and LPUA (University of Angers Laboratory of Psychology) and produced three deliverables:

- An international bibliographic analysis on the origins of the terrorist phenomenon, social perception and sociopolitical responses was performed in August 2010.
- The survey and interviews conducted with Spanish institutional operators made it possible to put together how the catastrophe of 11 March 2004 in Madrid unfolded, untangle what happened before and during the catastrophe and study the individual and collective resilience of the people and institutions (August 2011).
- Lastly, the survey carried out among Israeli safety and prevention institutions and operators as well as the summary of the survey data from previous reports were submitted in September 2012.

The MOCA research has sought to answer the following question: can we predict and prepare for the unpredictable? In this regard, the researchers have to analyse extreme crisis situations in more detail – such as when managing victims after a terrorist attack. The challenges concerning the vulnerability of transport infrastructure and their resilience mechanism – particularly in organisational and institutional terms – should be central focuses of the next research carried out on this issue.

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A BOOK
COHERENT CITIES: ACHIEVING PROXIMITY IN NEW WAYS

This book, published at the Documentation Française¹, is based on the studies awarded by the French Programme for Research and Innovation in Land Transport (Predit) in 2011.

To overcome the limits of the notion of “compact city” and its difficult implementation (for it requires everything to be within easy reach of everyone), the authors ask themselves a range of questions. Can a concept of a city be imagined that would have exactly the same virtues as “the compact city” in terms of distances to cover and car use, without being so demanding? Can proximity be achieved in new ways?

They therefore float the idea of a “coherent city”, defined by an urban arrangement such that everyone can live less than x minutes away from their work (x can be fixed at a low value, such as 20 minutes, medium, such as 30 minutes, or higher). Less demanding than the former, this concept only assumes the proximity of everyone to their workplace. This publication explores this coherency standard over the vast Parisian region from an original simulation model, the associated potentials of shortening the distances covered by car and the obstacles to be overcome – particularly in terms of housing – with a view to putting this into practice.

This test in the Parisian region, whose findings are sometimes surprising, prompts researchers and practitioners to change their perspective of the mechanisms behind urban imbalance, of the coherency between urban planning and transport, and the means of achieving this.

REDUCING THE ENVIRONMENTAL IMPACT:
ADVANTAGES OF THE HYBRID TRUCK

The noise and pollutant emissions from trucks that distribute or provide certain collective services are a major concern in urban areas.

Hybrid trucks can considerably reduce this pollution, especially if they have a “100% electric” drive mode.

As part of the GEODE project run by Renault Trucks, Ifsttar has conducted a detailed environmental assessment of a demo parallel diesel-electric hybrid truck, and compared it to a conventional diesel vehicle of the same capacity.

The acoustic study showed the crucial contribution of the “100% electric” model in all driving conditions with urban kinematics, with even greater benefits for inhabitants living in storied blocks of flats. The reduction in mechanical noise makes the rolling noise – generated mainly by the engine axle - seem much louder, and this is therefore the next challenge in reducing noise pollution. Pollutant emissions are also much lower on the hybrid version tested.

Over the typical 20 km distribution circuit of this range (320 hp, 19 t of GVW), CO₂ is cut by 20 to 25% depending on the load – as is fuel consumption. For its part, nitrogen oxide (NOx) is cut by 40% and hydrocarbons (HCT) by 60% in the mean load configuration (14 t in total weight) for which management of the two engines has been optimised.

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1 / By Emre Korsu, Marie-Hélène Massot, Jean-Pierre Orfeuil, Collection Predit “Transport, Recherche, Innovation”, La Documentation Française, August 2012.
THE LOGISTIC AND TRANSPORT CHALLENGES FOR SHOPS: FRIENDLY BETWEEN FRANCE AND GERMANY

The complex questions surrounding the organisation of goods carriage call for sustained studies.

This area of research is becoming all the more crucial since commercial journeys and movements of goods account for 40% of traffic in urban areas. But it has still not been explored in any real depth.

To factor in the increasing role of distributors in structuring transport chains in Europe, Ifsttar, through its Splott¹ unit, and the German DLR institute² are carrying out a comparative study of shops’ transport practices and their determinants. This has particularly been put into practice through the exchange programme of researchers between the two organisations. Over 120 shopkeepers, wholesalers, producers and carriers of clothing, pharmaceuticals and foodstuffs distribution circuits have been interviewed in the two countries. This study highlights the varied determinants of the transport demand of distributors.

Distributors’ transport needs thus depend on marketing strategies in terms of sales format, product range or assortment (microeconomic determinants) and the distributor’s position in the sector (meso-economic determinants). Consideration should also be given to macroeconomic determinants related to the economic and regulatory context as well as consumer habits.

ENERGY MANAGEMENT COMPONENTS EVERYTHING GETS BETTER OVER TIME

Untangling the how and why of electronic component ageing, their deterioration and their failures: these are the fundamental questions that the LTN, Laboratory of New Technologies, is trying to answer.

This ageing and deterioration is partly due to electric and thermal stresses to which semiconducting chips are subject – for example during their use in electric traction.

A new way of finding out what these stress levels are is to determine the temperature and current fields over bands in micro-sections of components that are around 100 micrometers thick. What needed demonstrating first was that an insulated gate component – in this instance an IGBT – could remain “functional” after being sectioned. The experiment, the success of which was far from certain at the outset, made us the very first team to have made such an unexpected demonstration on this type of component.

This demonstration opens up a vast field for tests and characterisations with a view to mapping current density and temperature fields over these bands in operation. Performed as part of the ANR FIDEA project, this research made thermal characterisations possible using micro-Raman techniques, and will be continued with thermoreflectance. The cutting effects still need correcting in this mapping, however. The challenge now is to test the behaviour of these components.

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2 / Institute for Transport Research at the German Aerospace Center (DLR).

THESIS

Zéhir KOLL, Dest
Renewal dynamics of the Motor Vehicle Fleet. Forecast and environmental impact (13/04/12)

Sophie ROUX, Dest
Transition of motorisation in France in the 20th century (03/12/12)

Raissa ONANENA GUELAN, Grettia/LTN Satory
Diagnosis of PEM fuel cells: selection of descriptors and operating point monitoring (20/11/12)

Arnaud DEVIE, LTE
Characterisation of the use of Lithium-ion batteries for electric or hybrid vehicles – application to the study of ageing and reliability (13/11/12)

Mohamed HOUCINE, LTE
Optimisation of trajectories for reducing the noise and fuel consumption of commercial aircraft during the approach and takeoff stages (06/03/12)

Andrea LOYER, LTE
Digital and experimental study of the screeching of rail braking systems (31/05/12)

Fulgence NAHAYO, LTE
Development of an acoustic optimisation model of two planes based on approach scenarios that enable a reduction in noise and fuel consumption (04/06/12)

Stéphane BUTTERBACH, LTN Satory
Electricity storage by combining supercapacitors and lead batteries for heavy vehicles (20/09/12)

Emmanuel FRAPPE, LTN Satory
Fault-tolerant architecture of static converter for modular power-traction 80-100kW fuel cell generator (17/12/12)

Sabrine MOU-MEEN, LTN Satory
Study of the robustness of SiC based JFET transistors with regard to electrical stress (28/03/12)

Ander AUDIKANA, LVMT
The politicisation of Spanish high-speed (1986-2011): crafting a myth, reaching a consensus, emergence (09/07/12)

Nicolas WAGNER, LVMT
Mathematical properties and economic applications: the dynamic balance of road traffic (24/03/12)

Marantonia LO PRETE, Splott
Commercial policy and environment: an evolving link. What the legal disputes in the French and Italian ports in the Mediterranean Sea are teaching us (26/11/12)

HDR - Laetitia DABLING, Splott
Logistical urban planning (06/06/12)

HDR - Francis PAPON, Dest
The return of the bicycle as a means of transport (11/10/12)
After 3 years, research area R is brimming with a wide diversity of activities – attesting to its extensive thematic scope.

For it does indeed encompass a traditionally significant part of the Institute’s activity, and particularly concerns the guidelines on infrastructure sustainability, extending the life cycle of structures, studying material damage, controlling natural hazards and reducing pollution and impacts for example.

In 2012, all of the research conducted represented some 7.5 million euros, making it the Institute’s largest research area in terms of volume.

For its last financial year, the area brought together 22 active operations, while a 23rd hit the drawing board. The six operations that were completed in 2012 produced key new knowledge or tools, especially for the urban and suburban environment, including “protecting soils in urban areas”, “controlling the risks of land movements in urban or sensitive areas” and the development of an “instrumentation system for preventing environmental risks”. The other three looked at “networked sediments, deterministic approach and operational implications”, “rockfalls and rockslides” and “Reinforcement by bonded assemblies and composite materials”. An innovative project to develop a portable traction device for shearing characterisation of bonded composite interfaces/concrete on structure was also completed.

Strategic and Stimulus Research Operations included the DEDIR project “from Sizing to the Sustainable Maintenance of Road Infrastructures”, which was set up and launched in 2012.
FLOODING RISK SURVEILLANCE TO ENSURE MORE EFFECTIVE ACTION

Some départements in South-East France are often affected by heavy rainfall, with the result that road users find themselves in a hugely vulnerable situation.

Through the interdisciplinary ANR project PreDiFlood, funded under the Risknat 2008 programme and completed in 2012, a surveillance system could be developed with regard to the flooding risk on road networks. Intended for road management staff, this tool proved to be particularly suitable for regions subject to heavy rainfall and rapidly rising water levels. The system provides mapping in real-time of the flooding risks, which is refreshed at regular intervals from data recorded by weather radar. A pre-operational prototype of the tool has been tested in the Gard département and areas where improvements can be made have been identified. Some of the system’s key features involve significant scientific breakthroughs. For example, high-resolution spatial measurement of rain, distributed rain-flow modelling on non-equipped streams and small rivers, or assessment of the sensitivity of road networks to flooding. The work and expectations of the road managers concerned were more clearly defined through discussions with the Gard Conseil Général.

At the end of the project, a demonstrator illustrates the information provided by the prototype developed for some rain events online. This can be consulted at: http://heberge.lcpc.fr/prediflood

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GOLEM: DEEP FOUNDATIONS IN CLAY SOILS

When structures are built on piles, these deep foundations can carry all or part of the lateral loads.

But there are still major scientific hurdles to be cleared, particularly the development of a method for sizing these piles with account taken of cyclic lateral loading. What’s more, few studies have been performed on clay soils. Below is the outline of the thesis by Meriam Khemakhem defended in 2012. The behaviour of piles driven into clay is studied using reduced centrifuged models. Solid clay and soft clay are modelled and both supple and rigid piles tested. The supple pile model, fitted with 21 levels of deformation gauges, shows how the bending moment profiles change over time. The reaction curves of soil P can be deduced based on the movement of pile y. The results under monotonic loading serve as a reference for analysing and quantifying the effect of cycles on soil-pile interaction. In particular, the use of monotonic experimental P-y curves demonstrated the final reaction of the soil and its relation with non-drained cohesion. For cyclic loading, the effect of the cyclic range and number of cycles on the pile head movement and on the maximum moment could be analysed through a parametric study. Empirical laws are put forward to assess the movement and maximum moment after n cycles depending on the monotonic moment and movement. Finally, endeavours are made to determine cyclic P-y curves from the monotonic P-y curves to describe the local response, at any depth, of the soil-pile system. The findings of this experimental research, co-funded by the Pays de la Loire Region (R2GC programme in partnership with the École Centrale de Nantes) have been partly utilised in the SOLCYP project (Cyclic stress on Piles, PN and ANR).

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1 / Experimental study of the response to monotonic and cyclic lateral loads of a pile driven into clay.

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1 / Coordinated by Ifsttar, this involved the CNRM-GAME, Instea, LTHE and PACTES laboratory.
REMOTE DATA ACQUISITION ON THE A10 MOTORWAY: THE INTELLIGENT ROAD?

*In partnership with Cofiroute, remote monitoring equipment has been installed on the A10 motorway to monitor the behaviour of an experimental stretch — renovated by in-place cement retreatment.*

The objective was to test new techniques for monitoring the performances of this innovative structure. On the surface of the treated materials course, a pre-crack was introduced and three types of sensors installed: a crack distancing sensor, two geophones placed on either side of the crack and two temperature probes. The sensors were connected to an acquisition system combining a Pegase board, developed at Ifsttar, conditioners and a remote transmission system. Thanks to the Pegase instrument platform, which includes a processor designed for signal processing, a highly effective acquisition system could be produced combining low frequency (crack opening, temperatures) and high-frequency (for geophones) acquisitions. On-site processing of measurements (calculation of signal ranges for example) considerably reduces the amount of data transmitted. The measurement results are temporarily stored on the Pegase board and automatically transferred to a data server via the 3G network. Online access to this server means that the measurements can be remotely monitored practically in real-time: traffic, temperatures, mechanical response of the structure.

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NANOCRystALLINE GRAPhENE FOR A LOW-COST HUMIDITY SENSOR

*The subject of the 2011 Nobel Prize in Physics, graphene is a carbon crystal of nanometric thickness.*

It is extremely sensitive to its environment, which makes it a material of choice when developing nanosensors for the City of the Future, as in the case of the Equipex Sense-City (see PIA page). In the joint research team between NACRE and the LPICM (Interfaces and Thin Layers Physics Laboratory), we have indeed shown that graphene could be used as an active material in low-cost relative humidity sensors. We began by producing electronic devices with nanocrystalline graphene. Graphene is made (according to a patented process) directly on a glass substrate and then put into contact with printed silver electrodes. All of the processes could be carried out in a very low-cost industrial technological flow. The devices are then characterised under variable humidity by the so-called “four-point” method. This method enabled the sheet resistance of the device to be determined, which significantly increases with relative humidity. This variation in resistance can be measured by commercial electronic components, which paves the way to graphene-based integrated sensors.

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URBAN CLIMATOLOGY

GREENERY IN THE CITY

*Planting widespread vegetation in urban areas would seem to foster better thermal comfort, but there are few observations for truly quantifying this effect on the water and energy cycle in cities.*

As part of the federative project to assess the role of vegetation in urban areas, overseen by the IRSTV and funded by the ANR (VegDUD 2010-2013), FluxSAP, an urban climatology measurement campaign was organised in June 2012 in the North-East of Nantes, which is already fitted out for permanent urban meteorology and hydrology observations at the Onevu. This involved 12 French partners. The campaign supplied reference data for validating heat and water vapour transfer models in a disparate urban site. By identifying their
sources, the contributions made by mineral surfaces can be separated from those from planted surfaces. The rich catalogue of measurements presents those concerning:

- water content and temperature in the soil,
- evapotranspiration in green spaces with a transpiration chamber,
- scintillometric transsects from roof terraces of tall buildings,
- passive tracer and temperature under a small captive balloon,
- air humidity and temperature on urban journeys and surface temperatures of buildings by infrared measurements using equipped vehicles.

### STRUCTURALLY REINFORCING ENGINEERING STRUCTURES: COMPOSITE MATERIALS ARE HERE FOR THE LONG-TERM

One of the methods used to strengthen reinforced concrete structures, the use of bonded composites, is well on the way to becoming a reference technique, particularly thanks to these materials’ countless qualities and their ease of application.

This market is therefore building on continuous development in a context of greater confidence. Ifsttar wanted to delve deeper into this theme and study the durability of these repairs in an extension campaign called “Reinforcement by bonded assemblies and composite materials”, which was completed at the end of 2012. Accelerated ageing campaigns, particularly by combining environmental and mechanical stresses, have demonstrated the swift progress made in the performances of the systems tested. These prompt us to continue our examination of the safety coefficients to be applied during sizing.

Several major breakthroughs have been made through this project, beginning with a more in-depth understanding of the deterioration mechanisms of concrete/composite bonds.

The operation enabled an innovative creep bench and associated study methodology to be developed to estimate the progress made in the assemblies’ performances. Non-destructive evaluation methods were developed along with a proposal and validation of damage and creep models. Ifsttar also took part in the ANR project INPERMIS and is conducting various contractual studies.

This research relies on the cross-disciplinary skills of Ifsttar and the Cete centres in liaison with manufacturers (SIKA, Freyssinet, Etandex). Their findings have been communicated in a wide array of journals including special issues of Construction & Building Materials (vol. 25/2) and the Revue des Composites et Matériaux Avancés (vol. 22/2).

Two theses by the University of Paris-East (R. Sadone and N. Houchou) have been defended.

### THESIS

**Bo Li**, ErA23

Determination of the compactness of thin coats of bitumen asphalt by high-frequency electromagnetic methods (27/03/12)

**Omar BENZARIA**, Ger

Contribution to studying the behaviour of piles under axial cyclic loading (14/12/12)

**Eva GRASSO**, Ger

Modelling of the spread of seismic waves: a fast multiple method (boundary elements) and its combination with the finite element method (13/06/12)

**Iman HAGHIGHI**, Ger

Characterisation of erosion and dispersal phenomena: development of tests and practical applications (24/09/12)

**Meriam KHEMKHEM**, Ger

Experimental study of the response to monotonous and cyclic lateral loads of a pile driven into clay (19/01/12)

**Kevin LEMAIRE**, Ger

Changing physico-chemical, microstructural and hydromechanical characteristics of silt treated with binders during water circulation (16/10/12)

**Yann LOTRAM**, Ger

Multi-scale modelling of pollutant transfer in urban soil (30/11/12)

**Philippe NAULIN**, Ger

Distributed hydrological modelling for predicting road blockages by flooding, application to the Département du Gard (03/07/12)

**Chi Cong NGUYEN**, Ger

Improvement of Bayesian MCMC approaches for regional flood analysis (13/07/12)

**Stéphane PERCOT**, Ger

Contribution of atmospheric deposition to the global pollution rates in urban environments – Pollutant–particle combination trends during the atmosphere-surface-sediment transfer (09/11/12)

**Minh Ngoc VIU**, Ger/Navier

Modelling of flows in fractured porous media by the singular integral equation method (26/09/12)

**Yolande SIKALI**, Macs

Sensors with optical fibres scattered by Brillouin effect: separation of dependence on temperature and on deformation (09/01/12)

**Jean HERISSON**, Mat

Study of the biosorption mechanisms of cementitious materials in drainage structure (16/10/12)

**Carlota PONS**, Mat

Durability of geomembranes in high density polyethylene used in waste storage installations (23/11/12)

**Michael SAILLIO**, Mat

Irresistible physical-chemical interactions in healthy or carbonated concrete. Influence on ion transport (10/05/12)

**Xiaoming WANG**, Mat

Modelling of multi-species transport in non-saturated reactive cementitious materials – deterministic and probabilistic approach (27/04/12)

**Manh Huyen VIU**, Navier

Effect of stress and temperature on the integrity of cement in oil wells (23/02/12)

**Qiong WANG**, Mat

Hydro-mechanical behaviour of bentonite based materials for radioactive waste storage (10/12/12)

**Navid SAEEDI**, Navier

A highly effective approach for analysing the delamination of infinitely long stratified plates (18/12/12)

**Khanh-Le TRAN**, Navier

Studies of the resistance and stability of steel cylindrical panels. Applications to engineering structures (20/12/12)

**Hoang Huyen VIU**, Navier

Modelling of flows in fractured porous media by the singular integral equation method (26/09/12)

**Manh Huyen VIU**, Navier

Modelling of flows in fractured porous media by the singular integral equation method (26/09/12)

**Daniel WEISS-PATRAULT**, Navier

Search for and use of analytical solutions for inverse problems of coupled thermoelasticity (06/12/12)

**Quoc Quan TRUONG**, Navier/Navier

Study of blocking mechanisms for a flow by a scaling product (20/12/12)
RESEARCH AREA 2
QUALITY, SAFETY AND OPTIMISATION OF TRANSPORT SYSTEMS

Research area 2’s laboratories are carrying out a range of research actions to make transport systems more ecological, safer and better suited to the mobility of people and property.

Firmly cross-disciplinary, these studies combine Engineering Sciences and Human and Social Sciences both for assessing or designing technical objects and for developing models for optimising systems.

This research area is distinct in that it made a significant contribution to the Veronese project, completed in 2012, with, in particular, federative actions being taken around such themes as eco-driving, new practices, assessing the use of communication and location technologies, energy optimisation in rail traffic management and the development of simulation platforms. The similarity of the Veronese and Serres operations enabled the teams to work effectively together.

Also worth mentioning is the close involvement of research area 2’s researchers in the European network of excellence NEARCTIS (overseen by Ifsttar, this is due to be concluded in 2013), whose central concern is optimising road traffic management via the inter-organisation convergence of research programmes in the field of “cooperative systems”.

They also played a large part in launching two institutes: the Railenium technological research institute (IRT), managed by the Lille Nord de France Research and Higher Education Cluster (Pres) and by the I-Trans cluster, and the IEED Vedecom\(^1\), managed by the Moveo’Tech foundation.

Research area 2 brings together all or part of the activities of five research units (Grettia, Estas, LPC, Lescot, Leost, Lepsis, Livic) and one jointly managed unit (Licit). It refers to three objectives of the 2010-2013 four-year contract: supply new technical tools for improving the safety and effectiveness of transport systems; promote a user-based design of transport systems and optimise the operation and use of genuinely intermodal networks.

\(^1\) Low-carbon energy institute of excellence, Institute of the Low-Carbon Communicating Vehicle and Its Mobility.
TOWARDS NEW COTS-BASED ON-BOARD RAIL CONTROL ARCHITECTURE

The objective of the FUI FerroCOTS project, overseen by Bombardier Transport, is to upgrade the on-board rail control system presenting electrical relay-based architecture with COTS\(^1\) components that can programmed – in this case FPGA\(^2\) boards.

This will foster scalability, facilitate maintenance, reduce the amount of space taken up on trains and cut control design costs... all the while guaranteeing a high level of safety and reliability. But the development of COTS-based architecture faces a considerable obstacle: the lack of appropriate specification and verification methods. The work by the Evaluation of Automated Transport Systems and their Safety (Estas) Department for the FerroCOTS project focuses on these two key stages in the development cycle.

In terms of specification, techniques for fine-tuning and setting out requirements have been developed. Through an iterative process, these make it possible to generate formal specifications in the form of logical properties from raw requirements extracted from the specifications. This process is based on various generic patterns that are used specifically and the traceability of the fine-tuning can be ensured through it.

In terms of verification/validation, Estas’ works focus on generating effective test scenarios to be carried out on the final model. These are designed so as to try and force the system to default with respect to the specifications generated. The test-based verification has been used by the project as a complementary technique to model-checking. It also makes it possible to prepare for the certification stage. The whole methodology has been applied to the case study “Passengers’ access system”, chosen for its complexity in terms of numbers of incoming/outgoing.

SERVING MULTIMODAL PASSENGERS OF THE FUTURE CAN’T LIVE WITHOUT THE INTERNET!

More and more passengers and means of transport have communication means with which they can be located at all times and can interact with a multimodal planning system in real time.

The continuous guiding of these passengers over the diverse means of transport available raises several problems in terms of technology and modelling.

From April 2011 to the end of March 2013, as part of the European Instant Mobility project, Grettia worked on producing a prototype aid for multimodal journeys based on Internet technologies of the future. The journey optimisation system put forward covers planning, monitoring, forecasting and communication functions in real time.

To test this service, the laboratory has also developed a multi-agent simulator reproducing the journeys of multimodal passengers and drivers in the Toulouse urban area. This is based on the multimodal network provided by its reference platform on intermodality, Claire-SITI. For this study, Grettia helped to optimise the use and operation of multimodal networks by representing users and transport means in an individualised and differentiated way. It supplies them with a planning and guiding service integrating up-to-date information and its impact on routes.

The research on this subject is currently being geared towards a consolidation of the simulator to make it into a generic online base for testing transport applications.

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1 / Commercial Off The Shelf.
2 / Field-Programmable Gate Array.

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1 / Including the Internet technologies of networks and objects, Cloud computing, Web services and social networks.
TRAFFIC SIMULATORS SPEAKING THE SAME LANGUAGE

To manage road traffic and the service to users in a sustainable fashion, a wide array of federative actions need setting up in association with simulation platforms.

In this regard, defining a data model common to Ifsttar’s different traffic simulators will go a long way to facilitating exchanges. As such, three laboratories (Grettia, Lepsis and Licit) have joined forces to look into the convergences between simulators and oversee their implementation. The first work phase involved pooling data in a multi-scale and multi-user context: Magister (multi-model), Symuvia (microscopic), Archisim (nanoscopic together with driving simulators) and Sapien (pedestrians/vehicles). Attributed a budget in the context of the Veronese project, three tasks have been carried out via a computer engineering service in 2012. The first task involved the listing and functional comparison of the data models used by Ifsttar’s simulators, in connection with the three emerging standards – EuroRoads, OpenDrive and RoadXML. The second produced a common data model, called a base, as well as specific extensions to each simulator (xml diagrams and documentation). Lastly, the third task involved exploring the technical possibilities for implementing a tool box common to the various existing simulation platforms. Now that this first phase is over, the action is being continued in three ways: produce a tool box for inputting and using data, produce a set of data common to the new format and study the convergence of output data from the simulators.

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1 / Towards an Optimised Operation of Network: Minimised pollution, Controlled energy, Maximised service, Protected environment.

DRIVE MORE SAFELY TUNE IN AGAIN...

Drive with your eyes, not forgetting your ears! The imminent hazards of the route are getting louder and can be heard inside vehicles.

The PRIMA-CARE project sets out to reduce road traffic accidents by increasing the driver’s vigilance and relieving his or her visual attention. It warns him or her with a sound alarm of the exact spatial location of the most hazardous obstacle and its danger level. Run by Ifsttar, this project, accredited by the I-Trans cluster and with €730K of funding from the ANR Predit for a total cost of around €1.52 M over three years, has had an international patent filed. Developed and implemented on a flexible, upgradable multiprocessor architecture, the system comprises multi-sensors (4 short- and long-range radars, each analysing 20 obstacles in 1/4 of a second), combined with sound effectors, an odometer, a gyroscope, a camera and GNSS receptor, connected by CAN bus to a measurement dating and processing platform - “EFFIBOX”. PRIMA-CARE concluded in May 2012 in Lille with a scientific presentation and demonstration day of the laboratory model, which many manufacturers and academics attended. The project received wide media coverage at regional and national level. The research on the current system will lead to new research projects being submitted on the detection and monitoring of vulnerable people, with applications on work site or factory machinery which cause a great deal of physical injuries every year. The work on the alarm ergonomics depending on the type of user will be continued.

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BRAIN DAMAGE AND DRIVING SKILL TBI VERSUS STROKE

The brain is capable of developing new strategies for making up for losses in zones that may have been injured.

Finalised in 2012, the Dextre project focuses on executive problems following a traumatic brain injury (TBI) or stroke, and their implications in driving ability. The purpose was to reveal adaptation strategies developed by people who pick up driving again on a regular basis, more than two years on from their brain injury, by instrumented observation in a driving situation. This was achieved from objective data (speed, the direction they are looking in), coding carried out by the observer in the vehicle and an overall assessment by a driving instructor. The findings show that TBI drivers maintain neurological scars that impact their executive functions and their way of managing driving a vehicle. Some TBI drivers manage the way they drive safely overall, but do not have sufficient “room for manoeuvre” for managing a critical situation, given their capacities. What’s more, they are not fully aware of their shortcomings. Stroke drivers are less concerned by driving errors than TBI drivers and generally perceive their functional state more clearly. They find it difficult to grasp the road traffic scene in its entirety and make up for this by shifting the direction they are looking in. That said, the stroke group studied was small, and another study on a larger group should be conducted to confirm this finding. Coordinated by Ifsttar Lescot, the Dextre project involved Henry Gabrielle Hospital and Ifsttar’s Lepsis laboratory. For 42 months, it received a grant from the ANR.

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1 / Executive Losses in Brain-Injured People.
RAIL ACCIDENT ANALYSIS
A VERY HUMAN ACHILLES HEEL

In rail accident analysis, feedback has extensively shown that human and organisational factors are the cause of most accidents.

In rail accident analysis, feedback has extensively shown that human and organisational factors are the cause of most accidents. For these factors to be considered, a strict methodology needs developing that incorporates data about the human operator in the feedback and in the analysis of an accident’s or incident’s stages. Under this research theme, Ifsttar conducted an expert appraisal in 2012 on behalf of Réseau Ferré de France. This involved studying and analysing the human factors and driving ergonomics for the European Corridors project equipped with the ETCS 1 system which replaces the KVB. The ETCS 1 should ultimately be put into use on all the lines currently equipped with KVB and replace it. The study set out to identify the specific situations in which the transition between driving equipment may incur a risk from the point of view of driving ability and activity (driving trains alternately by ETCS1 then by ground signalling), analyse them, measure their occurrence and risk and suggest additional specifications or a different organisation of use. This expert appraisal focused on the analysis of at-risk situations, of test scenarios for “ergonomics” and “human factors” studies, of simulation findings and of transcripts of interviews held with drivers. Two expert appraisal reports were produced and a third is currently being finalised.

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WEATHER AND TRAFFIC
A PROMISING CONNECTION

Snow, torrential rain, ice on the road, fog, strong wind...

There is still much room for improving the extent to which traffic operators and infrastructure managers take account of meteorological data and its influence on road traffic networks. And yet, a “weather-sensitive” approach to management would unquestionably help to improve road safety and traffic flow. The unexpected must also be foreseen!

Initiated with this aim in mind, the European action COST TU0702 held its final conference in Helsinki on 21 and 22 May 2012. The presentation of its findings to a wide section of the public gave external experts the opportunity to comment on the work carried out with a view to improving the final report before publication. The scientific obstacles to overcome and associated research avenues have been identified, while the first building blocks for sustaining the expert network that formed through the COST action have been put in place. Moreover, a technical report published by Ifsttar in September 2012 provides an overview of its findings. This is a collective work, the fruit of the deliberations and work of 28 authors – all members of the COST action that brought together European countries. Australia and Japan were also involved. Note the close collaboration with the Federal Highway Administration (FHWA) which is overseeing a similar programme in the US. The report includes recommendations for road infrastructure managers to help them to develop genuine “weather-sensitive” management strategies. From an operational point of view, the Licit – together with AREA – has developed a tool for predicting journey time on the motorway, called TPTEO, which uses toll transactions and factors the weather effects into these predictions. Lastly, note the start-up in 2013 of a new strategic research operation (COMET - Weather-sensitive characterisation of the state of the road & traffic conditions). This federates the skills of four of the Institute’s research structures (Licit, Lepsis, GER, Grettia), of the East France CETF/ERA 31 “Use of the Road in Adverse Weather Conditions”, the Lyons CETF/DLCF, Météo France, Joseph Fourier University (Grenoble) and the Institut Pascal (LABEX IMobs3).

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THESES
Ahmed MEKKI, Estas
Evaluation of the operating safety of complex systems: application to ERTMS qualification (10/04/12)
Philipe RICHARD, Estas
Contribution to establishing and detecting human stability as regards safety: application to guided transport systems (12/01/12)
Tibye SAUMTALLY, Grettia
Two-dimensional traffic models (04/10/12)
Virginie DAGONNEAU, IM-1/Lepsis
Study of the links between immersion and presence for developing a powered two-wheeler driving simulator (12/10/12)
Sébastien DEMELEL, IM-2/Livic
Construction of extensive maps for estimating the road risk: approach founded on merging local maps (14/12/12)
Siham HAIROUID, Lestos
Dynamic modelling of MIMO channels for rail transport (03/07/12)
Kais HASSAN, Lestos
Contributions to the environmental recognition capacities of Cognitive Radio for high-speed mobile applications (10/10/12)
Dafa Seynabou LOUM, Lestos
Multi-service high-throughput radio transmissions on optical fibres – Application to optimising the multi-user capacity in transport right-of-ways (23/02/12)
Benot MATHERN, Lescot
Interactive knowledge learning from activity traces: Synthesis of automations to analyse and model motor vehicle driving (12/03/12)
David REY, Licit
Minimisation of flight conflict risks by speed regulation (13/01/12)
HDR Fouzia BOUKOUR, Lestos
Advanced radio techniques of communication, location and detection for land transport (03/12/12)
Mobility, safety and the environment are the new priorities that the range of infrastructure networks must meet for transporting passengers and goods responsibly. Ifsttar’s experts are more particularly investigating two fields of action: powered two-wheelers (PTWs), and the construction of rail infrastructure in particular. Indeed, PTWs are becoming an increasing concern from the perspective of road safety. To more accurately target exposure to the risk this category runs and understand the specific types of behaviour, the Institute is working especially on trying to characterise and analyse the routes taken by PTWs – two areas where science is hitting a dead end for the time being. Moreover, Ifsttar is becoming ever more purposefully involved in the rail sector, which is benefiting from what has been learned in the road sector with design, renovation, modelling and auscultation techniques being adapted.

For the benefit of citizens, this research intends to produce driver assistance systems for users. It is also developing the tools required by managers for building and operating infrastructure in line with the new operating conditions and blending it as harmoniously as possible into the environment.
INTELLIGENT TRANSPORT
SAFETY THROUGH UNITY

In June 2012, Brussels hosted the closing seminar of the euroFOT1 project in which the Livic and Lescot laboratories played a very active part from its launch in 2009.

This project brought together 28 organisations in setting up operational tests under real conditions, aimed at statistically assessing the impact of eight advanced driver assistance systems.

In total, almost 1000 personal vehicles fitted out and equipped with these assistance systems drove around Europe for one year. Ifsttar and its partners thus collected invaluable data for assessing the impact of such systems on driver safety, efficacy and comfort. France set out to assess the speed limiter and cruise control of 35 equipped vehicles. The findings of this four-year project were presented on 26 and 27 June 2012 in Brussels to the main European stakeholders of research on transport. The public deliverables are available for downloading at: http://www.eurofot-ip.eu/en/library/deliverables/

EuroFOT was a unique opportunity for Ifsttar, the Livic and Lescot laboratories in particular to help improve vehicles and safety on our roads. This is because the data gathered provide new knowledge about how vehicles are actually used and their equipment. Researchers now have a clearer insight into the conditions under which systems are used and can assess the benefit provided by each of them.

Research into road safety through driving studies in natural situations is continuing at Ifsttar with the U-DRIVE project launched in 2012.

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1 / European Field Operational Test on Active Safety Systems.

RESTORING IMAGES
ALL MISTED UP

Vehicles now increasingly have an on-board camera, particularly for driver assistance tasks.

But some weather conditions which reduce visibility, particularly fog, can make this completely inoperative. To resolve this, the Lepis and Livic laboratories have developed methods that restore strong contrasts and, consequently, a compatible quality of image with their use by driver assistance systems. This research, undertaken for the ANR-Deufrako project called ICADAC, was completed in 2012.

These methods are based on a local contrast enhancing technique combined with a physical model for diffusing light in the atmosphere. They function at video rate and can be integrated directly into a vehicle. Demonstrations on vehicles have proven their effectiveness. They have been compared to current techniques on image bases that we compiled and which are made available to the community. This proved a convincing comparison since they systematically turned out to work faster with results of a higher quality.

Lastly, the potential gains brought about by restoring a detection technique upstream have been modelled in terms of detection rates and range. A gain in reaction time on a panel of human participants was also found in the context of assistance provided by heads-up display. The scale of these gains holds the promise of significant improvement being made in driver safety.

Automotive manufacturers have also shown particular interest in these techniques, which herald new driver assistance systems.

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POWERED TWO-WHEELERS, NOVICE RIDERS: BEHAVIOUR, PROBLEMS AND TRAINING POSSIBILITIES

Actions for reducing the accident rate among this particularly vulnerable population are urgent.

If we take account of the mileage covered, the risk of death during an accident is 20 times higher for a powered two-wheeler rider than for a car driver. These worrying figures are all the more applicable for novice riders. The ANR/Predit SIM2CO+ project, which follows on from the thesis research carried out by Samuel Aupetit on learning to ride powered two-wheelers in France, is therefore focusing on novice motorcyclists. They are being observed during all of their usual journeys over one month just after passing their driving licence. Their own bikes have been equipped and, in addition to the collection of objective data on the vehicle’s dynamics, the researchers are using logs and self-confrontation interviews to analyse the behaviour observed and understand the problems encountered by novices.

By cross-linking this data with the findings of a study on accident rates, the consortium’s partners (Ifsttar, University of Paris-Sud, University of Orléans, ECA-Faros and EPNC) have identified groups of problematic situations that are currently instantiated on a driving simulator. The intention is to get new drivers to try out these “at risk” situations in complete safety and to train them to recognise and anticipate such situations of potential conflict. The educational content and scenarios proposed to pupils, which are currently being developed, may be used through a website and low-cost “motorbike” driving simulators.

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TRACK BALLAST GEOMETRICAL DISORDERS
VISCOROUTE®2.0 TAKES THE TRAIN

Roads are deformed under traffic. For several years, the Institute has offered, along with ViscoRoute®2.0, a reference design software which incorporates the elastic or viscoelastic behaviour of road courses. The tool now applies to the rail sector.

Such a tool was missing in the rail sector, in a context where the increase in running speed of the High-Speed Lines (LGV), from 270 to over 320 km/h, seems to be accelerating the appearance of geometrical disorders observed in the track ballast of these tracks. To deal with this problem, a thesis aimed at understanding what causes these disorders and putting forward constructive measures for reducing them got under way in 2011 at Ifsttar (IM, Structures). ViscoRoute®2.0 has had an extension model added for the rail sector to provide the dynamic response of a rail track subjected to convoys travelling at constant speed. On the basis of numerical simulations carried out via this software, unfavourable combinations of stress and vertical acceleration in the track ballast have been revealed and considered as the cause for the disorders observed. A parametric study has identified the most influential factors on the accelerations calculated: speed, seat rigidity module, rail/ballast contact rigidity, etc. The effect of introducing an asphalt base course has also been looked into. The impact of these factors now needs testing and checking in laboratory trials, or by on-site measurements.

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FOUNDATION ENGINEERING
CYCLIC STRESS EXAMINED AT LAST

Although the regulations (EUROCODE 7 in particular) recommend that it be taken on board in foundation engineering, French and European technical documentation concerning the response of soils subject to cyclic and variable stress is incomplete.

In such a context, the national research project SOLCYP (Cyclic Stress on Piles) (2009/2013) provides key new knowledge after four years of work. With the innovative test database put together it will be possible to develop computing methods for sizing structures subject to cyclic loads. The standard application of the SOLCYP project presents a very high number of low-range cycles (up to several million), representative of stress endured by rail infrastructure.

Ifsttar has conducted experimental plot loading tests in partnership with the companies that take part in the project, on two reference sites – Merville (clay) and Loon Plage (sand) – on which deformation stress measurements have been carried out. To this end, the Institute has developed a specific instrument – the removable extensometer. The result of this was an original and unique database. Cyclic stress generates loading/unloading phases of the soil/foundation interface that can cause the load-bearing capacity of plots to deteriorate and deformation of the natural land to build up in a way that is incompatible with the requirements of rail platforms.

This study has thus shown that the ratio between the variable load due to the passage of trains and to the permanent load (structure weight) should be less than 50%.

These databases may be added to from studies on other soil types. They will help to develop behavioural models of the soil-foundation interface and ultimately to define a method for sizing the foundations of transport infrastructure subject to cyclic stress.

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GRIP AND THIN LAYERS OF WATER

When the road is wet, drivers are at risk, even when the water on the road is of shallow depth. Admittedly, situations of aquaplaning are becoming rare.

When the road is wet, drivers are at risk, even when the the water on the road is of shallow depth. Admittedly, situations of aquaplaning are becoming rare. But in periods of light rainfall, or just after a shower, the driver’s perception of the risks incurred is often insufficient since he or she does not adapt his or her driving speed appropriately.

There are few findings for defining a “critical” state of dampness when road grip falls sharply, despite a deceptively “safe” appearance of the surface. The low levels of water involved (< 1 mm), transition from wet to dry grip and impaction of the road coating microtexture are all factors that limit the development of research on the appearance of viscoplaning – a major cause of accidents on wet roads.

Yannick Beaufrut’s thesis, conducted at the Ease laboratory and funded as part of the European project SKIDSAFE (7th FP), was launched in 2009 to meet these research needs. Under experimental conditions (in the laboratory and on the road), this thesis more effectively characterised the grip of a road surface ranging from dry to completely flooded and defined a critical level of water (of around 0.1 to 0.3 mm) physically corresponding to the transition between a stable grip (level close to a dry surface) and a grip that rapidly diminishes with water.

Lastly, the effect of the microtexture (number of contact points, form of bumps) of the road surface and its masking by the film of water can be modelled.

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Ifsttar is increasing the amount of research being carried out to constantly improve road safety and work towards a mobility that protects the health of users and citizens. Beyond continuing the Detailed studies of accidents and the Register of road traffic accident victims, a number of Ifsttar’s studies are aimed at improving knowledge of the road risk. The main key words in this respect are standard scenario of an accident, malfunctions of the driving system, dynamic activity of vehicles, behavioural psychology, legal responsibilities, cognitive aptitude for driving of elderly people, social and territorial inequalities, lowered vigilance, alcohol, drugs and medicinal products, planning and integration of safety in territorial management as well as vulnerable users, causes of death or healthcare administered to casualties.

The biomechanical approach – an unavoidable Gordian knot of road traffic safety – is one of the subjects of excellence of Ifsttar, which is endeavouring to continue its work on modelling the human body with a view to predicting the risk of injury, improving user and transport protection and comfort and helping to design vehicles. The research activities conducted in this field comprise both modelling and testing out; these are developed at different scales, from the basic tissue to a person in his or her entirety. Lastly, in terms of the environment, mention could be made of the study on the effects of aeroplane noise on the health of inhabitants near airports.

Research area 3 groups together the activities of one research unit (MA) and three jointly managed units (LBA, LBMC, Umrestte). The few examples described in this report only represent a small proportion of the wide range of studies being carried out by these units.
MECHANICAL BEHAVIOUR AND MODELLING OF ABDOMINAL ORGANS AND THEIR ATTACHMENT SYSTEM

At the Laboratory of Applied Biomechanics, modelling of the abdomen has been geared towards a description of the liver and the attachment system of abdominal organs, for which their mechanical properties have been taken into account along with their vascularisation.

The detailed model of the liver therefore incorporates the vascular tree and provides a biofaithful description of lesions during an injury. In the same way, the importance of vascularisation in the organ attachment system and, as a result, the risk of haemorrhage incurred during an injury, has been highlighted. At the same time, these studies have emphasised the importance of vascularisation in the organ attachment system and, as a result, the risk of haemorrhage incurred during an injury. Characterisation of the intestinal tissues (small and large intestines) has been extended at stress speeds ranging from the virtually static (1cm/min) to dynamic (1m/s), revealing the dependence of the deformation rate on the behaviour of structures.

The clinical database of the Nord de Marseille Teaching Hospital regional “trauma center” started up in 2009 currently contains over 300 abdominal injuries. This base provides a description of the different injuries, and helps to show the importance of non-surgical treatment in medical care. Lastly, work has got under way on the morphometric and mechanical characterisation of the spleen and these rupture methods.

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Test specimen before and after traction. After traction, the test specimen is longer and torn.
TRANSPORT USERS: BE CAREFUL YOU DON’T FALL!

► All passengers develop a motor activity, intentional or reflexive, when they travel by public transport. By simulating this motor activity, the possibilities and/or difficulties of using a particular means of transport can be assessed, and the possible risks associated with this use – typically the risk of falling.

One of the main difficulties involves modelling the mechanisms of staying balanced. For several years, the LBMC has been working on this question in partnership with research teams specialising in virtual reality and humanoid robotics. Two theses were defended in 2012 on this subject. One, in partnership with the CEA-LIST, focuses on the consideration of balance constraints in the simulation of a movement entering or leaving a vehicle. The other, conducted with the Grenoble INRIA branch, looked into how balance is maintained after a disturbance – typically when a public transport vehicle brakes. These studies are ongoing, particularly with two new theses funded by Ifsttar and the Rhône Alpes Region.

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In France, where there is no specific procedure for monitoring elderly drivers, doctors have an advisory obligation to prescribe medical contraindications to driving. And yet they have no validated cognitive tools for assessing any repercussions of cognitive disorders on driving ability.

The first question in the MG-CogCAPA study, a project funded by the ANR, was raised by doctors concerning a protocol for detecting cognitive deficits that could impair driving skills. For that, 92 GPs, selected at random from professional lists, enlisted 541 drivers aged 70 or over. They gave their patients a road mobility questionnaire, two cognitive tests, a functional autonomy scale and a balance test. These tools were considered to have been completed in a satisfactory manner (75 to 99% depending on the test) and usefully in clinical terms (83 to 86%). 70% of the doctors said they were ready to use this protocol in their everyday practice. A simplified version of this should be available to doctors to help them to find a balance between preserving quality of life and safety for the person in question and those of other users.

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Example of fall kinematics induced by a disruption of the tramway emergency braking type (tests performed for the SAFEINTERIORS project - FP6 - 011290)
ROAD TRAFFIC ACCIDENTS
INCIDENTS THAT CAN TEACH AS VOLUMES

► Getting to the bottom of road traffic accidents so that they can be avoided more effectively!

This is the new challenge that should help save lives - S-VRAI proves it! This French acronym stands for: “Save Lives by Feedback from Incident Analysis”.

Started in 2012, the S-VRAI project therefore hopes to improve road traffic accident rates by analysing incidents gathered by the administration’s vehicle fleets used for official business and which are fitted with data recorders called EMMA (on-board recorders of accident mechanisms). The project should enable tools tailored to the analysis of incidents to be developed to pinpoint areas where progress can be made in making roads safer.

The project is focusing on six study themes:

► inciden
tality as an indicator of how dangerous roads are,
► improving knowledge of accident mechanisms,
► effectiveness of driver assistance systems,
► diagnosis and impacts of urban developments and infrastructure on accident rates,
► impact on drivers’ behaviour,
► characterisation of dynamic driving parameters.

With a view to respecting personal data about the drivers involved in the project, a complete legal protection system has been set up and authorisation has been granted by the CNIL for one year.

After fitting out some fifty vehicles, data collection began in August 2012. More than 500 events have already been recorded, including some 100 accidents over more than 2000 routes covering a broad expanse of territory.

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1 / Funded by the DGCR, this project is being carried out under the scientific oversight of Ifsttar, which federates the Cerut and several Cete centres.
Indicators

6 subsidiaries

€7M in partnership active revenue

80 active patents
Meeting the expectations of society and the business community as well as achieving leadership in our fields of expertise requires two things: anticipating the technical support needs of national and local public authorities as well as control authorities, and providing industrial stakeholders with expertise of the very highest standard. Indeed, thanks to knowledge or know-how developed through targeted research actions or programmes and to scientific facilities and material resources – some of which are unique in France and even Europe – researchers have been able to produce major findings that are subject to a proactive research utilisation strategy, ensuring a continuum from research to innovation.

Ifsttar has thus brightened the Institute’s visibility with respect to the business community through its subsidiaries, certifications and patents for example. These ties with the socio-economic sector provide us with a response in line with society’s needs, all the while enabling us to enrich our research programme. To extend and expand this process, Ifsttar is closely involved in competitiveness clusters focused on transport, the sustainable city and control of new materials.

With an equal interest in scientific, technological, economic and social challenges, Ifsttar intends to support the stakeholders concerned in working towards sustainable and responsible mobility by adapting infrastructure effectively and designing cities of tomorrow that are full of ethical and economic promise, and play an active part in national competitiveness.
SUBSIDIARIES AND HOLDINGS

A year of emergence for several new activities in a very difficult national economic context. First steps successful for the start-up Logiroad, launch of spin-off activities Ergoptim and Luxondes. Winning of impressive references for the start-ups LCPC-Experts and Civitec... Ifsttar is overseeing our intermediaries to showcase our expertise, knowledge and technologies incubated and developed by our researchers.

Entirely held by Ifsttar, the subsidiary ERT – Europe Recherche Transport – supports researchers involved in European projects. For the 2012 financial year, its turnover fell sharply to €340k given the end of the 7th FP and preparation of the next European framework programme H2020. Its activity is based on managing 19 projects. ERT is continuing its role as a national contact point for transport to the European Commission and, in this respect, participating in the European Transport Network Alliance ETNA+.

The LIER’s activity felt the full force of the drastic cut in public budgets, as this impacted directly upon the economic health of its customers. As such, the “testing” activity is still experiencing a historic economic slowdown this year, and awaits the re-writing of standards on safety barrier connection and queue end testing. The digital simulation activity confirms its development with growth of more than 15% to achieve €400k – a major proportion of which comes from foreign clientele. This increase in its business abroad is thanks to two LIER branches opened in 2011: in Poland and Turkey. Ifsttar holds 45% of the new subsidiary Transpolis SAS, a pooled innovation platform bringing together the “endurance”, “reliability” and “safety” test and innovative solution testing tracks for public transport and freight transport.

Maintenance of road networks, development basis of the new start up Logiroad
The partners associated with the members of the LUTB competitiveness cluster have focused their activity on: studies for validating the technical feasibility of test means setup sites, the detailed definition of work to be undertaken and obtaining the necessary funding for carrying this out. The working group’s progress has clarified its content and economic model; the pre-study “ecological diagnostic” determined the conditions under which the Les Fromentaux plots are used; and the administrative procedures to be taken prior to implementing the Transpolis platform on the Les Fromentaux site were identified. SMEs’ involvement in and commitment to the Transpolis project picked up pace at the end of 2012.

The young start-up Civitec, a subsidiary held at 75% by Ifsttar since the end of 2008, developed its strategic market analysis so as to restructure its range of services available and clarify its positioning. The product development plan was brought into line with these objectives and the team reorganised to combine the “development” and “profession-specific” fields of expertise for meeting customer expectations more effectively. The joint work of the technical and sales teams led to a strategic partnership agreement being signed with the French leading car equipment manufacturer Valeo during the 2012 financial year. The range of software regarding simulation and technical feasibility of test means setup sites, including the recruitment of an engineer to finalise the operation and development “gyroscan” and “flat scan” devices on the one hand, and finalise the operation and development software – 3D viewer – as well as the new generation of sensors and associated steering know-how of Ifsttar and the MEDDE scientific and technical network in managing infrastructures and helping to maintain road networks. Logiroad uses the GIRR software and “ODT” technology for recognition of Journeys by image processing, lifting itself back out of the red in 2012 after two years of falling profits. The 2012 turnover was more than €5.3M and the earnings positive by more than €450k. Citilog achieved more than 55% of its sales abroad, with excellent geographic distribution. As such, Asia-Pacific accounts for 13%, the American continent 14%, Europe 8% and Africa and the Middle East 20%.

Ifsttar also helped to start up a new business, “Luxondes”, led by the start-up Techprod. Luxondes uses an Ifsttar patent protecting the invention of Gyroscanfield. This measuring instrument can visualise, in real time and in 3D, the electromagnetic field emitted by any electronic device: smartphone, motors, aerosols, etc.

The striking facts of the 2012 financial year include the recruitment of an engineer to finalise the development and industrial application of “gyroscan” and “flat scan” devices on the one hand, and finalise the operation and development software – 3D viewer – as well as the new generation of sensors and associated steering technology on the other. These investments, added to the production of the first devices, represent efforts of over €100,000.

A commercial partnership has been set up with the manufacturer Nexio; participation in exhibitions, communication leaflet and email campaigns have presented the technology to the first prospects. The Swiss firm Nexans bought its first device.

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The Institute’s teams once again set about winning contracts both in response to national and European calls for tenders and in direct link with industrial partners. Our success rate has been high. In 2012, the Institute signed approximately 300 new contracts for almost €11M (excluding Equipex funding and certification contracts which represent the equivalent).

The contracts acquired from the French National Research Agency (ANR), the Directorate-General for Businesses (DGE) and new European contracts obtained under the 7th FP on Ifsttar’s themes brought in a little over €6M in 2012, much less (-55%) than in 2011. This result can be explained by the fall in calls for projects on Ifsttar’s themes launched by the French State and local authorities and by the 7th FP, pending the set up of the new framework programme H2020. The average value of these contracts for Ifsttar is somewhere between €120k and €160k. On the other hand, contracts drawn up with industrial partners enjoyed considerable fresh growth (+47%) compared with the previous year, and account for almost 45% of contracts notified by the Institute in 2012. 51% of the notified contracts were from the public sector and 49% of the Institute’s contractual activity directly involved a partnership with the social and economic spheres (industry or a local authority).

**Sustained contractual activities with the industrial sector**

In 2012, Ifsttar reported income of more than €7M that directly involved an industrial partner or a local authority – up by 5% compared with 2011. These activities with the social and economic spheres involve partnership-based research, expert appraisals, tests and certification. More specifically, direct research contracts (excluding expert appraisals, tests and certification) recorded with manufacturers, operators and territorial authorities stagnated after a sharp rise in 2011, to return to the same level as in 2010 with 2.9 million d’euros. Major partnerships were forged in close liaison with manufacturers, academics and territorial authorities under the future investment programme.

The involvement of the Institute’s teams in setting up and starting up these ambitious projects concerned: IRT Railenium, IRT Jules Verne, IEED Vedecom, the Efficacity project, Equipex Sense-City and the platform Innovation Transpolis.

**Increasing involvement in competitiveness clusters**

Thanks to Ifsttar’s strong regional foothold and the excellence of our laboratories, we are major stakeholders in the primary competitiveness clusters taking action for the transport, city and materials engineering sectors. We thus play a governance role and leads working groups in the Mov’eo, I-Trans, Advancy and LUTB clusters. We maintain close ties with System@tic, Vehicule du Futur (Vehicle of the Future), Novalog, Pegase, Gestion des Risques et vulnerabilite des territoires (Risk Management and Regional Vulnerability) and Solutions Communicantes Securisees (Secure Communications Technologies).

The relationship of trust forged between the members of the competitiveness clusters has increased the quality and quantity of research contracts accredited by these clusters and funded by FUIs (Interministerial Unified Funds) - while the percentage of projects selected by juries is going down. Efforts to more effectively support the eco-system of SMEs are continuing, but the share of direct contracts with SMEs remains stable, at around 10%.
In 2012, the team responded to all sorts of independent expert appraisal requests, especially for the export markets: automatic drivers for the Budapest metro lines 2 and 4, Panama metro line 1 and Algiers metro line 1. At CERTIFER’s request, the Estas has therefore assessed the development and validation of the software part of a system that detects users’ falls on the track for one of the metro lines in Budapest. This stage is necessary for the safety certification of the detection device.

On behalf of the Institute, the unit thus conducts technical assessments of the safety of ground, on-board or split control systems used on new lines or lines under repair.

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Based on vehicle and scene statements as well as clinical data, the LBA, made up of a multidisciplinary team (doctor, research and engineer), set up a method for reenacting real accidents involving light vehicle impact against vulnerable users. This method can determine the circumstances of the impact: speed and positions upon impact, identification of the zones of impact, possible slowing down of the vehicle. It draws from experimental knowledge and understanding of lesion mechanisms coupled with parametric studies by digital simulation with digital human body models. The findings of this research have responded to various expert appraisal missions with charges of aggravated intentional homicide.

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1 / Criminal Research Institute of the French National Gendarmerie.

**QUALITY OF CABLE TRAYS EXPERTISE AS A RESORT**

A dispute has arisen between TopGlass and Cegelec about the quality of cable trays delivered for the metro in Marseilles for renovating or equipping stations and tunnels.

Our expert appraisal work involved helping to determine chronology and responsibility. For the purposes of corrosion resistance in particular, these trays are made out of composite materials, a field in which TopGlass has significant experience. Indeed, TopGlass has already equipped several sites, including Eurotunnel, and others for Cegelec, from these same composite materials made up of pultruded sections made from glass fibre and polyester resin.

Beyond the expert appraisal of documents, we have conducted static and creep tests over several months in the Navier laboratory on support brackets of the cable tray. The dispute is now being handled in court.

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1 / A pultruded section is made from fibres lined up in the direction of the section and pulled through polymerised resin.
Problem affecting the Echinghen Viaduct

Coordinated intervention by the Ifsttar/Cete network

The product of an innovative approach in technical and architectural terms, at 1,301 metres long the Echinghen Viaduct is the largest of three structures enabling the A16 to cross the monts du Boulonnais.

With a principal span of 100 m, the longest structure of the Sanef network was commissioned in 1997. Its deck is made up of two concrete slabs (upper and lower) connected by a steel mesh. Longitudinal prestressing is provided by internal and external cables.

Following the discovery of a tear in a high-density polyethylene (HDPE) sheath on one of the viaduct’s external prestressing cables, the structure’s licensee, Sanef, called in the firm SNCF IGOA. The wires under the tear were found to be corroded and white traces spotted in the injection grout. Ifsttar and the Nord-Picardie and Lyons Cetes were subsequently contacted to carry out further investigations.

The networking between Ifsttar and the Cetes meant that all of the necessary skills could be mobilised in a coordinated manner. These included Ifsttar’s expertise in metallography, cables, injection grout and HDPE cable ageing. The “Prestressed structures” PCI (Nord-Picardie Cete) has helped to inspect the cables, while the 3CP capacitive sensor was implemented by the Département Laboratoire d’Autun.

These investigations have been put into practice by assessing the defect observed and what caused it, as well as the quality of injection by cement grout and the sheath. The conclusions necessary for monitoring the structure have been drawn.

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1. / Competence and Innovation Cluster.
Ifsttar
French Institute of Science and Technology for Transport, Development and Networks

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ANNUAL REPORT 2012

TESTING

GEOTECHNICAL CENTRIFUGE
TOP MARKS AGAIN FOR A ROBOT

Physical modelling in a geotechnical centrifuge is increasingly calling for the succession of operations “in flight”, which means without ever stopping the centrifuge.

This is possible thanks to the Teleoperator Robot (or TOP to those familiar with it), a 4-axis and vertical axis rotation cartesian robot that works under a macrogravity of 100xg. The control system of this robot, in service since 1996, was designed back in the late 1980s (Num 800 for those in the know), and so has now been given a makeover. Thanks to joint funding from Ifsttar and the Pays de la Loire Region, the robot’s “nervous system” has therefore been completely upgraded by the Nantes-based firm SEA Productique: simplified wiring, new human-machine interface, new control system, new functions (force control along three axes), new 1xg movement preparation post.

What’s more, the TOP has been fitted with a whole range of tools: penetrometer, clamp, shovel, foundations.

Following the acceptance phase, the first tests focused on the loading of surface foundations as part of a thesis jointly supervised with the Universidad de Los Andes in Bogota (Columbia) and partly funded by the Franco-Columbian action ECOS-Nord.

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TRAFFIC SIMULATORS
FABAC, THE ADVANTAGES OF BEING SMALL

With its major facilities, the Institute is solidly equipped for performing its traffic simulation tests, particularly in the Nantes centre.

In addition to its fatigue test track, the centre has 2 smaller traffic simulators – the FABAC1 machines. These machines can be used to apply life-size road loads to small test tracks (useful length 2m). Each of these comprises four running gear sets driven by an electric chain-motor unit. Fitted with single or twin wheels, these gear sets take it in turns to run on the road and then return to the top part of the machine. The machines are 10 m long, 2.5 m wide and had a motor capacity of 30KW. The loads applied are adjusted between 40 and 75 kN and their speed can range from 0.5 to 7 km/h.

To make up for their more limited performances than those of the test track, the FABAC machines are hugely flexible in use: short roads, high loading capacity (up to 1 million cycles per month), lower test cost. These features mean they are highly rated by companies for testing road surfaces or diverse equipment subject to traffic. Recent study subjects include:

- rutting of bitumen surface coats.
- durability of the bonding of concrete coats on asphalt.
- durability of surface coats in thin paving bonded to a bitumen surface.
- durability of grid-reinforced bitumen coats.
- traffic resistance of road gutters.
- durability of high-grip surface coats.

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1 / Continuous reinforced concrete fatigue.
DRIVER ASSISTANCE SYSTEMS
QUASPER DOES THE JOB

For the car industry, promoting the sector involves developing innovative and competitive technology, especially driver assistance systems.

In this context, the consortium of the QUASPER (QUAlification of Perception Systems) project, in which Ifsttar is taking part, includes all levels of stakeholder in the development chain to try and overcome the technological obstacles inherent in qualifying and certifying the functional performances of perception systems on-board or placed on an infrastructure.

Accordingly, to assess the performance of obstacle detection systems, Lemco has designed and developed a specific measurement platform because these systems, based on optic (camera, lasers, etc.) or electromagnetic (speed cameras) perception, are very difficult to assess. The required performance is very high (virtually zero rate of false alarms, very high detection rate), under difficult operating conditions at that (weather disrupts the operation of optical sensors in particular).

The performance is determined by assessing the ability to detect «standard» obstacles along a defined trajectory (speed and angle) by controlling the detection time using optical barriers that bring the obstacle into the detector’s field of vision. The trajectory is obtained by steering the vehicle using a driving robot.

The platform developed enables climatic situations to be reproduced (different rain and fog densities). Lastly, several types of obstacle can be used, particularly different dummies to assess the performance of pedestrian detection systems.

QUASPER is hugely flexible in use. First and foremost, it is mobile: any installation can be moved for use by a manufacturer or laboratory with setup times of around one day. It can also be configured, again in one day, to assess the performance of detection systems that are already installed on a vehicle. The driving robot means that intrusion in the vehicle equipped with the detector to be tested is not necessary.

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ACCREDITATION OF A NEW TRUCK CAB
VOLVO TRUCKS STEEL THEMSELVES FOR IMPACT

In the process of accrediting the design of a new range of heavy goods trucks, VOLVO TRUCKS has to carry out impact testing in accordance with regulation ECE R29/02.

For these tests, the vehicle is placed on the test bench comprising an impact pendulum on the SAINT PRIEST site near Bron, where Unex often offers the services of its measurement and test expertise.

The operations are conducted in a very meticulous manner. The laboratory sets up its 5 "rapid video" cameras for capturing the impact at a rate of 1000 images/second. Thanks to the precise analysis of these images from different viewpoints, protection of the cab occupants can be confirmed. The cab zone, which is not intruded upon during impact, is assessed from the images and compared with the space taken up by a representative test dummy. The same procedure is applied to observe the dynamic behaviour and resistance of different mechanical parts that connect the cab to the chassis.

These tests reproduce the truck chain collision configuration, a common accident on roads and motorways.

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METRO AND SAFETY
THE KEY WORD IS RESILIENCE

The primary aim of the European collaborative project SECUREMETRO is the most resistant design possible of trains and metros to the devastating effects of an explosion to reduce human loss as far as possible in the event of a conventional explosive attack.

Thanks to the very high quality images recorded, the researchers were able to accurately analyse the performance of the tests and behaviour of the car components. Find out more at http://securemetro.inrets.fr

Estas called on the Unex service unit to perform “rapid video” sequences of explosion tests. Unex therefore used two high-speed cameras (3000 i/s) on the specialist site in Spain, as well as the steering and acquisition equipment. In an initial campaign, 12 tests were performed on the new constituent parts of the vehicle in order to analyse their behaviour and resilience. A second stage entailed blowing up the full vehicle then assessing the behaviour of all of the parts.

Produced at a lower cost in partnership between three of the site’s units (MA, Unex, Lepsis), this will enable the Institute’s different simulators (in electronic and visual terms) to be harmonised and provide a better immersive driving experience in a complete vehicle.

The addition of a fourth screen on the left, by widening the angle of vision, increases the immersive experience. The same goes for the field of vision, made possible in the rear-view mirrors via a projection on screens secured on the side doors and between the front seats. The simulator is also fitted with a video acquisition system comprising 3 cameras (face, pedal and scene) and a digital recorder.

Use of the simulator in Salon-de-Provence shall apply to a broad spectrum of themes linked to driver safety, such as exploring visio-motor strategies, studying the effects of the social context on driving behaviour and comparing the attention capacities of young drivers and experienced drivers under certain alcohol levels.

There are also plans to introduce “Detailed Accident Studies” in simulation systems to identify accident factors on different populations of subjects or on populations under different alcohol levels.

The aim is to extend this activity to different stakeholders in the region.

5 / Inherently secure blast resistant and fire safe metro vehicles.

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ABDOMINAL INJURIES CAN OCCUR DURING CAR ACCIDENTS, POSSIBLY WITH SERIOUS CONSEQUENCES.

Abdominal injuries can occur during car accidents, possibly with serious consequences. The phenomenon of submarining, when the seat belt rises above the pelvis and compresses the abdomen, or incorrect seat belt use, can injure the abdomen. Passengers in the rear seats are more exposed to this risk due to the structure of these seats and less advanced restraint systems than in the front seats. But the regulatory test dummies for frontal impacts do not have a system for assessing the risk for this section of the body.

Together with Toyota Motor Europe, the LBMC has developed a new abdomen prototype for the frontal impact dummy THOR1, developed in the US under the impetus of the NHTSA2. THOR has already had several studies carried out on it internationally, particularly to improve its biofidelity and testing.

The abdomen prototype fitted with pressure sensors (APTS®) by LBMC has been assessed across several test campaigns of reference, including direct loading by the steering wheel or seat belt conducted by Ifsttar and crash tests performed at Toyota Motor Corporation in Japan. In 2013 it is due to be tested by the NHTSA’s Vehicle Research and Test Center (VRTC).

To continue with their work, Ifsttar and Toyota would like to contribute to international studies aimed at improving and standardising the THOR test dummy over the longer term.

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1 / Test device for Human Occupant Restraint.

AIR QUALITY
TOWARDS REAL-TIME MONITORING

In air quality metrology, gas chromatography is one of the most commonly used techniques.

Based on the separation of gas compounds, it enables the selective quantification of a large number of loosely concentrated compounds. Laboratory chromatographs are nevertheless bulky, expensive instruments, which mainly limits their use for post-analysis of samples, which might or might not be gas, in real time.

As part of a thesis in partnership with ESIEE-Paris, Ifsttar is co-developing a micro-chromatograph made using standard microelectronics production technology (silicon/glass). This system comprises a separation column that can be as long as 5 metres, as well as a thermal conductivity detector (TCD) consisting of a hot wire suspended in the middle of a micro-fluid channel. Each of these components is held on a one-millimetre thick chip a few centimetres long. The system can analyse a wide range of polluting volatile organic compounds such as benzene or toluene.

The compactness and low cost of these sensors makes their use possible for such applications as real-time monitoring of outdoor air quality (IMMAMENT project) or characterisation of air flows in a building using tracer gases.

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annual report 2012

Innovative data and image processing algorithms have been adapted to extract quantitative information about the small discontinuities detected and presenting low contrast compared with the environment.

This work, which calls for a high variety of skills, has involved several laboratories of Ifsttar (Macs, Livic) and the University of Paris 6. Several publications have appeared on the subject1.

Upgrades to antenna design and signal processing technologies now set great store by the use of polarisation diversity and of ultra-wideband (UWB) multi-frequency components which improve radar performances in terms of spatial resolution and penetration.

In this context, we have designed and produced a pair of original planar antennas of the bowtie slot type, with rear protection and fairly small in size (A4 format), for working at frequencies ranging from 270 MHz to more than 4 GHz on any kind of ground. The emitting and receiving antennas are connected on the ground to improve penetration of the electromagnetic energy.

Via FDTD simulations (time method), we conducted a very detailed parametric study into the operation of one antenna, and then of the complete radar system with diverse canonical environments. Thanks to the measurements taken in the sand pit of the Square des Périchaux (in Paris) in the presence of various small objects (conductors and dielectrics), it has been possible to study the radar performances, which correlate perfectly with the simulation findings. Innovative data and image processing algorithms have been adapted to extract quantitative information about the small discontinuities detected and presenting low contrast compared with the environment.

This work, which calls for a high variety of skills, has involved several laboratories of Ifsttar (Macs, Livic) and the University of Paris 6. Several publications have appeared on the subject1.


With the antenna open in its protection

ANTENNAS FOR GROUND-PENETRATING RADAR: TOWARDS POLARISATION DIVERSITY AND ULTRA-WIDEBAND IMAGING

Ground-penetrating radar moved parallel to the surface of the ground or a material makes it possible to detect deep dielectric discontinuities in a non-destructive manner (OR SIPRIEN and FISSURES).

With the protected antennas on the ground (sand pit of the Square des Périchaux Paris 15th

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Although we know how to protect ourselves against such problems in new structures, old structures suffering from such reactions need managing (there are a few hundred in France alone). In this respect, it must be possible to assess the actual condition of the structure, predict how the internal swelling reaction will evolve over several decades and validate by computation any repair methods envisaged.

The CESAR-LCPC computation by finished elements software is now equipped with a new tool, the RGIB module, for modelling the mechanical consequences of swelling reactions inside concrete. Based on a previous development (ALKA, which only looked at the problems of alkali-aggregate reaction), this module now boasts several functions inspired by the latest research on internal swelling reaction phenomena and on the needs identified through several expert appraisals: influence of the stress condition on chemical swelling, anisotropy, creep, hydric shrinkage, contact elements and so on.

The RGIB module is used to assess a wide variety of structures suffering from alkali-aggregate reaction or internal sulphatic reaction: bridges, dams, hydro-electric structures, etc.

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IFSTTAR’S PATENT POLICY
A CAREFULLY THOUGHT-OUT POLICY

Patent filings reflect the performances, expertise and excellence of Ifsttar’s researchers and play a part in its utilisation on the national and international stage.

The Institute has set itself the objective of continuing with the carefully thought-through development of its patent filing and software protection activities up to a dozen or so operations on average per year. At the same time, it is organising itself so as to optimise the maintenance cost and maximise the use of its patent portfolio. This development involves bringing about a culture of patents and software that can be used among researchers and motivating them over the long-term, particularly by factoring patents and research utilisation achievements into their assessments and through an appropriate incentive scheme. This policy is based on an effective process of protecting the knowledge acquired and its use under research contracts. Lastly, to bring the priority utilisation actions to the fore, the patent portfolio needs to be structured and surveillance set up around a dozen themes in connection with pooled research utilisation structures (CVT, SATT, PIA initiatives and Competitiveness Clusters).

In this context, hybrid cars come across as an ideal solution for manufacturers and drivers alike. Hybrid vehicles combine two key advantages, beginning with energy recovery during braking: when part of the vehicle’s inertial mechanical power is recovered by the electric engine acting as a generator and stored in the battery. What’s more, the instantaneous choice of the source in managing the energy use introduces some room for manoeuvre enabling optimisation of the functioning points of the different sources and converters of the vehicle. The patent defines an energy optimisation method for a standard hybrid vehicle with a fuel cell. This method is applicable in real time and incorporates a constraint on the dynamics of the fuel cell system with a local control. The principle adopted for optimising control of the hybrid system requires low computing power. Its upgradeable function makes it hugely robust for on-board applications on all of a car application’s cycles of use.

Ifsttar is working on the development of cleaner vehicles.

HYBRID VEHICLE
A ROBUST AND UPGRADABLE ENERGY MANAGEMENT ALGORITHM

In view of the increasing constraints linked to sustainable development, such as cutting the harmful gas emissions from transport, the development of more efficient vehicles in terms of energy use is a national and international research priority.

In this context, hybrid cars come across as an ideal solution for manufacturers and drivers alike. Hybrid vehicles combine two key advantages, beginning with energy recovery during braking: when part of the vehicle’s inertial mechanical power is recovered by the electric engine acting as a generator and stored in the battery. What’s more, the instantaneous choice of the source in managing the energy use introduces some room for manoeuvre enabling optimisation of the functioning points of the different sources and converters of the vehicle. The patent defines an energy optimisation method for a standard hybrid vehicle with a fuel cell. This method is applicable in real time and incorporates a constraint on the dynamics of the fuel cell system with a local control. The principle adopted for optimising control of the hybrid system requires low computing power. Its upgradeable function makes it hugely robust for on-board applications on all of a car application’s cycles of use.

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THE HAZARDS OF SKIING
THE KNEE – THE OTHER ACHILLES HEEL

The bindings on conventional skis, based on a mechanical design, aren’t perfect and cannot respond appropriately in all types of accident.

So is skiing a dangerous sport? Without a doubt, for both competitors and recreational skiers, who place particular stress on the ligaments of their knees, especially during a fall.

Our innovation makes use of a system comprising a shell made out of composite material that hugs the form of the knee. During a fall, this limits excessive tearing and rotation of the tibia in relation to the femur thanks to contact connection with the ski boot when necessary.

In the design stage, initially by digital simulation, we studied the injury mechanisms encountered in different fall situations. The benefit of the innovation has since been assessed and optimised in situ.

The patent filed is now being used by the firm Knee Guard SAS which intends to market the system by the end of this year (http://www.kneemax.com/).

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Ifsttar has been studying these risks for several years, and is the only French institute to be notified for the CE marking of falling rock protection kits. The CE marking of these kits is based on the Guideline for European Technical Approval, ETAG 27, published on 1 February 2008, which particularly provides for life-size impact testing. To this end, with its falling rocks testing station in Montagnole (South-East France), Ifsttar has the most effective tool in Europe for conducting these tests and enabling certification of the protection products.

In general, CE marking is obtained over two successive stages. First, an approval body assesses the product’s suitability for use and awards the European Technical Approval. The second stage entails an inspection of the product’s production by a notified body, after which it can obtain the certificate of conformity for the CE marking.

Since the certification of conformity system for falling rock protection kits is level 1, Ifsttar has to perform the initial inspection of the factory and the factory production check.

In early 2012, Ifsttar therefore drew up the standard for performing audits of the kit producers. Following a production inspection carried out by a trained auditor from the Scientific and Technical Network, the first CE marking for a French product was attributed by Ifsttar in April 2012.

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DEEP FOUNDATIONS IN FRANCE
THE NEW DESIGN RULES HAVE BEEN SET

The gradual set up of the Eurocodes, and of Eurocode 7 on geotechnical design in particular, have resulted in AFNOR’s publication in 2012 of standard NF P 94-262, which merges two former regulations: DTU 13.2 and Fascicule 62 Titre V.

This new standard has united the design rules for deep foundations in France. Paradoxically, prior to this standard coming into force, a pile was not designed in the same way depending on whether it was to support a bridge or a building. The new rules put forward are based on life-size pile loading tests organised at Ifsttar, and previously at the LCPC, since the late 1960s. Performed together with the Nord-Picardie Cete, the detailed analysis of data of several hundred loading tests is what led to new design rules being drawn up — that are more reliable and more effective. This work is therefore directly helping to increase the durability of structures, whilst making economical use of the raw materials implemented.

Moreover, this calibration of foundation design rules is still not very common elsewhere in the world and can give French companies an undeniable technical and economic advantage on some international markets.

Lastly, the information storage format can constantly populate the database with the tests conducted, either by Ifsttar or by other service providers.

After two years of work, a standard jointly drawn up by Ifsttar-Unex and PROTECOP is now being published: AFNOR standard XPZ74-322 “perforating and non-perforating impact reduction test protocol for chest, arm, forearm, leg and thigh protection”.

What makes this standard original is that it uses HYBRID III type anthropomorphic test dummies that were initially developed for crash tests. Specific injury criteria have been determined or extrapolated from vehicle accident analyses. The standard is mainly intended for public buyers of the ministries of the armies and interior.

A collaboration contract has been signed between Unex and PROTECOP to welcome the manufacturer’s staff to broaden the research to bullet-proof protection and extend the standard to Europe.

Traditionally focused on road safety, Unex has extended its activity to studying personal protection from all types of physical attack — whether or not accidental. The laboratory has thus conducted all sorts of expert appraisals on the effectiveness of personal stab protection equipping the army or law enforcement agencies. This protection includes leg protection, shoulder protection, arm protection and vests protecting the chest and back. But the effectiveness of this equipment — widely available on the market — is not determined in a harmonised way on European level. It is as difficult for a public buyer to make a choice as it is for manufacturers to prove the quality of their equipment compared with their competitors.

In view of this situation, Unex approached a major French manufacturer in the field — PROTECOP — to create an AFNOR working group on this theme.

After two years of work, a standard jointly drawn up by Ifsttar-Unex and PROTECOP is now being published: AFNOR standard XPZ74-322 “perforating and non-perforating impact reduction test protocol for chest, arm, forearm, leg and thigh protection”.

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IFSTTAR - French Institute of Science and Technology for Transport, Development and Networks

**INDICATORS**

- 1,267 employees
- €103M in budget
- 7,022 teaching hours in higher education
APPENDICES

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**HUMAN RESOURCES**

**IFSTTAR Breakdown by Gender**
- 38% Women
- 62% Men

**Total Number of Employees (Permanent and Fixed-Term Contracts)**
I.E. **1,232.8 Full-Time Employees**

**Breakdown of Employees by Domain**
- 19% Administrative
- 18% Technical
- 63% Research

**Breakdown of Staff by Gender and Age Cohort**

**Breakdown of Employees by Activity**
- 25% Support
- 3% Application / International
- 72% Research

**Breakdown by Gender and Site**

- **Bron**
  - Men: 108
  - Women: 484
  - Total: 592
- **Marne-la-Vallée**
  - Men: 290
  - Women: 227
  - Total: 517
- **Nantes**
  - Men: 63
  - Women: 34
  - Total: 97
- **Satory**
  - Men: 12
  - Women: 27
  - Total: 39
- **Villeneuve d'Ascq**
  - Men: 22
  - Women: 34
  - Total: 56
- **Marseille**
  - Men: 3
  - Women: 23
  - Total: 26
- **Belfort**
  - Men: 5
  - Women: 9
  - Total: 14

**Human Resources**
## Financial Resources and Expenses Excl. Depreciations

### Revenues

<table>
<thead>
<tr>
<th>Description</th>
<th>Euros</th>
<th>%</th>
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<tbody>
<tr>
<td>French Ministry of Ecology, Energy, Sustainable Development and Territorial Planning</td>
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<td>83.5%</td>
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<td>Grant for public service costs</td>
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<td>French Ministry of Higher Education and Research</td>
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<td>Research post-doctoral students</td>
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<td>Contracts and support secured for research activities</td>
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<td>Research contracts with public or private third parties</td>
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<td>Grants for research programmes or projects</td>
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<td>Income generated from research activities and service provision</td>
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<td>Fees for patents and licences</td>
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<td>Service provision</td>
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<td>Product sales</td>
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<td>Financial revenue and other income from day-to-day running</td>
<td>373,888</td>
<td></td>
</tr>
<tr>
<td>Exceptional earnings</td>
<td>183,876</td>
<td></td>
</tr>
<tr>
<td>Financial operations - Fixed assets</td>
<td>1,093</td>
<td></td>
</tr>
<tr>
<td><strong>Total revenues</strong></td>
<td><strong>103,659,705</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>

**Total Resources**

<table>
<thead>
<tr>
<th>Euros</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>103,659,705</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

### Authorised Expenses

#### Breakdown of Authorised Expenses Per Destination

<table>
<thead>
<tr>
<th>Description</th>
<th>Euros</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activities performed by research bodies</td>
<td>75,260,816</td>
<td>69.3%</td>
</tr>
<tr>
<td>Mobility, energy, environment</td>
<td>10,324,269</td>
<td></td>
</tr>
<tr>
<td>Quality, safety and optimisation of transport systems</td>
<td>16,238,027</td>
<td></td>
</tr>
<tr>
<td>Transport and health</td>
<td>8,195,854</td>
<td></td>
</tr>
<tr>
<td>Saving energy and natural resources for infrastructure</td>
<td>16,284,116</td>
<td></td>
</tr>
<tr>
<td>Durability of infrastructure, hazards and pollution</td>
<td>14,757,599</td>
<td></td>
</tr>
<tr>
<td>Safety and efficiency of infrastructure</td>
<td>9,460,951</td>
<td></td>
</tr>
<tr>
<td><strong>Joint actions</strong></td>
<td><strong>7,580,420</strong></td>
<td><strong>7%</strong></td>
</tr>
<tr>
<td>Major research facilities</td>
<td>244,692</td>
<td></td>
</tr>
<tr>
<td>Research utilisation</td>
<td>474,160</td>
<td></td>
</tr>
<tr>
<td>International exchanges</td>
<td>1,436,938</td>
<td></td>
</tr>
<tr>
<td>Scientific and technical information</td>
<td>3,464,580</td>
<td></td>
</tr>
<tr>
<td>Scientific partnerships</td>
<td>1,350,278</td>
<td></td>
</tr>
<tr>
<td>Ongoing training</td>
<td>609,772</td>
<td></td>
</tr>
<tr>
<td><strong>Support roles</strong></td>
<td><strong>25,697,510</strong></td>
<td><strong>23.7%</strong></td>
</tr>
<tr>
<td>Social action</td>
<td>744,864</td>
<td></td>
</tr>
<tr>
<td>Shared computer resources</td>
<td>4,748,129</td>
<td></td>
</tr>
<tr>
<td>Real estate - maintenance</td>
<td>1,012,159</td>
<td></td>
</tr>
<tr>
<td>Real estate - major renovation, acquisitions, construction</td>
<td>1,524,534</td>
<td></td>
</tr>
<tr>
<td>Head office overheads</td>
<td>7,840,048</td>
<td></td>
</tr>
<tr>
<td>Research unit overheads</td>
<td>9,241,078</td>
<td></td>
</tr>
<tr>
<td>Financial operations</td>
<td>184,470</td>
<td></td>
</tr>
<tr>
<td>Other general expenses</td>
<td>401,598</td>
<td></td>
</tr>
<tr>
<td><strong>Total expenses</strong></td>
<td><strong>108,538,746</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>

**Total Expenses**

<table>
<thead>
<tr>
<th>Euros</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>108,538,746</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

#### Breakdown of Authorised Expenses Per Type

<table>
<thead>
<tr>
<th>Description</th>
<th>Euros</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subsidised staff expenses for public service costs</td>
<td>77,243,584</td>
<td>71.2%</td>
</tr>
<tr>
<td>Other staff expenses (expenses on research contracts)</td>
<td>5,711,303</td>
<td>5.3%</td>
</tr>
<tr>
<td>Unscheduled operating expenses and investments</td>
<td>24,832,698</td>
<td>22.9%</td>
</tr>
<tr>
<td>Scheduled investments</td>
<td>751,161</td>
<td>0.7%</td>
</tr>
<tr>
<td><strong>Total Expenses</strong></td>
<td><strong>108,538,746</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>
STIMULUS AND SCIENTIFIC RESEARCH OPERATIONS (ORSI)

AREA W

11W063 Optimirr: Road materials that consume less energy and fewer non-renewable natural resources.
11W071 Fondams: FouNDAtions and ImproveMent of Soils.
11W091 Agrega: Aggregates for transport infrastructure construction that have fewer environmental impacts.
11W092 EpEES: Evaluating and forecasting the environmental impacts of transportation infrastructure.
11W093 Cementitious materials and manufacturing processes for sustainable development.
11W101 MATEopt: MAterials and Energy for OPTimising civil engineering structures.
11W103 Impact of low temperature geothermal energy on soils, watertables and structures.
11W111 Geological sequestration of CO2.
11W121 POP: Post-oil pavement.
11WP22 Impacts: IMPACTS - Designing materials for technologically sustainable construction.
11W122 Biosourced materials for sustainable construction.
11WP21 MD2E: Energy-efficient and sustainable road materials.

AREA 1

11100A Mobility projects: Via-Urba, Dezert, Accessmob, enqmob, etc.
111118 Freight transport.

AREA R

11R064 Performance-based and probabilistic approach of the service life of reinforced concrete structures.
11R075 Characterisation of thin road surfaces, of concrete cover for reinforcement and facing materials of infrastructure by non-destructive methods.
11R082 Management of structural hazards.
11R091 SER: Networked sediments: a deterministic approach and operational implications.
11R092 PSUR: Soil conservation in urban and road environments.
11R093 Natural Hazards – Limiting the risks of ground movements in urban areas or sensitive zones.
11R094 Sustainable infrastructure and structures.
11R095 Rockfalls and rockslides.
11R096 Reinforcement using composite materials and bonded assemblies.
11R101 Ageing and maintenance of drainage networks and facilities exposed to biophysico-chemical processes.
11R102 Sustainable stormwater management.
11R103 DoFeas: Dykes and waterway facilities: erosion, scour and earthquakes.
11R104 Risks of internal swelling reactions in structural concretes in strategic structures.
11R105 Siprien: Instrumentation systems for environmental risk prevention.
11R106 Plume: Predicting noise in urban areas, from the region to the city.
11R111 CCLEAR: Reducing the impact of climate on transport infrastructure.
11R112 Sécheresse 2: Effect of drought on buildings and infrastructure.
11R113 Séisme: Forecasting and mitigating the effects of earthquakes.
11R114 Hydrisk: Towards a comprehensive consideration of hydrological risk: characterisation, surveillance and management.
11RP11 Vibrations (formerly 11RP11).
11RP21 Fissures: Contribution to the detection of defects by signal and image processing.
11RP22 Dedir: From the design to the sustainable maintenance of roads.
11R124 Precas: Risk prevention and the collapse of underground cavities.
11R122 MCV: Controlling the life cycle of structures.
11R123 Aipad: Innovative approaches for improving the durability of structures.

AREA S

11S091 Palm: Forecasts and warnings during inclement weather conditions.
11S092 Composi-Gec: Demonstrator for self-diagnosing composite urban footbridges.
11S101 I2V: Impact of visual information on road user behaviours (formerly 11KEP1).
11S102 Prever: Risk prevention and evaluation, particularly for powered two-wheelers (formerly 11KEP3).
11S103 Eco-Surf: Study of tyre-pavement contact to achieve optimal and sustainable road surfacing properties (formerly 11LEP1).

AREA 2

112091 MSGDT: Measurements and simulations for sustainable traffic management.
112111 Veler: Visibility and clarity of the road environment: opportunity study for creating an ART.
IFSTTAR’s Stimulus Research (R21)

NEW R21
Splott - Commercial goods carriage flows.
LBA - Impact and vibrations on the braincase.
LBMC - Fiba3D 3D microscopic observations of fibrous soft biological tissue.
MA - Mobility of elderly pedestrians, cross-disciplinary approach.
Lescot - The virtual human.
LPC - Alzheimer’s disease, slight cognitive problems and safety when crossing the road.
IS Terre (GER 1 GESnv) - Urban seismological monitoring in the 21st century.

R21 2ND YEAR
LBMC - BioPIE Biomechanical criteria for prediction of shoulder discomfort.
LBA - Biomechanical characterisation of the human colon. Applications to traumatology.

NEW R21 VÉRONÈSE
Grettia - Traffic regulation based on multi-criterion optimisation.
Estas - Ontologies for evaluating the operating safety of track-guided transport systems.

IM-Ease/Dest - Evaluations with respect to sustainable development of energy consumption linked to the use of road infrastructure by light vehicles: connection between micro- and meso- approaches.
LPC - Eco-driving and road safety in the urban environment.
Licit - Modelling of processes and criteria for choosing transport means and routes.
Licit - Comparing two measurements of vehicle trajectories by completing the MOCopo collection.
Leost - LABCO-SIM: Virtual LABoratory based on CO-SIMulation for incorporating the unknown factors of GSM-R wireless telecommunication modules in the evaluation of ERTMS components and developments towards future ERTMS components (LTE-R and GNSS).

R21 2ND YEAR VÉRONÈSE
LTE - Transeco: Transport & ecological services.
Lescot - Changing driving habits to cut fuel consumption.
Estas - Living lab train.
Ifsttar covers a very large number of disciplines and most of its research projects require a regular exchange of scientific knowledge. In order to be able to combine a variety of approaches (economic, psychological, technological, sociological...), it is therefore very much in the interest of researchers to group together formally to gain a broader view of the issues they are dealing with.

This explains why, at the end of 2011, the Scientific Directorate set up 19 Ifsttar research and discussion groups (GERI) in which scientists from most of the institute’s research structures take part. Several of them also have members from outside the Institute, including industry, the public authorities and other research organizations. The GERIs provide a framework for multidisciplinary thought and discussion, as well as cross-presspectives and forward-looking studies. Each GERI is led by one or more Ifsttar scientists and deals with a specific research goal, a scientific tool, a particularly cross-cutting theme, or any other subject which would benefit from the involvement of players from several disciplines. Each GERI follows an annual programme of activities around its central theme which may involve seminars, national or international symposiums and the publication of a collective reference document, guides or papers, etc. The groups provide an excellent basis for the preparation of collaborations and projects, as well as the creation of reference groups which if necessary could provide a more comprehensive response to an issue concerning transport, planning or networks. In principle therefore, a GERI is a short-lived incubation structure which can nevertheless last for a number of years, depending on its scientific goals and development.

### ACRYLONYM FULL NAME LEADERS

<table>
<thead>
<tr>
<th>ACRONYM</th>
<th>FULL NAME</th>
<th>LEADERS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actor</strong></td>
<td>Social and functional acceptability of technical and organisational changes to transport systems</td>
<td>Farida Saad (Grettia)</td>
</tr>
<tr>
<td><strong>Anim@tic</strong></td>
<td>Collection and analysis of spatiotemporal data for studying travel practices and driving behaviours</td>
<td>Corinne Brusque (Lescot), Latifa Oukhellou (Grettia), Nour-Eddin El Fauzi (Licit)</td>
</tr>
<tr>
<td><strong>BDRS</strong></td>
<td>Databases for road safety research</td>
<td>Michele Guilbot (MA)</td>
</tr>
<tr>
<td><strong>Copie</strong></td>
<td>Behaviour of pedestrians in their environment</td>
<td>Jean-Michel Auberlet (Lepsis), Marie-Axelle Grané (MA)</td>
</tr>
<tr>
<td><strong>2RM</strong></td>
<td>Powered two-wheelers</td>
<td>Pierre Van Elslande, Nicolas Claibaux (MA)</td>
</tr>
<tr>
<td><strong>Dynave</strong></td>
<td>Vehicle dynamics</td>
<td>Pierre-Olivier Vandanjon (IM-Ease), Joël Yerpez (MA)</td>
</tr>
<tr>
<td><strong>EEST</strong></td>
<td>Energy, greenhouse effect and transport</td>
<td>Ariane Dupont (Dest), Laurent Hivert (Dest), Didier Piliot (LTE)</td>
</tr>
<tr>
<td><strong>GNSS</strong></td>
<td>Geopositioning and navigation using a satellite system</td>
<td>Juliette Marais (Leost)</td>
</tr>
<tr>
<td><strong>Itgur</strong></td>
<td>Integration of urban and regional track-guided transport</td>
<td>Claude Soulas (Grettia)</td>
</tr>
<tr>
<td><strong>MRT</strong></td>
<td>Modelling of transport networks</td>
<td>N. Farhi (Grettia)</td>
</tr>
<tr>
<td><strong>R5G</strong></td>
<td>5th generation road</td>
<td>Chantal de La Roche (DS), Nicolas Hautière (IM-Lepsis)</td>
</tr>
<tr>
<td><strong>Resat</strong></td>
<td>Network on vigilance, sleep and attention in transport</td>
<td>Connine Brusque, Catherine Gabaude (Lescot)</td>
</tr>
<tr>
<td><strong>RRT</strong></td>
<td>Work-related road risk</td>
<td>Bernard Laumon, Barbara Charbotel (Umrestte)</td>
</tr>
<tr>
<td><strong>SHT</strong></td>
<td>Disabilities and transport</td>
<td>Claude Marin-Lamellet (Lescot)</td>
</tr>
<tr>
<td><strong>Stic&amp;Its</strong></td>
<td>Information and communication sciences and technologies for intelligent transport (STIC&amp;ITS)</td>
<td>Marion Berbureau (Leost), François Peyret (Macs), Didier Aubert (Lepsis), Régine Seidowsky, Gérard Scemama, Mahdi Zargayouna (Grettia)</td>
</tr>
<tr>
<td><strong>Temis</strong></td>
<td>Techniques and issues for modelling and scientific computer science</td>
<td>Arnaud Bonnard (DS), Patrice Chatellier (Macs)</td>
</tr>
<tr>
<td><strong>Terroires</strong></td>
<td>Local areas, spatial planning and the organisation of transport networks and mobility</td>
<td>Alain l’Hostis (LWMT), Hélène Reigner (MA)</td>
</tr>
<tr>
<td><strong>TI</strong></td>
<td>Instrumentation techniques</td>
<td>Vincent Le Carn (Macs/SII)</td>
</tr>
<tr>
<td><strong>Tisic</strong></td>
<td>Processing of information, signals, images and knowledge</td>
<td>Allou SAME, Laurent Bouillaut (Grettia)</td>
</tr>
<tr>
<td><strong>VE</strong></td>
<td>Electric Vehicles</td>
<td>Serge Pelissier (LTE)</td>
</tr>
<tr>
<td><strong>Vélo</strong></td>
<td></td>
<td>Dest/Umrestte</td>
</tr>
</tbody>
</table>
MAINT UNIVERSITIES AND GRADUATE SCHOOLS
IN WHICH IFSTTAR EMPLOYEES TEACH

- Arts et métiers
- Centre Interrégional de Formation Professionnelle de Macon
- Centre National de la Fonction Publique Territoriale
- Cesam
- CVRH Macon
- École Centrale de Lyon
- École Centrale de Paris
- École des Hautes Études en Santé Publique
- École des Ingénieurs de la Ville de Paris
- École des Mines de Nancy
- École des Mines de Nantes
- École des Mines de Paris
- École des officiers de l’armée de l’air
- École d’Ingénieurs de la ville de Paris
- École d’Ingénieurs de l’Air et de l’Espace
- École d’Ingénieur Supméca
- École Nationale de l’Aviation Civile
- École Nationale des Ponts et Chaussées
- École Nationale des Travaux Publics de l’État
- École Nationale Supérieure d’Architecture de Nantes
- École Nationale Supérieure d’Architecture de Paris la Villette
- École Nationale Supérieure d’Architecture Paris Malaquais
- École Nationale Supérieure d’Ingénieurs de Bourges
- École Nationale Supérieure d’Ingénieurs du Mans
- École Normale Supérieure de Cachan
- École polytechnique
- École Polytechnique Universitaire de Lille
- École Spéciale des Travaux Publics du bâtiment et de l’Industrie
- École Supérieure d’Électronique de l’Ouest
- École Supérieure des Techniques Aéronautiques et de Construction Automobile
- École Supérieure d’Ingénieurs de Poitiers
- École Supérieure d’Ingénieurs en Électronique et en Électrotechnique
- École Supérieure d’Ingénieurs Léonard de Vinci
- Faculté des sciences économiques de l’Université de Rennes 1
- Institut des Techniques d’Ingénieurs de l’Industrie Pays de Loire
- Institut d’Ingénieur des Techniques du Bâtiment et des Travaux Publics de Champagne-Ardenne
- Institut d’Urbanisme et d’Aménagement Régional
- Institut National des Sciences Appliquées de Lyon
- Institut National des Sciences Appliquées de Rouen
- Institut Polytechnique des Sciences Avancées
- Institut Supérieur d’Électronique et du Numérique Lille
- Institut Universitaire de Technologie de Nice Côte d’Azur
- Ponts Formation Conseils
- Télécom Bretagne
- Université Aix Marseille
- Université Blaise Pascal
- Université catholique de l’Ouest d’Angers
- Université Colas
- Université Créteil Vitry
- Université de Bordeaux
- Université de Bourgogne
- Université de Bretagne sud (USB) de Lorient
- Université de Caen
- Université de Cergy
- Université de Compègne
- Université de Franche Comté
- Université de la Rochelle
- Université de Lille
- Université de Limoges
- UPE Marne La Vallée
- Université de Marseille
- Université de Nantes
- Université de Poitiers
- Université de Provence
- Université de Rennes
- Université de Strasbourg (EOST)
- Université de technologie de Troyes
- Université de Valenciennes et du Hainaut-Cambresis
- Université de Versailles Saint Quentin en Yvelines
- Université d’Evry Val d’Essonne
- Université d’Orléans - Polytech’Orléans
- Université d’Orsay
- Université du Littoral Côte d’Opale
- Université du Maine - Le Mans
- Université Joseph Fourier Grenoble
- Université Lyon 1
- Université Lyon 2
- Université Nanterre La Défense
- Université Nantes Angers le Mans
- Université Paris Descartes – IUT Paris 5
- Université Paris Est Créteil
- Université Paris Nord
- Université Paris Sud 11 - Orsay
- Université Paris Vincennes
- Université Paris Saint Denis
- Université Paris-Dauphine
- Université Pierre et Marie Curie
- Université Saint Étienne
- Université Savoie

7,022

hours of teaching in higher education

including

31%

at Master’s level.
BOARD OF DIRECTORS
AS AT 31/12/2012

► CHAIR
Hubert Du Mesnil Réseau ferré de France.

► VICE-CHAIR

STATE REPRESENTATIVES

► FRENCH MINISTRY OF EQUIPMENT
• Laurent Tapadinhas (appointee), French Ministry of Ecology, Sustainable Development and Energy.

► FRENCH MINISTRY OF TRANSPORT
• Christine Bouchet (appointee), French Ministry of Ecology, Sustainable Development and Energy.
• Pascal Chambon (substitute), French Ministry of Ecology, Sustainable Development and Energy.

► FRENCH MINISTRY FOR THE ENVIRONMENT
• Daniel Boulnois (appointee), French Ministry of Ecology, Sustainable Development and Energy.
• Thierry Hubert (substitute), French Ministry of Ecology, Sustainable Development and Energy.

► FRENCH MINISTRY OF RESEARCH
• Maria Faury (appointee), French Ministry of Higher Education and Research.
• Frédéric Getton (substitute), French Ministry of Higher Education and Research.

► FRENCH MINISTRY OF HIGHER EDUCATION
• Alain Bernard (appointee), French Ministry of Higher Education and Research.

► FRENCH MINISTRY FOR THE BUDGET
• Anthony Farisano (appointee), French Ministry of the Economy, Finance and Foreign Trade.

► FRENCH MINISTRY OF INDUSTRY
• Michel Ferrandéry (appointee), French Ministry of Economic Regeneration.
• Catherine Bellancourt (substitute), French Ministry of Economic Regeneration.

► FRENCH MINISTRY OF HEALTH
• Frédérique Cousin (appointee), French Ministry of Social Affairs and Health.
• Corinne Drougard (substitute), French Ministry of Social Affairs and Health.

FRENCH MINISTRY OF THE INTERIOR
• Aude Plumeau (appointee), French Ministry of the Interior.
• Fabrice Jauffred (substitute), French Ministry of the Interior.

FRENCH MINISTRY OF DEFENCE
• Thierry Bretheau (appointee), French Ministry of Defence.
• Michel Sayegh (substitute), French Ministry of Defence.

QUALIFIED MEMBERS

• Dorothée Briaumont Comité 21.
• Rémi Cunin Egis.
• Patrick Dieny Conseil général du Rhône.
• Geneviève Ferone Veolia Environnement.
• Guy Le Bras Gart.
• Brigitte Martin IFP Energies nouvelles.
• Hubert Du Mesnil Réseau ferré de France.

STAFF REPRESENTATIVES

► CFDT
• Joël Lelong (appointee).
• Jean-Michel Mescam (substitute).

► SUD Recherche EPST-Solidaires
• Christine Buisson (appointee).
• Daniel Olivier (substitute).

► CGT
• Paul Marsac (appointee).
• Nathalie Bourbotte (substitute).

► Force ouvrière
• Marion Bost (appointee).
• Séverine Somma (substitute).

GUESTS IN AN ADVISORY CAPACITY

• Jacqueline Lecourtier Chair of the Scientific Board.
• Hélène Jacquot-Guimbal Managing Director.
• Henri Van Damme Scientific Director.
• Bernard Bachellerie Ministerial accounting and budgetary controller.
• Odile Rios accounttant.
SCIENTIFIC BOARD
AS AT 31/12/2012

CHAIR
Jacqueline Lecourtier
VICE-CHAIR
Reinhard Gressel

SCIENTIFIC AND TECHNICAL MEMBERS

• Philippe Bisch Syntec Ingénierie.
• Daniel Clément Scientific Director, Ademe.
• Marc Duval-Destin Director of Research and Advanced Engineering, Groupe PSA Peugeot Citroën.
• Olivier Gagey Professor, Head of the Orthopaedics-Traumatology Department, CHU de Bicêtre.
• Pierre-Étienne Gautier Scientific Director, Inexia.
• António Gomes Correia Professor, Universidade do Minho (Portugal).
• Valérie Issarny Research Director, Inria.
• Vincent Kaufmann Professor, EPFL.
• Corinne Larrue Professor, Université de Tours.
• Barbara Lenz DLR - Head of the Institute of Transport Research, Université de Berlin.
• Philippe Martin Professor, Sciences Po; member of IUF; Managing Editor of Economic Policy; co-Director of the programme “Macroeconomics”, Cepremap; Research Fellow, CEPR (Londres).
• Jérôme Perrin “Véhicule électrique” Department, Renault.
• Jean-Éric Poirier Scientific Director, Colas.

STAFF REPRESENTATIVES

CFDT
• Frédérique Larrarte (appointee).
• Hugues Chollet (substitute).
• Gilles Vallet (appointee).
• Erik Bessmann (substitute).

SUD Recherche EPST-Solidaires:
• Sébastien Ambellouis (appointee).
• Thomas Robert (substitute).

CGT
• Reinhard Gressel (appointee).
• Fabien Chiappini (substitute).
• Olivier Burban (appointee).
• Charles Tatkeu (substitute).

Force ouvrière
• Mickaël Thiéry (appointee).
• Florent Baby (substitute).

MEMBERS IN AN ADVISORY CAPACITY

• Hélène Jacquot-Guimbal, Ifsttar Managing Director.
• Henri Van Damme, Ifsttar Scientific Director.

STANDING MEMBER

• Patrick Chabrand, Chair of the Ifsttar Researcher Assessment Commission.
LOCATION OF SITES AND RESEARCH UNITS

- **BELFORT**
  Bâtiment F
  Rue Théry Mieg
  Belfort Technopôle
  90010 Belfort
  Tel.: +33 (0)3 84 58 36 00
  Research units: LTN/FClab

- **GRENoble**
  Maison des Géosciences
  1381, rue de la Piscine
  38400 Saint-Martin d’Hères
  Research unit: ISTerre

- **LYON-BRON**
  25, avenue François Mitterrand
  Case 24
  69675 Bron Cedex
  Tel.: +33 (0)4 72 14 23 00
  Research units: LBMC/Lescot/Licit/LTE/UMRestte/Unex

- **LILLe-VILLENEUVE D’ASCQ**
  20, rue Élisée Reclus
  BP 70317
  59666 Villeneuve d’Ascq Cedex
  Tel.: +33 (0)3 20 43 83 43
  Research units: Estas/Leost

- **MARNE-LA-VALLÉE**
  6-8 avenue Blaise Pascal
  cité Descartes
  Marne-la-Vallée
  77447 Champs-sur-Marne Cedex 2
  Tel.: +33 (0)1 64 15 30 00
  Research unit: NaviEr

- **MARNE-LA-VALLÉE**
  19, rue Alfred Nobel
  cité Descartes
  Marne-la-Vallée
  77447 Champs-sur-Marne Cedex 2
  Tel.: +33 (0)1 64 15 21 01
  Research units: LVMT/MA

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ACRONYMS

ADEME French Environment and Energy Management Agency
AERES French Evaluation Agency for Research and Higher Education
PIARC World Road Association
ALDEN French National Research Alliance for the Environment
ANCRE French National Alliance for Coordinating Energy Research
ANR French National Research Agency
ANRT French National Research and Technology Agency
BRGM French Office of Geological and Mining Research
CCRT French Joint Research Centre on Transport
CRRDRT French Regional Advisory Committee on Technological Research and Development
CECF French Centre for the Study and Design of Prototypes
CEDR Conference of European Directors of Roads
CEMAGREF French National Centre for Farm Machinery, Agricultural Engineering, Water and Forests
CERTIFER French Rail Certification Agency
CERTU French Centre for the study of networks, transport, urban planning and public buildings
CER French Centre for Road Education
CETE French Public Works Design and Research Office
CFTR French Committee for Road Engineering Techniques
CUTRE Industrial Agreements for Transport Research
CIRAD Centre for International Cooperation in Agricultural Research for Development
CNES French National Centre for Space Research
COP Goals and Performance Contract
COFRAC French Accreditation Committee
CSTB French Scientific and Technical Centre for Building
DGIM French General Directorate for Infrastructure, Transport and Maritime Affairs
DRI French Directorate for Research and Innovation
DSFR French Road Safety and Traffic Delegation
ENPC French National Civil Engineering School
ENPTE French National School for State Public Works
EPIC French Public Industrial and Commercial Institution
EPST French Public Scientific and Technical Institution
EPSF French Public Institution in charge of Rail Safety
EQUIPEX Facilities of Excellence
ESPARR Study to monitor a population of road crash casualties in the Rhône Department
ERT Europe re cherche transport
FIT International Transport Forum
FOR Former Open Road
GERI Ifsttar Research and Discussion Group
GES Greenhouse gas
GIS Scientific Consortium
HOR Research Supervision Accreditation
IDDRIM French Institute for Roads, Streets and Infrastructure for Mobility
IDEX Initiatives of Excellence
IEED French Institutes of Excellence on Zero Carbon Energy
IFSTTAR French Institute of Science and Technology for Transport, Development and Networks
IGN French National Institute for Information on Geography and Forests
INERIS French National Institute for the Industrial Environment and Risks
INRETS French National Institute for Transport and Safety Research
IRSN French Institute for Radiological Protection and Nuclear Safety
IRSTEA French National Research Institute of Science and Technology for Environment and Agriculture
IRSTV French Urban Scientific and Technical Research Institute
IRT French Technological Research Institutes
ITS Intelligent Transportation Systems
LABEX Laboratories of Excellence
LCPCE French Central Civil Engineering Laboratory
LGV High Speed Line
LIER INRETS Road Equipment Testing Laboratory
LNE French National Metrology and Testing Laboratory
LRPC French Regional Civil Engineering Laboratory
MEDDE French Ministry of Ecology, Sustainable Development, Transport and Housing
MESR French Ministry of Higher Education and Research
ODEC Organisation for Economic Co-operation and Development
WHO World Health Organisation
ONEU Nantes Observatory of Urban Environments
UN United Nations
PACA Provence-Alpes-Côte d’Azur
FP European Framework Programme for research and technological development
PIA Future Investments Programme
PREDIT French Programme for Research and Innovation in Land Transport
RES Research and Higher Education Clusters
PST Scientific and Technological Cluster
RAPF Paris Municipal Public Transit Authority
RFF France’s Railway Network Operator
RNE French National List of Institutions
RST Scientific and Technical Network
SATT Transfer of Technology Acceleration Company
SCSP Grant for Public Service Costs
SETRA French Research Department for Transport, Roads and their Development
SNCF French National Railway Company
SNDD French National Strategy for Sustainable Development
SNRI French National Strategy for Research and Innovation
SOERE French Observation and Testing System for Environmental Research
SPI Engineering Sciences
SPIGA Engineering Sciences, Earth Sciences and Architecture
STAC French Civil Aviation Technical Centre
STIM Information Sciences and Technology and Mathematics
TRA Transport Research Arena
TRB Transportation Research Board
UPEM-MLV University of Paris-Est Marne-la-Vallée
UR Research Unit
UMR Jointly Managed Research Unit
USIRF French Union of French Road Industry Associations
PTW Powered Two-Wheelers

ABREVIATIONS OF IFSTTAR RESEARCH STRUCTURES

DEST Department of Transport Economics and Sociology
ESTAS Evaluation of Automated Transport Systems and their Safety
GER Department of Geotechnics, Water and Hazards
GRETTIA Engineering of Land Transport Networks and Advanced Computing
IM Department of Infrastructure and Mobility
LBA Laboratory of Applied Biomechanics
LBMC Laboratory of Impact Mechanics and Biomechanics
LEMCIO Laboratory of Co-operative Mobility and Measurement
LEOST Laboratory of Electronics, Waves and Signals for Transport
LEPSIS Laboratory for Operations, Perception, Simulations and Simulations
LESCOT Laboratory of Ergonomics and Cognitive Sciences for Transport
LICT Transport and Traffic Engineering Laboratory
LWIC Laboratory of Vehicle–Infrastructure–Driver Interaction
LPC Laboratory of Driver Psychology
LTE Transport and Environment Laboratory
LTI Laboratory of New Technologies
LMCQ City, Mobility and Transport Laboratory
MA Department of Accident Mechanisms
MCs Department of Measurements, Testing and Computational Science
MAT Materials Department
SDE Department of Engineering Structures
SPLIT Production Systems, Logistics and Organisation of Transport and Work
UNRESTTE Jointly Managed Unit for Epidemiological Research and Transport-Work Environment Surveillance
UNEX Experimental Testing Unit

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