



2010 ANNUAL REPORT



Institut national de recherche sur les transports et leur sécurité

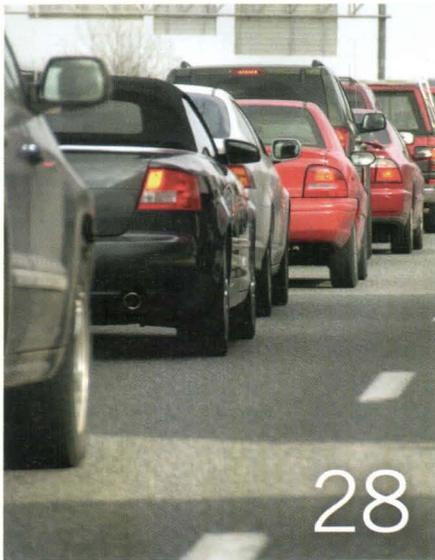


Laboratoire Central des Ponts et Chaussées





INRETS and LCPC officially merged on January 1st, 2011 in order to create **IFSTTAR, FRENCH INSTITUTE OF SCIENCE AND TECHNOLOGY FOR TRANSPORT, DEVELOPMENT AND NETWORKS**. Single document combining the activities of both institutions, LCPC and INRETS, even though they were still separate during 2010, to ensure continuity and report on a year spent preparing for this merger.



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EDITORIAL

YVES BAMBERGER,
HÉLÈNE JACQUOT-GUIMBAL
& GUY BOURGEOIS

Confronted with an ambitious and complex set of objectives listed in its new contract, LCPC's 2010 action campaign focused on two key levers: orienting research around sustainable development priorities, and consistently pursuing a strategy in favour of building partnerships.

Thanks to the reorganisation of fifteen research units into five departments, the Laboratory adopted a more streamlined and better coordinated structure. Through membership in the IDDRIM Institute as one of its founding entities, LCPC has confirmed its dedication to problems experienced in the field by companies or infrastructure managers. On the other hand, its multiple partnering commitments expressed in submittals to "Future Investment Programme" calls for projects also underscore the scientific excellence inherent in Laboratory activities.

2010 was also noteworthy for the promotion of a stronger international presence. Convinced of the pertinence of LCPC's strategic vision, European agencies in the sector have entrusted the Laboratory with the mission of organising the Transport Research Arena event for year 2014. I would also like to point out the cooperative relationships established with some preeminent research centres in foreign countries, notably in the United States, Japan and India. Moreover, our all-out effort to introduce new scientific approaches resulted in extended stays by four researchers hosted at their foreign counterparts' facilities.

All of these strategic course changes did not impede some remarkable performances, both financially and scientifically: between 2009 and 2010,

"ORIENTING RESEARCH AROUND SUSTAINABLE DEVELOPMENT PRIORITIES, AND CONSISTENTLY PURSUING A STRATEGY IN FAVOUR OF BUILDING PARTNERSHIPS."

an 8% growth in own resources was recorded, while revenues generated from research contracts rose by 14% and the number of articles published in top-rated international journals jumped 35%. Moreover, the quality of doctoral student supervision resulted in a drop of the average thesis completion period to 3 years, 2 months.

I would like to close by celebrating another type of performance, namely that of both INRETS and LCPC support units, which worked tirelessly throughout 2010 so that the new IFSTTAR entity was entirely operational as of January 1st, 2011.

As I'll be at the helm of this new entity, I'm fully aware of the magnitude of challenges to ensuring that IFSTTAR quickly builds the kind of international reputation that has served INRETS and LCPC so well. ■

By virtue of decree issued by the President of the French Republic on January 11th, 2011, Ms. Hélène JACQUOT-GUIMBAL, Certified Civil Engineer, is hereby appointed as Managing Director of the IFSTTAR Institute.

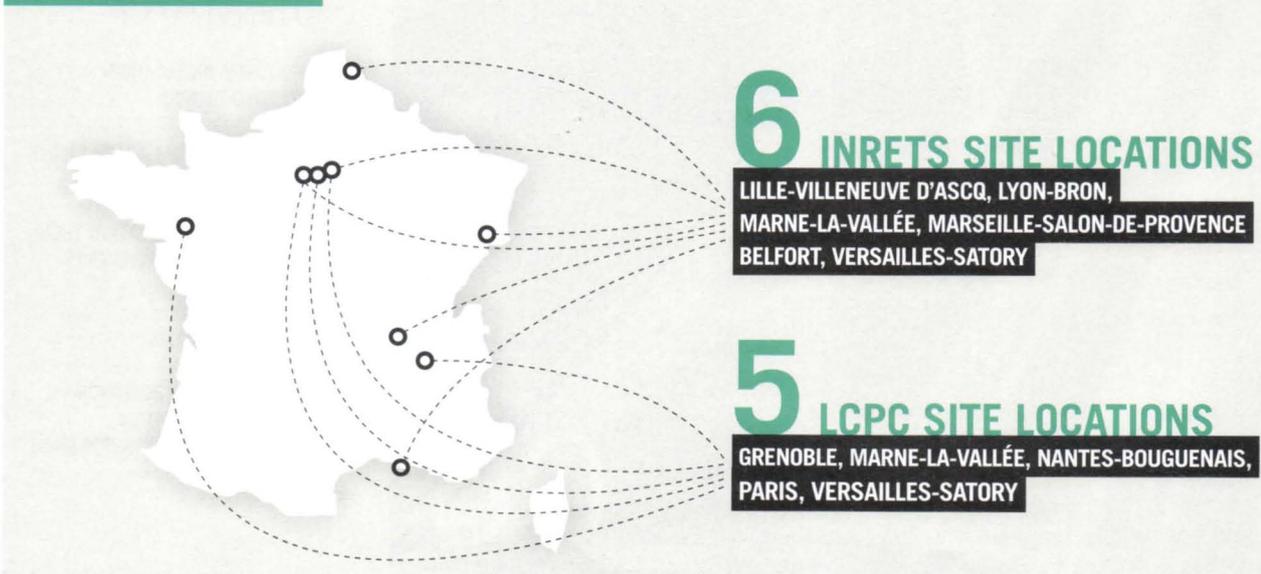
Hélène Jacquot-Guimbal ■

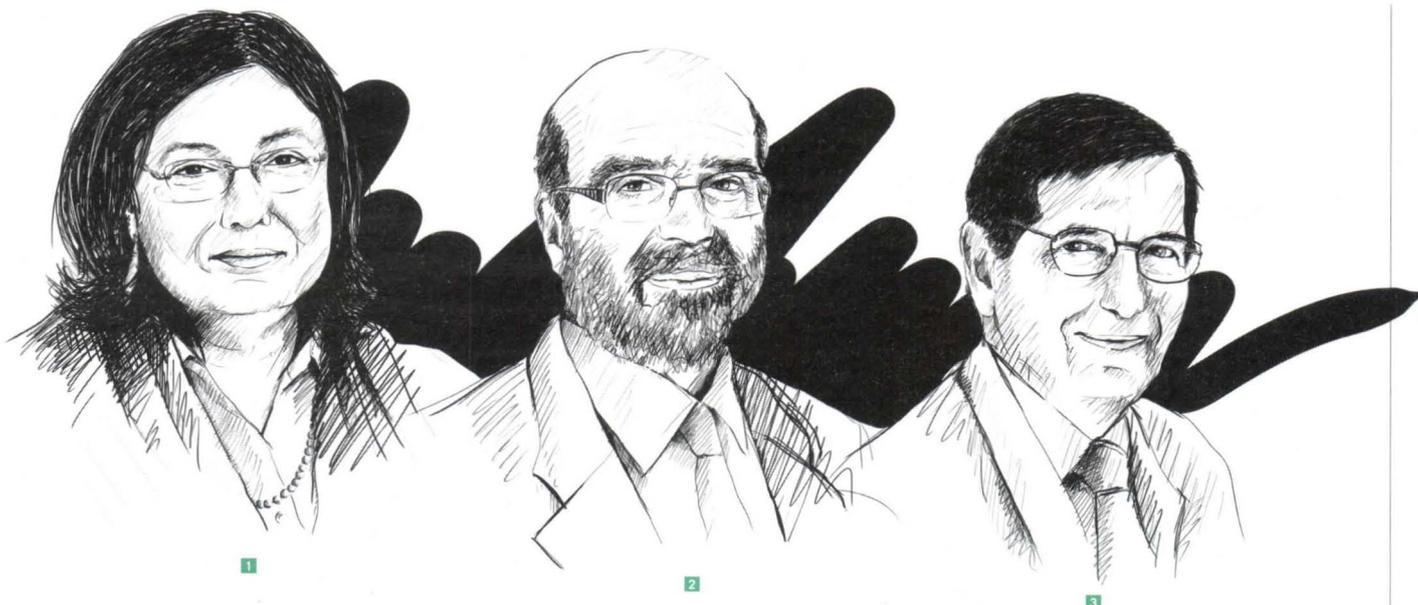
Former LCPC Managing Director, through end of 2010

Yves Bamberger ■

President of LCPC Board of Directors

INRETS AND LCPC SITE LOCATIONS





As the last year of the INRETS' short 25-year existence, 2010 was the most brilliant on record. While 2009 had already been a breakthrough year, 2010 raised the bar even higher, with: a budget surplus by year's end, and this despite deteriorating economic conditions; all-time highs in the number of scientific publications, research contract-generated revenue and patent filings; subsidiaries enjoying excellent health; and an outstanding recruiting campaign aimed at young researchers.

While a good deal of energy during 2010 had been channelled into preparing the merger with LCPC, a fruitful effort during which trust and poise ultimately prevailed over the Institute's natural apprehension, just as much effort went into submitting bids to the "Future Investment Programme". The outcome of these initiatives, though not yet known with precision and bound to improve even further, attests to the strength of both INRETS' territorial orientation and the academic and industrial partnerships it has built with research/university clusters and the competitiveness clusters in Lille, Marne-la-Vallée, Versailles-Satory, Lyon and Marseille. With INRETS and LCPC now speaking in unison

"IFSTTAR PROVIDES FRENCH PUBLIC-SECTOR RESEARCH WITH A VERY POWERFUL TOOL, HERETOFORE MISSING ON THE INTERNATIONAL STAGE."

within these partnerships, the value of Institute input has undeniably been enhanced.

At a time when Europe, through its 8th R&D Framework Programme, has opted to promote "smart, green and integrated transport" from among this century's 7 major societal challenges, it is abundantly clear that IFSTTAR provides French public-sector research with a very powerful tool, heretofore missing on the international stage. Over the course of INRETS' years of activity, construction of the European research space for the transport field will have served as a guiding light for the Institute. No doubt IFSTTAR will capitalize on this base of knowledge and experience that has been developed with such amazing foresight. ■

Guy Bourgeois 3

Former INRETS Managing Director, through end of 2010

Yves Bamberger 2

President of INRETS Board of Directors

YEAR 2010 AT A GLANCE

1 290 full-time equivalent (FTE) employees on Dec. 31, 2010



1 318 employees on Dec. 31, 2010



146 research contracts



€15 121 951 revenue generated from contracts



73 expert appraisal missions



72 doctoral theses defended



350 articles accepted in "A"-rated international reviews



31 books published



LET'S HEAR FROM...

...JACK SHORT

IT'S WITH THE SLOGAN "BETTER POLICIES FOR A BETTER LIFE" THAT THE OECD TAKES ITS STANCE. FOUNDED IN 1961, THIS INTERNATIONAL ORGANISATION ASSISTS GOVERNMENTS IN RESPONDING TO ECONOMIC, SOCIAL AND GOVERNANCE CHALLENGES. THE NUMEROUS AND DIVERSE TOPICS TREATED RANGE FROM AGRICULTURE, FISHING AND DEMOGRAPHICS TO INNOVATION AND SUSTAINABLE DEVELOPMENT. SO WHERE DOES TRANSPORT FIT IN?

Jack Short: Since 2006, all questions relative to the transport topic have been addressed within a single body, the International Transport Forum. Existing units within the OECD organisational structure were combined to give rise to this cohesive, multimodal, global and strategic entity devoted to transport issues. As such, the Forum has adopted the same rationale that led INRETS and LCPC to merge and generate synergy from their respective skills. Our Forum, which assembles leading government representatives and public sector practitioners alongside the business and industrial communities, researchers and members of civil society, hosts discussions on transport-related topics of world-wide strategic importance. All perspectives are encouraged and given voice. Approaches can be compared, yet beyond a simple melting pot of ideas, a venue for exchanging guidelines and a strategic / technological observatory, our sessions are oriented around implementing practical steps.

The Forum studies transport systems and delivers opinions intended to help governments improve their policies. As for road safety, OECD was the first body to propose limiting speeds and controlling blood-alcohol levels. At the time, many countries still refused to adopt these measures, prior to their gradual enactment and now widespread acceptance as standards.

HOW HAVE LCPC AND INRETS CONTRIBUTED TO FACING THESE CHALLENGES?

J. S.: For a very long time, some 30 to 40 years, OECD and presently the Forum have enjoyed solid ties with both LCPC and INRETS. A tremendous amount of work has been produced jointly, particularly on pavement surfacing, a topic where LCPC has few rivals in the world. Other topics include climate change, road safety and vulnerable members of society (e.g. pedestrians, bicyclists, motorcyclists, the mobility-impaired). I'd also like to mention a recent report on the lorry of the future that sparked controversy for raising some sensitive issues. The Forum does not shy away from controversy. There was also the report on "powerfuel", which at one point was being presented as a cure-all. Moreover, LCPC and INRETS are well represented on Forum executive committees and working groups, with a record of



"THE PIVOTAL CONTRIBUTIONS OF THESE TWO INSTITUTIONS HAVE STRENGTHENED FRANCE'S POSITION AS A TRANSPORT EXPERT ON THE INTERNATIONAL SCENE."

JACK SHORT

Secretary General of the International Transport Forum, term expires in August 2011.

active participation in decisions involving research policy priorities. The pivotal contributions of these two institutions have strengthened France's position as a transport expert on the international scene. In exchange, French expertise has been enriched thanks to the fruitful dialogue held between our organisations, at least I hope so. Such dialogue is crucial, especially during periods of economic crisis when solutions must be derived collectively. Transport turns out to be a highly sensitive indicator of fluctuations in the state of economic health. For example, if a GNP figure declines by 3%, it is observed that the retail sector loses 10% while transport plummets by 20%.

WHAT IMPRESSIONS WILL YOU KEEP FROM THE YEAR 2010?

J. S.: Without a doubt, the major breakthrough lies in highlighting areas of vulnerability within the transport sector during crisis situations, whether economic or climatic. With economic pitfalls, ensuring transport flexibility obviously becomes a major strategic planning concern. The inclement weather experienced at the beginning of 2010, coupled with eruption of the Icelandic volcano, further exposed a critical shortcoming, namely the lack of communication with users and absence of intermodal information. Uncertainty must also be brought under control! ■



... ANNE-MARIE LECLERC

PIARC, THE WORLD ROAD ASSOCIATION, IS LIKE AN SENIOR CITIZEN WHO ENJOYS REMAINING VERY ACTIVE.

Anne-Marie Leclerc: The association celebrated its 100th anniversary in 2007, in Paris where it was founded, and now comprises over 118 member countries. PIARC holds a special place in the world for its focus on mobility issues from a broad perspective, an approach that involves considerable reflection on societal trends. The notion of mobility is tied to the provision of a basic public service that nations must guarantee to their populations in a form that's adequate, adapted to their needs and safe.

In this context, I'm well aware of our responsibility given the high expectations on the part of road and transportation professionals. PIARC has become the premier international forum for exchanging information and knowledge covering this entire field, for industry, decision-makers and governments.

BEYOND THE CONTRIBUTIONS OF THE FORMER INRETS AND LCPC ENTITIES, WHAT WILL BE IFSTTAR'S SPECIFIC ROLE AS REGARDS PIARC?

A.-M. L.: We must avoid tying ourselves to working traditions established in the past. Mobility is a long-term field of study, projecting us 20 or even 30 years into the future, therefore requiring an increasingly global approach. The keyword to any such approach is de-compartmentalise, to engage specialists across disciplines in promoting dialogue and in seeking solutions that could not have been anticipated just a few years ago. And I'm thrilled to share this challenge with INRETS, LCPC and now Ifsttar. France's contribution and that of its national PIARC committee, as guided by several LCPC members, is key for the Association. Especially dynamic, LCPC and INRETS are devoted, much like us, to expanding horizons and stimulating discussion on various transport-related objectives and issues.

To illustrate the challenges at hand, let's look at the advent of new propulsion sources, including electricity, which will reshape the debate over individual mobility vs. collective mobility. It goes without saying that greenhouse gas emissions will decrease, but does this environmental benefit provide positive effects on mobility *per se*, on urban congestion? In the strategic plan we've adopted, our goal is to derive new approaches for dealing with the mobility of people and goods.

We've also redrawn PIARC's scope of intervention, by extending the Association's geographic coverage. As part of a drive to expand our group, we'd like to invite more partners to contribute to the forums and exchanges sponsored.

THIS DECADE HAS BEEN DEDICATED TO ROAD SAFETY.

A.-M. L.: The Association fully supports the work of the World Health Organisation (WHO) in promoting better traffic conditions, as a means for improving safety, and moreover stands behind UN efforts in this area. Road safety depends on several factors, including the quality of infrastructure and regulations. We therefore provide an attractive forum for WHO given our ability to reach major decision-makers and governments. Road safety offers a poignant example of knowing how and when to bring specialists together from different disciplines. If each field of specialisation understands the challenges facing other fields, then the solution will be even more sustainable, and this is true for all challenges inherent in mobility. ■

ANNE-MARIE LECLERC

Deputy Undersecretary to the General Directorate of Infrastructure and Technologies with the Quebec Ministry of Transport, in addition to President of PIARC



“ESPECIALLY DYNAMIC, LCPC AND INRETS ARE DEVOTED, MUCH LIKE US, TO EXPANDING HORIZONS AND STIMULATING DISCUSSION ON VARIOUS TRANSPORT-RELATED OBJECTIVES AND ISSUES.”





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DISTINGUISHED
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CLOSE-UP OF THE TWO INSTITUTES

MISSIONS, STRATEGY, ORIENTATION

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ACCORDING TO ITS 2010-2013 OBJECTIVES-BASED CONTRACT, INRETS HAS EMBARKED ON AN AMBITIOUS PATH, FOCUSING SQUARELY ON CHANGES IN THE PROVISION OF SAFE AND SUSTAINABLE MOBILITY SERVICES.

THE 2010-2013 OBJECTIVE

Submitted for Ministerial signature during summer 2010, the 2010-2013 objectives-based contract was the outcome of extensive exchanges held as of 2009 by an assembly of 120 individuals, of whom 30 were named from outside organisations, divided into 6 thematic groups. An initial list of scientific or cross-disciplinary topics was refined

A FORWARD-LOOKING PROGRAMME SEGMENTED BY THE INSTITUTE'S VARIOUS SITES

Lille-Villeneuve d'Ascq:
RAILLENIUM (TRI); ICON (Labex); SATT (part of the University of Lille-Northern France academic-research cluster).

Lyon-Bron / Saint-Etienne:
Transport research centre (contained within Idex-Lyon); PLIBAT (Equipex); Engineering of living tissue evolution (Equipex);

Marne-la-Vallée: Sustainable cities (IEED); Urban futures (Labex); CLAIRE-SITI (Equipex); Centre Belgrand (Equipex).

Marseille-Salon de Provence: Research, education and technology transfer platform devoted to the virtual human (INBS); SATT PACA-Corsica sponsored by the six regional universities.

Versailles-Satory: VeDeCom (IEED); Reliability Institute (Labex); VERTEX (Equipex); SIMU56 (Equipex); FiMecaSys (Equipex).

Note: Projects written in bold featured INRETS as project leader.

and revised during the substantive discussions held. A set of shared strategic orientations covering a 10-year time frame was ultimately produced; these orientations included **green mobility, transport optimisation, road safety, application strategies and governance.**

Segmented into fields and action plans, this contract stipulated 28 objectives, all of which complied with the commitments adopted during the Grenelle Environment Roundtable. It also distinguished ongoing research from new projects and posted a number of performance indicators so as to offer partners (Ministries, companies, service operators) a real-time and comprehensive view of deliverable recipients and contents made available during contract execution.

Generally speaking, this document stresses interdisciplinary collaboration and follows the recommendations forwarded by AERES. The draft budget, established to both incorporate constraints imposed by the economic crisis and draw down the €1.25 million inadvertently earmarked for INRETS on its 2009 SCSP budget allocation, was adjusted to satisfy the most recent public finance guidelines stemming from the newly-adopted three-year finance law. The revised document therefore matches "the reference budget trajectory", as required by the latest instructions issued to State transport operators (Prime Minister's circular dated March 26th, 2010). In operational terms, a "control chart" was implemented to regularly summarise the trends in all major service management indicators.

FUTURE CAPITAL INVESTMENT PLANS

Preparing bids in response to calls for tender within the scope of the "Investissements d'Avenir" capital investment programme mobilised many teams throughout 2010. Across all its sites, INRETS was requested to join consortia as either leader or partner in most categories presented. The upbeat spirit of partnerships the Institute has been able to forge was readily apparent, as was its strong credentials relative to these transport topics. ■



◀ INRETS' Bron facility.



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FOR LCPC, 2010 WAS SHAPED BY THREE LANDMARK EVENTS WITH FAR-REACHING IMPACTS ON THE LABORATORY'S FUTURE: SIGNATURE OF A NEW OBJECTIVES-BASED CONTRACT WITH THE FRENCH GOVERNMENT, AGREEMENT TO COMMIT RESOURCES TO BID ON FUTURE INVESTMENT PROGRAMME PROJECTS, AND PREPARATION OF THE MERGER WITH INRETS. THESE ACTIONS, WHICH INVOLVED ALL UNITS, WERE COMBINED WITH A RESTRUCTURING OF RESEARCH TEAMS IN MOVES MADE EFFECTIVE MAY 2010, AS A FOLLOW-UP TO A BROAD SET OF NEGOTIATIONS HELD WITH CONCERNED PERSONNEL AND GOVERNING BODIES.

THE 2010-2013 OBJECTIVES-BASED CONTRACT

This contract represents the accomplishment of two successive initiatives covering different time periods. The first, conducted in 2009 with the participation of all units in addition to fruitful exchanges with partners, was intended to establish a 10-year road map, as a means of stretching the planning horizon far enough to see through the impacts of current short-term action plans. On this basis, the draft four-year financing contract could be written after considerable attention to the needs expressed by oversight ministries and other partners. Signed by five Ministers or Cabinet-level Secretaries, this contract tasked LCPC with 38 objectives, each of which had been matched with several indicators in order to track progress. Research, which accounts for 70% of the organisation's activity, is heavily oriented towards achieving Grenelle Environment Roundtable priorities, especially as regards energy savings and natural resource conservation, as well as management of natural risks, including climate change-related risks, green building and the development of non-road transport modes. Other objectives include activities tied to the application of results: expert appraisals, instruction, support provided to public authorities, and certification. Moreover, several systems are listed in the contract specific to management functions and support-related efforts.

FUTURE CAPITAL INVESTMENT PLANS

With a strategy emphasising sustainable development topics and promoting the application of research findings in favour of economic actors, LCPC submitted bids beginning

FOUR AWARD-WINNING PROJECTS

Four projects reviewed during bidding for the categories of facility excellence (Equipex), laboratory excellence (Labex) and technology research institutes (TRI) were announced as winners at the beginning of 2011:

Equipex Sense-City presented by the University of Paris-East (UPE) academic research cluster, supervised by LCPC.

Labex Urban Future ("Futurs Urbains"), also presented by the UPE cluster.

TRI "Railenium", presented by the University of Lille-Northern France cluster, with both LCPC and INRETS among the project partners.

TRI "Jules Verne", presented by the University of Nantes-Angers-Le Mans cluster.

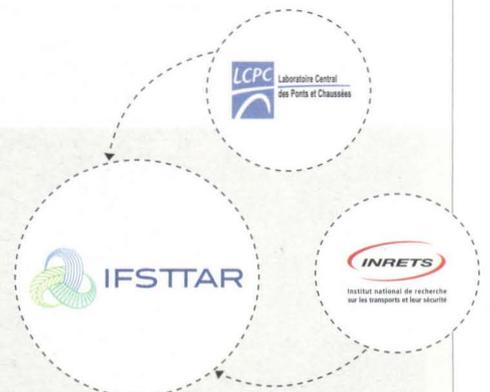
in 2010 on several calls for tender within the scope of the "Future Investments" (PIA) projects. These proposals were accompanied by high-level scientific partners, as part of consortia composed around cluster facilities accommodating research and university-level academics. ■

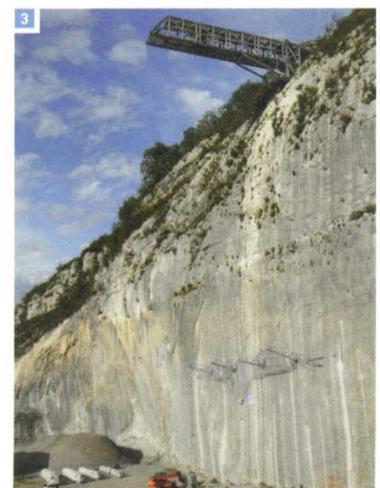


LCPC's Paris offices ► on the boulevard Lefebvre.

PREPARATION OF THE LCPC-INRETS MERGER

The Ministry of Ecology, Sustainable Development, Transport and Housing sought to merge LCPC and INRETS in order to closely coordinate research conducted in their two closely-related fields and thereby take advantage of a broader and more varied potential in generating scientific approaches. 2010 was devoted to laying the foundation for a new institution, with emphasis on the provision of support services to facilitate organisational operations. Following the lengthy administrative path to implementing this sort of transformation plus coordination difficulties introduced due to multiple sites for both parties, the official decree announcing the creation of Ifsttar was promulgated on December 30th, 2010 to take effect on January 1st, 2011.







The Bienvenue Building where LCPC's and INRETS' Paris-based facilities will be combined in 2012.

- ▶ **January 19th**: Creation of Idrim. **1**
- ▶ **February**: Roads Plenary Session, held in Nantes.
- ▶ **March 17th**: Visit by the American Deputy Secretary of Transportation, John Porcari. **2**
- ▶ **April 21st**: 1st project meeting for construction of the future Bienvenue building site in Marne-la-Vallée.
- ▶ **May 4th-6th**: PRAC 2010 Seminar on Risk prevention and Driving assistance systems, plus Closing Seminar for the SARI Project, organised jointly by LCPC and INRETS.
- ▶ **June 17th and 18th**: Structural Engineering Plenary Session held in Lille.
- ▶ **July 7th-9th**: LICIT organised, on behalf of the

AHB45 Committee (Traffic Flow Theory and Characteristics) of the American Transportation Research Board, its second summer session and the associated conference, held in Annecy, assembling 63 participants representing 13 countries, around an agenda featuring 38 presentations.

▶ **September 16th**: Inauguration of the rockfall testing station. **3**

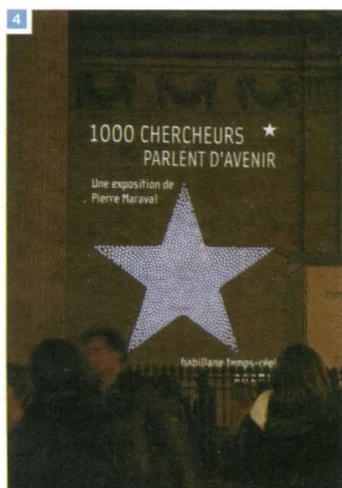
▶ **October 8th**: Signature of the 2010-2013 objectives-based contract between LCPC and the French government.

▶ **October 18th**: Franco-Indian seminar showcasing LCPC, IRSTV and CiSTUP, hosted by Gérard Hégon.

▶ **October 18th-24th**: 1,000 researchers at Paris' Panthéon, a photography exhibition laid out by the artist Pierre Maraval, involving the participation of more than 30 INRETS and LCPC researchers. **4**

▶ **November 26th**: Joint INRETS-LCPC stand for the CIFRE Forum in Paris.

▶ **December 1st**: Creation of GRETTIA from a merger of GRETTIA and LTN-Marne. This new unit contributes to the development of engineering techniques specific to transport networks and systems, in addressing problems related to integration, intermodality, reliability and systems analysis. Its field of expertise includes roads and public transit with a focus on guided transport systems. **5**



PARTNERSHIPS, JOINT VENTURES

IN AN EFFORT TO ENSURE THE CONSISTENT AND EFFECTIVE USE OF THEIR KNOWLEDGE, LCPC AND INRETS MAINTAIN CLOSE PARTNERSHIPS WITH LEADING ACTORS IN THEIR RESPECTIVE FIELDS OF EXPERTISE.

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Allenvi*: A long-term alliance devoted to critical sustainable development goals



*National Alliance for Environment-based Research

For Allenvi (acronym of the National Alliance for Environment-based Research, officially launched on February 9th, 2010 by the Minister of Higher Education and Research), 2010 marked the beginning of what will certainly be a long and rich adventure. With its 12 founding members (including LCPC) and 15 associated members, this Alliance encompasses over 15,000 researchers, engineers and technicians in pursuit of a single objective: promoting a consistent and interdisciplinary approach to fulfilling the four major sustainable development challenges, namely **Food Supply, Water Supply, Climate and Land Use Planning.**

As of April 2010, Allenvi's organisation featured 12 thematic working groups, 6 of which include participants from LCPC, on topics as diverse as water, climate, environmental assessment, risks, regional territories and natural resources, cities and mobility.

An initial seminar, held in July, provided a framework and road map for each group. The second seminar took place in December and focused on identifying the set of research priorities shaping the 2011-2012 schedule. Let's note that these efforts made it possible, in March 2011, to issue the set of environmental research priorities proposed for the 2012 calendar of the ANR National Research Agency.

This Alliance also certified the first 13 networks of observation and experimentation systems for environmental research (designated by the "SOERE" label) in September and then in October published the SOERE 2011 call for tender.

The initial evaluation of activities undertaken by the young Alliance already points to fantastic successes and confirms the beginning of a long and fruitful scientific and human endeavour. ■





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INRETS urges ANCRE* to support more effective research in the energy field

Since 2010, INRETS has been overseeing work by the "Energy and Transport" working group (GP6) as part of the National Alliance for Energy Research Coordination (Ancre), which was created upon government request in July 2009.

Ancre has extended partnerships beyond its founding members (CEA, CNRS and IFP) with French public sector research bodies concerned by energy-related problems. These partners include INRETS, which is involved in efforts to identify and ultimately overcome the main obstacles to solutions, be they scientific, technological, economic or societal. This mission involves, among other things, analysing the skills possessed by French research entities through establishing a detailed map and proposing specific programmes (from fundamental research to producing actual demonstration units) to resolve these issues.

In all, over 500 experts were invited to participate in the nine thematic groups, five of which were dedicated to energy sources (*energies stemming from biomass (GP1), fossil fuels and geothermal sources (GP2), nuclear (GP3), solar (GP4), marine, hydraulic and wind (GP5)*). Three other groups focused on end use (*transport (GP6) supervised by INRETS, buildings (GP7) led by the CSTB Institute, and industries and agriculture (GP8) led by CNRS*). The last group (GP9), more interdisciplinary in nature, was involved in forecasting and results compilation.

The activity of group GP6, directed by INRETS, entailed a two-pronged approach, i.e. by sector and by discipline. Nearly 80 scientists from the Institute contributed their expertise on vehicles, motor technology and energy across all transport sectors: road, maritime and river, rail, and air.

Emphasis was placed on vehicle weight reduction and aerodynamics as well as on the energy efficiency of transport systems.

GP6 held three meetings in 2010, with the agendas concentrating on road and rail applications plus system efficiency considerations. Air transport topics were not included since CORAC's activities already cover these topics extensively. On the other hand, the maritime and river transport sector has not yet received sufficient attention from the standpoint of "energy" research.

By the end of 2010, GP6 had released an initial summary report with a series of recommendations on hurdles or technologies that merit further study, with specific items identified and an outline of a skills map. Their work will continue in 2011.

With the exception of air transport, let's point out that a very large proportion of the GP6 scope has relied on output by PREDIT working groups and, as such, offers great complementarity. ■



**National Alliance for Energy Research Coordination*



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LCPC proud to be one of IDRRIM's* founding members

The Institute of Roads, Streets and Mobility-enhancing Infrastructure (IDRRIM) was created on January 19th, 2010 by transforming and expanding the CFTR (French National Committee for Road Technologies). LCPC, as one of the Institute's founding members, had the opportunity to participate in IDRRIM's layout and constitution, and then in its official launch.

IDRRIM's founding originated in one of the conditions stipulated in the voluntary commitment agreement signed on March 25th, 2009 by the French government (Sustainable Development Ministry - MEDDTL), the Public Works profession (FNTP, USIRF and STPF trade associations),



**Institute of Roads, Streets and Mobility-Enhancing Infrastructure*

local public authorities (ADF) and private engineering concerns (*Syntec Engineering*). This agreement was introduced for the purpose of promoting the practical implementation of a series of ten commitments, covering the design, construction, maintenance and operations of mobility-enhancing infrastructure (www.idrrim.com and RGRA Review, issue 892 - March 2011). IDRRIM is responsible for mobilising within a single body the entire range of actors in the fields of land transport infrastructure construction and management, making it a preferred venue for coordination efforts.

LCPC is a member of both the Board of Directors and Executive Board of IDRRIM, in addition to playing an active role on several operational committees that contribute to

the Institute's dissemination of results; these committees include:

- ▶ "Opinion" Committee.
- ▶ "Methodology" Committee (including the National Surface Characteristics Group, GNCDS).
- ▶ "Qualification - Certification" Committee.
- ▶ "Coordination - Cooperation" Committee.

LCPC's first tangible contribution to IDRRIM consisted of sharing responsibility and control over the Roads Plenary Session in Nantes, beginning with the 2011 event. This annual gathering of French road professionals was initiated by LCPC and has been organised by the Laboratory in early February for the past 20-plus years. ■

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The field of urban water management revises its scope of action

Urban water management activities are some of the most critical performed by local and regional authorities and basically encompass discharging stormwater, collecting wastewater and reducing pollutant effluent. More recently, management techniques designed at the parcel or district scale, which are more in sync with the natural water cycle, have been developed as part of broadening technical approaches to issues concerning land planning, urban amenities and societal aspects.

For a long time, this operational activity has nurtured close relations with research teams in the field of urban hydrology, whose results stem in large part from *in situ* observations and experiments, with monitoring using time scales extending a year or more. In this context, creating the SOERE (acronym for "system of observation

and experimentation in environmental studies") URBIS, which has received Allenvi certification, will allow coordinating a series of multidisciplinary and distributed approaches covering several distinct territories (Nantes Metropolitan Area, Lyon Council of Governments, Paris Region).

Alongside these advances, a club of local authorities in support of SOERE, in the form of a non-profit, is currently being constituted in order to consolidate at the national level the myriad relations already existing at the local level. By involving technicians with regional organisations in addition to elected officials in establishing and monitoring actions conducted within an observatory setting, this structure will guarantee the relevance of research programmes currently underway and help ensure permanent resource allocations. ■

IDRRIM'S ORGANISATIONAL STRUCTURE

- President: Yves Krattinger, French Senator representing the Haute-Saône
- Managing Director: Marc Tassone
- Members of the Board of Directors
- Strategic Council
- Scientific and Technical Council
- 8 Operational Committees:
 - ▶ Opinion
 - ▶ Methodology
 - ▶ Qualification - Certification
 - ▶ Training - Research - Innovation
 - ▶ Streets and urban spaces
 - ▶ Coordination - Cooperation
 - ▶ Forecasting
 - ▶ Engineering



◀ Gulley placed in the Bottière Chesnaie green district (Nantes).



LCPC remains very active in IRSTV*

IRSTV is an interdisciplinary research federation sponsored by CNRS. This Institute encompasses some 20 laboratories throughout western France, in addition to developing a comprehensive vision of urban environments and building methods and tools to facilitate sustainable city planning practices and public policy evaluation. LCPC's role in these efforts has been substantial. Besides a presence on the Institute's executive body, researchers with both the GER (Geotechnical Engineering, Water and Risks) and IM (Infrastructure and Mobility) Departments contribute to many IRSTV joint research projects:

- ▶ ONEVU, which stands for Nantes Area Urban Environmental Observatory, is a system pursuing a number of objectives, including: acquiring long-term data, characterising material and pollutant flows in various media (air, water, soil), and analysing transfers between these media in correlation with land use practices. ONEVU is Nantes' branch of the national URBIS/SOERE system dedicated to the urban environment, under IRSTV's coordination.
- ▶ In the field of urban microclimatology, the GER unit models the water cycle as a function of moisture transfers

between the various urban media (atmosphere, soil, hydrological networks, vegetation, built environment) along with the influence of urbanised soils. GER teams have also coordinated a regional project devoted to characterising the impacts of human activity on the physicochemical properties of urban soils.

- ▶ As for urban background noise, the IM Department has contributed to developing sound propagation models that incorporate the properties of urban landscape shapes and the interaction of sound with urban media (soil, air, buildings, vegetation). The department has also been studying the quality of sound environments (noise mapping).

Moreover, LCwPC is associated with some major ANR-sponsored interdisciplinary projects coordinated by IRSTV and focusing on the evaluation of environmental and socio-economic impacts from public policies tied to human activity and social practices. Two such projects are EvalPDU (Evaluation of urban transportation plans) and VegDUD (Impacts of greening the city). ■



**Research Institute on Urban Sciences and Techniques*

PRIZES AND AWARDS

LIKE EVERY YEAR, MANY INRETS AND LCPC RESEARCHERS RECEIVED AWARDS IN 2010 FOR THE QUALITY OF THEIR WORK AND CONTRIBUTIONS.

▶ **Hassan Ali**, with the GER Department, received the 2010 Jean Kerisel Prize awarded by the French Society for Soil Mechanics and Geotechnical Engineering (CFMS).

▶ **Faïcel Chamroukhi**, with LTN MIV, was honoured with the Best Poster Award from e-EGC's Winter School session entitled "Statistical Learning and Data Mining", held at Hammamet in February.

▶ **François Combes** (LVMT) came away with the prize for the best presentation by a young researcher at the European Transport Conference held in Glasgow during October (ETC Prize, Neil Mansfield Award).

▶ **Cécilia Cruz**, with SPLOTT, received "WCTRS Honourable Mention", in recognition of submitting the best paper from a young researcher, entitled: "How is 'own account transport' well adapted to cities?" at the WCTR conference in Lisbon.

▶ **Romain Gallen**, with LEPSIS/LIVIC, was bestowed the silver medal at the Young European Arena of Research (TRA) in Brussels. This medal was awarded under the heading "mobility and intermodality".

▶ **Siham Hairoud**, with LEOST, was recognised for submitting the "Best Student Paper" at the ITST 2010 conference in Kyoto.

▶ **Anne Aguilera (LVMT), Jean-Loup Madre (DEST) and Dominique Mignot**

received the Prize for the best scientific article from APERAU (International Association of Urban and Regional Planning Schools).

▶ **Anaïs Mayeur**, with IM/LEPSIS, won the Prize for the best thesis in 2010 from the Doctoral School, for entry no. 261: "Human cognition, behaviour and conduct" from the University of Paris V.

▶ **Laetitia Martinie**, with MAT, was runner-up for the René Houpert Prize competition held during the 2010 AUGC meeting of the University Association of Civil Engineers.

▶ **Miguel Padeiro**, also with LVMT, was awarded the 2010 thesis prize from the University of Paris-East, through its affiliation with the Doctoral School called "Urban and Regional Transport Planning" ("Ville Transport Territoires"), in October 2010.

▶ **Judith Princetion**, with GRETI, received a prize for the best presentation during INRETS' doctoral workshop sessions held in Lille, in addition to the "2010 Best Paper Award" from the Transportation Safety Management Committee.

CLOSE REGIONAL TIES

AT EACH SITE WHERE THESE TWO INSTITUTES EXERCISE THEIR ACTIVITIES, A WIDE ARRAY OF MUTUALLY BENEFICIAL PARTNERSHIPS HAVE BEEN BUILT WITH LOCAL AND REGIONAL ACTORS FROM ALL ECONOMIC SECTORS AND ACADEMIA. PUBLIC AUTHORITIES, UNIVERSITIES AND RESEARCH INSTITUTES, COMPETITIVENESS CLUSTERS, MEMBERS OF THE MINISTRY'S RST SCIENTIFIC AND TECHNICAL NETWORK, AND INDUSTRIALISTS ARE CONTACTED ON A DAILY BASIS IN ORDER TO CONSOLIDATE EACH CENTRE'S GEOGRAPHIC INFLUENCE WHILE DISSEMINATING ALL OF THE KNOWLEDGE AND EXPERTISE IT HAS GENERATED.

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Paris Region



PREPARATIONS FOR THE UPCOMING INSTALLATION OF IFSTTAR HEAD OFFICES AND SOME RESEARCH AT THE MARNE-LA-VALLÉE SITE

Construction is progressing nicely with the "Bienvenue" Building, where Ifsttar offices and researchers will be moved on the Cité Descartes campus. The neighbouring Paris-East Science and Technology Cluster (PST) will offer a pool of 1,500 researchers, engineers and doctoral students representing research organisations, graduate schools, institutes and the University of Paris-East. Synergies between PST research teams will be created through a number of joint venture projects, two of which are sponsored by LCPC and INRETS:

- ▶ the Belgrand Centre, which groups resources earmarked for the use of databases on urban and mobility-related topics;
- ▶ the Immanent project, for highly distributed and nomad instrumentation for both the Transport and Urban sectors.

STRONG LEVEL OF COMMITMENT TO COMPETITIVENESS CLUSTERS

Heavily involved in the oversight of competitiveness clusters *Advancity* and *Mov'eo*, INRETS has moreover presided over the *Advancity's* Mobility Scientific Council and contributed to the work of several Strategic Orientation Committees.

INRETS has participated in the *Mov'eo* initiative via a number of strategic action plans and the MOVEOTEC foundation. Both LCPC and INRETS have also been associated with several of the projects undertaken by these clusters, as exemplified by the following:

- ▶ CLAIRESITI project: An "intelligent" referencing system for the intermodal transport of passengers, with a pilot site set up in the Seine St-Denis Department north of Paris. This project, developed by INRETS teams in Marne-la-Vallée, has been certified by both the *Advancity* and *Mov'eo* clusters.
- ▶ The three projects CO-DRIVE, SCOREF and PLATA, all of which involve joint collaboration, are aimed at developing communications systems for the automobile in association with Renault, PSA, Valeo and a few innovative small and medium firms.

PARIS REGION RESEARCH ON TRANSPORT SERVICES TAKES AIM AT THE FUTURE

As founding members of the University of Paris-East, both INRETS and LCPC are closely affiliated with the university's



▲ Aerial view of Paris.

scientific departments as well as with the Doctoral Schools within the research and academic centre (PRES).

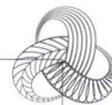
In 2010, the capital investment programme rallied Paris Region laboratories around a series of projects sponsored by this PRES. Among these initiatives, *EQUIPEX Sense-city* was devoted to the topic of nanomaterials and nanosensors adapted to physical infrastructure, urban and transport services and the environment. For its contribution, *LABEX Futurs Urban*, which has engaged five research units, adopted an interdisciplinary approach in urban contexts by coordinating highly-specialised research with the capability of *in situ* experimentation in connection with the Descartes Cluster based in Marne-la-Vallée.

These institutions are also participating alongside the University of Paris-East and the Sorbonne-Paris Cité in the Paris Region's Innov Society for Accelerated Technology Transfer (SATT).

Moreover, the partnership with Versailles-Saint Quentin has been strengthened by the joint development of proposals for the *Investissements d'Avenir* investment programme. The project sponsored by the new institute VeDeCoM plans on hosting at the Versailles-Satory site over 200 new researchers (including 19 assigned from LCPC and INRETS) working on three topic areas: electric or hybrid vehicle components, onboard communications systems, and new mobility systems. ■

REGIONAL PARTNERS

PST - University of Eastern Paris;
PRES - University of Eastern Paris;
Competitiveness clusters: *Mov'eo*,
Advancity.



Nantes



ENHANCED TIES WITH REGIONAL PARTNERS

In 2010, LCPC (Nantes Centre) maintained and extended its ties with regional partners throughout western France, primarily located in the Loire Valley Region, but also in the neighbouring regions of Brittany and Poitou-Charente.

Within academia, these partnerships have taken the form of participation in undergraduate instruction and doctoral training (via the SPIGA and STIM doctoral schools), in addition to launching new joint research projects (*Algoroute* with the Nantes-based laboratories CEISAM and GEPEA, stereovision texture measurements in conjunction with the Poitiers-based Xlim-Sic Laboratory), assistance in the organisation of conferences (the 2010 Materials Congress held in Nantes with IMN, the ITS Congress in Saint-Brieuc entitled "Regions and Movements" held September 30th through October 1st, 2010).

On December 10th, 2010, the R2GC (regional civil engineering research network) project, supervised by LCPC and financed by the Loire Valley Regional Council, held its closing seminar. This project, which included CSTB, ECN and GeM as partners, will be extended into 2011 to continue work on a GIS project before incorporation into a CNRS research consortium dedicated to civil engineering.

The year 2010 will be remembered for the "emergence" on the scene of the UNAM PRES research institute, in which LCPC has become an associate member through contributions to several of its working groups. Moreover, LCPC continues to enjoy active membership in the IRSTV Research Institute on Urban Sciences and Techniques, a consortium it now leads.

CLOSE PARTNERSHIPS UNDER THE AEGIS OF COMPETITIVENESS CLUSTERS

The partnerships established with project owners and decision-makers, the world of industry and consulting firms have grown closer through stronger emphasis on the two Loire Valley competitiveness clusters, PGCE and EMC², for which LCPC is a founding member.

The removal of PGCE's certification in 2010 has not altered LCPC's support, as the Laboratory continues to participate in and coordinate the entity's various bodies (Board of Directors, Executive Bureau, working groups, research project evaluation and certification commission). LCPC has specifically been involved in organising events for the technical community, including "Innovation and regulation in the field of public works", on September 21st, 2010, and as a contributor to a session determining the near-term evolution of this resource centre cluster.

Within the scope of these partnerships, the call for projects as part of the investment programme outlined in France's "Great Loan" (launched during the last quarter 2010) led LCPC-Nantes to take a large stake in promoting three ambitious Institute-driven projects:

- ▶ *IRT Jules Verne*, sponsored by the EMC² competitiveness cluster.
- ▶ *IDEX IC-West*, sponsored by two regional PRES (academic/research centres) in the Loire Valley (UNAM) and Brittany (UEB).
- ▶ *IEED France Energie Marine*, sponsored by IFREMER Brest. ■

REGIONAL PARTNERS

Regional Consultative Committee on Technological Research and Development (CCRDT).
PRES - University of Nantes-Angers-Le Mans.
University of La Rochelle, Poitiers.
Competitiveness clusters: EMC², and Civil Engineering / Green Building - Loire Valley Sustainable Construction Resource Centre.



On July 24th, 2010, the Deputy Director of LCPC's Nantes Centre died under tragic circumstances. Olivier Havas (47 years old, ICPEF-credentialed engineer) had joined the LCPC staff on March 1st, 2008. Prior to this appointment, Olivier had directed Nantes' CIFP training centre since January 1st, 2005 and before that held several technical posts with: the Saint-Nazaire Port Authority from September 2002 to December 2004; the Vendée Departmental Planning Office from July 1998 to August 2002, and the Charente Land Planning Office from September 1995 to June 1998.

The Lille-Villeneuve d'Ascq Centre



2010 PRESENTED A PANOPLY OF INITIATIVES SHOWCASING THE CENTRE WITHIN LOCAL ENTITIES.

The Centre's Deputy Director further spread the facility's renown among scientific actors within its regional academic jurisdiction: University of Lille 1, Ecole Centrale - Lille, Regional Transport Research Consortium, Polytech Lille, SPI Doctoral School, International Campus Office for Transport Safety and Interoperability, the 2007-2013 North-Pas de Calais regional CPER programme in the field of transport research.

The Centre has maintained an active presence in project governance and coordination for the "*i-trans*" competitiveness cluster throughout 2010, subsequent to its certification renewal in 2009 as a cluster with international reach. The Lille-Villeneuve d'Ascq unit sits on the Scientific and Technical Committee, Board of Directors, Executive Bureau and Programme Committees. Moreover, three projects, with applications submitted for ANR financing and involving one or more INRETS teams, have already been certified by the cluster in 2010.

This Centre has also contributed to working groups set up within the framework of the "rail industry" initiative launched in Valenciennes in October 2010 by the Minister of Industry, as an extension to the convention held on French industry.

Within the scope of a mandate issued by the Regional Economic, Social and Environmental Council (CESER

North-Pas de Calais), the Centre's Deputy Director was given the opportunity to co-author a report on the port development strategy of the region's maritime zone, in application of reforms adopted during previous years. This report was unanimously approved by assembly members in October 2010.

Lastly, a large share of the Centre's activity towards the end of the year was focused on preparing for the announced merger between INRETS and LCPC, in addition to assembling the three bids for projects covered by the future capital investment programme sponsored by the PRES-University of Lille-Northern France, namely:

- ▶ LABEX "SyTiMOBIL": Safe, Intermodal and Sustainable Transport Systems for ageing and mobility-impaired populations, led by the University of Valenciennes;
- ▶ LABEX "ICON": Information, Communications and Nanotechnologies, led by the Lille Institute of Electronics, Microelectronics and Nanotechnologies;
- ▶ IRT "Railenium", comprising an ambitious programme of constructing a test loop dedicated to rail infrastructure plus a full array of components, with support provided by a Technological Research Centre, led by the *i-trans* cluster and RFF railway company. The Villeneuve d'Ascq Centre is responsible for overseeing two of the eight research programmes cited, namely: "intelligent interactions between infrastructure and vehicles", and "civil engineering and soil mechanics". ■

REGIONAL PARTNERS

PRES - University of Lille-Northern France;
Competitiveness cluster: *i-Trans*.

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The Bron Centre



A COMPREHENSIVE AND CONSISTENT APPROACH FOR SATISFYING ENVIRONMENTAL CRITERIA

Thanks to thermal audits conducted on buildings during 2009 and then validated in 2010, the Bron facility now possesses an actual energy parcel map complete with prescriptions in terms of energy efficiency improvement and building maintenance goals.

The company transport planning approach introduced at the Bron site has been further developed with two informational meetings on carpooling and transit pass (CITY-PASS) purchase incentives following the agreement signed between the SYTRAL transit operator and INRETS. A bicycle parking facility was installed with the potential to accommodate 26 spaces plus safety kits made available in laboratory offices.

Research teams, notably from LTE, were mobilised for several months on a project called "PLIBAT" aimed at producing exceptional scientific equipment as part of the capital investment programme. The intention here has been to assemble on the Bron site all scientific equipment

required to ensure solar electric mobility for various types of vehicles, including buses and lorries.

STIMULATING REGIONAL DEVELOPMENT THROUGH LEVERAGING PARTNERSHIPS

The Deputy Director's staff played an active role in discussions held surrounding the organisation of transport research services throughout the region, as reflected in the IDEX project (Initiatives of excellence) sponsored by the Lyon-Saint-Etienne PRES. Staff members also acted as stakeholders in efforts deployed by local authorities regarding new regional plans (e.g. revision of the Regional Higher Education and Research Plan, Regional Climate, Air and Environment Plan) and by the Lyon Metropolitan Council (Climate, Transport and Urban Planning at the metropolitan scale, Lyon Area Development Council). The inclusion of INRETS among "Rhône-Alps Energy Environment" members has provided the opportunity for LTE to study, among other things, alternative fuels and latest-generation electric motor technology. ■

REGIONAL PARTNERS

PST - University of Lyon-Rhône-Alps
PRES - University of Lyon
Competitiveness cluster: LUTB.

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Marseille - Salon-de-Provence



THE ACCIDENT MECHANISMS UNIT UNDER THE SPOTLIGHT

Entitled "How to promote and ensure necessary long-term change?", the Francophone Road Safety Workshop was held in Lyon on November 22nd and 23rd, 2010 under the banner of the 23rd Jacques Cartier Assembly. This event mobilised the Accident Mechanisms (AM) unit, which sits on the scientific committee and produced several of the papers delivered during the proceedings. This same unit had been assigned during 2010 scientific responsibility for a major project called "SVRAI" (acronym for Saving Lives by means of Incident Feedback Analysis), financed during its initial phase by DSCR. Supervised by the Certu Institute, SVRAI has involved a large number of teams from the Ministry's Scientific and Technical Network. Subsequent phases are planned to associate local and regional authorities with these efforts. Research conducted has been intended to provide greater insight on accident tendencies through use of the latest knowledge obtained from measurements of incident rates under natural driving conditions. The scope of research has been extensive (500 instrumented vehicles ultimately), with the implementation of recorders fully designed and developed by the AM unit's DYN team.

EXTENSION OF THE APPLIED BIOMECHANICS LABORATORY'S TESTING FACILITY

In 2010, the testing facility containing the Marseille-based Applied Biomechanics Laboratory's (ABL) catapult was expanded by 200 m². Offering direct access for the unit assigned to set up experiments, this additional space has

been allocated for storing shock test vehicles and technical equipment.

This works programme provided the opportunity to install amenities to improve working conditions (showers, lavatory, heating) and upgrade the site's safety features.

The ABL Laboratory is now housed in a 950-m² building entirely dedicated to shock testing.

The testing activities performed inside this Laboratory have since been oriented around obtaining a quality certification. Towards this objective, an initial set of procedures has been identified and written, with validation provided by onsite teams.

STRENGTHENING LOCAL AND REGIONAL TIES

During the summer of 2010, efforts intensified to consolidate the Centre's local and regional ties. These actions included involvement in the bidding process relative to the capital investment programme, support offered to local authorities on an array of projects and certification steps by the area's three competitiveness clusters: Eurobiomed, Risk Management and Regional Vulnerability, and Pegase. The Centre's participation in the Traumatology Foundation and Archimedes Committee on the dissemination of scientific culture, in the capacity of research organisation representative from the PACA Region (south-eastern France) (CORPACA), has provided the unit with the stature to influence research alliances and act as a key strategic partner throughout the region, at a time when society is expressing increased concerns over mobility. ■

REGIONAL PARTNERS

PRES - Aix-Marseille
Competitiveness clusters:
Eurobiomed, PEGASE.



INSTITUTE COMMUNICATIONS

DURING 2010, THE COMMUNICATION TEAMS WITH BOTH INSTITUTES HAVE PURSUED THE STRATEGY OF DISSEMINATING COMMUNICATION SUPPORTS AND TOOLS WHILE EMBARKING ON A NEW PATH TO ACCOMPANY, BEGINNING INTERNALLY, THE PROCESS OF MERGING THE TWO ORGANISATIONS.

► LCPC and INRETS publications

EDuring 2010, LCPC continued publishing its "Lettre L" monthly newsletter informing all internal and external partners of the Laboratory's latest events, with a much greater move to online readership over the course of the year. As a matter of fact, since September, the newsletter is being sent to subscribers by e-mail and remains accessible on the Website.

INRETS also continued in 2010 with publication of the AXES newsmagazine offering a popularisation of research findings in the field of transport. Also released as a monthly, AXES serves as a communication support for all of the Institute's research work.



► Web resources

INRETS has developed a Web magazine entitled "I-media", as a complement to the AXES magazine. This tool focuses on a number of topics raised in the paper version in addition to publishing other news reports. LCPC's communication and information services teams have collaborated on a project to launch new sites specific to the Laboratory. The migration in favour of new tools and their integration into existing systems made 2010 a very busy year.

► The events calendar

ATEXPO 2010: February 3-4, 2010, Versailles Exhibition Centre (Paris)

Rendez-vous Carnot: May 5-6, 2010, Lyon

TRA: June 7-10, in Brussels,

INTERROUTE&VILLE: October 2010, Metz

Jacques Cartier Assembly: November 2010: 2 seminars organised by INRETS in conjunction with the CERTU Institute and MEDDTL Ministry.

Cifre Forum: November 26, Paris

INRETS-LCPC joint stand ►
at the Cifre Forum.



LCPC's participation in the joint stand hosted by the MEDDTL, DGITM, CETE, Certu and Setra organisations for the INTERROUTE & VILLE show.

QUALITY ASSURANCE POLICY

INRETS AND LCPC HAVE FOR THE PAST SEVERAL YEARS INITIATED A NUMBER OF APPROACHES DESIGNED TO CONTINUOUSLY IMPROVE THEIR ACTIVITIES, PARTICULARLY AS REGARDS DEVELOPING QUALITY MANAGEMENT POLICIES, RESULTING IN THE ADOPTION OF MANY PROCESSES AND PROCEDURES AS WELL AS AN ISO 9001 CERTIFICATION AND COFRAC ACCREDITATIONS.

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LCPC's quality improvement approach: Presentation of LCPC certifications and accreditations

LE LCPC EST CERTIFIÉ « ISO 9001 »

LCPC has been "ISO 9001" certified since October 2002, with renewals awarded in 2005 and 2008 (extending through October 31st, 2011) for its **quality management system** in the 5 activity areas of:

- ▶ research, development, studies and expert appraisals, certification, and testing for:
- ▶ civil engineering materials and structures, geotechnical engineering and natural risks, the environment and transport infrastructure operations

From September 2005 to October 2010:

LCPC successfully completed two renewal audits, one in September 2005 the other in September 2008, and 9 monitoring audits between 2006 and 2010. Certification activity had been added to the ISO 9001 scope in September 2005. The ISO 9001 certification is valid through October 31st, 2011.

LCPC HOLDS AN ACCREDITATION FROM "COFRAC TESTS", AWARDED IN ACCORDANCE WITH THE ISO 17025 STANDARD

for the **7 following testing programmes:**

- ▶ prog. no. 3: Tests on hydraulic concrete and its components (PCM/Paris),
- ▶ prog. no. 5: Tests on concrete reinforcements (MACOA/Nantes),
- ▶ prog. no. 29-1: Tests on metal materials, mechanical testing (MACOA/Nantes),
- ▶ prog. no. 8: Tests on asphalt mixes and their components (SMIT/Nantes),



Certified quality management system, recorded under no. 9915173 for the Paris and Nantes sites



Accreditations:
no. 1-0005 (Paris site)
no. 1-0535 (Nantes site)
Range of applications available on www.cofrac.fr



Accreditation no. 5-0044
Range of applications available on www.cofrac.fr

- ▶ prog. no. 23: Tests on rocks and aggregates (SMIT/Nantes),
- ▶ prog. no. 86: Tests on bitumen and by-product binders (SMIT/Nantes),
- ▶ prog no. 105: Tests on special products intended for hydraulic concrete structures (PCM/Paris).

From 2006 to 2010: LCPC successfully completed 2 certification renewal audits, in January 2006 and January 2008, plus 6 monitoring audits. Programme no. 29-1 was added in June 2005. The Paris site has been accredited "COFRAC Tests" through May 31st, 2011, while the Nantes Centre's accreditation is valid until February 28th, 2013.

N.B.: In 1979, LCPC was one of the 5 founding laboratories of RNE, which went on to become COFRAC in 1994.

LCPC HAS BEEN AWARDED ACCREDITATION BY "COFRAC INDUSTRIAL PRODUCT CERTIFICATION", IN ACCORDANCE WITH THE STANDARD EN 45011 (SINCE MAY 1ST, 2006)

for the **EC marking of aggregates** (Directive 89-106: "Construction Products"). The accreditation body was notified via the system "2+": (audit focusing on plant production controls) for aggregate production quarries.

From 2006 to 2010: LCPC successfully completed 6 monitoring audits at its Head Office and at 2 quarry sites. The January 2010 renewal audit concerned extending validity of the "COFRAC Industrial Product Certification" accreditation until March 31st, 2015. ■



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Cooperation with CNER, the National Road Research Centre in Rabat (Morocco)

L CPC took part in a cooperative mission with Morocco's National Road Research Centre (CNER) based in Rabat.

Crucial to this cooperation was the introduction of a quality management system within the CNER organisation, along with CNER certification for its diagnostic and monitoring services as of 2011 and a proposal to improve the local road maintenance management system.

Two CNER managers, Fatiha ORAICHE (Head of the Management Systems Department) and Rachid

TABBOUCHY (Head of the Diagnostic Unit), were hosted at LCPC's Nantes Centre August 3rd through 6th and then November 29th through December 3rd, 2010.

For the record, Morocco's road network comprises:

- ▶ 916 km of operating motorways and 600 km under construction,
- ▶ 40,000 km of rated paved roads,
- ▶ 17,000 km of rated unpaved paths,
- ▶ 15,500 km of roads under construction or being improved within the scope of the second rural roads capital improvement programme for 2005-2012. ■



1 CNER was created in 1979, under the name "National Pavement Diagnostic Centre", as a Roads Directorate Unit. In 1986, it became an autonomous entity affiliated with a Roads Directorate Division and went on to be called the "National Road Research Centre".

2 The Centre employs 64 staff, 9 of whom are engineers, divided among the departments of diagnostics, road management systems and research.

3 The Centre also runs a laboratory for materials identification testing (soils, sand-gravel mixes) and for tests on hydrocarbon materials.



THE INTERNATIONAL STAGE

ESTABLISHING COOPERATIVE VENTURES WITH RENOWNED INSTITUTES, ORGANISING ACTION PLANS WITHIN THE SCOPE OF INTERNATIONAL NETWORKS, BUILDING THE EUROPEAN RESEARCH SPACE, PLAYING A WELL-RESPECTED ROLE OF INFLUENCE AND COOPERATION, AND DISSEMINATING FRENCH EXPERTISE AND SPECIALISATION ARE AMONG THE MAJOR GOALS BEING PURSUED BY INRETS AND LCPC ON THE INTERNATIONAL SCENE.

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An international renown

The wealth of experimental knowledge, whether applied or finalised, generated by LCPC in all aspects of sustainable mobility has been hailed by the international community. This recognition places the Laboratory among the world's leading research actors in the fields of transport, infrastructure and civil engineering.

Defined in Objective 17 of the Objectives-based contract (2010-2013), the Laboratory's international strategy contributes to its level of scientific excellence achieved and, along these lines, several partnerships were initiated in 2010 with ARRB (Australia) on topics related to weigh-in-motion systems and with the Federal University of Rio. LCPC has also expanded its existing cooperative relationships with: the American Federal Highway Administration and IIT of Kharagpur (India), in addition to organising a mission in Japan that gave rise to working seminars held with institutions like PWRI, NILIM and PARI.

Participation in shaping the European research framework is another one of LCPC's missions, with the aim of completing the European research space and striking

a better balance in sharing projects and research facilities, both signs of efficient resource use at the scale of the entire continent. This strategic vision was underscored when Paris won the bid to host the 2014 TRA (Transport Research Arena) European conference combined with LCPC's commitment, at the request of the MEDDTL Ministry, to jointly handle the programming task in taking the lead on urban topics as part of the Urban Europe Joint Programming Initiative. LCPC was also successful in implementing a permanent and transnational ERA-NET-ROAD bidding structure in the activities of CEDR, which has gained considerable momentum by holding its first plenary session in September in Brussels and by wrapping up the "roads and climate change" work programme.

In 2010, LCPC was awarded six European projects. Moreover, the 5th-generation road project (R5G) took a major stride forward with the formation of the FOR working group within FEHRL (federation of European civil engineering research laboratories). LCPC is one of the five leaders promoting this dynamic European approach and has made major contributions to developing strategic research plans. ■



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INRETS intensifies its European and international action campaign

Beyond preparing its merger with LCPC, the year 2010 was spent by INRETS refining its European and international strategy with respect to Objectives 21 and 22 of its objectives-based contract for the period 2010-2013.

According to the rationale adopted in the Lyon Declaration of December 2008, in application as of 2009 by the European Commission's publication of the "green book" entitled *Towards a new urban mobility culture*, the Institute has fine-tuned a number of system components to enable retaining a key role in the European research space. Let's recall that the strategic document, signed on December

2nd, 2008 during France's tenure as the European Union President, offered in the Lyon Declaration laid out for the field of surface transit research a Year 2020 Vision of the European research space. Moreover, as part of this momentum, INRETS and LCPC were able to gain acceptance of this strategy by seven European institutional and scientific networks.

Also during 2010, INRETS continued to participate in building a European transport research alliance and has plans to intensify efforts over the coming years. This objective, as stipulated by the new organisational committee, entails a stronger presence in Europe's scientific /



institutional networks, along with attendance at European technological forums and platforms on land transport, the production of widespread guidelines for future research and innovation framework programmes, and involvement in the latest European projects. The objective through year 2013 had already been reached as of the end of 2010, one more proof of the relevance of INRETS' commitment to the European research scene.

On the international level, the Institute's priority has focused on three areas where it plays a highly influential and cooperative role in the field of transport and transport research. INRETS has won accolades as a leading actor in OECD / ITF (*Organisation of Economic Co-operation and Development / International Transport Forum*) and from the concerned countries, as well as in the Union for the Mediterranean, on behalf of the Moscow Declaration in favour of the Road Safety Decade, as promoted by both the United Nations and World Health Organisation. ■



▲
The European Commission in Brussels, the stage for many research-related debates.

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Key mobility statistics

L CPC and INRETS have for several years been displaying their interest in developing researcher exchanges with their main scientific partners, especially in Europe, Japan and North America, in order to mutually recognise the excellence of our research efforts and accompany our best researchers along a guided international path to boost their careers.

Several researchers packed their bags for long-term stays abroad (lasting a year or longer) with Australia's ARRB (Didier Bodin) and the Universities of Berkeley (Min Tan Do) and Georgia Tech (Laetitia Dablanc and Kostas Chatzis).

In terms of "incoming" mobility, we welcomed a number of foreign researchers through several channels,

like contract-based recruitment in the case of Michael Regan from the University of Melbourne entering LESCOT, or as a sabbatical leave (Prof. Ryoji Matsunaka, with Kyoto University, on a research stay set up during 2010), or within the framework of European projects and contracts (Charlene Hallett, from UNSW, as a contributor to the European project INTERACTION; and Anurag SONI, from IIT New Delhi, attracted by a Marie Curie project and subsequently involved in a COST project).

Researcher mobility thus constitutes a significant dimension for the Institute in pursuing not only our scientific and international strategies, but our human resource policy as well. ■

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INRETS and LCPC share the European scene in 2010

The steady level of participation shown in European associations and contacts established with the Commission have made it possible for INRETS and LCPC to initiate new European projects, raise financing and strengthen their role and strategy within the European research space.

INRETS has continued its support for the governance of European associations and the Virtual Centre of Excellence; moreover, it has joined a new association, called ERTICO, while maintaining its contribution to discussions over preparation of the 8th PCRD framework programme (involving national and EU consultations). The Institute offers its expertise within a number of European working groups, led by the OECD. INRETS has also been developing bilateral collaborative ventures with countries such as Germany.

For its part, LCPC has consolidated its presence as well on the Brussels stage through contributing to the output

of associations and responding to consultation requests. The Laboratory has joined the "Refine" working group focusing on infrastructure research and expanded its role within FEHRL on the federation's "Forever Open Road" project, during proceedings of the 5th-generation European road initiative. LCPC continues to supervise the ERA-NET ROAD II project as well as activities of the CEDR research group; it has also been commissioned by Allenvi to oversee France's input into the joint Urban Europe programming devoted to the theme of the sustainable city.

On both the LCPC and INRETS sides, the internal efforts helping facilitate access for researchers to European projects have been intensified through: targeted information, accurate advice, logistical assistance, and accompaniment.

The INRETS subsidiary called ERT has contributed to the success of several project bids and provides valuable support in managing European projects. ■



For year 2010, INRETS:

- was a stakeholder in 3 European associations: ECTRI (transport-based research), FERSI (road safety), and ERTICO (intelligent transport systems);
- was a member of 6 European excellence networks: Humanist, ISN, EURNEX, Nearctis, VPH, and HYCON2;
- was a partner in 31 projects connected with the 7th R&D Framework Programme;
- coordinated 7 projects within the 7th R&D Framework Programme (including those administratively overseen by ERT);
- participated in 11 COST projects;
- participated in 6 OECD-ITF working groups;
- received €1,876,562 through European research contracts.

LCPC's numbers for 2010 showed the Laboratory:

- was a stakeholder in 3 European associations or platforms: FEHRL (road research), ERTRAC (automaker), and ECTP-Refine (building and infrastructure);
- was a partner in 11 projects connected with the 7th R&D Framework Programme;
- coordinated 2 projects within the 7th R&D Framework Programme;
- participated in 5 COST projects;
- participated in 3 OECD-ITF working groups;
- received €1,781,815.70 through European research contracts.

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International presence: Expertise in Japan, Brazil and Australia

The year 2010 brought heightened cooperation with Japan, and in November LCPC organised a study trip to the country for the purpose of discussing research topics of common interest with PWRI (Public Works Research Institute) during a bilateral seminar, as well as with NILIM (National Institute for Land and Infrastructure Management), NIMS (National Institute of Materials Science) and PARI (Port and Airport Research Institute).

LCPC was also able to strengthen its partnerships in Brazil, with COPPE UFRJ (Universidade Federal do Rio de Janeiro) on topics related to the industrial use of concretes and the design of structures with limited environmental impact, as well as with IPR (Instituto des Pesquisas Rodovias) on pavement control and maintenance and with the University of Santa Catarina (FUSC) on issues related to sensors and lorry traffic controls.

LCPC concluded a strategic framework agreement with ARRB (Australian Road Research Bureau) on study topics tied to lorries in particular, on the heels of 15 years of sustained exchanges, either informal or held within the scope of OECD projects or working groups; this groundwork will give rise to researcher exchanges.

Our expertise has frequently been requested; examples include: Morocco for road safety training, the Congo by the

Public Works Ministry, and Cameroon where the Laboratory has been assigned to certify the LABOGENIE Laboratory.

In Asia, INRETS has pursued contacts with its Japanese partners (contact initiated with Kyoto University, hosting a delegation from MLIT and the Tokyo Highway Company in conjunction with the ENTPE Engineering School) and developed closer relations in Malaysia where MIROS (Malaysian Institute for Road Safety) requested our expertise in the specific field of driving simulators.

INRETS researchers continued with their road safety assessments in Vietnam, as part of a World Bank/EGIS-sponsored project. In Australia, an agreement was signed with QUT and several joint INRETS/QUT projects were selected for both European financing (the Optimum project) and Australian financing (ARC). Cooperative ties with Universitas Indonesia were also strengthened, as INRETS was chosen to intervene in the Nusentara project (expert appraisal on an urban transit line running between Jakarta and the University's main campus in Depok).

On the African continent, INRETS has become associated with SITRASS as a means of offering its expertise in road safety to the countries of Senegal and Cameroon. ■

French delegation at an American research centre during a study trip held in September 2010.

FOCUS USA

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LCPC

Cooperation with the Turner Fairbank Center, affiliated with the American Federal Highway Administration in Washington D.C., has made it possible for a researcher to analyse, over a 4-month period, the behaviour of an ultra high-performance, fibre-reinforced concrete adapted to civil engineering structures. Another researcher initiated a one-year stay at the University of California at Berkeley to pursue a specialisation in pedestrian traffic. Among the delegations of FHWA colleagues and several universities, LCPC also hosted an American "scanning tour" devoted to bicycles and motorcycles, in addition to participating in its own study trip organised by FEHRL focusing on the United States' major centres of infrastructure research. The first Franco-American symposium on infrastructure safety in Troyes showcased our researchers, who were responsible for three presentations. Let's also mention the assignment of an LCPC staff member for two years at SHRP (Strategic Highway Research Program) in Washington D.C. in order to study, from the inside, how

American research activities were organised and managed.

INRETS

Besides its participation on the TRB, two events highlighted INRETS' cooperation established with the United States during 2010:

The first was the visit by John D. Porcari, American Deputy Secretary of Transportation, to Lyon on March 17th, 2010. The discussion agenda, which featured presentations by several researchers and laboratory directors, also contained:

- ▶ rail research and INRETS expertise in the field of rail safety
- ▶ social, societal and economic "viability" of passenger and freight transport services
- ▶ research conducted at INRETS on distraction in the transport sector.

The Vice Minister, American DOT representatives and INRETS representatives agreed on the benefit of re-establishing relations between INRETS and two of DOT's three major research bodies, namely:



- ▶ Turner Fairbank, for road-related research;
- ▶ Volpe Centre, for the other modes of transport, with special emphasis on the themes of intermodality and distraction. These exchanges provided the American delegation with a vision of the predominant role played by INRETS in transport research at both the European and international levels. The second noteworthy event was the announcement of international mobility towards some of our primary North American partners: 4 INRETS researchers headed off on research missions lasting a few months to one year at U.C. Berkeley, Penn State University and Georgia Tech. In addition, cooperative agreements were signed with Penn State and the Texas Technological Institute, while another agreement is being negotiated with the Virginia Transportation Institute.



IN THEIR WORDS...

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"I DEVELOPED A RESEARCH PROJECT ON DISTRIBUTION ACTIVITIES IN AMERICA'S LARGEST METROPOLITAN AREAS."

While at the SPLIT Laboratory (INRETS), I coordinated a research project on the logistics services shaping America's major metropolitan areas. I was naturally interested in feeling the pulse of American research on this very topic. Undeniably far ahead of us in many aspects of logistics, the Americans invented the concept of a "hub", these package distribution centres, with Federal Express. Today, they manage "mega distribution centers" just outside urban zones.

In this area of research, my sense is that there's no better place than the source to learn about phenomena, as they germinate or where they make their appearance with the greatest impact. Such is the case for freight handling and its suburban logistics found in the U.S.

The field of metropolitan logistics has been undergoing tremendous development, especially as a result of globalisation, Internet use and trade acceleration. The Atlanta area has witnessed a tripling in its number of warehouses over 10 years and a package shipped by FEDEX might

make up to 24 stops before arriving at its destination, meaning that the notion of freight shipment has been radically altered. A package no longer gets warehoused, it simply transits.

And yet even in the United States, for the time being, no quantification approach has yet to be devised for this phenomenon, which has made for one happy researcher!

On assignment at the Georgia Institute of Technology for the year 2010-2011, I have not cut ties with my laboratory SPLIT: in fact, I've been following the doctoral students (thanks to Skype!) and returned to France already 4 times to either teach or participate in a team seminar and various European workshops. One of my objectives with this American experience is to write my application for a research director accreditation as well as complete a collective book on these subjects.

I've been able to establish new ties that I hope will be lasting, thus expanding the post doc pool, in addition to co-authoring articles with American colleagues well versed in these freight-related issues; at my level, I've made every effort to build INRETS' transatlantic renown.

I've decided to continue this adventure for another year (2011-2012), in Los Angeles this time, with the *Metrans* Laboratory (run by USC and Caltech). Research performed at this facility is conducted with a highly interdisciplinary emphasis and significant focus on freight. ■

Laetitia Dablanc

GEORGIA INSTITUTE OF TECHNOLOGY IN 2010/11



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My one-year stay, from August 2010 until August 2011, at the University of California Berkeley offered one of those experiences that mark the life of a researcher.

After spending 16 years working in the area of pavement skid resistance, I was interested in gaining exposure to other fields. The new needs facing society where LCPC has sought to respond (energy conservation, passenger mobility and safety, risks due to climate change, etc.) guided me to the urban setting, in particular looking closely at problems of trip-making and exposure to accident-related risks. My initial contacts made within the framework of a CalFrance project directed me to the Institute of Transportation Studies (ITS Berkeley), an organisation actively involved in research topics of interest to me. Berkeley's two ITS centres, SafeTREC and PATH, where I spent my time, began concentrating on mobility problems as of the 1990's. Today, they're working on integrating technological progress made in the wireless communications field to provide information that's more comprehensive and better adapted to users.

"I USED MY STAY TO IDENTIFY RESEARCH ORIENTATIONS AND POTENTIAL JOINT VENTURES BETWEEN LCPC AND UC BERKELEY."

Minh-Tahn Do

CALIFORNIA PATH UNIVERSITY OF CALIFORNIA AT BERKELEY



Besides the personal "reinvigoration" side of this mission, I feel that my role, as head of a research team, also consists of gradually preparing the team to be ready to enter new fields of investigation.

I took full advantage of my time in Berkeley to work on modelling pedestrian traffic and identifying research topics along with the potential for collaboration between LCPC and U.C. Berkeley.

So what image do I come away with from this stay among American research teams? The willingness to make attempts and the speed of large-scale implementation of research products, in most cases promoted by close university/industry collaboration. ■

INTERNATIONAL PAPERS AND PRESENTATIONS DELIVERED



● INRETS
● LCPC
● INRETS et LCPC

INRETS	
COUNTRY	PRESENTATIONS
Australia	8
Belgium	11
Brazil	3
Canada	7
China	4
Croatia	1
Cuba	1
Egypt	2
Germany	18
Greece	3
Hungary	4
Israel	4
Italy	10
Ivory Coast	1
Japan	12
Lithuania	1
Malaysia	2
Monaco	6
Morocco	1
Netherlands	4
Norway	2
Poland	2
Portugal	45
Senegal	1
Singapore:	4
South Korea	1
Spain	3
Sweden	4
Thailand	1
Tunisia	11
Ukraine	1
United Arab Emirates	1
United Kingdom	11
United States	35

LCPC	
COUNTRY	PRESENTATIONS
Australia	4
Austria	1
Belgium	7
Brazil	2
Canada	5
China	4
Greece	1
Italy	6
Japan	6
Mexico	3
New Zealand	4
Norway	4
Portugal	1
Singapore	1
South Korea	1
Sweden	1
Switzerland	6
Tunisia	3
Turkey	1
United Kingdom	2
United States	14

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PAPERS DELIVERED
ACROSS 39 COUNTRIES



DOCTORAL TRAINING

RECRUITMENT, THESIS DEFENCES, MONITORING, DOCTORAL WORKSHOPS, LINKS WITH DOCTORAL SCHOOLS, CIFRE...

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In 2010, doctoral training received considerable attention from INRETS. Let's note that the financing of doctoral students was absorbed to a greater extent by co-financing arrangements or external financing (CIFRE stipends, contractual supplements, regional financial aid, etc.). For all INRETS' doctoral students taken as a whole, 45% are being financed from external sources, 39% by the Institute and the other 16% in a co-financing arrangement. The number of Research Director Accreditations (HDR) has been steadily rising, while the number of doctoral students supervised directly by the Institute has also been constantly increasing and now stands at 41%. As key partners in this training activity, the doctoral schools have been reallocating their resources, as evidenced by a smaller number of "reference" doctoral schools located near the sites of Lille-Villeneuve d'Ascq (ED SPI no. 72), Lyon (ED MEGA no. 162) and Paris-Marne-la-Vallée (ED VTT no. 528 and MSTIC no. 532).

Nearly 90% of the 2010 Ph.D. graduates found employment as of the 1st quarter 2011. This high Ph.D. placement rate testifies to the outstanding relations maintained by INRETS with future doctoral graduate employers, in both the private sector (e.g. consulting firms, transit operators, facility managers) and public sphere (universities, public authorities). The introduction of many teaching posts or in-company internships for students as part of their doctoral contracts also helps explain this strong employment placement rate.

The distribution of nationalities among doctoral student enrolment is extremely broad (in all, 38 nationalities represented), with 52% being French. In 2010, seven students brought praise to INRETS by receiving commendations during international conferences or at awards ceremonies organised by the doctoral schools. ■

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THESIS DEFENCES

42

INCOMING DOCTORAL STUDENTS

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The length of doctoral studies is less than 3.3 years. This excellent result is the outcome of combined efforts in choosing thesis topics and applicants as well as in closely involving senior staff and the organisation in monitoring activities. Nearly 60% of doctoral students complete their degree before expiration of their contract, and over 85% of new graduates find employment straight away, in a long-term post with either a private or public entity.

52 new theses were initiated during autumn 2010, with 20 being financed by the organisation through subsidies (including 3 with regional co-financing, i.e. Loire Valley and Alsace) and 10 tied to research contracts (European projects, FUI, ENR, Loire Valley Region, Valeo, BRGM, DGA and Vitres), 9 CIFRE sponsorships (5 Renault, Charier, FNTP-Eiffage, Méca, Arcelor Mittal, Areva, Schlumberger, RFF, Cerib), 2 jointly supervised theses (France/Senegal and France/Chile), plus 11 other externally-financed theses

including RST network personnel (IPE4A, ITPE or IPEF, active employee status).

A large majority of theses are supervised by a thesis director named by the organisation, and the registered doctoral schools are connected with the sites of the host teams (the schools SIE and MSTIC at the University of Paris-East; and schools SPIGA, STIM and MPL affiliated with the University of Nantes-Angers-Le Mans for a total of 43 doctoral students). This result stems from the scientific policy adopted at the LCPC level since 2006, which consists of better integrating departmental research groups into the local university fabric via thesis supervision with research oversight by either LCPC staff or local academics.

4 new doctoral students, enrolled for the 2010-2013 period, entering into an LCPC doctoral contract have received a teaching post, with the UPMC Sorbonne Universities, UPEC (Créteil, for two of them) and UPE-MLV (for the other two). ■

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THESES SUCCESSFULLY DEFENDED IN 2010



2. SCIENTIFIC AND TECHNICAL FIELDS

INTRODUCTION TO THE SCIENTIFIC FIELDS: THE TREMENDOUS ASSET OF POSSESSING A SYSTEMIC AND MULTIDISCIPLINARY APPROACH

As a precursor to their merger, INRETS and LCPC worked throughout 2010 on a mutual adaptation of their research activities, which on the whole display very broad scientific coverage throughout the transport chain, from facility construction to actual use and impacts. As a sequel, the task of defining Ifsttar's scientific strategy will be the focus of 2011.

This report presents an assessment of year 2010 accomplishments for each research orientation, by overlapping the scopes of projects undertaken by both institutions, whose objectives tend to be similar and/or consistent, rather than proceeding by two separate assessments.

Orientations under headings "W" (Conserving Energy and Natural Resources) and "1" (Mobility, Energy and the Environment) target research on energy consumption patterns, environmental impacts over various time scales and current construction-related challenges. Orientation headings "R" (Expertise in Assessing Durability, Risks and Nuisances) and "2" ("Transport System Quality, Safety and Optimisation") encompass

studies on transport system organisation, durability and risk management. Lastly, orientation "S" ("Ensuring Road Safety and Modernising Transport Infrastructure") places emphasis on efforts in connection with transport safety, an area that also takes the spotlight in orientation "3" ("Transport and Health").

We can already state that beyond establishing a more comprehensive set of topics, Ifsttar's mark on future research programmes will be a reliance on systemic approaches that by their nature provide for a multidisciplinary framework. A major advantage with research output by Ifsttar teams (SPI, STIC, SHS and SDV) lies in the effective cross-referencing of disciplines as well as a systematic incorporation of human factors. These characteristics are already noticeable in the assessments presented below of each orientation's contributions.

Let's also commend the Institute's teams for their outstanding reactivity during 2010 in submitting responses to calls for future investment programme initiatives, which will definitely shape the course of future research in this field.

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350

NUMBER OF ARTICLES
ACCEPTED IN "A"-RATED
INTERNATIONAL REVIEWS

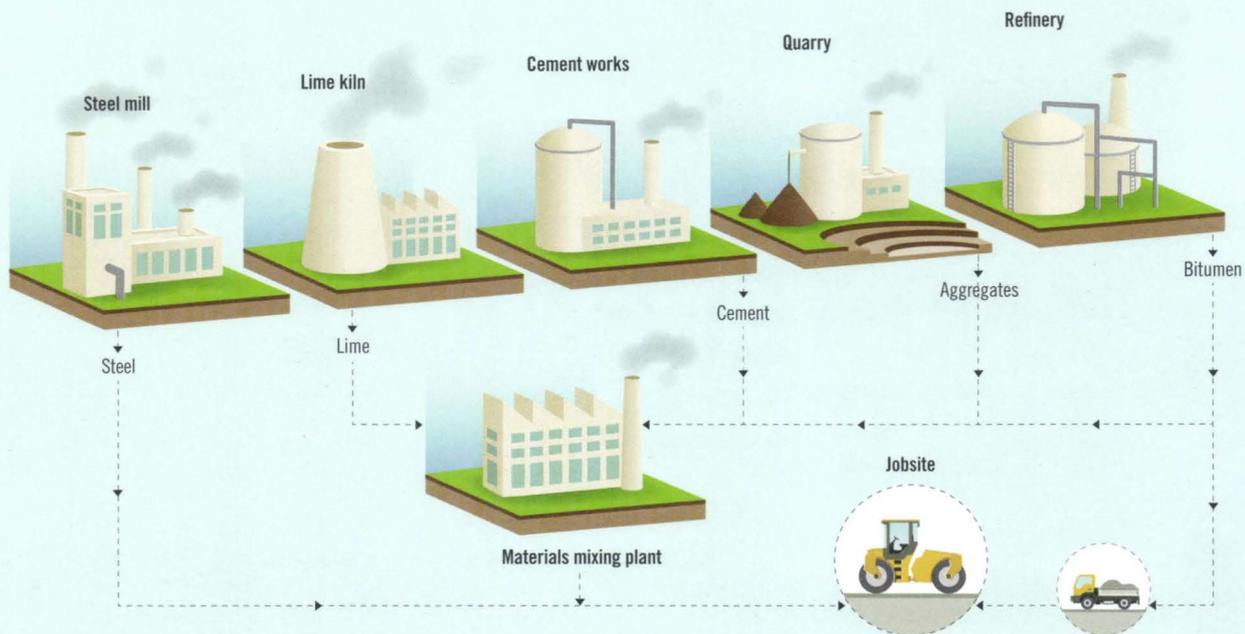
31

NUMBER OF BOOKS
PUBLISHED

72

NUMBER OF DOCTORAL
THESES DEFENDED

Research orientation W: Conserving energy and natural resources	30
Research orientation 1: Mobility, environment, energy	34
Research orientation R: Expertise in assessing durability, risks and nuisances	38
Research orientation 2: Quality, safety and optimisation	42
Research orientation S: Ensuring road safety and modernising transport infrastructure	48
Research orientation 3: Accident analyses, biomechanics, health	52



Origins of the various road components.

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RESEARCH ORIENTATION W/ CONSERVING ENERGY AND NATURAL RESOURCES: LCPC'S EFFORTS AND GRENELLE ROUNDTABLE CHALLENGES

SAVING ENERGY AND REDUCING GREENHOUSE GAS EMISSIONS ARE TWO PRIORITIES CLEARLY PROCLAIMED BY THE MINISTRY OF SUSTAINABLE DEVELOPMENT, WITH A TRIPLE OBJECTIVE ADOPTED FOR YEAR 2020 REGARDING THE NATION'S ENERGY AND CLIMATE POLICY:

- ▶ 20% FEWER GREENHOUSE GAS EMISSIONS.
- ▶ 20% LESS ENERGY CONSUMPTION.
- ▶ A RISE FROM 9% TO 23% IN THE PROPORTION OF RENEWABLE SOURCES IN TOTAL ENERGY CONSUMPTION.

Sequestering CO₂ during concrete demolition and then storing it, along with developing hydraulic binders with lower CO₂ emissions, introducing low-energy asphalt products or substitutes, optimising the transport of building materials (aggregates, fill) so as to limit both energy consumption and CO₂ emissions, utilising the full surface geothermal potential, taking advantage of the road as a solar panel, converting vibrational energy from structures into electrical energy and lastly contributing to expanded wind energy resources by establishing rules for their foundation design, offer a wide array of practical proposals crafted by LCPC and the RST technical network to meet the next decade's challenges.

As regards resource savings initiatives, this topic corresponds with the intentions of the Ministry of Sustainable Development to conserve resources (water and mineral-related) and preserve natural environments. Such an environmental objective is tied to an economic objective as well, in recognising that biological diversity and natural resources contribute directly to the global economy at a rate of over 40%.

Here again, LCPC's efforts, in conjunction with the RST network, have advanced towards this objective through a set of actions focused on: deriving savings from material use (whether in engineering structures or buildings), raising the rate of onsite material recycling and reducing water consumption, optimising the use of mineral fossil resources in bitumen, or enhancing waste reuse. The technical and environmental knowledge base on resources and processes available for infrastructure (i.e. the OFRIR+ base), developed with support from the ADEME Agency and accessible via the Website <http://ofrir.lcpc.fr>, creates the opportunity to share with industry and project owners information on the state-of-the-art relative to a whole host of methods, indicators and properties specific to materials and structures. A comprehensive vision is being sought, along with an evaluation of the ecological footprint of engineering projects, in addition to incorporating environmental parameters as of the design phase, whether the project focus be road or rail.



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Green Concretes

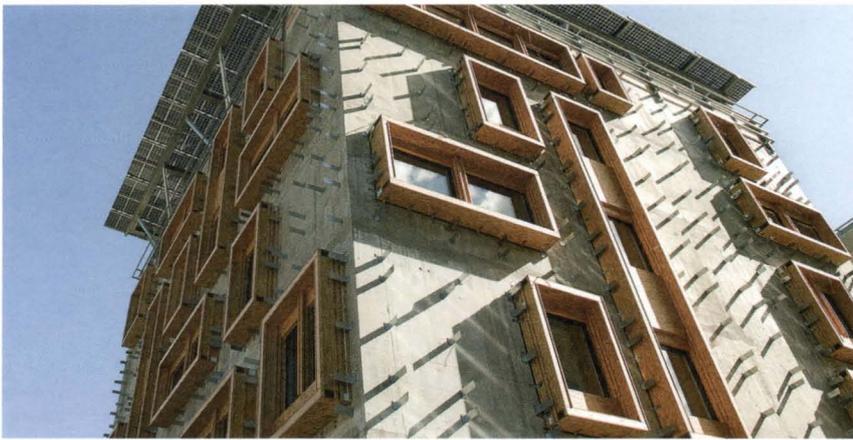
The research project entitled “Green Concretes” was launched in 2006 and wrapped up with a seminar held on December 21st, 2010 hosting an audience of over 150. This project addresses a current context in which concrete is responsible for approx. 5% of all CO₂ emissions associated with human activity, where these emissions stem primarily from cement. The research therefore was directed at

integrating environmental considerations at the concrete material scale. Tasks included evaluating the environmental impact of concretes designed using common materials and then studying the possibilities offered by innovative components in terms of both environmental impact and concrete performance.

The project was organised according to a 4-point outline, featuring: an evaluation of the

environmental impact of concrete; analysis of new binders capable of mitigating this impact; reuse of industrial by-products or wastes as concrete mix components; and the *in situ* placement of concrete offering environmental advantages. Several joint venture projects have provided the opportunity to study the behaviour of a super-sulphated cement (Holcim), as well as a sulpho-aluminous clinker (Italcementi) and granulated blast furnace slag (Ecozem). Thanks to the involvement of various regional CETE technical centres (Lyon, Western France and Paris), a number of studies conducted *in situ* have proven capable of formulating and introducing concretes composed of either demolition aggregates or metakaolin.

On the whole, these research efforts have yielded a better perception of the environmental impact of concrete and its production process. It has also been shown that the generation of alternative solutions can entail a drop in performance whose effect would need to be evaluated. ■



Example of a construction project with a mitigated environmental impact.

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An experimental worksite for testing green concretes

At the beginning of 2010, LCPC set up an experimental project site to demonstrate the correlation between performance obtained from concretes with limited environmental impacts and contemporary construction processes.

It was recently revealed⁽¹⁾ that in light of the priorities defined during the Grenelle Environmental Roundtable, the technological progress achieved with concrete has resulted in a decrease of traditional cement quantities required. An interesting finding especially given the fact that this component accounts for nearly 80% of both the “climate change” and “energy resource consumption” impacts for every cubic metre of concrete cast.

Research described in the literature has made it possible to derive materials with mitigated environmental impacts that still display a mechanical performance adapted to the ultimate function. On the other hand, the corresponding production process caused modifications to

Reinforced concrete shear wall incorporating slag and cast on a slab that had been mixed while adding fly ash.

the mix design that are hard to reconcile with maintaining a high level of fluidity. Moreover, such design modifications hindered the development of early-age strength and rapid formwork removal, two traits that offer compatibility with industrial building schedules.

With the aim of assuaging concerns raised over the use of these new materials, an experimental worksite was set up in collaboration with VINCI and SIKA during the winter season 2009-2010. At this site, a series of concretes whose cement content had been substituted for up to 60% by industrial waste (e.g. slag, fly ash) were applied in order to fabricate the vertical load-bearing elements. The polymer combinations served to obtain higher fluidity for 90 minutes followed by a sharp increase in strength, which in turn allowed, in spite of the extremely low temperatures, a fast rotation of formwork tools. ■



(1) Habert Guillaume and Rousseau Nicolas, Study of two concrete mix design strategies to reach carbon mitigation objectives, *Cement & Concrete Composites*, 31 (2009) 397-402.

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Understanding the sedimentation phenomenon in view of improving concrete performance

Concrete homogeneity (i.e. granular distribution within the cement matrix) serves in part to substantiate the mechanical performance exhibited by the material. The sedimentation phenomenon observed in certain concretes is indeed capable of weakening the material.

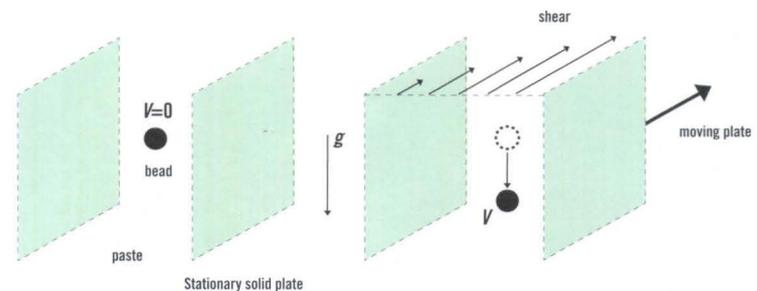
Improving both the mix design and placement of new concretes requires a thorough understanding of this phenomenon. The Navier Laboratory launched an experimental campaign to achieve this specific purpose. By inserting a rheometer into the Institute's exceptional Magnetic Resonance Imaging facility dedicated to civil engineering applications, the behaviour of glass beads within model concrete specimens could be detected (velocities, spatial distribution). This particular study¹ revealed that while sedimentation does not occur in paste while at rest, it is distinctly present

(1) G. Ovarlez, Q. Barral, P. Coussot, *Three-dimensional jamming and flows of soft glassy materials*, *Nature Materials* 9, 115-119 (2010).

once this fluid starts to flow. The observations recorded could be modelled based on equations of a Newtonian fluid by adopting as viscosity the apparent viscosity of the yield stress fluid.

The research performed has led to predicting grain sedimentation velocity as a function of the particle size and mechanical behaviour of a

concrete or mortar specimen. This breakthrough constitutes a first step towards optimising the mix design and placement technique for new concretes. By enhancing concrete performance, it then becomes possible to introduce smaller quantities, thus leading to material and energy savings. ■



Modelling of the observations derived from Newtonian fluid equations.

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BADIFOPS: In pursuit of an in-depth experimental knowledge of ultra-high performance fibre-reinforced concretes (UHPFRC)

Prevalent over the past ten years or so, this UHPFRC category of concretes offers remarkable mechanical and durability qualities that open the possibilities for lightweight, durable structures using fewer material resources. Often associated with a high level of prestressing, these structures display a behaviour that has yet to be determined with precision when adding passive reinforcements to the composition. More specifically, no reliable method currently exists to predict either the opening and spacing of cracks or the ensuing ductility. These shortcomings have limited the potential applications of the material in buildings and engineering structures.

The BADIFOPS project, adopted by the RGC&U network of Civil and Urban Engineers in 2010, has been geared to implement "simple" tests in order to better control UHPFRC cracking caused by adhesion with passive reinforcements, through use of optical fibre instrumentation among other approaches. This more detailed experimental knowledge base must allow for completing the set of design rules and proposing preliminary layouts



that demonstrate the structural benefit, material savings and design robustness, especially as regards earthquake-resistant applications.

This project, subsidised by the Ministry of Sustainable Development at a cost of €816,000 and supervised by LCPC, has also involved the EIFFAGE company and the CSTB and SETRA research bodies. ■

Pseudo-ductile, multi-cracking behaviour of a structure composed of an ultra-high performance fibre-reinforced concrete observed during a beam shear strain test conducted on the LCPC-Paris structural testing platform.



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Rail research on the right track

A research partnership was signed between the RFF rail infrastructure operator and LCPC with the goal of improving the level of carbon energy efficiency of rail capital investments. This objective involved a review of proposals to modify the design and operating protocol for high-speed lines as well as the primary lines constituting the national rail network. The intention here is to promote project technical design, with an emphasis on geometry (profile,

curvature, etc.), works scheduling and operating modes (e.g. velocity).

RFF provides the benchmarks, technical data and a CIFRE scholarship to fund doctoral theses. To measure actual consumption quantities, tests on the new lines' rolling stock will be conducted. LCPC makes available its renowned methodology for measuring environmental impacts as well as its various vehicle models to perform consumption estimations. ■

Construction base for the Rhine-Rhone high-speed line project.



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Streamlining earthworks to promote resource-friendly and sustainable structures

Earthworks give rise to a large portion of the total cost of road and rail projects and moreover attract strong interest from the field of applied research. Project owners are in fact concentrating on cost reductions and mitigation of new project impacts on material resources and energy expenditures, not to mention structural quality and durability improvements.

The French experience in the field of earthworks has, until the recent past, been characterised by a preference for basic empirical aspects. As a result, the prescriptions deduced

from previous experience cannot be readily extended to new situations not yet encountered. To allow for such an extension, up-to-date research on soil treatments and hydraulic binders, plus the development of innovative approaches focusing on *in situ* material applications, has been undertaken through reliance on a more scientific strategy within the scope of national projects (TerDOUEST, MCTF) or regional initiatives (MICATT and NDDL).

The outcome of these efforts has provided a better understanding of the physicochemical aspects of the mechanisms that trigger hydraulic setting in fine-grained soils treated with lime and/or hydraulic binders, in addition to a more refined definition of the conditions required to guarantee treatment durability. Other outcomes have been to modify Standard NF P 94-100 (test of soil capacity to undergo treatment) and lay out the short-term reuse possibilities following treatment of marginal natural materials that until now had been left in storage depots (e.g. mica-shale alterites, highly plastic clays).

Moreover, it appears that the continuous measurement of geotechnical parameters required for earthworks monitoring is feasible by virtue of innovative processes (contribution to developing onboard intelligence for the worksite equipment of tomorrow). ■



Instrumentation of the reference embankment built with treated soil as part of the TerDOUEST project.



Development of cementitious compounds on a quartz grain from a fine-grained loamy soil (observation using scanning electron microscopy).

DOCTORAL THESIS DEFENCES

Bérengère Lebeval - MACS / CEA LETI

Real-time analysis of the microstructure of a cementitious material (concrete) by developing an immersed submicron acoustic imaging technique that relies on a distribution of microsonars within the medium.

Tangi Le Borgne - GER

Characterisation and quantification of elements disturbing the setting process during a soil treatment procedure.

Laetitia Martinie - MAT

Prediction of fibre direction during placement of a cement composite material.

Nicolas Maubec - GER

Characterisation of lime-clay interaction mechanisms during soil treatment: Physicochemical and mechanical couplings.

Viet Anh Nguyen Trung - NAVIER

Design of wood core bridge sandwich slabs.

Valérie Viranaiken - MAT

Study of smoke emissions generated during the production of hydrocarbon mixes.

Deniz Yilmaz - GER

Unsaturated hydrodynamic characterisation of alternative materials used in road construction: Experiments and instrumentation.



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RESEARCH ORIENTATION 1 / MOBILITY, ENVIRONMENT, ENERGY: A CIVIL ENGINEERING DISCIPLINE REINVENTED TO SAVE ENERGY AND MITIGATE ENVIRONMENTAL IMPACTS

OBSERVE AND ANALYSE MOBILITY AND LAND USE TRENDS
EVALUATE TRANSPORT SYSTEMS AND THEIR ORGANISATION
REDUCE ENERGY CONSUMPTION AND ENVIRONMENTAL IMPACTS FROM VEHICLES.

Research orientation 1 encompasses the activities of four research units (DEST, LTE, LTN-Satory and SPLOTT) and one joint unit (LVMT). Three objectives laid out in INRETS' 2010-2013 four-year financing contract make specific reference to this orientation. The research programmes presented herein illustrate some of these units' contributions, yet are far from covering their entire scope. The reliance on new technologies (GPS and data generated from mobile phones) to observe mobility trends and analyse relations with the regional level are prevalent among the current topics under study. Research focusing on clean and efficient vehicles (i.e. electric and hybrid), from both a technological and socioeconomic perspective (acceptability, market potential), is being ascribed greater importance, along with the effort to introduce innovation into mobility systems.

Safety and security, in addition to risk perception within transport services, have also given rise to a number of research endeavours.

Analyses of environmental nuisances (noise, air pollution, greenhouse gas emissions) on humans remain a key challenge, as does the development of appropriate environmental indicators (according to a multi-nuisance approach) and, more broadly, the problem of devising an environmental evaluation protocol.

Lastly, transport system durability (design, operations, use) and regional systems lie at the core of this orientation's concerns, as evidenced in particular through: modal choice, modal shift, multimodality, intermodality, workplace organisation, tradeoffs between transport and land use, transport-related greenhouse gas emissions, and correlations between energy pricing, trip-making behaviour and locational decisions.



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PLATHÉE: A platform for energy efficiency and environmentally friendly hybrid trains

The major objective of this project was to identify and to evaluate new technologies for electrical energy in order to reduce strongly consumption, pollutant and CO₂ emissions for ICE urban railway locomotives.

New technologies used are electrical generator like biodiesel group and PEM fuel cell system, for energy storage it was used a association of batteries and supercapacitors, energy flux between traction motor, generator and storage system was managed thanks to compact and modular power converters using the last technology of the power IGBT module, capacitors and inductances.

This platform was designed based on a standard existing shunting locomotive body equipped with electrical motor and completely re-designed for this new electrical topology. One of this original study was to establish and design different algorithms for the energy management based on the simple concept of delivering energy for the travel by the generator, and energy storage system deliver peak power for acceleration and short time thrust.

IFSTTAR-LTN was strongly involved on the design of the innovative power converter, the supercapacitor characterisation and choice, and the investigation on the energy management validation.

Results of the tests in railway conditions show a strong gain on energy consumption (20% for



long distance, 40% for shunting works, 85% at parked situation). Pollutant emission reduction is expected to 60 to 99%, CO₂ reduction 20 to 40%.

This project as tramway project STEEM equipped with supercapacitor energy storage, show the strong advantage of the on board energy storage for urban transportation system. ■

A rail platform for evaluating both the energy and environmental gains from the use of new energy technologies.

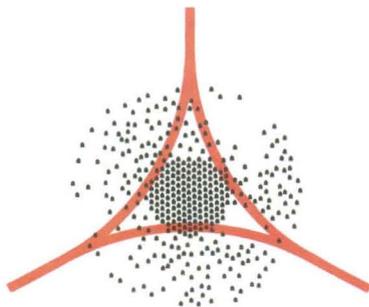
INRETS CONTACT: caroline.gallez@ifsttar.fr

Myths and practices in achieving transport-planning coordination: Contrasted views of four Swiss and French metropolitan areas

Enhanced coordination between transport services and planning priorities has received considerable attention among professionals as well as researchers and land development actors. Far from being a recent concern, this topic has once again been brought to the forefront by the notion of sustainable development with the emergence of new challenges.

At this point, how have actors involved in overseeing local urban development and transport policy been assimilating the changing perspectives over the past decades, in making the transition from a city designed to suit the automobile to the sustainable city? This research, financed by both the CNRS and Ademe Energy and Environment Agency, compares

four Swiss and French metropolitan areas: Bern, Geneva, Strasbourg and Bordeaux. Urban planning and transport policy directions, as charted over the past 50 years, serve to identify the set of factors favouring change or, on the other hand, factors explaining the preference to maintain the same political choices. ➤



◀ Urban planning - transport coordination concept, Report by Walther and Leibbrand, Bern, 1954.

Action plans adopted are heavily influenced by national cultures and their ramifications in the various local contexts. The impact of regional reforms on policy changes must be examined with great care. The creation of institutions that integrate planning and transport competencies at the metropolitan scale is not a sufficient step to

proceed with implementing coordinated policies, as exemplified in the cases of Strasbourg, Bordeaux and Geneva. In contrast, Bern's approach proves that coordination between transport and urban planning can take shape outside of any kind of formalised institution. Far from the static images associated with the notion of a planning - transport balance, coordination appears as a process for smoothing over differences between network development, corresponding use patterns and urban growth. ■

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Logistics sprawl in Atlanta

For the past ten years, major US cities such as Atlanta (fifth economic centre of the country) have experienced a rise in their position as logistics hubs. At the same time, the relative position of smaller cities and rural areas was decreasing. Even traditional logistics areas such as port-cities (i.e. Savannah for the south-east) have been 'by-passed' by freight flows, containerised goods being carried directly from import ports towards major distribution centres (DCs) close to consumer markets.

In Atlanta, the number of warehouse and logistics facilities increased by 240% between 1998 and 2008. Inside metropolitan areas, these facilities increasingly locate at the metropolitan fringe. This phenomenon is referred to as 'logistics sprawl': in Atlanta, between 1998 and

2008, the average distance of warehouses to their barycenter has increased by 3 miles, while the average distance of all establishments to their barycenter has increased only by half (1.5 miles).

Local governments have not yet taken these evolutions and their impacts (increased truck-miles and congestion) into account. Three counties have been observed. For the first county, central but with logistics facilities located in a poor area, logistics activities bring good jobs and revenues for the county. They wish to consolidate and further develop these activities. The second county, newly urbanised and 30 miles south of Atlanta's downtown, has established mega distribution centres (over 500,000 square feet) as a niche they wish to develop. The third

county, in the north and already very developed, wishes to stabilise and ultimately reduce the importance of logistics facilities to focus on tertiary developments in the future. ■



▲ A very busy market of very large-sized distribution terminals in the vicinity of Atlanta (Henry County, in the southern metropolitan area).

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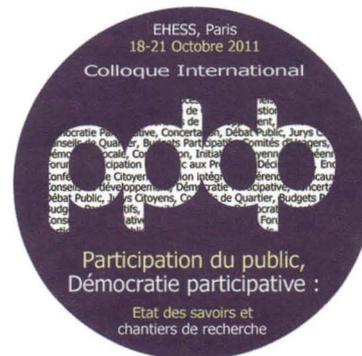
National research group on Participatory Democracy and Public Participation in Decision-Making: Assessment and prospects

The group, chaired by the Institute for Humanities and Social Sciences of CNRS (National Centre for Scientific Research), aims to develop research on participatory democracy and public participation in decision-making processes. It promotes the coordination, the exchange and the sharing of research work that each associated partners (14) and laboratories (55) undertakes. The success of the first doctoral days illustrate the vitality of the research field in France, its opening set of themes and scientific disciplines. The growing activities of the Group intend to shape this field, especially with a new academic review, *Participations* (De Boeck).

The Group focuses on citizens' contribution, beyond their usual involvement in the institutional political life, to choices about society. Its research

work covers all the fields where collective movements meet processes of institutionalisation aiming at the inclusion of the citizens in the working-out and the implementation of public action and decision.

The Group thus constitutes the favourite tool for dialog between the community of social scientists (at CNRS, IFSTTAR, INRA, CEMAGREF, CIRAD), the institutions and companies that have to implement public participation in decision-making processes (ADEME, the French Environment and Energy Management Agency; ARF, the Association of French Regions; CNDP, the National Commission of Public Debate; RFF, the National Rail Network; RTE, the French Electricity Transport Network; EDF Inc., the French Electricity Board), and the civil society (FNE and ADELS). ■



▲ The Scientific Research Group holding its first Congress in October 2011.



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Indicators of environmental sustainability in transport



The work carried out in the frame of the COST 356 action "EST - Towards the definition of a measurable environmentally sustainable transport" and published in May 2010 (INRETS report n°282) tries to answer the following questions:

- ▶ How can environmental impacts of transport be measured?
- ▶ How can measurements be transformed into operational indicators?
- ▶ How can several indicators be jointly considered? And how can indicators be used in planning and decision making?

Firstly we provide definition of indicator of environmental sustainability in transport. The functions, strengths and weaknesses of indicators as measurement tools, and as decision support tools are discussed. We define what environmental sustainability in transport may mean through the transport system, the concepts of sustainable development and of environment. The concept

of chain of causality between a source and a final target is developed, as a common reference for indicators and assessments. As the decision making context influences the perceived and actual needs for indicators and methods, we also analysed the dimensions and context of decision making. We derived criteria and methods for the assessment and selection of indicators of environmental sustainability in transport, in terms of measurement, monitoring and management. The methods and the criteria are exemplified for seven chains of causality.

Methods for a comprehensive joint consideration of environmentally sustainable indicators are analysed and evaluated. They concerned aggregated or composite indicators as well as multi-criteria methods. Five case studies are presented.

Finally, recommendations for continued research and development of indicators and joint considerations methods for assessment of environmental sustainability in transport are given. ■

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Project entitled FLUIDE (French acronym for River, City, Intermodality and Durability)

Working towards a service offering durable mobility: France's major river cities and their ports. Comparative study featuring Paris, Lyon, Lille and Strasbourg, plus international comparisons within the framework of the Sustainable Cities programme sponsored by the

ANR Agency. This project is intended to examine how river ports are capable of contributing to the development of a sustainable freight transport system, especially by promoting modal shift in favour of waterways, through the harmonious integration of extensive urban spaces. ■

THESIS DEFENCES

Mohamad Albakjaji - DEST
Pollution of the Mediterranean Sea from hydrocarbons released by maritime traffic.

Thierno Aw - LVMT
The new town of Marne-la-Vallée and its integration into the Paris Region's urban dynamic: Evaluation of the pros and cons for consolidating a polycentric layout of urban transport systems.

Faïcel Chamroukhi - LTN
Latent process regression used in curve modelling, classification and tracking.

Alexis Conesa - LVMT
Modelling of metropolitan transit networks as part of the regional planning process: Applications to the North - Pas-de-Calais and Provence-Alps-Riviera Coast regions.

Nicolas Coulombel - LVMT
Towards a better representation of housing demand: Study of the role of monetary and non-monetary costs in households' residential strategies.

Virginie Dejoux - DEST
Mobility impairment: Individual characteristics, mobility practices, the physical and social environment.

Felipe Garcia Castello - LVMT
Mobility of individual consumption: Systemic analysis and disaggregated modelling elements.

David Guerrero - SPLOTT
Zones of influence for French ports: Between models of network and gravitation.

Florent Le Nechet - LVMT
A multi-scalar approach to the links between daily mobility, morphology and sustainability in European metropolitan areas: Case studies of Paris and the Rhine-Ruhr region.

Thai Phu Nguyen - LVMT
Design and application of a road information model and its impacts on traffic.

Benjamin Pradel - LVMT
City venues! Temporary use of urban amenities and event-driven city life: The latest urban trends.

Anne-Catherine Rodrigues - SPLOTT
Women lorry drivers: Working careers and relationship to a field whose labour profile has been increasingly shifting.

Gwendal Simon - LVMT
Tourist practices in the Paris metropolitan area: An analysis of intra-urban movements.

Sébastien Wasterlin - LTN
Experimental approaches and probabilistic analysis for the diagnosis of a PEM-type fuel cell.

Shuning Yuan - DEST
GPS data analysis methods in individual mobility surveys: Missing data and their estimation.

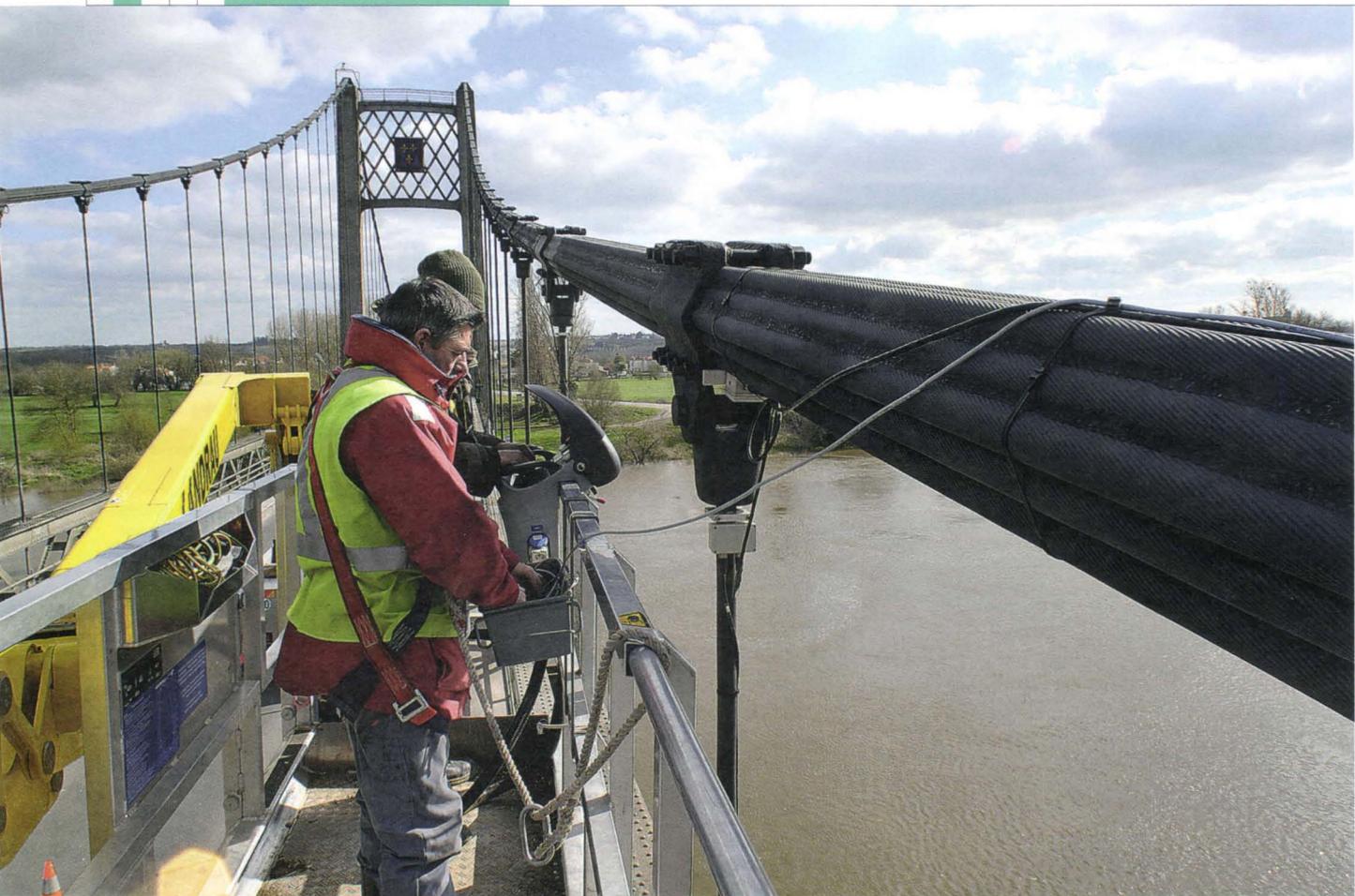
Thomas Zeroual - SPLOTT
Can sustainable transport policies promote clean freight transport? Application to the retail sector in the North - Pas-de-Calais region.

ACCREDITATIONS TO SUPERVISE RESEARCH ("HDR" CERTIFICATION)

Anne Aguilera - LVMT
Employment, mobility and space.

Jean Debrie - SPLOTT
Contribution to a public action-based geography: Transport between networks and regions.

Latifa Oukhellou - LTN
Diagnosis by means of shape recognition: Contributions of generative models and merging techniques in a situation of imperfect labelling.



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RESEARCH ORIENTATION R/EXPERTISE IN ASSESSING DURABILITY, RISKS AND NUISANCES

AS WITH OTHER RESEARCH ORIENTATIONS UNDERWAY AT THE LCPC LABORATORY, ORIENTATION "R" (ENTITLED "EXPERTISE IN ASSESSING DURABILITY, RISKS AND NUISANCES"), WHICH STARTED UP IN 2010, HAD A BUSY YEAR LOGGING 23 RESEARCH PROJECTS AND 7 SEPARATE DEVELOPMENT PROJECTS.

The entire volume of research conducted under this heading involved some €11 million in LCPC's own resources and another €4.6 million directly allocated, with 9 of the projects corresponding to activities sponsored by the RST scientific and technical network with a direct link to this orientation. Given the scope of these efforts, research orientation "R" accounted in 2010 for a large share of LCPC's overall activity, especially given its focus on: infrastructure sustainability, structural life cycle extension, material pathology studies, natural hazard mitigation, and nuisance and impact control. Several major projects were concluded in 2010 with sizeable contributions to the knowledge base. Among them, the "Sécheresse" project explored the effects of drought on buildings. "Sécheresse 2", scheduled as a follow-up for launch in 2011, will specifically investigate clay shrinkage and swelling, as part of a framework agreement signed with the INERIS Institute.

The Suburban Basin Hydrology project, wrapped up in 2010, will be succeeded in 2011 by a research mission intended to incorporate hydrological risks at the global scale, for which a

cooperative venture with the Météo France Weather Agency has already been initiated.

The Durability and Ageing of Polymers for Civil Engineering Applications project also came to a successful completion in 2010; its results served to develop a number of behaviour prediction models specific to these more recent polymeric materials, whose ageing phenomena remain relatively unknown.

Among the other studies completed during 2010, let's cite advances on the characterisation of soils and linear structures by means of electromagnetic methods (as a substitution for the nuclear methods currently in use, which have given rise to a number of risks and constraints).

Moreover, a new action campaign based on a novel and up-to-date approach, under the banner "CCLEAR", was prepared during 2010. This project, which is aimed at minimising the impact of climate change on transport infrastructure, will take shape over the period 2011-2013 and is expected to produce recommendations regarding methods and design techniques currently in use.



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Multilevel platform for modelling the durability of concrete structures

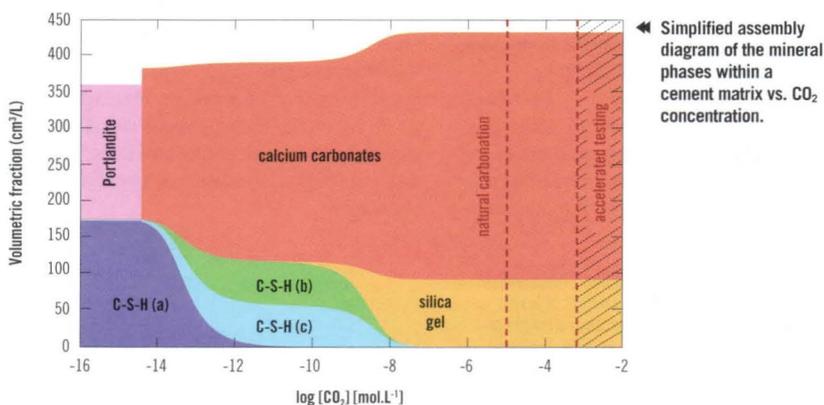
Within the Materials Department, the "Microstructure, Sustainability and Modelling" Group has been working on predicting the life cycle of concretes exposed to the penetration of harmful agents such as atmospheric carbon dioxide or chloride ions. It is recognised that a performance-based approach has been ongoing since 2004 focusing on sustainability issues using a series of laboratory-measured indicators.

Yet concrete mix designs have in the interim become much more complex and presently contain a wide array of additives (e.g. fly ash, slag, silica fume, limestone filler) in order to satisfy the requirements to reduce greenhouse gas emissions.

Against this backdrop, building models capable of quantifying the life cycle of concrete structures is now considered a necessity. The objective here is threefold: contribute to understanding the

mechanisms at work, provide the possibility of predefining concrete mix designs able to meet the imposed life cycle criteria; and reduce the costs associated with laboratory testing.

A platform for modelling the physicochemical processes of concrete deterioration, when exposed to external aggressions, has been developed at LCPC. This tool has been devised in collaboration with the Navier Laboratory by running the finite volume computation code called "*Bil*" (designed by Patrick DANGLA), in conjunction with the Matlab® software. Model output via this platform integrates the various physicochemical mechanisms inventoried and underscores the complex couplings taking place between transfers (water, ions, water vapour) and chemical reactions (hydration, carbonation). Various modelling levels are indeed available: first "engineering" type models, then an intermediate category whose purpose is to identify durability indicators by means of an inverse analysis of experimental results, and lastly comprehensive models. First-level models have been set up as probabilistic to account for variability in model input data. ■



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Urban sound mapping simplified through use of a GIS software package

Since enactment of the December 30th, 1996 Law on Air Quality and the Rational Use of Energy (LAURE), conurbations with over 100,000 population are required to adopt an urban transportation plan (PDU) with the aim, among other things, of reducing the impact of transport facilities and services on the environment.

This same law also stipulates a re-evaluation of the PDU Plan every 5 years, though it did not set forth the specific procedure to follow. Sponsored by IRSTV⁽¹⁾ in coordination with the Nantes Metropolitan Government, the ANR Eval-PDU (2008-2012) project has pursued this mission by gathering several research actors specialised in environmental issues. The "Acoustics" team with the UR EASE unit (part of the IM Department) joined in the proceedings of the IRSTV's GIS⁽²⁾ workshop in order to craft an approach for producing new noise maps adapted to address local challenges.

As opposed to the conventional tools that had been used until now within the scope of European Directive 2002/49/EC relative to evaluating and managing environmental noise, this latest approach features full integration

within a dedicated GIS freeware (OrbisGIS), along with simplified computations and an algorithm optimisation routine for producing noise maps.

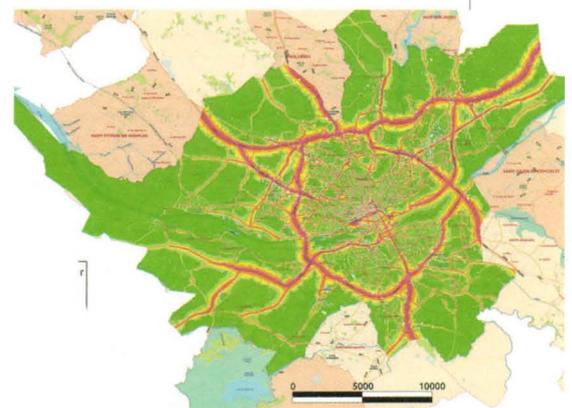
This new strategy results in noise maps at the scale of a large conurbation like Nantes, while offering a significant reduction in computation time (down to a few hours vs. several days when implementing conventional tools). This substantial savings makes it possible to compare a number of PDU scenarios within a relatively short time period, which corresponds to the constraints imposed by a decision-making process. Along the same lines, the services currently developed around the OrbisGIS software will soon provide local and regional authorities with the opportunity to generate their own noise maps by directly using the resources of a Web service and then distributing their maps through new dynamic media available for consultation (geospatial PDF, interactive Internet map). ■

(1) IRSTV: Acronym for the Urban Scientific and Technical Research Institute (CNRS 2488 Research Federation designation), whose members include LCPC.

(2) Geographic Information System (GIS).

(3) Lden: Noise level indicator, in compliance with European Directive 2002/49/EC.

Lden⁽³⁾ sound level, measured in dB(A) of road noise in either the city of Nantes or the Nantes metropolitan area, as calculated according to a simplified approach that has been incorporated into a GIS software (OrbisGIS). This ANR-sponsored project "Eval-PDU" is supervised by the IRSTV Institute⁽¹⁾.



2002 Road Lden indicator



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European project ISTIMES: Experiments at the Montagnole rockfall test station

One of the objectives of ISTIMES project (www.istimes.eu) is to evaluate the potentialities offered by the integration of different electromagnetic techniques able to perform non-invasive diagnostics for surveillance and monitoring of transport infrastructures. Experiments in controlled conditions are so necessary to analyse the characteristics and potentialities of diverse EM sensing techniques for the infrastructure monitoring. The full-scale rockfall test station of Montagnole (French Alps)

owned by IFSTTAR has been so used to practise such test. Test were carried out on a reinforced concrete beam (16 m long and 21 tonnes) laid on two pillars screwed on two foundation structures realised at ground level.

Experiments addressed the progressive damage, at different stages, of this structure submitted to falling blocks impacting the soil close to its foundations (indirect impact) and in a second phase directly onto the structure.

Steel blocks of 2.5 and 10 tonnes were used and two falling actions scenarios were unrolled:

- ▶ Impacts onto ground at 5m from the North pillar: 12 launches from 100 kJ up to 6000 kJ.
- ▶ Direct impacts onto beam at 6m from beam North extremity: 4 launches from 25 kJ up to 125 kJ.

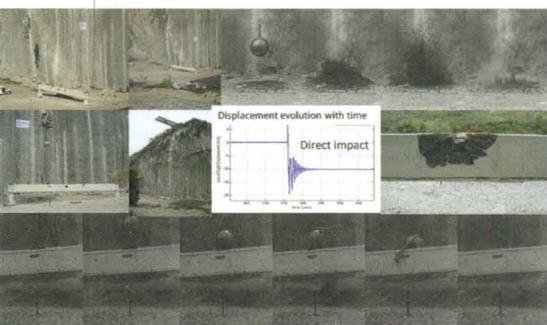
The follow-up of ground evolution before and after solicitations was realised by ground penetrating radar and electrical resistivity tomography.

Additional measurements with geophones were also realised.

Beam displacement follow-up under impact (and eigenmodes by post-processing) was realised with a high speed cooled infrared thermography system, an optical displacement system and a ground based synthesis aperture radar. Additional measurements with rapid digital video camera were also realised.

Finally, long time monitoring (night and day) of apparent surface temperature fields were made using an uncooled infrared thermography system. Measurements by ground penetrating radar and distributed optical fibre sensors were realised between impact to monitor the stress and rebar status.

To conclude, during these trials allowed to demonstrate that such methods are able to instantly give information on plastic deformation of the structure. ■



◀ Overview of the structure at the test site - Illustrations of ground impact (10 tonnes from a height of 60 m) and impact on the beam (2.5 tonnes from a height of 5 m) - Displacement measurement vs. time during a direct impact - View of the beam after final impact.

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Presentation of an RGIB module of the "CESAR-LCPC" Finite Element programme

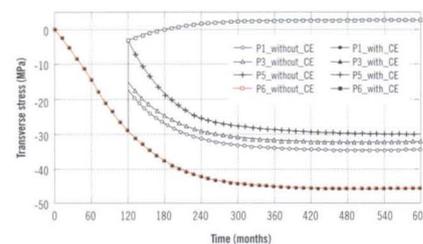
Internal swelling reactions (ISR) can affect hydraulic concrete structures by causing cracking and expansion of the material which lead to degradation of structures mechanical behaviour. These pathologies mainly consist in alkali-aggregate reaction (AAR) and/or delayed ettringite formation (DEF). The modelling of these phenomena in CESAR-LCPC F.E. code was based on a sub program called "ALKA", for AAR, and newly developed sub program called "RGIB" that

allows modelling the behaviour of a structure affected by AAR or DEF. This program takes into account several coupled phenomena: effects of the early age thermal history, anisotropy of the imposed expansion related to the direction of concrete casting, damage resulting from cracking of the material, drying shrinkage and coupling between the expansion and the state of stresses.

Many case-studies have shown that it is necessary to model displacement discontinuities in the concrete, mainly to take into account two phenomena:

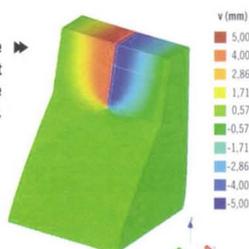
In addition to multi-cracking, observation of isolated cracks with an important opening, resulting from interactions between pathology and mechanical behaviour of the structure. Control of these cracks opening sometimes requires an explicit modelling.

Among techniques available to deal with ISR affected structures, the stress release can be effective (e.g. sawing of dams). To evaluate the potential



▲ Stress release in a dam after sawing.

Transverse displacement after closing the saw cut.



efficiency of this technique, creation of cutting lines in the structure, and reclosing of the cut as a result of subsequent swelling need to be modelled (Figures 1 and 2).

The algorithm development aimed to possibly combine contact elements and non-linear coupled models of durability mechanics related to ISR modelling. ■



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15th-16th June 2010 extraordinary floods in the Var region: Post-flood field gathering of hydrological data

Extraordinary floods occurred on the 15th and 16th of June 2010 in the Var region around the town of Draguignan. This flood event caused 25 death of people, and about 35,000 persons were affected by damages, that were estimated to exceed several hundred millions of euros. The rainfall accumulations exceeded locally 400 mm in 24 hours, and important floods were observed on all the rivers in the region.

Within the Hymex research program and with the support of the SCHAPI department of the French Ministry of Ecology, the Ifsttar organised in October 2010 a field survey involving several research teams. The main objective was to provide peak discharge estimates and information on the chronology of the flood, for all the rivers affected by the event, and given that most of the stream gauge stations had been destroyed by the flood.

These field investigations led to 36 peak discharge estimates that cover the entire



View of the June 2010 flood flow cross-section on the Florieye River upstream of Taradeau.

hydrographic network of the region. This data set has been shared with institutional and research partners of the survey. It will be used for both adaptation of local risk management plans (revision of inundation prevention plans, integration of the Nartuby and Argens rivers into the food vigilance procedure), and further research works about this outstanding event. The Ifsttar is now involved in other post-event studies: hydrological analysis of the event, and contribution to the assessment of return periods of the floods. ■

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Evaluation and diagnostic of building energy performance

LCPC, acting within the framework of the MACS Department, is developing data measurement and processing systems to limit heat losses in buildings while reducing unnecessary energy expenditures.

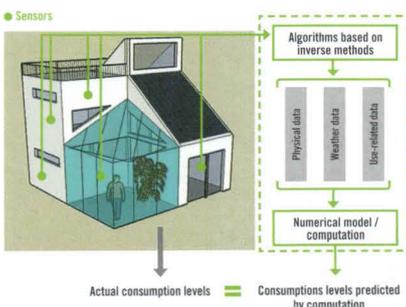
The set of buildings chosen, which are responsible for approximately half the country's energy consumption, actually represent one of the richest sources of energy savings should extensive thermal renovation programmes be implemented. To proceed along these lines, methods will need to be applied that allow accurately assessing building performance and then prudently guiding the ensuing works.

LCPC's efforts have pursued this strategy by developing intelligent instrumentation methods

intended to very closely monitor energy performance over time and identify the intrinsic characteristics of buildings. Such an approach consists of combining the measurements output by a small number of standard, low-cost and non-invasive sensors with a numerical model.

It has been demonstrated that identification algorithms are indeed capable of determining, in real time, the energy status of buildings along with the thermal characteristics of its various components, for the purpose of distinguishing the share of total consumption ascribable to environmental loading from the share due to actual use. These research advances have led, among other things, to a patented device for performing the in situ characterisation of building envelopes.

Several research projects (Immanent, ANR/MEMOIRE as one example) involving renowned partners like CSTB, LEPTIAB and CETE-Western Regional Office are committed to this topic. Partnerships with innovative start-ups (Activity, Solamen) will help disseminate the results of these efforts among industry professionals. ■



Intelligent instrumentation methods make it possible to analyse and accurately predict actual building energy performance.

THESIS DEFENCES

Hassan Ali - GER

Hydromechanical characterisation of natural soils by means of in situ testing.

Gaëlle Baudouin - GER

Foundation soil reinforcement through the use of vertical rigid inclusions.

François Bretaudeau - MACS

Reduced-scale modelling for the purpose of adapting seismic wave shape inversion to civil engineering and at the subsurface.

Khaled Chahine - MACS

Enhancement of the geophysical radar investigation depth by means of signal processing.

Alexandre Cury - SOA

Abnormality techniques applied to a structural health monitoring campaign.

Ahmed Frikha - MACS

Mechanical wave propagation within a continuous cable.

Hussein Khraibani - IM

Exploration of reliability modelling methods for optimising road maintenance policies.

Olivia Leroy - IM

Application of (geo)statistical tools to an analysis of data on acoustic propagation at complex sites.

Renaud-Pierre Martin - SOA

Analysis on mod.

Thi Thanh Nhan Hoang - ERA01 Toulouse

Study of the behaviour of a fractured rocky terrain: Application to the Saint-Béat Tunnel.

Virginie Perrier - SOA

Development and validation of mechanics-corrosion interaction models applicable to civil engineering cables, based on corrosion testing under prestressed conditions.

Jean-Philippe Seguin - MACS

Use of shape memory alloys to control vibrations.

Ahmed Selloum - MACS

Accurate and real-time integrated estimation of the position of a mobile device within a modelled environment in digital card form.

Benjamin Richard - SOA

Mechanical behaviour of concrete structural elements deteriorated by corrosion: Problem areas associated with modelling the steel/concrete interface in the presence of corrosion.

Bao Viet Tran - NAVIER

Micromechanical approach to studying the behaviour of a non-saturated cracked medium.

ACCREDITATIONS TO SUPERVISE RESEARCH ("HDR" CERTIFICATION)

Denis François - IM

Environmental evaluation of road infrastructure: Introduction of local alternative materials.

Ferhat Hammoum - MAT

Contribution of the multi-scale to the study of pavement material durability.

Frédéric Taillade - MACS

Contribution to the detection of "hidden objects": Vision through diffusing media, non-destructive structural controls.

Luc Thorel - GER

Contribution to centrifuge-based modelling.



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RESEARCH ORIENTATION 2 / QUALITY, SAFETY AND OPTIMISATION: SAFE, EFFICIENT AND UNIVERSALLY ACCESSIBLE TRANSPORT SYSTEMS

PROVIDE A NEW TECHNICAL TOOLBOX TO IMPROVE THE SAFETY AND EFFICIENCY OF TRANSPORT SYSTEMS.

PROMOTE A USER-CENTRED TRANSPORT SYSTEM DESIGN.

OPTIMISE THE OPERATIONS AND USE OF TRULY INTERMODAL NETWORKS.

These objectives, written into the INRETS' 2010-2013 four-year financing contract with the State, refer to research orientation 2, which combines the activities of five laboratory units (GRETTIA, ESTAS, LPC, LESCOT and LEOST) as well as three joint units (LICIT, LEPSIS, LIVIC).

This orientation offers a major advantage by associating an Engineering Science approach with a Human and Social Sciences perspective in order to evaluate or design technical objects in addition to building system optimisation models. The array of groundbreaking results published during 2010 and presented herein provides a partial glimpse of the extensive output of teams affiliated with this 2nd research orientation.

Efforts expended in this domain are also noteworthy for their tremendous contribution to the VERONESE project, with among other things the implementation of collective actions shaped around topics such as "green driving", the evaluation of communication and localisation technology, and simulation platform development.

Other successes in 2010 include: mobilisation of several laboratories working on this orientation within the European NEARCTIS network of excellence, whose accomplishments feature a final state-of-the-art assessment in the field of "cooperative systems" and the launch of a series of strategic debates on comprehensive inter-organisational research programmes at the European scale.



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Two-dimensional modelling of traffic in dense road networks

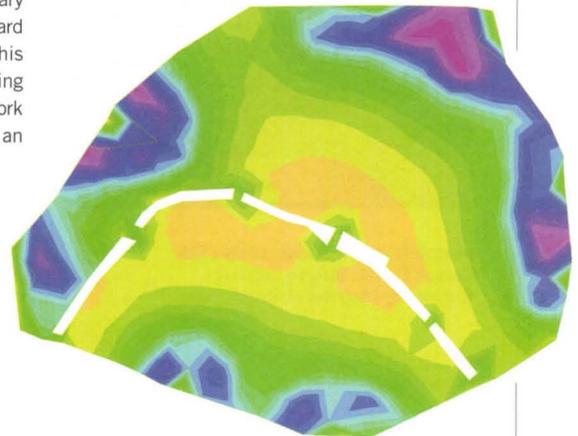
The GRETTIA research centre initiated in 2010, as part of an ENTPE-sponsored thesis programme, developmental work on a two-dimensional traffic model. The focus here lies in dense, extensive networks, with the aim of approximating the network using a two-dimensional orthotropic medium, i.e. a medium that is able to distinguish preferred propagation directions.

The level of traffic in the network is approximated by the flow of a two-dimensional (surface) fluid. This model incorporates the balance between supply and demand and is therefore well suited to conduct impact evaluations at the macroscopic scale. The primary model outputs provide a macroscopic view of traffic (directional flows at each point) and the various costs of origin-destination trip-making.

The model describes traffic over very large and dense networks or else on the secondary surface network, as a complement to a standard macroscopic traffic model. According to this second configuration, the model avoids requiring a highly-detailed description of traffic in a network with too few measurement points to produce an exhaustive analysis of traffic conditions.

This research effort will last through the end of 2012 and the ultimate model derived will be combined, as part of the Digital City project, with both the MAGISTER-GSOM multi-model traffic platform and the *UrbaSimCE* pollutant emission model, which is currently under development. ■

Two-dimensional model, traffic load.



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“StatAvaries 2”: A decision-making software

The significant decrease in headways, combined with a programme to automate a portion of the metro rail network, has constrained the RATP operator to change its control system. Beyond the modifications introduced on the operations side, this modernisation campaign

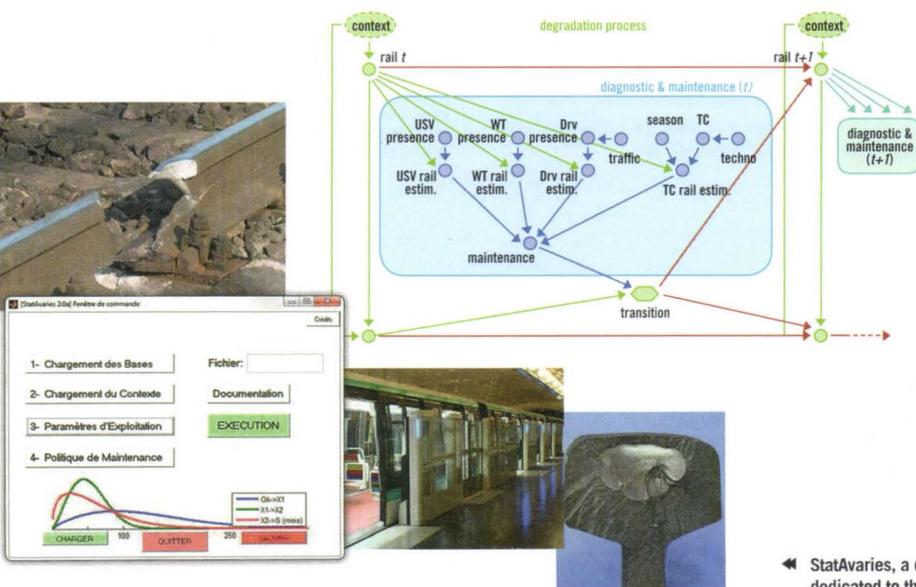
underlies a critical topic: detection of rail track failure. Up until now, this detection process has for the most part relied on the previous control system and train conductors. RATP has thus sought to build a tool that assesses the impact of a range of choices (in the areas of operations

and maintenance) on the indicators of each line, namely: availability, preventive and corrective maintenance actions.

A statistical model of the type VirMaLab (output by the virtual maintenance workshop) has been developed for the purpose of accurately simulating: rail deterioration, the complete diagnostic chain, and maintenance policy. Special attention has been paid to modelling rail deterioration (through introducing a semi-Markovian approach) as well as determining the possibilities offered to users for varying a wide array of parameters.

In order to better match RATP's specific needs, i.e. evaluation of specific indicators given a precise schedule, an original and multilayer VirMaLab approach has been devised. This set-up shows a variable picture of system granularity over time, thereby depicting both the degradation dynamics of the targeted defect and the associated indicators (internal defect / preventive maintenance, failure/schedule lapses, etc.).

Featuring a user-friendly interface to facilitate its application, the StatAvaries software is currently installed in the STF Rail Facilities and Engineering unit and heavily used within the scope of the OCTYS programme. ■



StatAvaries, a decision aid software tool dedicated to the rail sector.

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TerraMagna/Terradynamica: Dynamic traffic simulation for digital urban platforms



Illustration of functionalities on the CSTB Centre's EVECITY platform, which has successfully integrated simulation tools.

In forging a solid partnership with the CSTB Building Research Centre and as part of its contractual commitments, the LICIT Laboratory has been working towards integrating its dynamic traffic simulation tools into a series of 3D digital platforms dedicated to urban management issues.

The interface between the Symuvia traffic simulator and CSTB's EveCity virtual reality platform was finalised in 2010, along with completion of the TerraMagna project (2008-2010). This global platform interacts directly with the traffic motor in order to both recover the dynamic positions of vehicles and execute auxiliary modules for evaluating relevant environmental nuisances, in particular noise propagation. Results of this module execution may be visualised either as a map or in auralised (acoustic) form. Noise emissions are

provided in a workable format thanks to advances by the LTE unit. Ongoing research is intended to enhance tool sharing, especially through implementation of a common data structure.

The LICIT facility is involved in other projects built around digital platforms for the city, including Terradynamica. Launched in 2010 under the aegis of Thalès, Terradynamica (2010-2013) has been assigned to develop an integrated pedestrian/vehicle simulator guided by an advanced (AI) actor management system. The LEPSIS team has also contributed to these efforts. Moreover, as part of the Digital City project (2009-2013), LICIT has been working closely with GRETTIA on designing traffic models specifically suited to estimating atmospheric pollutants, as well as with IGN on generating data production chains as required by the traffic simulation protocol. ■

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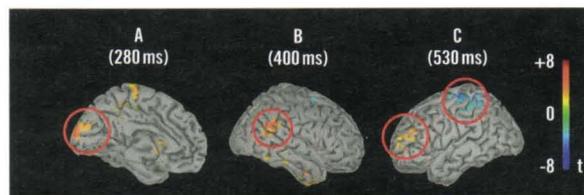
Contribution of neuroimaging to the study of attention lapses during automobile driving

How can the impact be assessed of a modification in attentional demand on the cerebral mechanisms involved in processing relevant information from a driving scene?

This novel study, undertaken within the scope of the DACOTA project (ANR, Predit 2005) as a joint venture with the University of Lyon 1 (LEACM/CRIS) and CERMEP (Bron), focuses on finding an answer to this question.

The cerebral activity of test subjects performing a simulated driving task has been recorded using a magnetoencephalograph (MEG). Results indicate that by increasing the demand for attention through active listening of a radio broadcast (requiring answers to questions) actually affects

the response to traffic signals (changing from green to orange) and to road signs. This impact is felt during the sequence covering detection, categorisation and all subsequent decision-making (braking/turning). This study has proved that such an impact, resulting in heightened or muted activity within different parts of the brain, varies depending on the type of information to be processed and shows a strong correlation with degree of urgency (obligation to stop/road directions to follow). ■



Significant difference maps (t-test).

Publication reference: Fort, Martin, Jacquet-Andrieu, Combe-Pangaud, Foliot, Daligault, Delpuech. Attentional demand and processing of relevant visual information while simulated driving: a MEG study. *Brain Research*, 2010, 1336: 117-127.

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Test scenario generation for distributed system validation

European Union set up a European rail traffic management system "ERTMS" to ensure, with high level of safety, train operation on different European rail networks. As the full deployment of this system is long and

expensive, evolutions are necessary and raise other technological challenges. The goal is to determine how to use ERTMS specifications to produce test scenarios. This work presents methods, models and tools dedicated to the generation

of test scenarios for the validation of ERTMS components based on functional requirements. The development of ERTMS system requires adequate methods for Modelling and evaluating its behaviour. Evaluation and certification of the



system can be done by generating test scenarios applying formal methods. The Unified Modelling Language (UML) is a widely accepted Modelling standard in industry. However, it is a semi-formal language and it does not allow verification of system behaviour. In this case, formal models like Petri Net can be used. These methods are used in order to formalise ERTMS specification. Tests scenarios are generated on the basis of Petri net models. One scenario is considered like a firing

sequence in the reachability graph of the Petri net. Then, test scenarios are applied on ESTAS's ERTMS platform simulator in order to check the components behaviour. Finally, the approach, developed in this document, has been applied to ERTMS components in order to demonstrate the validation and certification costs reduction and also to minimise the upgrade and retrofit constraints and validation cost. ■

Rail traffic simulation. ►



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Use of a driving simulator to gain familiarisation with a front-to-back collision warning system

By warning drivers whenever the trailing distance between vehicles becomes too small, front-to-back collision risk warning systems eliminate a large number of accidents, especially in cases where driver attention is diverted. Yet drivers are not inclined to accept such a system due to the frequent warnings issued that serve no purpose.

Within the scope of the FUI Matiss project, LPC has been working on the impact of familiarisation gained on a simulator with this driving assistance system (in terms of both acceptance and use). Sponsored by the Mov'eo research cluster and supervised by Renault's Technical Simulation Centre, the project (2008-2010) has associated three other partners, from industry (Oktal) and scientific research (Collège de France, INRETS- LPC).

Results indicate the distinct advantage derived from simulator-based familiarisation with the system, as opposed to a simple reading of the guide describing system operations. This use of a simulator enables drivers to actively explore the system's capacities and limitations, in addition to acquiring more knowledge of its underlying operations, thus instilling greater confidence in the system while generating more efficient interactions and safer behaviour behind the wheel. Towards meeting the goal of a *bona fide* application, the level of realism inherent in the simulator must also be taken into account: drivers draw greater benefit from an active form of familiarisation delivered on a "full-scale" simulator rather than on a mini simulator. ■

Use of a simulator to provide context for a driver.

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INRETS

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"VeLo": Inter-Vehicle Communication and accurate relative Localisation

Coordinated by ST Microelectronics and finalised at the end of 2010, the industrial research project entitled "VeLo" has assembled a consortium featuring ST Microelectronics, Autocruise, CEA LETI, INRETS-LEOST along with the CNRS' millimetre-scale platform.

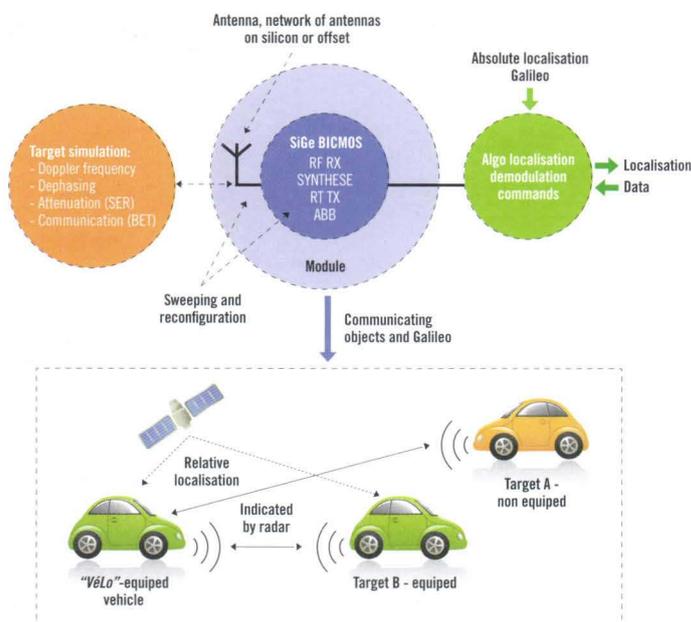
This project, budgeted at € 1.85 million and benefiting from ANR financing (part of the agency's 2006 telecom programme), has successfully developed a prototype automobile radar, equipped with the capabilities of inter-vehicle communication and accurate relative localisation of all obstacles within radar coverage. The radar, communications and localisation functions rely on the new Ultra-Wideband (UWB) radio technology transposed at 79 GHz. In 4 GHz of bandwidth, brief pulses account for a duration of 750 picoseconds; consequently, they provide a level of localisation precision to within a tenth of a metre for a radar range extending 30 m. System blocks were produced in employing the BiCMOS9MW silicon-based technology developed by ST Microelectronics.

The operations of these blocks turn out to be compliant with the specifications ►►

defined upon initiating the project. A doctoral thesis, jointly supervised by the IEMN Institute of Nanotechnology Electronics and Microelectronics and the LEOST Laboratory, was successfully defended on the topic of accurate relative localisation of obstacles.

Moreover, this project has incorporated steps leading to standardisation. The 79 GHz (77-81 GHz) band has been designated as the permanent band for short-range automobile radar systems and, owing to this fact, will be imposed upon

all automakers. In 2009, a memorandum was submitted back to the Commission in support of the options developed as part of this VeLo project. In time, both short- and long-range automobile radar systems will be operated exclusively at the millimetre frequency. The combination of radar, communications and relative localisation functions into a single, highly-integrated sensor (hence resulting in low production costs) over a large scale makes for a very appealing technique when using this millimetre-scale UWB. ■



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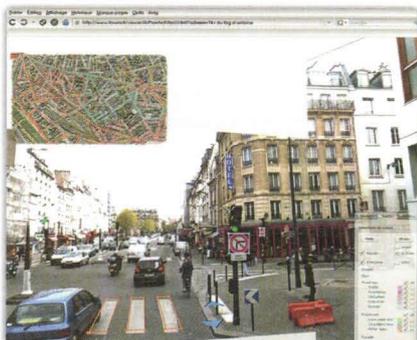
“Itowns”: Automated detection of vertical signs for virtual urban browsers

Promoted by the IGN Institute and financed by the ANR Agency since 2008, the *Itowns* project is intended to define and test new types of virtual urban browsers.

The primary difficulty with this mission pertains to acquiring a substantial quantity of data, including a broad selection of city images from

various vantage points, prior to processing and formatting into a database application designed for browsing ease and speed via a visual interface. For purposes of demonstration, the proposed interface, which allows moving around on the streets of Paris’ 12th arrondissement, is accessible on the project Website (<http://www.itowns.fr/>).

Project partners have collaborated in order to extract the set of key elements from the bank of images, including text for precise sign identification and faces to deliberately blur. Lepsis and Era 27, affiliated with the Strasbourg LRPC facility, contributed to the detection and surveying efforts on images conveying two types of objects: vertical road signs and pavement markings (pedestrian crossings, turn arrows, etc.). These elements provide the visual landmarks pinpointed to assist reading images during a browsing session. ■



◀ Significant activation differences between active and passive radio listening when perceiving a traffic light change from green to orange.

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“ACCESS₂ALL”: Universal access to public transit systems

Initiated at the end of 2008 and completed in December 2010, coordination of the ACCESS₂ALL European project focused on developing public transit systems more accessible to users with mobility impairments.

This initiative mobilised INRETS and its subsidiary ERT, a Romanian computer company, along with five research entities based in Germany, Portugal, Greece and Sweden. In evaluating needs, cataloguing best practices and studying the links between accessibility and safety, among other things, researchers have sought to facilitate mobility of this user category throughout the trip-making chain. The four INRETS research units participating in this project were: LESCOT, LBMC, LTN, and DEST. ■

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Reading list: The psychology of risk-taking

Diving dangerously, smoking, drinking, living on the edge, gambling... but why are we taking all these risks? *The psychology of risk-taking* (Editions Lavoisier, 2010), the latest work by Jean-Pascal Assailly, provides a comprehensive view of the state of research conducted on this extremely complex topic.

The reasons pushing us to take risks are to be found not only in our psyche, but in our body and environment as well. With an obvious focus on psychology, while pursuing an exploration of biology and context, this book has been laid out in three parts.

It begins by presenting current theories on risk-taking behaviour and on what actually differentiates us when faced with risk. This read offers an outstanding opportunity to understand how age, gender or even personality fundamentally guide us and how the quest for sensations, combined with our tendency to be impulsive, anxious, shy or superstitious, can be so influential. ■



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“SURTRAIN”: Train monitoring platform built from the joint implementation of image and sound analysis algorithms

The *SURTRAIN* project, which was completed in June 2010, demonstrated the feasibility of an integrated onboard audio/video monitoring platform to assist with the tracking of perpetrators of criminal acts on trains.

Alongside project partners SNCF, CEA/LIST and MARTEC, the LEOST Laboratory has devised a new set of detection and localisation algorithms for noise-related events (screams) based on signals captured by a network of microphones. Two official system demonstrations were successfully carried

out during the test train's commercial operations. Thanks to support for the system expressed by the SNCF Railway Company, LEOST is now seeking to evaluate its algorithms over longer rail itineraries. The laboratory has also applied these results to raising the level of safety for at-grade crossings.

The *SURTRAIN* project was awarded the *Transport System Quality and Safety Prize* at the Predit 4 programme's halfway point, during a Crossroads event held on May 11th, 2011 in Bordeaux. ■



Interface of the *SURTRAIN* supervision application developed by the partner CEA. Two functionalities of this interface consist of posting information relative to sound alarms (received by the network) and activating the suspect movement tracking feature.

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“TEMPUS/TPTEO”: A new generation of travel time estimation algorithms

In the topic area of travel time estimation and prediction, LICIT has devised a new series of urban and interurban algorithms.

For urban trips, this project focused on introducing an integrated approach towards estimating multimodal travel times, extending door-to-door and in real time, in order to derive algorithms adapted to itinerary calculations within multimodal transport networks. The resulting tools have been incorporated into a platform labelled “TEMPUS”.

On the interurban side, the proposed travel time estimation methods collate all available information (traffic data, toll transactions and their data fusion step) and have built in the

impacts of meteorological events. Findings from this research, conducted in partnership with AREA, have been programmed into the TPTEO demonstrator device. ■



Developing multimodal features for future trip-making.

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THESIS DEFENCES

Samuel Aupetit - LEPSIS
Ergonomic study of learning to drive a motorcycle from a prevention standpoint.

Fabien Badeig - GREIA
An active environment for multi-agent simulation: Application to crisis management in transport systems.

Aurélien Banet - LESCOT
Risk awareness and attitudes among motorcyclists when faced with risk situations.

Nabil Benmansour - LIVIC
Three-dimensional reconstruction of the road by means of stereovision.

Krystyna Biletska - GREIA
Real-time estimation of origin-destination fluxes at an intersection with traffic lights by means of multi-sensor data fusion.

Romain Billot - LICIT
Analysis and modelling of the impact of meteorology on road traffic.

Aurélien Bousquet - LICIT
Travel time-based optimisation of multimodal itineraries at the scale of a dense conurbation.

Zoi Christoforou - GREIA
Modelling in order to estimate incident probabilities and process their responses on highway networks.

François Defossez - ESTAS
Discrete and formal modelling of temporal demands in the validation and evaluation of rail safety.

Aurélien Duret - LICIT
Heterogeneities in highway traffic: Identification, quantification, modelling and impact on traffic flows.

Imade Fatani - LEOST
Contribution to the study of combined source-channel optimisation of a video transmission in a wireless MIMO context: Application to onboard video-surveillance for public transport systems.

Norbert Fouemkeu - LICIT
Uncertainty modelling on airplane trajectories.

Houda Hamama - LESCOT
Impact of diverted attention situations on information extraction and processing strategies under automobile driving conditions.

Sanaa Jabri - ESTAS
Test scenario generation for distributed system validation: Application to the European Railway Traffic Management System (ERTMS).

Sofiane Kachroudi - GREIA
Control and optimisation dedicated to multimodal traffic regulation over extensive urban networks.

Émilie Masson - LEOST
Study of electromagnetic wave propagation in curved tunnels with asymmetric cross-sections for metro and rail applications.

Ali Mroue - LEOST
Study and evaluation of an ultra-wideband, monostatic multi-radar system: Application to the detection and identification of objects falling on railways.

Nizar Obeid - LEOST
Evaluation of localisation performance using a millimetre, ultra-wideband radar for automobiles.

Meriem Raïrafi - ESTAS
A standardised approach for evaluating rail system security: From functional decomposition to the behavioural model.

Antoine Tordeux - GREIA
Modelling of road user interactions.

ACCREDITATIONS TO SUPERVISE RESEARCH (“HDR” CERTIFICATION)

Roland Brémond - LEPSIS
Road visibility: A multidisciplinary approach.

Christine Buisson - LICIT
Understanding, quantifying and reducing highway congestion.

Sébastien Glaser - LIVIC
Intelligent roads and driving assistance tools: From risk perception to decision-making.

Claude Marin-Lamelle - LESCOT
Psycho-ergonomic approach to situations involving disabled ridership in transport systems.



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RESEARCH ORIENTATION S / ENSURING ROAD SAFETY AND MODERNISING TRANSPORT INFRASTRUCTURE

ACHIEVING A DRASTIC REDUCTION IN THE NUMBER OF TRANSPORT-RELATED DEATHS REMAINS A NATIONAL AND INTERNATIONAL OBJECTIVE. TODAY, THESE EFFORTS HAVE BEEN ASSOCIATED WITH TRANSPORT SYSTEM QUALITY CONSIDERATIONS, IN PARTICULAR FROM ENVIRONMENTAL, SOCIAL AND ECONOMIC PERSPECTIVES.

Ever-increasing needs in the areas of passenger and freight transport make it absolutely necessary to rely on infrastructure networks adapted not only to new constraints as regards user safety but also to changing operating conditions, with optimal integration into the environment.

Intended as a complement to the orientations established in under the "W" and "R" headings, the set of research conducted under orientation "S" comprises projects dedicated to either a specific topic (road safety), specific objects (rail), or broader considerations, focusing on structural design and computations, new materials and their monitoring.

As regards Road Safety, six projects raise the following issues:

- ▶ Impacts of lorry traffic on the safety and durability of transport structures: Plinfra.

- ▶ Measurements, predictions and management techniques aimed at roads and traffic during inclement weather conditions: PALM.

- ▶ Links between road perceptions and user behaviour: I2V.

- ▶ Evaluation and prevention of road-related risks, specifically those involving bicycles and motorcycles: PREVER.

- ▶ Pavement surfacing optimisation as a function of skid resistance, noise and rolling resistance from the time of service start-up until their renewal: ECOSURF.

- ▶ Traffic evaluation and improvement and the effects of traffic on both the environment and safety: SERRES.

In terms of research organisation, after assessing current conditions and inventorying external needs (provided by the RFF and SNCF companies), an initial series of two research projects (PLATIF and VIF) could be validated, for implementation effective over the period 2010-2013. Devoted not only to rail platforms and track but also to all types of guided transports, both of these research projects offer an approach to analysing infrastructure broken down "by component". This strategy is intended to facilitate the subsequent assimilation of other "objects" (bridges, tunnels, etc.) or other cross-disciplinary challenges (e.g. sustainable development and the environment, facility management, materials, instrumentation) by relevant Institute actors, in adopting the principle whereby each project must encompass for every single component examined all aspects relative to either the new infrastructure (design, etc.) or the infrastructure already in service (monitoring, etc.). Four projects have been included within this part of orientation "S". The first two provide breakthroughs in computation methodology: pavement structure design, and soil behaviour and structures through a finite element-based approach. The two remaining projects are run more like demonstrator projects: a footbridge made of composite materials, and specifications of an "invisible construction site". The results of the first two projects have given rise to a more detailed presentation.



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INFRACALL: The infrastructure-based “e-call” service

INFRACALL is an accident warning chain configuration activated via infrastructure.

Comprehensive, this project comprises sensors able to detect the collision of a vehicle with the infrastructure, and extends through the transmission of an alarm to a call centre and its subsequent processing.

Infracall is a project sponsored by the Single Interministerial Fund (FUI), conducted jointly by an infrastructure manufacturer (Aximum), a telephone operator providing the SMS connection (Bouygues Telecom), an automaker responsible for relay to the call centre (PSA), and a motorway concessionaire (SANEF) offering a suitable test site. The LIVIC Laboratory was assigned the detection and analysis phases.

Sensors attached to the infrastructure are able to continuously measure the accelerations experienced by the infrastructure. A camera snaps a

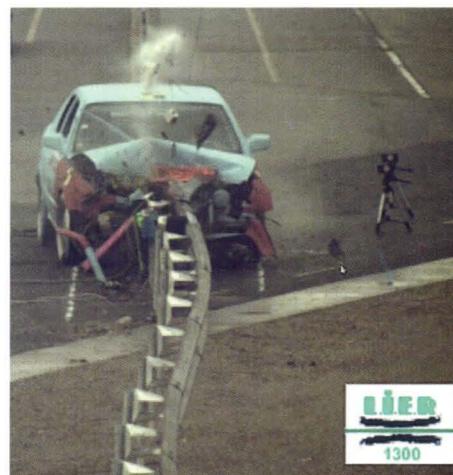
photograph, which is necessary for the operator to determine accident severity. A priority SMS message is then sent to the IMA (Inter-Mutual Assistance) warning processing centre.

The system has been validated during crash tests, the most violent being a frontal shock test at 110 km/hr with a vehicle weighing 1,300 kg. The most heavily exposed sensor transmitted its alarm in 30 ms and was able to detect a 45-g maximum acceleration. The alarm was sent in 30 seconds.

In conjunction with this testing campaign, a statistical accident study carried out in the Paris Region offered the opportunity to select test sites and improve understanding of the different types of accident zones.

The next step calls for instrumenting a shock attenuator placed on a motorway onramp under the jurisdiction of the SANEF network. ■

Frontal crash test - The sensors, while ejected, still had enough time to transmit information on the collision.



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Detection of two-wheeled vehicles by means of fixed video sensors

Despite the decline of road deaths in recent years, the movements of two-wheeled vehicles in urban areas remain a potential problem. Infrastructure and behaviour are in some instances poorly adapted and generate difficulties in the mutual compatibility of each vehicle category.

The aim of this thesis, which is part of the METRAMOTO project, is to develop a tool to automatically count two-wheeled vehicles in urban areas using a fixed video system placed beside the road. This system must be able to count all vehicles and classify them into various categories.

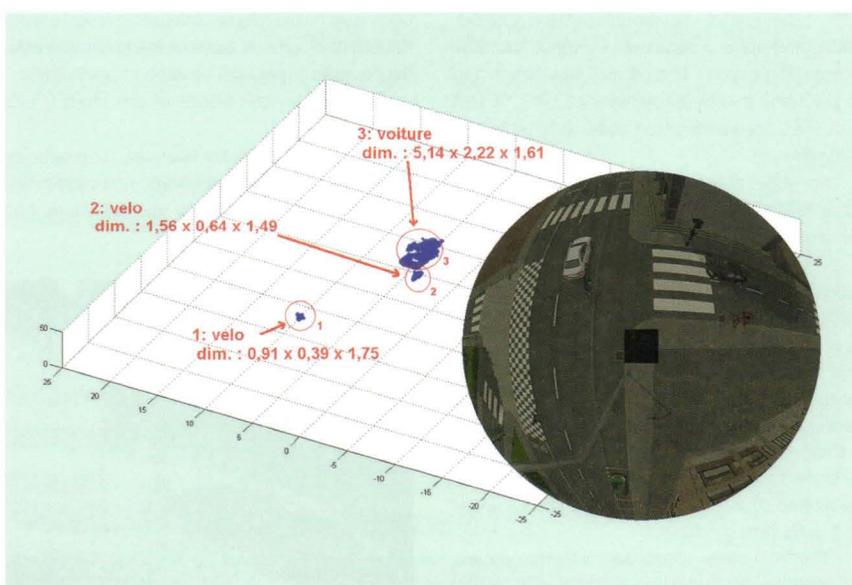
For this purpose, we used two cameras to apply stereovision methods, in an effort to obtain the both the distance and dimensions of the various vehicles, in addition to reducing the detection errors linked to their shadow on the ground.

The approach uses two omnidirectional cameras with fisheye lenses, placed one above the other, on a pole about 10 metres aboveground facing down. These cameras are designed to cover the scene 25 metres all around the pole.

The initial tests, intended to determine the type of cameras used and their position relative to the observed scene, were conducted using

the Pro-Sivic simulator. This software is able to simulate different types of video sensors and generate realistic scenes. These tests served to validate the sensor selection and justify the choice of optical wide angle (fisheye).

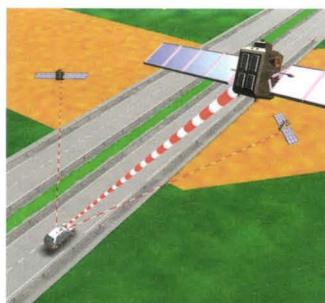
As a next step, these tests will be performed on actual intersections, using a prototype already produced with the configuration of cameras defined by simulations. ■



Vehicle detection provided thanks to stereovision. ►

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Environmental impact of the French Intelligent Speed Adaptation System (LAVIA)



In 1999, the French Ministry of Transport launched a significant program of experimentation and evaluation in order to assess the effects of different kinds of intelligent speed adaptation (ISA) systems in terms of driver acceptance and effectiveness of speed reduction in their daily trips. The LAVIA (Limiteur s'Adaptant à la Vitesse Autorisée) has been tested in France's Yvelines department with three variants: advisory, voluntary limited and mandatory limited. An experiment carried out over a one-year period, on a sample of 90 drivers using 20 equipped vehicles,

generated a considerable set of recorded data under natural driving conditions. Key results on safety have been reported in several papers. Besides the initial project objectives, which were restricted to acceptance and safety impact studies, it appears that a major aspect, in line with sustainable mobility challenges, concerns LAVIA's impact on fuel efficiency. In this report, we presented the results of an extensive statistical analysis focusing on the respective impacts on fuel consumption of the system's three variants. Several statistical methods, both descriptive and explanatory, were

introduced in order to study their usefulness in analysing the natural driving data obtained from large-scale field operational tests (FOT). The impacts of the LAVIA system on fuel consumption are discussed in detail, along with the system's interaction with posted speed limits, infrastructure type, trip goals and congestion levels. A discussion on the relationship between speed limit regulation policies and fuel consumption is provided as a conclusion. ■

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Completion of the 11 S 063 project: Advanced tools for computing pavement structural design

This research project, extending between 2006 and 2010, was intended to enhance the French pavement design method, while developing a series of pavement structure computation tools. The project was conducted in partnership with the network of LPC, SETRA and STAC organisations, in addition to university partners.

An initial stage of the project was devoted to updating the Pavement Structure Design and Dimension Guide originally published in 1994.

The second stage involved pavement modelling. Several computation tools were developed or improved, including the *Viscoroute* software application (for viscoelasticity computations), and two modules of the CESAR-LCPC structural computation code: CVCR (for viscoelasticity and nonlinear elasticity), and ORNI (for predicting rutting). Other accomplishments of this stage were modules for the ALIZE pavement design software dedicated to airport runways and special loads (e.g. industrial platforms).

The final stage associated with this project focused on analysing the behaviour of actual

pavements and drawing comparisons with modelling output. An experiment was also performed on the fatigue carousel in order to study the effect of various types of loads (simple axle, double axle, triple axle) on asphalt pavements.

Among the main results of this project, let's mention:

- ▶ the *Viscoroute* software package, for producing quick computations of pavements in viscoelasticity, and the CVCR module (for viscoelasticity and

nonlinear elasticity) as part of the CESAR-LCPC computation code;

- ▶ updates to the ALIZE software (for airport runways and special loads);

- ▶ latest update of the Pavement Structure Design Guide (to be completed in 2011), and the publication of a standard specific to pavement design (the NF P 98-086 Standard). ■

The pavement design standard was updated in 2011. ▼





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Progress report on the 11S 082 project: Use of finite elements in geotechnical engineering

Geotechnical projects, even the most common ones, are becoming more frequently justified by computations performed according to the finite element method. The incorporation of contacts between soils and structures, as well as soil constitutive laws (whose domain of validity rarely gets mentioned) and issues regarding the numerical quality of solutions (i.e. convergence quality obtained for iterative processes, appropriateness of the mesh for the given problem), are aspects easily capable of influencing the finite element analysis.

This project has been organised around four research approaches:

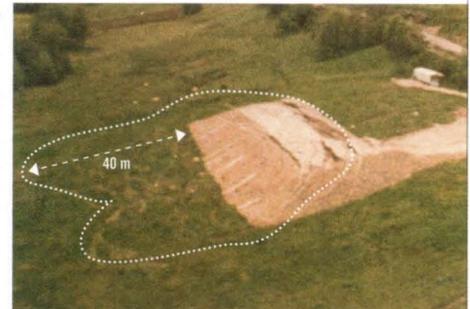
- ▶ analysis and evaluation of existing computation tools,
- ▶ influence of modelling processes and development of result quality indicators,
- ▶ critical analysis of computations relative to actual structural behaviour,

▶ **"Mud-mats": Offshore foundations for oil rigs at sea: Failure mechanisms, stability of the tunnel face, excavation underneath the water table, analysis of the behaviour at failure of an experimental embankment built on an unstable slope.**

▶ recommendations for geotechnical structural computations by means of the finite element method.

In order to generate a choice of theoretical bases to be recommended, we've offered to develop a set of local error estimators capable of assessing, after execution of the computation, whether or not the mesh applied is sufficiently well adapted and, if not, to indicate the zone to be modified as well as the modification required.

From a more general standpoint, we're proposing to improve the quality of how computations are used according to the finite element method, by highlighting the limitations of potential interpretations based on the results generated.



The beneficiaries of these research findings are all actors involved in producing finite element computation tools, designing structures and verifying computation protocols derived from these numerical analyses. ■

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The SARI project: Multidisciplinary and complementary approach among actors

The SARI⁽¹⁾ project is a coordinated action programme sponsored by PREDIT that took place between 2005 and 2010, with the objective of improving road safety in rural zones where some 2/3 of all accidents occur, primarily as a result of loss of vehicle control.

SARI project financing: €4 million, Ministry of Ecology, Sustainable Development, Transport and Housing (DSCR and DRI).

26 public sector laboratories and technical research centres (CNRS, Engineering schools, INRETS, LCPC, CEA, CETE and universities).

3 Departmental Councils (Côtes d'Armor, Maine-et-Loire, Essonne)

11 firms (subsidiaries of major groups, and small and medium industries).



◀ PREDIT Prize award ceremony, May 2011.

"Designing a complement to current on-board safety technologies, with greater focus on processing road specifications and data on the road environment in order to introduce a safety dialogue with network users" was the stated mission of this action programme, which required developing coordination among a new set of research actors, including local and regional authorities, road-related industries and a broad cross-section of disciplines: applied mathematics; mechanics; automation, physics, dynamics, optics, signal processing, electronics, social psychology, law, and economics.

The involvement of local and regional authorities lent a real legitimacy not only in developing a series of relevant products, but also in verifying that product acceptability studies were appropriate.

The contributions received from CETE Technical Centres proved critical in terms of onsite road experiments, as CETE researchers provided the resources for evaluating and validating the effects of new systems.

The solutions proposed by SARI offered improved driver information on road conditions, which were responsible for a good share of accidents. This

information, relayed by infrastructure facilities that were effectively localised, detailed and relatively inexpensive, required diagnostic tools in order to localise the most significant dangers and evaluate the risks incurred by users. ■

(1) SARI: French acronym for Automated road monitoring to inform drivers and facility managers.



THESIS DEFENCES

Jamil Dakhilallah - IM/LIVIC
Composite risk of sliding off the roadway and a proposed assistance technique.

Romain Gallen - IM/LIVIC
Estimation of an index measuring the risk associated with road visibility in an on-board comparison with geometric and atmospheric visibilities.

Omar Khemoudj - IM/LEPSIS
Development of a weigh-in-motion system.

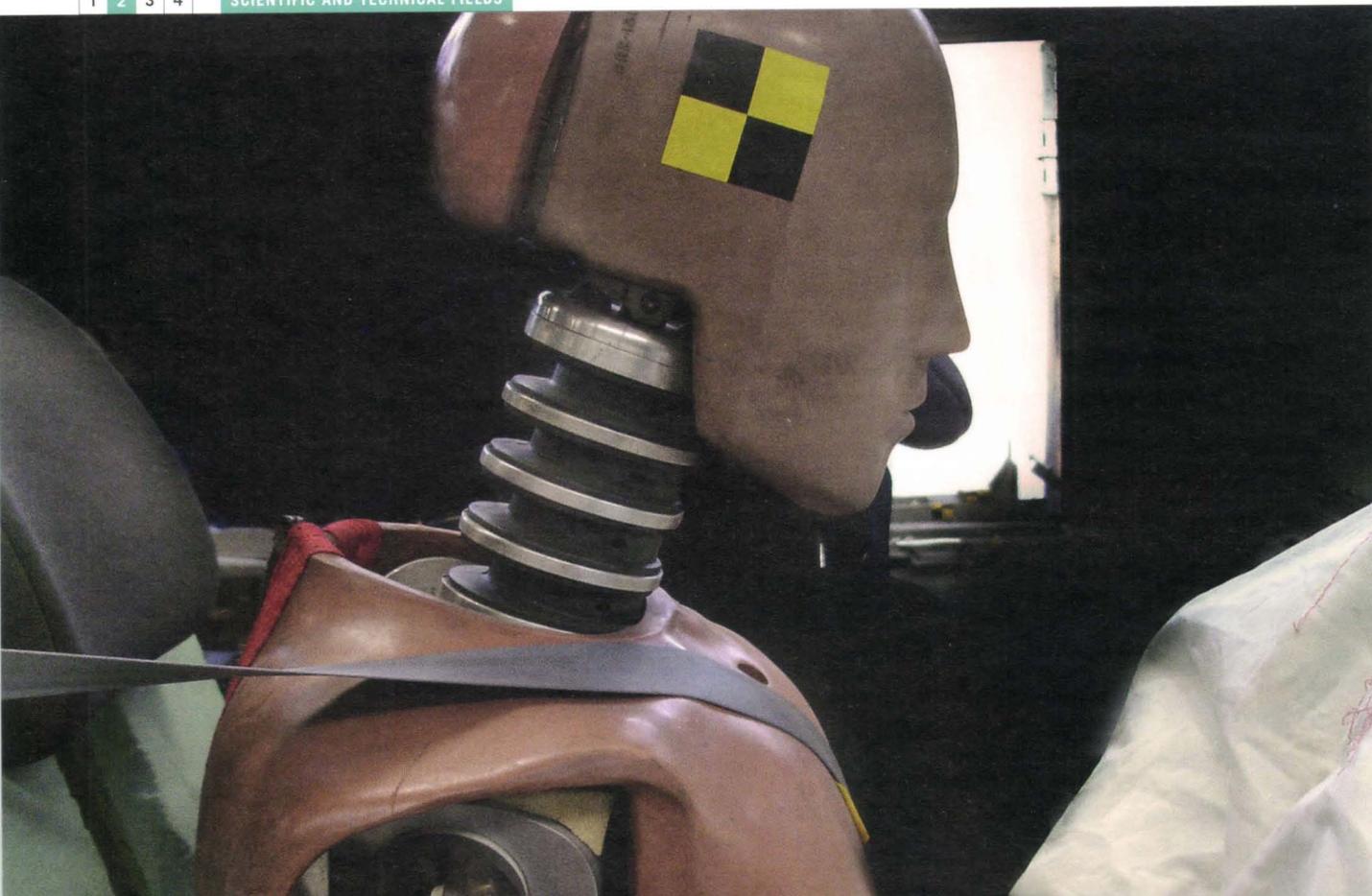
Josselin Petit - IM/LEPSIS
Design and evaluation of a real-time, computer-generated image visualisation operator for driving simulators.

ACCREDITATIONS TO SUPERVISE RESEARCH ("HDR" CERTIFICATION)

Roland Brémont - IM/LEPSIS
Road visibility: A multidisciplinary approach.

Sébastien Glaser - IM/LIVIC
The intelligent road and driving assistance tools: From risk perception to decision-making.

Minh Tan Do - IM
Pavement skid resistance.



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RESEARCH ORIENTATION 3/ACCIDENT ANALYSES, BIOMECHANICS, HEALTH FOR A MOBILITY THAT PRESERVES THE HEALTH OF BOTH USERS AND RESIDENTS

CONTRIBUTE TO THE BASE OF EPIDEMIOLOGICAL AND ACCIDENT ANALYSES TO BETTER UNDERSTAND THE INTERACTIONS BETWEEN TRANSPORT AND HEALTH. PROVIDE TOOLS TO IMPROVE ROAD SAFETY AT THE LOCAL LEVEL. PURSUE THE STUDY OF HUMAN BODY COMPLEXITY AS PART OF THE BIOMECHANICAL MODELLING PROCESS.

Three objectives listed in INRETS' 2010-2013 four-year financing contract make direct reference to this research orientation, which combines the activities of one dedicated unit (MA) and three joint units (LBA, LBMC and UMRESTTE). The few examples selected to illustrate the significant results generated during 2010 only represent a small share of the broad range of research output by these units. Beyond focusing on Detailed accident studies and creating a Registry of road accident victims, several projects have specifically targeted improved knowledge of road-related risks. The list of principal keywords convey the standard accident scenario terminology, including: driving system malfunctions, dynamic vehicle activity, behavioural psychology, legal responsibilities, cognitive driving aptitude of the elderly, social and geographic inequalities, lapses

in vigilance, alcohol, narcotics and medicines, safety enhancements and incorporation into regional management policy, as well as vulnerable user categories, causes of death or health care response for injuries.

The biomechanical approach entails modelling the human body in order to: predict the risks of developing lesions; evaluate and improve user protection and comfort; and provide vehicle design assistance. The research activities conducted within this field involve both modelling and experimentation and have been developed at various scales: human tissue, organs, and the human being itself.

Moreover, as regards the environment, mention should be made of a study dealing with the effects of airplane noise on the health of airport area residents.



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Disparity in road risk zones

The risk of being involved in an accident varies depending on the type of urban zone. This risk has been measured for residents of less privileged districts within the Lille Metropolitan Area and then compared with measurements for populations living in nearby more affluent districts.

The residents of designated Underprivileged Urban Areas experience, on the whole, a 36% greater risk of being involved in a road accident.

This higher risk rate soars to 44% for men while remaining at 17% for women. Residents of these "at-risk" areas between the ages of 20 and 39 are 46% more likely to have an accident than their similarly aged counterparts in more well-to-do districts, yet this additional risk exposure drops to 28% for the 40+ age cohort.

For children, this upward bump in risk equals 10%, though let's not overlook that underprivileged areas have a higher proportion of children in their

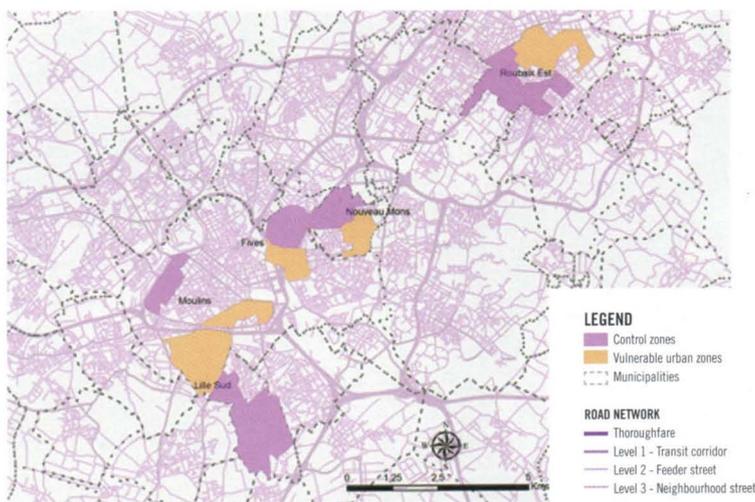
demographic mix, with a quarter of the population aged 15 and younger. Children therefore present a significant road safety challenge.

Moreover, the non-working population is primarily at risk due to the large numbers of youth involved in road accidents, although in reality all professions and socio-professional categories exhibit higher risk in these more economically disadvantaged areas.

Accident victims tend more often to be passengers or pedestrians, given that access to automobile ownership has become a source of new forms of inequality.

It can also be observed that for residents of such distressed zones, accidents occur closer to the place of residence (3.7 km) compared to accidents recorded in more affluent districts (4.3 km).

In many cases, actions prescribed within the scope of major urban projects consist of opening these districts to neighbouring zones with different demographics. Yet such initiatives raise the level of risk for all residents affected by the project, while the number of accidents related to strictly local activities, especially those involving younger pedestrians, is quite substantial. This number is likely to increase with the influx of new vehicles into the target area. ■



Localisation of study zones.

Design / layout: Mochand Mekane, Geosymcom - INRETS 2009

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Building an effective model of a child

Since 2006, one of the LBA Laboratory's main areas of research has focused on producing a digital model of the human child.

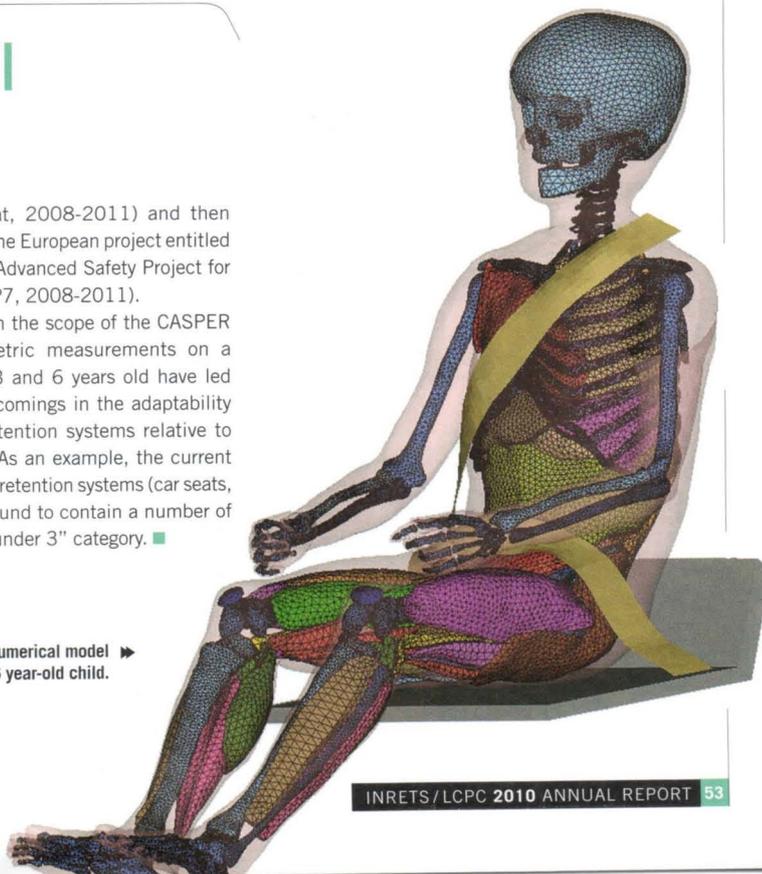
Advances during 2010 have finalised the geometric characterisation of soft organ growth in both the thorax and abdomen. This research was coordinated within LBA around several Master's degree internships, a doctoral thesis (Baptiste Sandoz, defended in January 2010) and the ANR-sponsored project entitled "Secur-enfant" (2006-2010).

Another breakthrough in 2010 was completion of the first digital model using finite elements of a 6 year-old child in its entirety with a reliable biological replication based on scanned images (torso and head), along with the scaling of an adult's geometry (appendages). This model has made it possible to study the lesion-producing mechanisms when exposed to shock, and moreover the work programme has given rise to a thesis

(François Coulongeat, 2008-2011) and then partially included in the European project entitled CASPER (for "Child Advanced Safety Project for European Roads", FP7, 2008-2011).

Once again within the scope of the CASPER project, anthropometric measurements on a sample of children 3 and 6 years old have led to highlighting shortcomings in the adaptability of seat belts and retention systems relative to human morphology. As an example, the current classification of child retention systems (car seats, booster seats) was found to contain a number of deficiencies in the "under 3" category. ■

First finite element numerical model of a 6 year-old child. ►



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Bicycle accidents: Cycling for sport is not the same as cycling for transportation

The accident rate for bicyclists on the road is far from negligible. The accident data currently disseminated overlook no less than 90% of cycling injuries, even more so when the injuries are less serious and/or self-inflicted (i.e. absence of a third party to the accident).

The Rhone Department's Registry of Road Traffic Victims, based on statistics recorded by the care units at public and private hospitals, is much more comprehensive and realistic. It shows a total of 1,000 bicycle injuries a year for the department, compared with the 100/year figure reported.

The data for 1996 through 2008 (16,849 cyclists hurt on the road) indicate less severe accidents in cities than in rural areas, most likely due to the slower speeds travelled by both bicycles and motor vehicles. Registry data also demonstrate that wearing a helmet reduces the risk of serious head injury by 66% in urban areas and 93% in the rural zones.

A complementary survey conducted among a population of 898 cyclists found that the helmet is very well perceived and extensively used by sports cyclists, yet is not viewed favourably and only worn infrequently among cycling commuters or those who use their bicycle as a means of transport. Moreover, the focus on heightened visibility when riding in traffic, which constitutes an additional level of protection, remains poorly understood. Three-fourths of urban cyclists are dressed in dark colours and 25% admitted to never riding at night with a light. An upcoming study will be dedicated to distinguishing among the standard bicycle accident scenarios. ■

Wearing a cycling helmet in the city ► reduces by 66% the risk of serious head injury.



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Biomechanical characterisation of abdominal structures

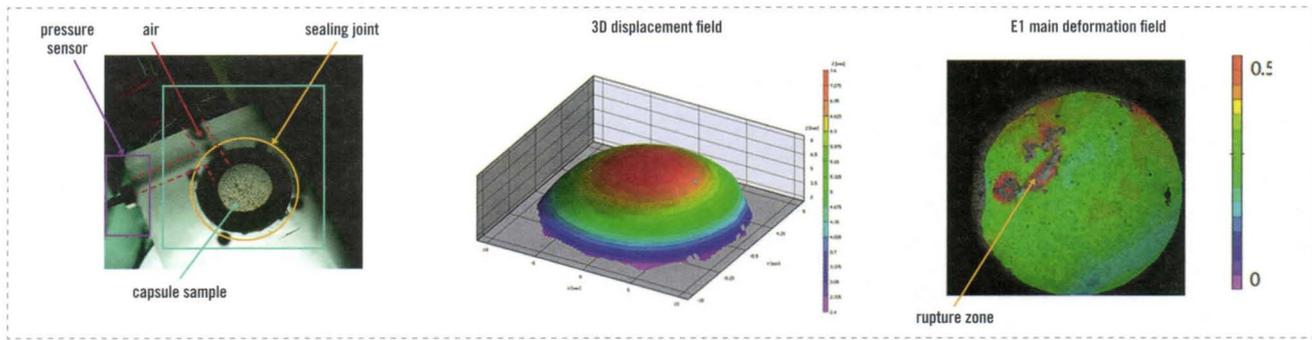
New methods for biomechanical characterisation of abdominal structures have been developed.

An experimental protocol has been set up to analyse the behaviour of the abdominal wall under two types of loads (uniform pressure and local

contact). The deformation of several abdominal walls under these different loadings has been observed by using 4 video cameras. These cameras allowed performing stereovision on both the internal and external faces of the abdominal walls. Such protocol has been made possible thanks to 3 new

equipments acquired during these last two years by the laboratory of biomechanics and impact mechanics with INRETS funding.

In parallel, tests for mechanical characterisation of the hepatic capsule, a planar fibrous connective tissue, have been performed.



First, unidirectional tensile tests have been carried out on samples of superficial hepatic tissue. These tests allowed the quantification of hyper elastic properties of the hepatic capsule and some local failure criteria, especially, a strain failure criteria, defined from 2D full strain field

measured by digital image correlation. Thanks to the acquisition of tools for 3D strain full field measurement (video cameras and software), the same type of characterisation has been carried out for a more realistic loading of the hepatic capsule, i.e. an inflation test. ■

Swelling test on the hepatic capsule, with measurements of the 3D displacement and deformation fields.

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Telephone and road safety: Sharing expertise with the Inserm Institute

Automobile driving is a complex task that requires strong perceptive, motor and cognitive capacities. As a result of the distraction induced, telephoning while behind the wheel could constitute an accident risk. As the new century gets underway, the majority of countries have not yet opted for an outright ban on telephone use when driving, like in France, but instead prohibit drivers from using the hand-held communication devices. Evaluating the efficiency of such a regulatory measure in terms

of both acceptability and safety, in addition to drawing comparisons with other types of road safety enhancement measures and estimating the economic impact, offer the research paths intended to assist decision-making in the area of road safety public policy. The specific task assigned by the DSCR Directorate for Road Traffic and Safety to a group of CNRS researchers, Inserm and teams from Dest, Lescot, MA and Umrestte was to assemble a knowledge base from all this recent input.

A diversion of available attention resources, causing disturbance to the driving activity, is a practice experienced by nearly half of all drivers in France (particularly acute among youth, men and professional road users). One of the main conclusions drawn from this expert evaluation is that such diversions engender a threefold increase in the risk of having an accident, whether a hands-free device has been installed or not, with one accident in ten nationwide attributable to calling while driving. In spite of these findings, according to experts, drivers are still unable to fully assess the risk they're taking when communicating behind the wheel, while institutional responses tend to be muted, with a focus on driver behaviour and introducing regulations. Until now, the socio-economic data available have not justified a ban on phone use while driving. ■



Poster campaign to build awareness of the risk taken when using the phone while driving.

THESIS DEFENCES

- Virginie Astier - LBA**
A Finite Element model of the articular shoulder complex: Applications to reconstructive surgery.
- François Gabrielli - LBA**
Contribution of time-frequency techniques to the mechanical characterisation of the human body sustaining a shock.
- Anais Garo - LBA**
Biomechanical modelling of the effect of bone structure age: Application for the simulation of fractures.
- Perrine Koelll - LBMC**
Development of a biomechanical model of the vertebral column based on 3D internal-external relations: Bi-planar radiography and Moiré fringes.
- Flore Larcher - MA**
Automobile driving assistance systems and liability issues under French law.
- Lghani Menhour - MA**
Synthesis of automobile steering wheel controls for the diagnostic of sudden itinerary change: Development and experimental validation.
- Baptiste Sandoz - LBMC**
Contribution to the geometric and mechanical modelling of the child's torso.

ACCREDITATIONS TO SUPERVISE RESEARCH ("HDR" CERTIFICATION)

- Raphaël Dumas - LBMC**
Methodological contribution to the three-dimensional kinematic and dynamic analysis of motion.
- Martine Hours - UMRESTTE**
Contribution to the study of health impacts due to environmental risks.



3. APPLICATION OF RESEARCH FINDINGS, INDUSTRIAL RELATIONS, EXPERT APPRAISALS

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PARTNERSHIP
CONTRACTS

€ 15

MILLION IN CONTRACT-GENERATED
REVENUE

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THE EXPERTISE DEVELOPED OVER THE COURSE OF EXTENSIVE RESEARCH PROJECTS AND PROGRAMMES, ALONG WITH A FULL RANGE OF FACILITIES AND SCIENTIFIC EQUIPMENT (SOME BEING ONE-OF-A-KIND IN FRANCE OR EUROPE), HAVE PROVIDED AN IDEAL SETTING FOR RESEARCHERS. THEIR IMPRESSIVE RESULTS HAVE GIVEN RISE TO A HIGHLY-FOCUSED APPLICATION STRATEGY THAT SPANS A VERY BROAD CONTINUUM FROM RESEARCH THROUGH INNOVATION. TO CONSOLIDATE AND BUILD UPON THIS MOMENTUM, THE INRETS AND LCPC ENTITIES HAVE BECOME HEAVILY INVOLVED IN COMPETITIVENESS CLUSTERS TIED TO TRANSPORT ISSUES, THE SUSTAINABLE CITY AND THE UTILISATION OF NEW MATERIALS, ALL WITH THE AIM OF STRENGTHENING FRANCE'S STANDING.

INTELLECTUAL PROPERTY

In 2010, the intellectual property efforts of these two entities remained above the average output for similarly-sized public-sector research laboratories, i.e. with a median annual value of more than 5 filings.

INRETS proceeded during 2010 with the filing of 11 intellectual property assets, including 4 patents and 3 software applications, while LCPC accounted for a total of 15 assets, encompassing 6 patents and 5 software applications.

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PATENTS AWARDED TO
THE TWO INSTITUTIONS

PROMOTING A RESPONSIBLE FORM OF TECHNOLOGY TRANSFER

INRETS embraces the move to accompany innovation by participating in construction of the VALORIS platform, designed to mobilise the collective efforts of 30 leading actors from France's major industries, small and medium firms and research centres. This initiative was launched by ANRT in March of 2010 and has been hailed as a reference for deriving economic value from public research findings. Moreover, it has provided a tangible national response to the *Guide for a responsible partnership* produced at the European scale. The relations nurtured by INRETS and LCPC with the professional community in the fields of transport and civil/urban engineering are reflected not only by both entities' attention to technology transfer, but also by their mutual effort to stimulate the role of incubator. In this context, the *ErgOptim* development process achieved a milestone with the vote of confidence in this new activity announced at the December 3rd, 2010 INRETS Board meeting. *ErgOptim's* objective entails identifying

application potential for the research results and expertise generated in ergonomics at the LBMC and LESCOT facilities. Relying on scientific methods and a software tool dedicated to advanced ergonomic simulation (RPx), these applications target large industrial clients, along the lines of Renault, PSA, Volvo Trucks, Alstom and SNCF (railway). Initially set up in 2009, the project entitled "*Luxondes*" (instrument for measuring electromagnetic fields radiated by modern equipment, notably cell phones) has reached a maturation stage, as evidenced by the recent submission of a licensing approval request. The joint venture agreement signed on August 31st, 2010 between INRETS and ASF (motorway concessionaire operating in Southern France) sealed a partnership initiated several years prior to develop an alarm radio beacon intended to dramatically reduce the risk of pile-up accidents on motorways. This device was based on an initial patent and subsequently gave rise to a joint patent filing.



SUBSIDIARIES AND JOINT VENTURES

BROADENING THE SCOPE OF ACTIVITIES AND CREATION OF LCPC-EXPERTS

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Acting to support researchers within the framework of European projects, the ERT organisation (*Europe Recherche Transports*) posted record turnover in 2010, topping €620,000. The outstanding performance of this subsidiary (100% held by INRETS) is owed to its effective participation in European projects devoted to transport, along with the renewal of its PCN (National Contact Point) Transport mission with the European Commission for years 2010 and 2011.

The INRETS/LCPC merger has apparently served to intensify ERT's level of activity, especially in light of the upcoming calls for projects as part of the 7th R&D Framework Programme.

LIER's testing activity has been slightly hampered by order cancellations due to the economic downturn. In contrast, numerical simulation projects have continued to expand, accounting in 2010 for a turnover of €300,000 vs. €179,000 a year ago, for a 67% rise. A key consideration here is that 38% of this figure was generated from studies conducted for foreign clients.

On the whole, LIER's 2010 financial results remained quite stable, posting a total turnover of €2.238 million. Faced with the prospect of site relocation by 2012, the Laboratory became actively involved in the TRANSPOLIS project, sponsored by the LUTB cluster, alongside other major industrial partners like Renault Trucks, IRISBUS and UTAC, as well as a few academic partners.

The young start-up CIVITEC, 75% held by LCPC and INRETS with an equal split between the two, completed its first financial year of operations in 2010 with a turnover of €250,000. This entity proposes a platform dedicated to

building models and running simulations of environment perception systems (sensors) and their control functions. The line of Pro-SiVic[®] software provides the automobile and vehicle safety industries with the capability to design, evaluate and validate system performance and reliability.

CERTIFER is a rail certification and appraisal organisation in which INRETS holds a 15% stake; despite competitive pressures, this entity has posted steady growth in activity. 2010 turnover exceeded €4.75 million, for a net gain of 21% compared to 2009.

INRETS is also a 2% shareholder in the former start-up CITILOG. World leader in the automated detection of road incidents through image processing with a relay to road facility managers, CITILOG suffered a setback in 2010 with the cessation of Chinese contracts, as these had constituted a significant source of overall activity. Yet the continuation of domestic project work, combined with an increase in recurring maintenance activities, compensated for a portion of this loss. The organisation's total turnover declined 42% relative to 2009, from €5.5 to €3.2 million.

The year 2010 was highlighted by the creation of a joint appraisal subsidiary (*LCPC-Experts*) between LCPC (40% participation), Egis (40%) and the PRES UPE cluster (20%), combining to offer a contribution potential of some 3,500 researchers. This new entity provides service to professionals in the building and development industry, through proposing very highly-specialised expert appraisal missions. The objective pursued by *LCPC-Experts* is to quickly reach a turnover of €1 million and then extend to €3 million over a 5-year horizon. ■

Rail, an area where both INRETS and LCPC have won recognition for their extensive expertise.



INDUSTRIAL RELATIONS

EXPANDING RELATIONS WITH INDUSTRIAL PARTNERS

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RESULTS

Despite the economic downturn, year 2010 further strengthened INRETS' and LCPC' reputations for scientific excellence among key socio-economic actors. The total amount of direct contracts concluded with industrial partners represented an increase of some 15% over 2009, climbing from €1 to €1.147 million. Among the most noteworthy joint ventures initiated, let's cite cooperation with TOYOTA for the protection of senior drivers, EPSF for rail safety and ASF for highway safety.

The ratio of direct contracts entered into with small and medium firms to all direct contracts also rose, from 7% in 2009 to 11% in 2010. This growth, with further potential for improvement, reflects the organisation's sustained efforts in promoting and disseminating research findings at various events sponsored by Chambers of Commerce and Industry, trade shows reserved for small and medium firms, in addition to initiatives directed at OSEO or the ANRT innovation agency.

PARTNERSHIPS WITH INDUSTRY

Shaped in large part by framework programmes signed with large firms operating in the road, rail and waterway transport sectors, strong relations have been built over the years with partners Alstom, RATP, SNCF, Valeo, Renault, Faurecia and Toyota, as well as in the infrastructure sector with RFF, EPSF and VNF, among others.

In 2010, INRETS organised or participated in several project reviews, seminars, daylong study sessions, trade shows and other events, offering in each instance a forum and meeting venue suitable for concluding direct contracts or initiating cooperative ventures.

Such was the setting for a presentation of research activities to the Federation of Rail Industries before an assembly of leading actors from throughout these sectors.

THE CARNOT NETWORK

Operating under the banner of the Carnot Institute since 2007, INRETS took the lead in coordinating the 2010 Land Transport Alliance event, combining 15 Carnot member institutes (out of the 33 active organisations), concentrating on issues in transport.

As the last year of existence for both INRETS and the INRETS Carnot Institute, 2010 was noteworthy

for an intensive partnership-building campaign, in association with its main industrial partners in favour of the strategic programme choices made by INRETS' Carnot Institute. Valeo, Renault Trucks and Alstom contributed to determining the proper allocation of the ANR Agency stipend towards financing source-related initiatives (green car, ERTMS, virtual man).

Since 2006, LCPC has been a member, along with the ENPC Engineering School, University of Marne-la-Vallée and Esiee), of the consortium entitled "Vitres" (acronym for City, Transport Infrastructure, Networks, Environment and Services), which offers the Laboratory the opportunity to boast the title of Carnot Institute member. This label promotes, among other things, collaboration with private sector partners and enables benefitting from ANR Agency financing, in an amount based on the sum of contracts signed with private partners. Every year, the Carnot-Vitres Institute has received between €370,000 and €470,000. This "allowance" serves to finance:

- ▶ scientific and technological resourcing projects (acquisition of scientific equipment, thesis scholarships, post-doc assignments, foreign missions, etc. within the scope of research projects conducted by the Carnot laboratories);
- ▶ so-called "profession-building" actions (e.g. legal support, intellectual property management, sharing of best practices and tools).

Over the past four years, 31 projects have been subsidised in this manner, worth a total amount of nearly €1.5 million.

COMPETITIVENESS CLUSTERS

Given the strength of its regional roots, INRETS played a very active role in 2010 overseeing the MOV'EO, I-Trans, ADVANCITY and LUTB clusters and moreover embraced the status of top-tier member within SYSTEM@TIC.

The level of trust established between cluster members was manifested by participating in projects sponsored by the Single Interministerial Fund, with a slightly higher number of projects despite a more restrictive selection process. The proportion of research contract allocations channelled via a cluster out of total entity resources amounted to 4% in 2010 vs. 3.7% in 2009. ■





EXPERT APPRAISALS

IFSTTAR'S RESEARCH EFFORTS RELY UPON THE INNOVATION EXPECTATIONS AND NEEDS EXPRESSED BY COMPANIES, INDUSTRY, PROJECT OWNERS AND PUBLIC POLICY DECISION-MAKERS GATHERED DURING CONSULTING OR APPRAISAL MISSIONS.

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LCPC appraises demonstrators used in the "Green Tax on Lorries" project

Within the scope of implementing measures adopted during the Grenelle Environment Roundtable, the Sustainable Development Ministry (Infrastructure, Transport and Maritime Affairs Directorate, DGITM), in conjunction with the Ministry of Budget and Public-Sector Accounts and Reforms (Customs and Excise Duties), initiated towards the beginning of 2009 a competitive process for introducing a green taxation system on lorries weighing over 3.5 tonnes throughout the national and local networks. The laboratory's MACS Department based in Nantes (part of the GEOLoc Group) contributed its expertise to DGITM on satellite positioning.

The four candidates selected for this competition were asked to supplement their initial proposal and final bid with demonstrator systems. All four opted for satellite technology (GNSS) in order to detect lorry crossings at toll-charging points on the network, coupled with a data transfer protocol between on-board terminals and the computation centre through use of GSM technology.

The GEOLoc team was assigned to organise two testing campaigns (in March-April 2010 for the initial proposal and October-November 2010 for the final bid), with an additional contribution from CNES on quality aspects relative to the selected GNSS components.

These campaigns capitalised on the expertise and tools developed by the team regarding GNSS receiver

Description of the instrumentation installed on lorries.



evaluation, with an emphasis on the reference trajectory determination system. These tests made it possible to assess the robustness and maturity of on-board terminals equipped with a GNSS receiver. They also helped define mapping correlation software applications for detecting crossings at toll-charging points while travelling on the national and local road networks in French Departments 44 and 35. ■

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Technical assistance for the quality approach adopted inside a Qatari laboratory

The QGOSM (Qatar General Organisation for Standards and Metrology) Laboratory, located in Doha, was awarded the ISO 9001 certification for its quality management system by the Bureau Veritas certification body in June 2010.

This milestone acknowledges the technical assistance offered by LCPC since 2007 to Qatar's laboratories within the QGOSM group as part of the broader framework of a technical assistance contract signed with the nation of Qatar.

The impetus behind this mission was provided by EADS and the Welding Institute, two French companies involved in a Qatari joint venture (EADS-IS CCQ). Contractually bound with QGOSM, these two entities collaborated with LCPC Departments in order to assist the host country in refining its "civil engineering and road-related" activities. The LNE Laboratory was also requested for input regarding QGOSM's other sectors (metrology, electrical devices, precious metals, etc.).



The quality manual has since become operational (V1.04), along with the process map. The training of laboratory personnel in both the quality approach and requirements associated with the ISO 9001 international standard was scheduled in English, with simultaneous translation into Arabic by an onsite interpreter. The next step will focus on certifying laboratory test procedures according to the ISO 17025 international standard, as COFRAC has accepted to conduct all evaluation steps until receipt of the corresponding certifications.

In all, LCPC and LPC network staff will have completed some 20 missions of one week each, broken down as follows: 4 missions on quality management, 2 on hygiene and safety, and 14 on quality testing in the three technical units of "Asphalt", "Soils and aggregates" and "Building materials". ■

◀ The French delegation welcomed in Qatar.

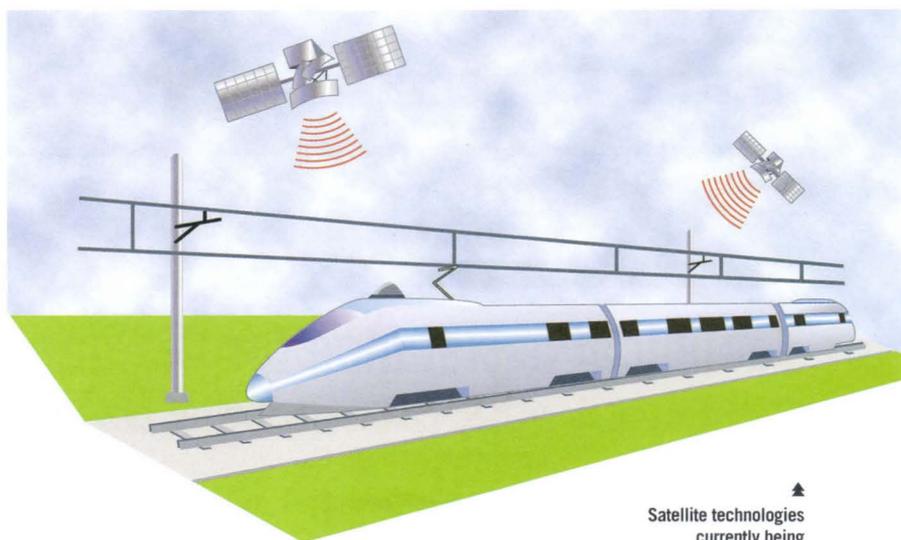
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Application of Galileo to rail localisation

Rail, like the other modes of transport, has been incorporating over the past decade or so satellite technology applications, especially those involving localisation (GNSS). The range of anticipated applications has widened thanks to the potential offered by European systems EGNOS then Galileo, whose services include information on signal integrity. These solutions pave the way to rail applications oriented around ensuring the safety of passengers and freight, though their performance under actual environmental conditions still needs to be demonstrated, along with proof of qualification and certification of future on-board receivers supporting this rail safety system.

The LEOST Laboratory has been examining these issues since 1998 and has progressed within the scope of the European project LOCOPROL or, more recently, the PREDIT project called Tr@in-MD. In 2008, the DGITM (Infrastructure, Transport and Maritime Affairs) called upon the team's expertise to determine the array of potential GNSS applications in the rail sector and better identify the various obstacles, including the mandatory compliance demonstration of all new equipment (in this case, a GNSS receiver), plus meeting all rail safety requirements.

This field of investigation implies conducting studies under actual use conditions, in order to assess equipment performance and the impact of local receiving environments. The approach proposed in 2010, on behalf of DGITM, included a series of measurement processing methods



▲ Satellite technologies currently being studied for the rail transport sector.

to evaluate output on the basis of precision, availability, continuity and integrity. These methods were then implemented on recorded datasets to demonstrate their applicability when quantifying performance indicators. ■



French Guiana: Coming to the rescue of the Larivot Bridge

Built between 1974 and 1976, the Larivot Bridge is a strategic structure that enables the RN1 national highway to cross the Cayenne River in Guiana and connect the capital with Kourou, where the region's space centre is located. 1,225 m long, this bridge rests on 34 piers, each composed of a massive reinforced concrete joist embedded into 6 inclined metal piles filled with concrete.

On November 25th, 2009 however, following a 21-cm subsidence of Pier No. 13 (see photo), the bridge was closed to all traffic. A committee of experts was urgently convened by the Infrastructure Directorate of the Guiana Public Works Office to assist in managing this predicament. The committee, presided by Thierry Kretz with the Setra Agency and on which Bruno Godart represented LCPC, was assigned to introduce strict monitoring controls at the bridge site, in addition to the emergency reinforcement of Pier 13, and inspection and diagnostic of the other piers. The committee was asked to propose reinforcement solutions that would lead to quickly reopening the facility to traffic. An underwater inspection revealed that a pile of Pier 13 had been sheared and cropped and moreover that the pier had been in a state of unstable equilibrium, whereby its collapse could, by means of chain reaction, cause the entire bridge to collapse.

As part of this joint appraisal mission, LCPC's professional contribution focused on diagnostic methodologies pertinent to pile degradation, detailed monitoring and pile corrosion assessment.

Despite the availability of control methods specific to foundation pile integrity for built structures, these approaches were found to be non-applicable to this bridge's submerged piles. An investigation carried out among companies working in the offshore business concluded that the diagnostic methods actually employed (ultrasound imaging, TOFD, ACFM, pulsed eddy currents, etc.) were not applicable to the case of this bridge. A team of divers was thus requested (after securing pier P13) to measure



▲ State of the metal pile at the level of the failure zone: A considerable amount of corrosion by dissolution can be observed.

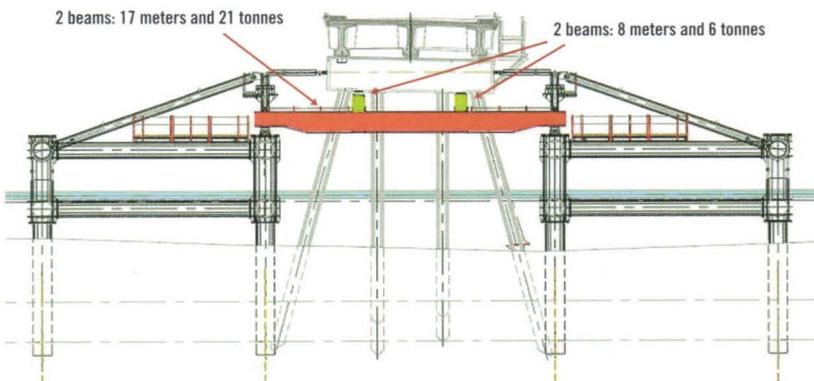
the residual thickness of the underwater metal pile sleeve at various points using an ultrasonic wave device, as this is the only non-destructive method capable of yielding quick and reliable results.

LCPC also participated in designing the close monitoring campaign and defining alarm thresholds. This campaign, intended to ensure the safety of personnel assigned to investigate and reinforce the structure, was launched by LRPC-Bordeaux by installing inclinometers on joists of several piers.

The reinforcement of Pier 13 relied on an underpinning step that consisted of building upstream and downstream of the pier (without destabilising it) two 4-pile platforms interconnected by a metal frame placed underneath the joist (see figure).

The next step was to explain the origin of these structural disorders. Pile failure was caused by corrosion due to dissolution. The role of microorganisms (i.e. biocorrosion) in accelerating this deterioration was indeed likely, though the welding seams were not implicated. The identified corrosion had caused local perforation of the sleeve at a spot where the concrete had decomposed, allowing the sleeve to be crushed and torn, followed by pile subsidence.

After mobilising the RST network in an effort to save the Larivot Bridge, French Minister Jean-Louis Borloo sent a letter of gratitude and congratulations. ■



◀ Underwater inspection has made it possible to establish a diagnosis relative to Pier 13.

TESTING

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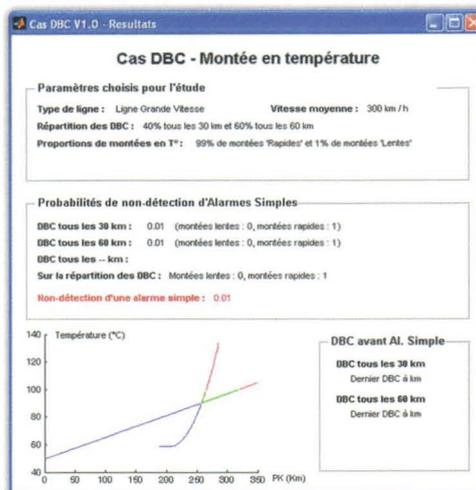
Rail security: Detection of hot axle boxes

At the request of EPSF, two research units affiliated with INRETS, ESTAS and LTN combined their respective skills to tackle the topic of operational security and detection of hot train axles as part of the CAS-DBC project⁽¹⁾.

The risk associated with undetected abnormal heating of a train axle box would be to trigger axle failure, which in turn causes train derailment with all the serious consequences that entails. By relying on results from ANR's Deufrako ROSA⁽²⁾ research project as well as on available statistical data, this study sought to characterise, model and quantify the risk of an accident, along with each control measure by means of a safety systems approach. During a second phase, several cases of axle temperature rise were modelled so as to determine the best pace for introducing ground detection systems.

In addition to the reports published, two parametric tools for quantifying the risk induced by the appearance of a hot axle box over the national railway network were submitted to EPSF. ■

(1) Acronym for the "Safety Characterisation of the Hot Box Detection function".
(2) Rail Optimisation Safety Analysis.



◀ Probabilistic tool for characterising the axle temperature rise.

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Experimental validation of on-board lorry weighing systems

Lorries are subjected to various rules relative to driver qualification, speeds and loading weights. Each lorry is assigned a maximum permissible threshold beyond which the load is considered excessive. An overloaded lorry becomes unstable and, consequently, capable of causing accidents, particularly in the presence of strong winds during turns. An overloaded vehicle also causes infrastructure deterioration. On-board lorry weighing therefore offers a combined commercial, economic and social utility.

With the assistance provided by a weighing system, freight haulers load their vehicles appropriately in avoiding

excess or insufficient loads. They're able to identify the optimal loading that corresponds to a maximum use of vehicle capacity. From their vantage point, road and infrastructure facility operators rely on on-board weighing systems to assess fines for load limit violations, in an effort to eliminate a road hazard source.

Knowing lorry load weight in real time is highly useful information and has given rise to the following applications:

- ▶ in driving assistance systems, to prevent the risk of a lorry overturning;
- ▶ for controlling excess loads and avoiding pavement and bridge damage;



► in order to calibrate the weigh-in-motion stations already installed at several sites.

The doctoral thesis defended in December 2010 established the conditions for installing an economical and reliable on-board weighing system in lorries, based on an estimation of dynamic impact forces.

The choice of appropriate lorry model to take infrastructure characteristics into account has been analysed, yielding a set of model parameters that enhance estimation reliability.

In order to validate the estimation algorithms, an experimental campaign run on a fatigue carousel, called the Accelerated Load Facility (ALF), was conducted in Melbourne during March 2010, in cooperation with the ARRB (Australian Road Research Board) Laboratory. A number of sensors, such as strain gauges, LVDT displacement sensors, accelerometers and pressure sensors, were installed onto the ALF (as illustrated in the figures).

Placed adjacent to wheel hubs, these gauges measure the amount of deformation due to shearing strain, hence the vertical force. This so-called axle instrumentation method provides a force measurement reference and allows drawing comparisons with model output.

As for eventual follow-up work, an experiment using a semi-trailer tractor is being prepared for the purpose of validating the test approach in real time on a track. ■



▲ So-called axle instrumentation method, experimentally applied on the ALF in Australia.



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Development of a cyclic triaxial test on asphalt mixtures

In order to evaluate the rutting resistance of an asphalt mixture, the current approach adopted is based on tests using a rutting device capable of simulating the action of a wheel travelling over an asphalt plate. This test, which is quite reliable when classifying standard materials, has however demonstrated its limitations when determining the rutting resistance of pavements on trolleybus lines. Moreover, the temperature and pressure conditions are fixed and the applied loading is not homogeneous, making it poorly adapted to deriving constitutive laws.

In this context, a new temperature-controlled triaxial test on asphalt mixtures has been designed in conjunction with the doctoral thesis of Juliette Sohm. This test makes it possible to assess mixtures under stress states close to actual pavement loadings (either monotonic or cyclic axial stress, at a constant confinement pressure). The 80-mm diameter specimen is fitted with sensors for measuring axial and radial deformations according to variable parameters: temperature, axial stress, confinement pressure, and frequency.

This test enables analysing mixture behaviour subjected to a wide range of loadings: creep under static loads, short-term cyclic behaviour (complex modulus), and long-term cyclic behaviour (rutting). Its benefit lies in

characterising innovative asphalt materials whose rheology remains relatively unknown (i.e. hot, warm or cold mixes, use of new binders).

Initial test applications were devoted to studying creep under a static load, leading to the development of a model for platform computations in the presence of static loading. Current studies are focusing on rutting characterisation and modelling, with severe and highly-concentrated traffic loads (trolley cars and buses). ■



◀ Development of a triaxial test on an asphalt mix layer.

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Safer moving walkways for skiers

Subsequent to a fatal accident that occurred in 2004, a Ministerial order was issued to more strictly govern the operations of moving walkways, and its STRMTG Division (responsible for ski lifts and guided transport systems) was assigned to ensure compliance. The equipment managers were interested in increasing operating speeds from 0.7 m/s to 1.2 m/s, in order to convey more skiers to the tops of ski slopes.

To assess the risks tied to such an increase in speed while quantifying all eventual trauma sustained by users when activating moving walkway safety systems, the STRMTG Division requested the involvement of UNEX (acronym for INRETS' Experimental Testing Unit). The ensuing testing campaign was intended to establish an original protocol, in addition to conducting a series of *in situ* tests and validating the technical safety solutions introduced by ski resort moving walkway manufacturers.

By taking advantage of the experience gained during crash tests, UNEX engineers simulated the hazardous positions of a 6-year-old child on a walkway moving at 1.2 m/s and then measured both the pinching forces acting on body members and strangling forces. At this age, the skier is quite vulnerable, especially when falling flat on the stomach or when an arm or scarf gets caught in the drive mechanism at the end of walkways. Generally speaking, at such high speeds, the primary risk for skiers occurs while exiting the walkway.

Engineers worked to modify the sensors on an impact dummy in order to adapt it for evaluating the risk of child injury caused under hazardous conditions (arm or scarf).

Full-scale experimental site.



The data analysis provided by experimental measurement systems mounted on the walkway served to assess risk-making criteria and highlighted potentially dangerous situations.

UNEX proposed to its audience of manufacturers several leads for improving their products, including the possibility of reversing the system's direction of rotation as well as simple solutions for manually releasing the drive mechanism powering the walkway. Following this testing campaign, a number of safety features were modified by manufacturers in an effort to upgrade installation safety.

Completely satisfied with the outcome of this initial round, STRMTG sought to standardise all facilities in use, namely by requesting UNEX to test the walkways of two other French manufacturers during 2011. ■

MEET UNEX

UNEX (or INRETS' Experimental Testing Unit) began as a shared test platform offering the services of some ten engineers and technicians specialised in studying passive automobile safety and evaluating accident injury risks. This activity has been extended to assessing systems and structures exposed to shock, as well as characterising materials in a state of rapid dynamics.

UNEX allocates 70% of its activity to INRETS' in-house research requests stemming from individual research units, with the remaining 30% devoted to expert appraisals or industrial services relative to facilities evaluation or new product development processes.

The unit's knowledge base has been built through mastering rapid dynamic measurements, high-speed digital cinematography (1,000 to 10,000 images/second), plus a solid set of skills in metrology and the capacity to reproduce multiple configurations of shock test set-ups, from characterisations conducted on a few square-centimetre sample to a full-scale vehicle crash test on a dynamometric shock wall.

The testing facilities consist mainly of: a crash catapult (capacity: 2 tonnes, 120 km/hr), a shock simulation catapult mounted on a decelerating truck (capacity: 800 kg, 70 km/hr, programmable deceleration), 5 high-speed digital cameras, mountable shock data acquisition systems, impact dummies, and a set of over 400 sensors (measuring acceleration, force, displacement, moment and pressure).

The unit also offers an efficient technical team and fully-equipped workshop able to design and build a variety of experimental assemblies and prototypes, from simple sensor adaptation to the transformation of a vehicle into a driving simulator.





PATENTS

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“BIND”: A toolbox used to analyse experimental data

Efforts to implement a shared software platform for interpreting the data collected during experiments on instrumented vehicles or simulators led, in 2010, to creating the BIND framework.

Developed in a Matlab environment, the BIND software may be considered like a toolbox dedicated to the analysis of experimental data. This application, inspired by the LESCOT approach to data modelling and benefiting from the extensive research performed on software architecture, has been designed to compile digital and videographic data as well as streamline access to these datasets in view of subsequent interpretation. Consequently, this framework proposes a number of high-level functionalities (e.g. data access control in both reading and writing modes, graphics module synchronisation, mathematical computations) that serve to quickly build processing scripts and analytical software; moreover, it promotes data use by supporting interactions between the team's researchers and developers, which in turn accelerates the cycle of “defining operational hypotheses/statistical validations”.

Several data enhancement applications (video-based information coding, calculation of automatic indicators, etc.) have already been released thanks to BIND, thus providing the opportunity to take advantage of not only software developments but also expert knowledge in the area of data analysis.

BIND has led to filing a declaration of inventorship along with a submission to APP. The choice of most suitable software licence for disseminating this state of progress is being decided. BIND inventors Arnaud Bonnard and Damien Sornette are currently tackling issues related to research applicability. ■

Data collection, transmission and processing system.



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Night fog detection by onboard vision

The driving assistances are being enriched with vision capabilities. But degraded visibility conditions alter the operation of these systems. The night fog detection is a component, which allows characterising the video signal and realising new types of driver assistance.

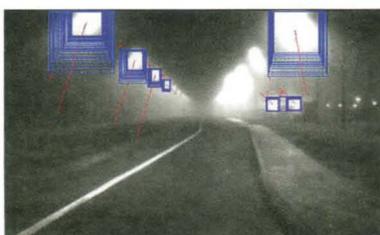
The work presented was carried out as part of the projects ANR DIVAS and ANR-DEUFRAKO ICADAC. This work is of great interest to a French automotive supplier and a German car manufacturer.

The fog is visible through the interaction of light with droplets of water. At night, the light comes from street lighting and vehicles lights. Thus, the camera sees the presence of halos around light sources and a backscattering veil generated by our own lights. This veil is visible in the absence of external light sources. The achieved detection relies on the identification of these two phenomena. The developed system was tested on a vehicle from LIVIC, as well as with data obtained in the fog chamber of Clermont-Ferrand.

A software combining the two types of detection has been achieved and a patent is pending.

This work will be pursued to quantify the characteristics of the detected fog, thus allowing the realisation of driver assistances which adapt dynamically to weather conditions. ■

The fog detection step relies on the presence of light halos in the environment (first illustration) or, in the absence of light sources, on the presence of a backscattering veil generated by the vehicle equipped with the patented system (second illustration). ▼



EQUIPMENT

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“VICTOR”: Instrumented vehicle used for studying driver behaviour

The project to instrument a new vehicle for the purpose of collecting data for input into an analysis of driving activity under in situ conditions was wrapped up in May 2010, with implementation of the VICTOR project.

The instrumentation found in the Peugeot 307 VICTOR, used as an acronym of “Instrumented Vehicle for studying Driver Behaviour”, was designed in order to measure, in as non-intrusive a manner as possible, a set of parameters capable of reporting on driver activity. Accordingly, a variety of systems collect information in real time relative to the driver (e.g. an oculometer, camera on the driver’s face), the vehicle (actions involving mechanics, dynamics) and the environment (GPS positioning). When experiments are run, researchers accompany the participant and record, by means of observation charts, a number of items in addition to the measurements. VICTOR has been equipped with dual controls, which allow for the presence of a driving instructor to ensure the safety of passengers and other

road users. This protocol proves necessary during studies conducted on specific populations (e.g. individuals with a history of cranial trauma or afflicted with age-related diseases).

VICTOR, like its predecessor MARGO (LESCOT’s other instrumented vehicle), makes use of MOPAD, the laboratory’s Labview acquisition software. This design feature ensures both data collection homogeneity and compatibility with BIND, LESCOT’s data interpretation platform. VICTOR’s installation is very quick, though its technological possibilities remain limited: in essence, VICTOR offers a stable version of the developments previously tested on MARGO.

Since its introduction, 90 participants have already taken part in experiments using VICTOR. Vehicle designers Philippe Deleurence and Bruno Piechnik are currently working on the relevant documentation and quality procedures. ■



▲ The Peugeot 307 VICTOR.

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Implementation of the PEGASE generic map with field-specific applications

As part of its R&D efforts aimed at sensor networks, the MACS Department has developed a generic wireless platform capable of satisfying measurement and processing needs associated with heterogeneous and complex data: PEGASE (acronym for Generic Expert Platform dedicated to On-Board Wireless Applications).

Since February 2009, the PEGASE platform has been licensed by LCPC to the company A3IP (located in the town of Sautron in France’s Loire-Atlantique Department), which until now has sold around 200 units. The PEGASE system serves as the foundation for a turnkey solution to a structural monitoring set-up or else as a roadmap for development and rapid prototyping.

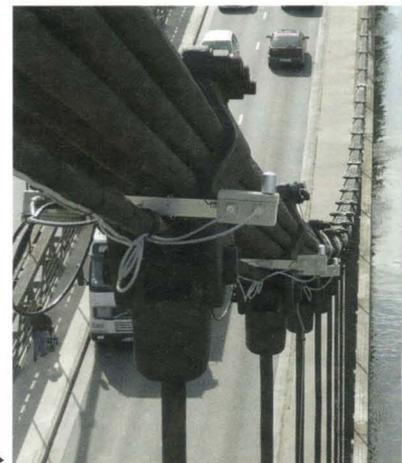
PEGASE has stimulated instrumentation renovation on the Ci-Bing Bridge in Taiwan by the French firm Advitam, whose capacity to communicate via the TCP/IP protocol has enabled tracking, both remotely and in real time, erosion phenomena on piles detected locally through a series of PEGASE maps equipped with accelerometers, inclinometers and water level sensors.

The PEGASE system also provides the basis of LCPC’s new CASC sensor, whose purpose is to acoustically monitor bridge cables. Over a 3-year period, some 20 PEGASE-CASC sensors were installed on the Ancenis suspension bridge to validate the new system under actual use conditions.

Several other specialisations have also been featured on the PEGASE map, including: real-time control of drinking water quality, pollution sensors placed in urban locations, and structural deformation indicators.

Moreover, a professional training module has been developed with a focus on the PEGASE system. A number of sessions have been (and will continue to be) hosted for companies, laboratories and LCPC’s partner schools.

Besides the intrinsic system improvements to be introduced as required, the MACS team has built into PEGASE the potential to operate around the clock on solar panels. ■



► Instrumentation installed on the Ancenis Suspension Bridge (western France).



CERTIFICATION

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ACQPA's activities within the LCPC environment

Created in 1994, ACQPA (acronym of the Association for the Certification and Qualification of Anti-Corrosion Paints, and set up as a non-profit) includes LCPC as one of its founding members. This organisation delivers, via a third-party arrangement, a recognised French certification label for paints that provide structural protection. The association oversees three major aspects of the certification process that are both complementary and necessary: paint system quality (anti-corrosion, use in marine environments and concrete), qualification of painting staff, and qualification of supervision

inspectors. ACQPA has therefore assembled all relevant actors concerned by the quality of structural protection; its members have been split into four boards (Designers, Producers, Applications specialists, and Technical centres/Experts). The independence of ACQPA's decisions is maintained thanks to a well-balanced representation of these four boards on the association's Board of Directors and various certification committees.

LCPC has been acting in the capacity of Secretary General since ACQPA's creation, in addition to providing technical secretariat support to three certification committees related to paint

systems. This responsibility implies managing 485 individual paint systems and another 250 products involving some twenty manufacturers. Moreover, ACQPA has certified 380 operators and 36 inspectors in 2010 alone, bringing its total personnel qualifications awarded to 3,566 operators and 260 inspectors. This strong spurt in activity has necessitated creating and filling a permanent Managing Director's post within the association.

As 2010 drew to a close, all activities heretofore performed by LCPC on behalf of the association were officially transferred over to ACQPA. ■

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INRETS placed on the rails

The activities of certifying and evaluating rail system safety, whether conducted at ESTAS or LTN, are handled by assigning personnel or establishing industrial partnership contracts via the French Rail Certification Agency, which INRETS helped create at the request of the Transport Ministry.

The Institute has also been involved on its own behalf with project consulting assignments, such as in Lille for doubling the capacity of the metro

system's Line 1. In 2010, INRETS' contribution was directed to the field of urban public transit focusing on electric tramway lines powered by ground sources in the cities of Angers and Reims, as well as on various automated pilots for the metro systems of Lyon, Algiers and Budapest. The automatic lateral guiding system on buses in Bologna was also appraised.

In the field of rail transport, INRETS advanced the certification process for many safety devices

equipping the standardised European Train Control System (ETCS/ERTMS), including odometric systems, on-board calculators for French or other trains (Breda in Italy, Siemens in Germany), and equipment for signalling and switching stations. The Institute also has a stake in: service start-up of the renovated Bourg-Bellegarde line, introduction of ERTMS on the Eastern France-European high-speed rail line, and repeat participation in safety-related work on cross-Channel lines. ■

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LCPC certification activities

LCP, in partnership with the CETE regional research centres, has been pursuing certification activities either under its own aegis or on behalf of certifying bodies within the scope of subcontracted auditing and testing missions (AFNOR, ASCQUER, ACQPA, ASQPE, CERIB, AFCAB) on products used in civil engineering applications (steels, cements, aggregates, road equipment).

Since 2003 (as posted in the Official Journal, July 22nd, 2003 issue), LCPC has also been designated as a European "notified body" for the certification of industrial products, which includes

placing the EC marking on aggregates. In this role, the Laboratory has awarded since May 25th, 2004 a total of 113 certificates to quarries for their mastery of the aggregate production process.

These activities rely on the work of several technical divisions with COFRAC accreditation for testing, in accordance with Standard 17,025, and a COFRAC-accredited certification unit compliant with Standard 45011 for product certification system management. Sector managers lay out the annual monitoring plan and validate all pertinent certification decisions, while auditors assess the

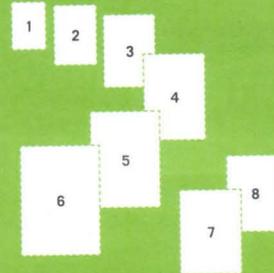
means of production and product quality and the certification unit oversees both the financial flows and contractual commitments.

The financing sources for certification activities stem entirely from fees generated according to certification guidelines or as specified in subcontracting agreements signed with the certifying bodies. For year 2010, a tally of these activities amounts to a revenue of €2.134 million for expenditures totalling €1.702 million. ■

PUBLISHING POLICY

INRETS's and LCPC's publishing activities constitute a natural outlet for disseminating knowledge and showcasing research findings. The Institute's editions and publications are intended for scientific communities, technical companies, universities, public authorities and, more broadly, a civil society that knows no national borders. ■

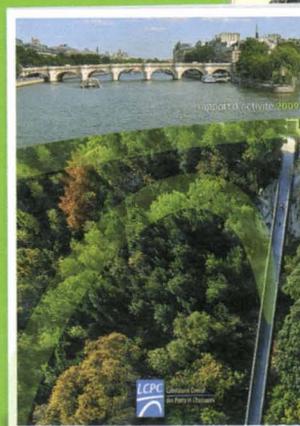
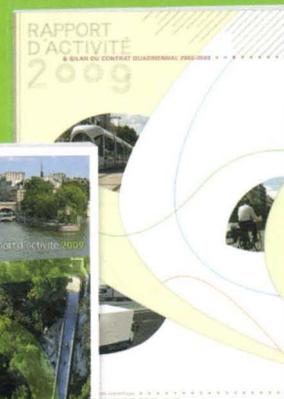
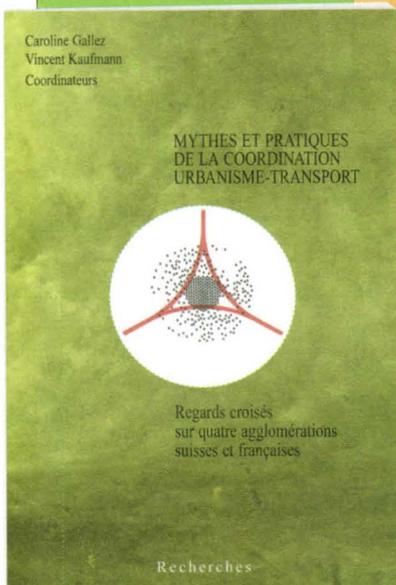
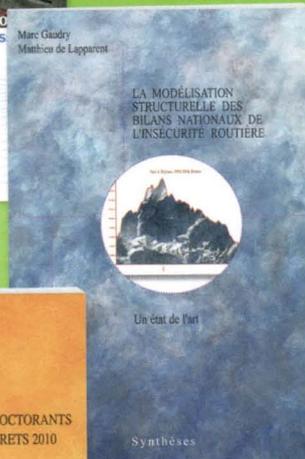
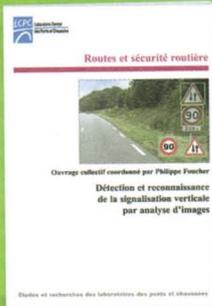
2010 RELEASES COMPRISE



- ▶ 9 published texts, including one reprint, in LPC's Studies and Research collection (« *Etudes et Recherches* ») 1 2
- ▶ 5 published texts, including one reprint and one English language version, in the Test Methods collection
- ▶ 4 published texts, including one reprint and a CD-ROM, in the Technical Guides collection
- ▶ 3 books published jointly with the Setra Agency
- ▶ 13 published doctoral theses
- ▶ 2 issues published of the *Bulletin des Laboratoires des Ponts et Chaussées* (BLPC) scientific journal 3
- ▶ 3 publications released in INRETS' *Syntheses* collections 4
- ▶ 3 publications released in INRETS' *Proceedings* collection 5
- ▶ 5 publications released in INRETS' *Research* collection 6

Rounding out the Institute's 2010 publication calendar are:

- ▶ LCPC's 2009 Activity Report 7
- ▶ INRETS's 2009 Activity Report 8
- ▶ Four-year financing contracts with the State
- ▶ Catalogue of Publications





PUBLICATIONS AND DOCUMENTATION

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CASSIS: Open to the public

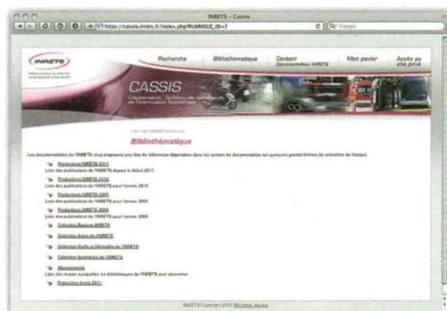
Access to the CASSIS documentary collection for the entire Internet community was made available during third quarter 2010, via the INRETS Website. The Institute considers this objective a critical one in that it provides the window to expose and allow consultation of research work and corresponding publications. Web users are able to find in this open archive system all

references to INRETS' scientific output and moreover are led to the unabridged text of these publications, in complete legality and in compliance with the rules of confidentiality. CASSIS also offers access to the catalogue of INRETS libraries, containing over 60,000 references in the transport field.

Various functionalities have been added to accompany visits to the site, including: export of bibliographical lists, shortcuts for triggering pre-established requests to list INRETS' Collections or publication directories by year, and compilations of results. An online help tool is also available to visitors for consultation and/or download. ■

NUMBERS OF VISITS DURING THE 10-MONTH PERIOD OF PUBLIC CONSULTATION

MONTH	UNIQUE VISITORS	TOTAL VISITS	PAGES	HITS
Nov 2010	83	312	58,313	72,263
Dec 2010	307	1,018	159,503	214,107
Jan 2011	538	1,530	166,780	253,621
Feb 2011	494	1,238	105,584	174,256
March 2011	529	1,298	104,790	177,437
April 2011	545	1,203	81,233	132,869
May 2011	505	1,183	105,901	163,599
June 2011	379	949	70,116	106,617
July 2011	348	905	86,047	123,637
August 2011	333	995	104,503	144,172
Total	4,061	10,631	1,042,770	1,562,578



<http://www.inrets.fr/ressources-and-documentation/services-ist/cassis.html>

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LCPC pursues its policy of storing publications in the "HAL" open archive

The Documentation Unit decided to set up a publications repository within the "Hal" system and has received subsequent support from the Laboratory's Scientific Division. This publication storage facility has been streamlined thanks to direct interfacing between the in-house documentary portal *Callistée* and the open archive. A total of 224 publications were deposited during 2010, vs. 570 in 2009, the year this policy was adopted. ■

<http://hal.archives-ouvertes.fr/>





4. APPENDICES

AS OF JANUARY 1ST, 2011

1.313

LCPC'S 663 PERSONNEL,
AND INRETS'
650 PERSONNEL

11

SITE LOCATIONS

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AND MISSIONS

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LIST OF LCPC RESEARCH PROJECTS AND MISSIONS

LCPC RESEARCH PROJECTS

11K051	MTT: Metrology of traffic and traffic-related trajectories	11MEP1	Durability in rock formations - Underground storage
11K062	Controllability	13N051	ACTENA: Monitoring of inaccessible tensioned cables
11K063	Involving infrastructure as part of a road risk management strategy	11N052	RSI: Prevention, modelling and repair of structures affected by delayed ettringite formation
11K081	PLINFRA	11N062	MOGC: Optical Methods for use in Civil Engineering
11K091	PALM: Forecasts and Warnings during inclement Weather conditions	11N063	Structural monitoring through the use of imaging techniques
11K101	I2V: Impacts of visual indices dedicated to driving (formerly 11KEP1)	11N064	Sensors and information processing
11K102	PREVER: Risk prevention and evaluation (formerly 11KEP3)	11N065	Structural pathologies: Diagnostic and treatment of structural pathologies
11KEP2	SERRE: Solutions to ensure environmentally-friendly road use	11N066	Optimisation of pavement maintenance: Incorporation of user and neighbour expectations, and environmental considerations
11L061	Streamlining earthworks for cost-efficient and durable structures	11N071	Characterisation of thin pavement layers, asphalt concrete and infrastructure cladding materials by means of non-destructive methods
11L062	Green concretes - environmentally-sensitive concretes: Reductions in greenhouse gas emissions	11N072	SOLEM: Characterisation of Soils and Linear Structures through use of Electromagnetic Methods
11L063	OPTIMIRR: Road materials that consume less energy and fewer non-renewable natural resources	11N073	MADMECA: Life-cycle maintenance and extension for steel structures and cabled structures
11L064	Performance-based, probabilistic approach for the life cycle determination of reinforced concrete structures	11N074	Internal pavement damage: Mechanisms and detection
11L071	Durability and ageing of polymers used in the field of civil engineering	11N081	Management of structural risks
11L091	AGREGA: Aggregates used in transport infrastructure construction causing fewer ecological impacts	11N091	Reinforcements using composite materials and bonded assemblies
11L092	EPEES: Evaluation and prediction of environmental impacts due to transport infrastructure	11N101	Ageing and maintenance of drainage networks and facilities exposed to biophysicochemical processes (formerly 11NEP1)
11L093	Cementitious materials and manufacturing processes in pursuit of sustainable development goals	11N102	Risks of internal swelling reactions in structural concretes on strategic facilities (formerly 11NEP2)
11L094	Sustainable infrastructure and structures	11N103	SIPRIEN: Instrumentation system for environmental risk prevention (formerly 11NEP3)
11L101	MATEOPT: Materials and Energy for Optimising civil engineering structures (formerly 11LEP2)	11N104	Rail platforms and guided transport systems (formerly 11NEP4)
11L102	ECO-Surf: Study of tyre-pavement contact to achieve optimal and sustainable properties of road surfacing materials (formerly 11LEP1)	21N04241	<i>Méfisto</i> : Test bench dedicated to asphalt mix fatigue cracking
11L103	Impacts of low-temperature geothermal energy on soils, aquifers and structures (formerly 11LEP3)	11P052	CESAR-LCPC: Performance improvement and professional development
11LEP1	Mitigation of the climatic impact on transport infrastructure	11P061	TRGMSO: Geotechnical surveying techniques, and geotechnical modelling of sites and structures - Soil and rock rheology
11M052	Rock-related risks	11P062	Measurement of cracking impact on the behaviour and durability of structures made of cementitious composites
11M061	Urban noise: Predicting noise in urban environments	11P063	Advanced pavement structure computational and design tools
11M062	Hydrology in urban Environments	11P064	Modelling and numerical simulation of heterogeneous materials with a discrete composition
11M063	Characterisation and treatment of stormwater drainage residue	11P065	Fondephe: Physical foundations of the mechanical behaviour of materials used in pavement structures
11M064	Seismic hazards and risks	11P066	PCMP: Physical Chemistry of Porous Media
11M065	Drought: Evaluation of risks related to drought	11P071	FONDAMS: Soil Foundations and Improvements
11M071	Vibrations: Reducing vibrations in urban settings	11P081	Use of finite elements in geotechnical engineering: Modelling of soil blocks and geotechnical structures by the finite element method
11M072	OSS: Structures located in seismic zones	11P091	<i>Composi-Gec</i> : Demonstrator of urban footbridges built using composite materials, with self-diagnostic capacity
11M081	Hydrology of suburban catchment basins	11P101	Rail track infrastructure (formerly 11PEP1)
11M091	SER: Networked sediments: A deterministic approach and operational implications	11P102	<i>MansProd</i> : Unsaturated granular materials and sustainable manufacturing processes (formerly 11PEP2)
11M092	PSUR: Soil conservation in both urban and road environments	11P103	Contributions of modelling in the field of sustainable construction (formerly 11PEP3)
11M093	Natural risks: Mitigating the risks of ground movement in urban or sensitive zones		
11M094	Rockfalls and rockslides		
11M095	FURET: Invisible construction sites		
11M101	Predicting noise in external environments: From the regional to urban level (formerly 11MEP1)		
11M102	Sustainable stormwater management (formerly 11MEP3)		
11M103	DOFEAS: Dykes and waterway facilities: erosion, caving and earthquakes (formerly 11MEP2)		



LIST OF SPECIFIC RESEARCH ACTIONS UNDERTAKEN BY INRETS DURING 2010

ORIENTATION 1: MOBILITY, ENERGY AND THE ENVIRONMENT

DEST: EEST (Energy, greenhouse effect and transport): Quantification and evaluation methodology aimed at greenhouse gas emissions and pollutants generated by the transport sector.

LTE: Hybrid vehicles and vehicle dynamics: Braking optimisation on hybrid vehicles and the potential for recovering the corresponding energy.

Acceptability of innovative vehicles: Identifying individual factors (representations, appropriation) and social factors (acceptability) capable of either facilitating or hindering the substitution of a conventional vehicle by an electric or hybrid vehicle.

Use of electric vehicles.

Transport policies and climate change: An international comparison.

LTN Satory: Multicriteria optimisation of rail traffic with the goal of minimizing energy consumption.

LVMT: Knowledge of professional trip-making: Gaining further knowledge of professional trip-making, understanding the determinants and share of overall mobility.

Map of airport locations and low-cost service offering: How is regional land use being reshaped?

SPLOTT: Organisation of package delivery services, by emphasising an understanding of constraints, especially in two specific areas: the sorting platform and local delivery routes.

INTEGRATIVE PLATFORMS (IP)

LPC: Lifelong learning: Compiling the body of knowledge produced by INRETS on lifelong learning (classroom education, driving instruction, licensing exam, post-license training, rehabilitation, training for older drivers).

LTN Marne-la-Vallée: ITGUR: "Innovations in urban and regional guided transport services": Multidisciplinary approach involving improved public transit, especially guided services, in terms of performance, safety and competitiveness.

LESCOT: Situations involving transport for the disabled: Stimulating research on "Disabilities" at INRETS; improving the visibility of INRETS' research activities on this topic; promoting synergy across the various approaches; positioning INRETS at the forefront of research conducted on disabilities.

LEOST: GNSS: "Global navigation satellite system": Developing and proposing a localisation system based on the use of satellites (GNSS) in order to meet the needs of transport system researchers and users.

SSTT: "Land transport safety and security": Establish a strategic SSTT research agenda and pursue a number of research options around selected projects, these and joint ventures.

GRETIA: ACTOR: "Social and functional acceptability of both technical and organisational changes".

ORIENTATION 2: TRANSPORT SYSTEM QUALITY, SAFETY AND OPTIMISATION

LPC: Expansion of road/rail network connections.

LTN MIV: "Diag PAC": Converter for high-powered fuel cell placed in a default situation.

INTEGRATIVE PLATFORMS (IP)

DEST: LTMAE IP: "Leisure, tourism, mobility, regional planning and the environment", along with the mission: "Transport forecasts and sustainable development".

Public participation in the Transport decision-making and research processes (IP 2: "Public conversation").

Energy, Greenhouse Gases and Transport.

LTE: Electric vehicles: Deriving a consensual scientific vision on the advantages and disadvantages of electric vehicles as an alternative to the internal combustion vehicle in order to limit environmental impacts in accordance with various use scenarios.

LVMT: Local-level planning, spatial layout and the organisation of transport and mobility networks.

ACTIONS LYING WITHIN THE SCOPE OF THE "VERONESE" PROJECT

ESTAS: ERTMS: "European Rail Traffic Management System": Performance-based analysis of the ERTMS communications subsystem.

"Living lab train": Building the bases of a living laboratory dedicated to mobility assistance services on-board a vehicle.

Energy optimisation strategies in rail traffic management.

GRETIA: Cooperative systems.

Modelling / Generic simulation of Transport Networks: Development of transport system models (traffic flow models intended to optimise systems management, models designed for a posteriori evaluations and planning).

Assessment of the impacts on safety due to the adoption of management measures: based on an evaluation of safety-related impacts caused by motorway traffic control measures in a suburban setting, offering a proposal for optimising such measures.

LEOST: "Diag-Audio": Assessment of the feasibility for an automated system to detect certain types of defects in rail components, derived from the principle of "monitoring by listening" practiced by train conductors.

Numerical simulation platform for software radio applications on vehicles (both road and rail): the objective here is to simulate, using the OPNET discrete event simulator, wireless communication networks, whether cooperative or not, by accounting for both system and application specificities.

LESPIS: Pedestrian modelling: Creation of an open-source pedestrian simulation platform and acquisition / processing of pedestrian data in an open medium, with the aim of compiling an open database.

LESCOT: Green driving: Implementation of a driver assistance system to help reduce fuel consumption.

LICIT: Multisource travel time estimation in urban settings: Developing a set of real-time road information generation tools by reliance on tracking vehicles.

LPC: Motorists' attitudes and behaviour relative to the electric vehicle: Analysis based on surveys and road tests using instrumented vehicles from the perspective of fears and apprehensions regarding this new mode and possible repercussions on road safety.

Promoting the choice of a more ecological mode of transport - green driving, cycling, public transit: Examining how to change motorists' behavioural habits from the standpoint of favouring environmental protection.

ORIENTATION 3: TRANSPORT AND HEALTH (ACCIDENT ANALYSES, BIOMECHANICS AND HEALTH)

LPMC: AQUARIUM: "Advanced Quantification of Aortic Rupture for Injury Understanding and Modelling": Study of aortic lesion phenomena when experiencing an automobile collision.

MA: Hybrid vehicles and vehicle dynamics: Braking optimisation on hybrid vehicles and the potential for recovering the corresponding energy.

INTEGRATIVE PLATFORMS (IP)

MA: Motorcycles: This platform is intended to unite researchers from both INRETS and outside entities specialised in the field in order to address issues, in all their multiple facets, relative to motorcycle use of the basic road traffic system.

COPIE: Pedestrian behaviour when interacting with the immediate environment, especially in an urban environment.

Database used for road safety research, instituted to fill a need for organisation, information and communication in the field.

UMRESTTE: Road Risks related to Work and the Workplace

WHO (World Health Organisation) Centre for Collaborative Studies.

TESS-PED (Transport, the Environment, Safety, Health issues in Emerging and Developing Countries): Promoting exchanges between teams or researchers working in similar countries or common topics across different regions of the world; consolidating multidisciplinary approaches; coordinating and expanding INRETS' expertise and research capabilities; establishing lasting partnerships; and strengthening the Institute's international visibility in this field.

LIST OF COURSES TAUGHT

2009/2010 ACADEMIC YEAR

Staff member	INRETS / LCPC	X / ENS / EC / ENSTA	ENPC / PFE	ENTPE / ENSAN / ESIEE / IPSA	University / IUP / IUT	Other
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ANDRÉ Michel	INRETS					
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AUBERLET Jean-Michel	INRETS					
AUBERT Didier	INRETS					
AURIOL Jean-Claude	LCPC					
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BARBARIN Samuel	INRETS					
BARD Pierre- Yves	LCPC					
BAROGHEL BOUNY Véronique	LCPC					
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BENINE NETO André	LCPC					
BERENGIER Michel	LCPC					
BERMOND François	INRETS					
BERRI Akli	INRETS					
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BHOURI Neila	INRETS					
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CHEVALIER Christophe	LCPC					
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COHEN Simon	INRETS					
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COUSSOT Philippe	LCPC					
COUSSY Olivier	LCPC					
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DELHOMME Patricia	INRETS					
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HAYAT Saïd	INRETS					
HENRIQUEZ Martin	INRETS					
HUGOT Myriam	INRETS					

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Staff member	INRETS / LCPC	X/ENS/EC/ENSTA	ENPC/PFE	ENTPE/ENSAN/ESIEE/IPSA	University / IUP/IUT	Other
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FINANCIAL RESOURCES AND EXPENDITURES (EXCLUDING DEPRECIATION)

LCPC

REVENUES

	Euros	%
Ministry of Ecology, Energy, Sustainable Development and Regional Planning	45,826,659	80.4 %
Subsidy for public service provision	45,826,659	
Ministry of Higher Education and Research	69,804	0.1 %
Subsidy for public service provision	69,804	
Finalised contracts and support allocated to research activities	6,159,058	10.8 %
Research contracts signed with public or private sector third parties	2,412,229	
Subsidies on research projects or programmes	3,746,829	
Value generation from research activity and service provision	4,217,169	7.4 %
Fees for patents and licenses	339,021	
Service provision	3,784,609	
Service provision	93,539	
Other subsidies and revenues	757,352	1.3 %
Other subsidies	549,286	
Financial revenue and other earnings from ordinary operations	100,918	
Exceptional earnings	102,941	
Financial transactions - Fixed assets	4,207	
Total revenues	57,030,042	100.0 %
Carryover from 2009	3,912,571	
Total resources	60,942,613	

MANDATED EXPENDITURES

Breakdown of mandated expenditures by recipient	Euros	%
Activities performed by research entities	40,046,468	70.8 %
Road safety	6,448,732	
Environment, natural risks and sustainable development	13,621,598	
Infrastructure	19,976,138	
Joint actions	3,818,898	6.8 %
Exceptional testing facilities	535,813	
Research applications	428,353	
International exchanges	617,617	
Scientific and technical publications	1,677,562	
Scientific partnerships	218,558	
Permanent training	340,995	
Support functions	12,695,903	22.4 %
Social actions	666,422	
Shared computer facilities	2,336,490	
Property-related - maintenance	1,266,260	
Property-related - major works, acquisitions, new construction	387,386	
Head office overhead	5,654,300	
Research entities' overhead	2,137,316	
Financial transactions	0	
Other general expenditures	247,729	
Total expenditures	56,561,269	100.0 %
Carryover to 2011	2,881,344	
Contribution to the reserve fund for financing head office transfer operations from Paris to Marne-la-Vallée	1,500,000	
Total	60,942,613	

Breakdown of mandated expenditures by type	Euros	%
Personnel expenditures on subsidies for public service provision	40,354,290	71.3 %
Other personnel expenditures (i.e. on research contracts)	1,474,588	2.6 %
Unscheduled operations and investment	13,809,192	24.4 %
Unscheduled operations and investment	923,199	1.6 %
Total expenditures	56,561,269	100.0 %



INRETS

REVENUES

	Euros	%
Ministry of Ecology, Energy, Sustainable Development and Regional Planning	43,858,234	77.0 %
Subsidy for public service provision	43,858,234	
Ministry of Higher Education and Research	214,315	0.4 %
Subsidy for public service provision	214,315	
Finalised contracts and support allocated to research activities	8,899,205	15.6 %
Research contracts signed with public or private sector third parties	1,458,006	
Subsidies on research projects or programmes	7,441,199	
Value generation from research activity and service provision	865,625	1.5 %
Fees for patents and licenses	16,467	
Service provision	849,158	
Service provision	0	
Other subsidies and revenues	3,109,260	5.5 %
Other subsidies	451,965	
Financial revenue and other earnings from ordinary operations	141,529	
Exceptional earnings	2,515,766	
Financial transactions - Fixed assets	0	
Total revenues	56,946,639	100.0 %
Carryover from 2009	0	
Total resources	56,946,639	

MANDATED EXPENDITURES

Breakdown of mandated expenditures by recipient	Euros	%
Activities performed by research entities	36,065,051	65.4 %
Mobility, energy and the environment	10,583,645	
Quality, safety and transport system optimisation	17,048,480	
Transport and health	8,432,926	
Joint actions	3,534,032	6.4 %
Exceptional testing facilities	0	
Research applications	335,981	
International exchanges	723,409	
Scientific and technical publications	1,629,063	
Scientific partnerships	420,321	
Permanent training	425,258	
Support functions	15,519,471	28.2 %
Social actions	92,397	
Shared computer facilities	2,539,499	
Property-related - maintenance	57,026	
Property-related - major works, acquisitions, new construction	223,635	
Head office overhead	2,518,907	
Research entities' overhead	7,032,249	
Financial transactions	0	
Other general expenditures	3,055,758	
Total expenditures	55,118,554	100.0 %
Carryover to 2011	1,380,577	
Total	56,499,131	

Breakdown of mandated expenditures by type	Euros	%
Personnel expenditures on subsidies for public service provision	34,601,680	62.8 %
Other personnel expenditures (i.e. on research contracts)	4,273,391	7.8 %
Unscheduled operations and investment	16,008,943	29.0 %
Unscheduled operations and investment	234,540	0.4 %
Total expenditures	55,118,554	100.0 %

COMPOSITION OF THE BOARDS OF DIRECTORS

YEAR 2010

INRETS

PRESIDENT

Yves Bamberger - Director of Research and Development, EDF

VICE PRESIDENT

Yves Crozet - University Professor, Université Lyon 2

MEMBERS REPRESENTING THE MINISTRIES

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Laurence Piketty (appointee)
William Sassi (substitute)

Ministry of Higher Education

Daniel Ganoac'h (appointee)

Ministry of Transport

Régine Bréhier (appointee)
Pierre Valla (substitute)

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Ministry of the Interior

Anne Lebrun (appointee)
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APPOINTED MEMBERS EXTERNAL TO THE INSTITUTE

Claude Arnaud - Director of Research and Innovation, Véolia

Yves Bamberger - Director of Research and Development, EDF

Rémi Bastien - Director of Research, Advanced Studies and Materials, Renault

Marie-Pierre Meynard - Director of Innovation and Research, SNCF

Yves Crozet - University Professor, Université Lyon 2

Bernard Darniche - Go Tactic System

Guy Le Bras - GART

Brigitte Martin - Head of Motor Department, IFP, Lyon

Yves Ramette - Deputy Managing Director for Projects, Engineering and Capital Investment, RATP

ELECTED PERSONNEL REPRESENTATIVES

Researchers

Christine Buisson (appointee) - Director of Research, LICIT
Martine Wahl (substitute) - Research Project Manager, LEOST
Hugues Chollet (appointee) - Research Project Manager, LTN
Joël Lelong (substitute) - Research Project Manager, LTE

ITA

Mouloud Haddak (appointee) - Research Engineer, UMRESTTE
Nathalie Bourbotte (substitute) - Research Technician, ESTAS
Pierrette Charnay (appointee) - Design Engineer, UMRESTTE
Maryse Basseporte (substitute) - Research Technician, IST Cluster, Marne-la-Vallée

ATTEND THE BOARD MEETINGS IN A CONSULTATIVE CAPACITY

Christine Bénard - President of the Scientific Council

Guy Bourgeois - Managing Director

Mireille Gravier-Bardet - Secretary General

Bernard Bachelier - Financial Controller

Odile Rios - Accountant

GUEST MEMBERS

Jean-Pierre Médevielle, Deputy Managing Director in charge of International Affairs

Bernard Cambou, Scientific Director

Dominique Mignot, Deputy Scientific Director

LCPC

PRESIDENT

Yves Bamberger - Director of Research and Development, EDF

VICE PRESIDENT

Michel Ray - Technical and Innovation Director, EGIS

GOVERNMENT REPRESENTATIVES OVERSEEING ECOLOGY-PUBLIC WORKS-TRANSPORT

Ministry of Ecology, Energy, Sustainable Development and Maritime Affairs assigned Green Technologies and Climate-related Negotiations (MEEDDM)

Pierre Valla (appointee) - Deputy Director - Research and Innovation Directorate, General Commission for Sustainable Development

Jean-Bernard Kovarik (appointee) - Deputy Director of Studies and Forecasting, General Directorate for Planning, Housing and Nature

Daniel Boulnois (appointee) - Deputy General Director, General Directorate for Planning, Housing and Nature

Claire Hubert (substitute) - Bureau Manager, Research Department, Research and Innovation Directorate, General Commission for Sustainable Development

Jean Lévêque (substitute) - Manager of the Construction and Technical Policy Subdivision, General Directorate for Infrastructure, Transport and Maritime Affairs

Jean-Pierre Bardy (substitute) - DHUP, General Directorate for Planning, Housing and Nature

GOVERNMENT REPRESENTATIVES OVERSEEING RESEARCH

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Laurence Piketty (appointee) - Director of the Energy, Sustainable Development, Chemicals and Processes Sector, General Research and Innovation Directorate

Armel de la Bourdonnaye (appointee) - Manager of the Research and Innovation Strategy Unit

William Sassi (substitute) - Project Manager for Transport, General Research and Innovation Directorate

Bruno Larousse (substitute) - Project Manager, Energy and Sustainable Development, General Research and Innovation Directorate

PRESIDENT OF THE SCIENTIFIC COUNCIL

Christine Bénard
Director of Research, MICHELIN

GOVERNMENT REPRESENTATIVES OVERSEEING INDUSTRY

Ministry of Ecology, Energy, Sustainable Development and Maritime Affairs assigned Green Technologies and Climate-related Negotiations (MEEDDM)

François Raymond - Manager of the Office of General Affairs and Performance, General Directorate of Planning, Housing and Nature

Xavier Foata - Manager of the Mineral Resources Division, General Directorate of Planning, Housing and Nature

OTHER APPOINTED MEMBERS

Philippe Bisch - Scientific Director, IOSIS

Dorothee Briau - Managing Director, Comité 21, French Committee for the Environment and Sustainable Development

Marie-Pierre Meynard - Director of Research and Technology, SNCF

Antoine Frérot - Managing Director, Véolia Environnement

Éric Vantal - Departmental Director of Roads and Streets, Ain Departmental Council

ELECTED PERSONNEL REPRESENTATIVES

Fabien Chiappini (appointee)
Marie-Line Gallenne (appointee)
Jean-Louis Chazelas (appointee)
Marc Quiertant (appointee)
Thierry Chaussadent (substitute)
Christophe Joubert-Boitat (substitute)
Pierre-Olivier Vandanjon (substitute)
Frédérique Larrarte (substitute)

ADDITIONAL ATTENDEES AT BOARD OF DIRECTORS' MEETINGS

Bernard Bachelier - Head of Budget Control Unit - MEEDDM

Hélène Jacquot-Guimbal - Managing Director, LCPC

Olivier Havas, puis **Michel Boulet** - Deputy Director, Nantes Centre, LCPC

Henri Van Damme - Scientific Director, LCPC

Jean Bonny - Director, LCPC

Dominique Payan - Secretary General, LCPC

Arnaud Depince - Accountant, LCPC

Christian Gavériaux - Project Manager, LCPC



COMPOSITION OF THE SCIENTIFICS BOARDS

YEAR 2010

INRETS

PRESIDENT

Christine Bénard - Scientific Director, Technology Centre, MICHELIN Tyre Manufacturing Company

APPOINTED MEMBERS EXTERNAL TO THE INSTITUTE

Michel Amiet - DGA/DGET, Defence Ministry

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Christine Bénard - President, Scientific Director, Michelin
Pierre-Étienne Gautier - Scientific and Technical Director, Innovation and Research Division, SNCF

Françoise Combelles - General delegate to the RATP Innovation and Sustainable Development Mission

François Gardes - University Professor, Paris 1 Panthéon Sorbonne, Economics Department

Lisa Hakamies-Blomqvist - Director of NordForsk (Nordic Research Council)

Valérie Issarny - Director of Research, INRIA, ARLES Project

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Florence Masbernat - Director of Engineering Processes, ALSTOM Transport

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Louis-Rachid Salmi - Professor, University of Bordeaux 2, ISPED

INSTITUTE PERSONNEL REPRESENTATIVES

Corinne Blanquart (appointee) - Research Project Manager, SPLOTT

Mireille Chiron (appointee) - Director of Research, UMRESTTE

Mouloud Haddak (appointee) - Research Engineer, UMRESTTE

Juliette Kauv (appointee) - Research Engineer, LTN

Hugues Chollet (substitute) - Research Project Manager, LTN

Robert Joumard (substitute) - Research Engineer, LTE

Étienne Lemaire (substitute) - Research Engineer, ESTAS

Jean-Emmanuel Michel (suppléant) - Design Engineer, MA

LCPC

PRESIDENT

Christine Bénard - Scientific Director, Technology Centre, MICHELIN Tyre Manufacturing Company

VICE PRESIDENT

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Jean-Pierre Marchand - Consultant, ROUTE ET CONSEIL

Alain Pecker - President and Managing Director, S.A. GÉODYNAMIQUE ET STRUCTURE

Yves Perrodin - Director of the Environmental Sciences Laboratory, ENTPE Engineering School

Ginette Arlguie - University Professor, Construction Materials and Durability Laboratory, LMDC, NSA, UPS Civil Engineering

Daniel Clement - Director of Research ADEME

EX-OFFICIO MEMBERS

Régine Bréhier (appointee) - Director - Research and Innovation Directorate - General Commission for Sustainable Development - Ministry of Ecology, Energy, Sustainable Development and Maritime Affairs

Claire Hubert (substitute) - Research and Innovation Directorate - General Commission for Sustainable Development, Ministry of Ecology, Energy, Sustainable Development and Maritime Affairs

Ronan Stephan (appointee) - General Directorate for Research and Innovation, Ministry of Higher Education and Research

William Sassi (substitute) - Project Manager, General Directorate for Research and Innovation, Ministry of Higher Education and Research

Jean Lévêque (appointee) - Manager of the Construction and Technical Policy Subdivision, Transport Infrastructure Division, General Directorate for Infrastructure, Transport and Maritime Affairs, Ministry of Ecology, Energy, Sustainable Development and Maritime Affairs

Philippe Redoulez (substitute) - Director of the SETRA Agency

Guy Bourgeois (appointee) - Managing Director, INRETS

OTHER MEMBERS

Representative of the CETE Technical Centres

Jean-Daniel Vazelle - Director, CETE - North-Picardy Regional Office

CNRS Representative

Philippe Bompard - Deputy Scientific Director of the Engineering Sciences Department, CNRS Research Centre

Elected personnel representatives

Laurent Gaillet (appointee)

Olivier Burban (substitute)

Fabien Chiappini (appointee)

Véronique Bouteiller (substitute)

Sylvie Proeschel (appointee)

Frédérique Larrarte (appointee)

Marc Quiertant (substitute)

Hieu-Thao Huynh (appointee)

Jean-Michel Simonin (substitute)

Louis-Marie Cottineau (appointee)

Jacques Ehrlich (substitute)

INVITED TO ATTEND COUNCIL MEETINGS

Hélène Jacquot-Guimbal - Managing Director

Sandrine Lefebvre-Guillaud - Management and Oversight Advisor

Henri Van Damme - Scientific Director

PERMANENT COUNCIL GUESTS

Jean Bonny - Director

François de Larrard - Permanent Secretary

Serge Piperno - Director of Research, ENPC

JANUARY 1ST, 2011, IFSTTAR IS BORN

THE PUBLICATION OF DECREE NUMBER 2010-1702 DATED DECEMBER 30TH, 2010 OFFICIALLY FOUNDED THE FRENCH INSTITUTE OF SCIENCE AND TECHNOLOGY FOR TRANSPORT, LAND PLANNING AND NETWORKS (IFSTTAR). FOR A LOOK BACK AT 2010, A YEAR DEDICATED TO PREPARING FOR THIS MERGER.

Climate change and, more broadly, the challenges associated with sustainable development have placed constraints on our urban societies, requiring a drastic re-evaluation of regional development patterns, services and relevant engineering approaches. Against this backdrop, the French government has decided to unite the efforts of the LCPC Laboratory specialised in civil engineering research and the INRETS National Transport and Safety Research Institute, in order to address these challenges through a new public entity assigned the scientific and technological scope to authoritatively cover the fields of mobility and construction.

As of spring 2010, H el ene Jacquot-Guimbal, LCPC's Managing Director, was appointed to head up the new entity emanating from the merger of these two research institutes. To ensure a successful outcome, Ms. Jacquot-Guimbal set up a number of working groups tasked with auditing the respective operating modes of the range of support services, with the aim of identifying synergies and potential discrepancies to be resolved. Upon completion of this analytical phase, an intermediate report was distributed to the various oversight Ministries.

During the second half of 2010, an intense team involvement in the project was focused on the priority objective of ensuring operational support services as of January 1st, 2011, the official launch date of Ifsttar, acronym for the newly-formed French Institute of Sciences and Technology for Transport, Development and Networks.

A NEW INSTITUTE, A NEW IDENTITY

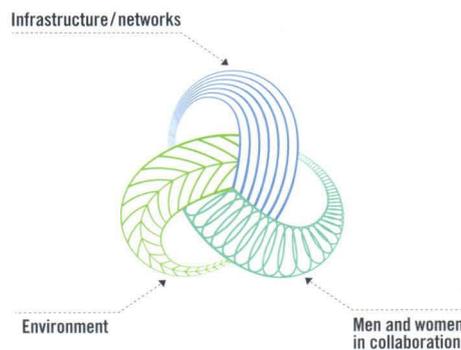
A participative approach was adopted to help create a new identity for Ifsttar. A committee composed of some 20 volunteers from LCPC and INRETS met in a working group format to consult and direct steps towards establishing this future visual identity. Dubbed the "Brand workshop", with branding implying identification of a logo, this workshop held fruitful exchanges between volunteers, observers and official representatives of the two organisations. ■

LOGOTYPE



A logotype composed of both a sign and a typeset.

SIGN



A sign that suggests synergy, complementarity and the connections between different professions.

TYPESET

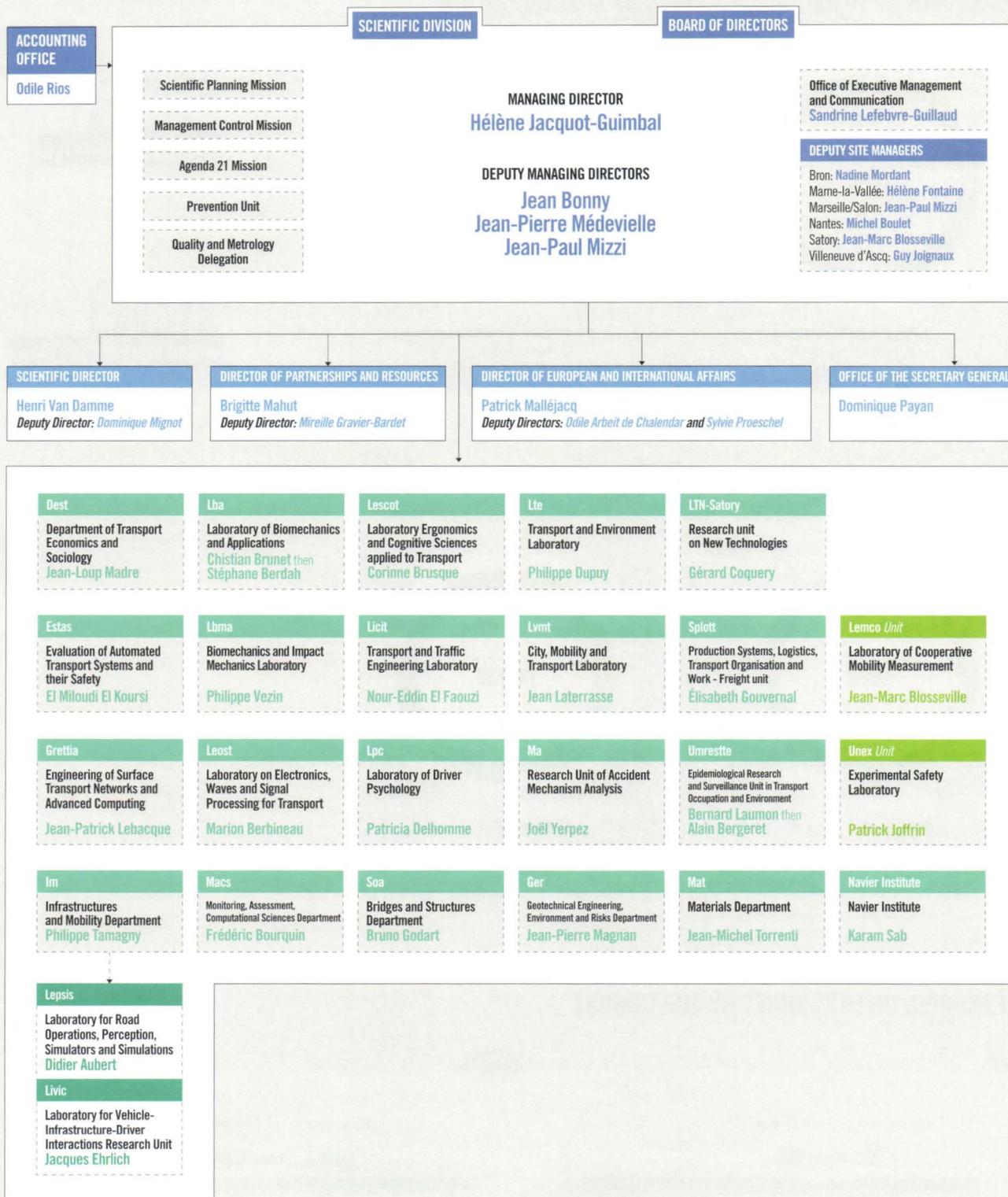
IFSTTAR

Simple and solid: a lineal typeset (in a sans serif font)
Respected, serious and elegant: A streamlined typeset using only upper case lettering.



ORGANISATIONAL CHART

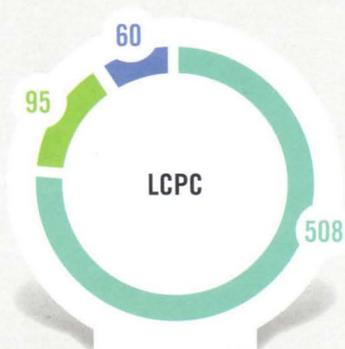
AS OF JANUARY 1ST, 2011



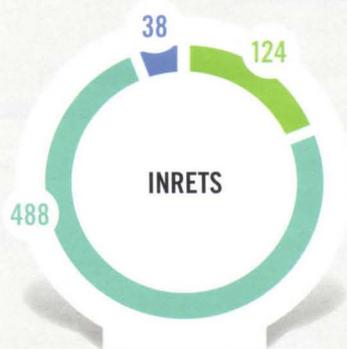
HUMAN RESOURCES

AS OF JANUARY 1ST, 2011

BREAKDOWN OF PERSONNEL BY FIELD OF SPECIALISATION



- Research and Expert appraisals
- Applications, dissemination and international action
- Support functions

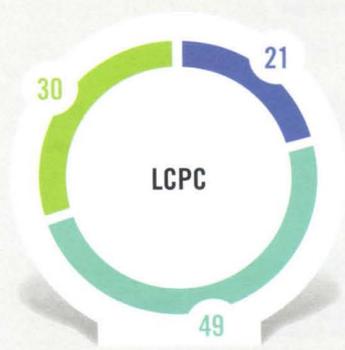


- Research and Expert appraisals
- Applications, dissemination and international action
- Support functions

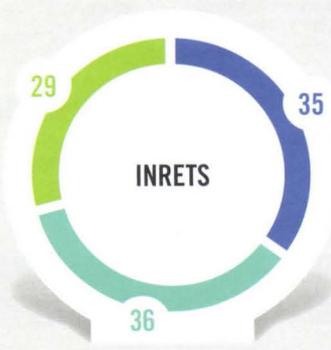
663
LCPC STAFF (656.4 FTEs)

650
INRETS STAFF (633.66 FTEs)

BREAKDOWN OF PERSONNEL BY EMPLOYMENT STATUS



- Administrative
- Technical
- Research



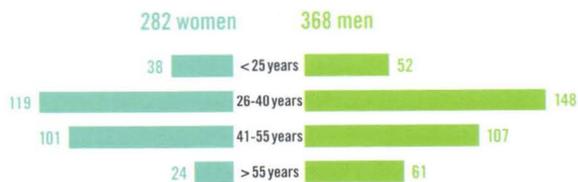
- Administrative
- Technical
- Research

BREAKDOWN OF PERSONNEL BY AGE COHORT

LCPC



INRETS





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SOA/GER/MAT

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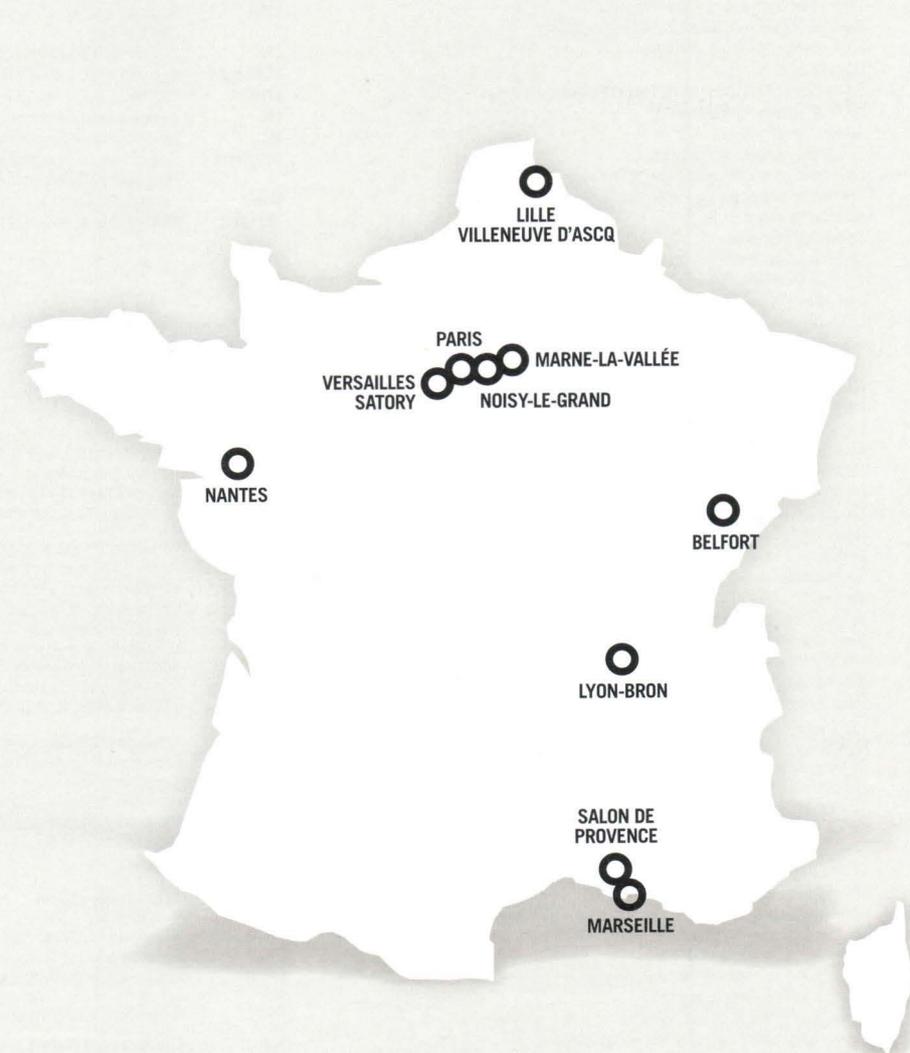
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VERSAILLES-SATORY

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78000 Versailles
Tél.: +33 (0)1 30 84 40 00
Research entities: LEMCO/LPC/LTN



ACRONYMS

ADEME	Environment and Energy Management Agency
AIPCR	Permanent International Association of Road Congresses (World Road Association)
ALLENVI	National Research Alliance for the Environment
ANCRE	National Research Co-ordination Alliance for Energy Sustainability
ANR	National Research Agency
ANRT	National Research and Technology Association
ARBB	Australian Road Research Bureau
BRGM	Bureau of Geological and Mining Research
CEDR	European Conference of Road Facility Managers
CEISAM	Chemistry and Interdisciplinary Approaches: Synthesis, Analysis and Modelling
CEMAGREF	National Centre of Farm Machinery, Agricultural Engineering, and Water and Forests
CERTU	Centre for the study of networks, transport, urban planning and public buildings
CETE	Public Works Design and Research Centre
CFTR	French Committee to promote road engineering techniques
CIFRE	Industrial Agreements for Training through Research
CIRAD	Centre of International Co-operation in Agronomic Research for Development
CNES	National Space Studies Centre
CO	Objective-based contract
COFRAC	French Accreditation Committee
COST	European Co-operation in Science and Technology
DGA	General Directorate for Armament
DGCIS	General Directorate for Competitiveness, Industry and Services
DGITM	General Directorate for Infrastructure, Transport and Maritime Affairs
DOT	Department of Transportation
DSCR	Delegation for Road Safety and Traffic Conditions
EADS	European Aeronautic Defence and Space Company
EASE	Environment, acoustics, safety and eco-design
EMC2	Steel assemblies and complex composites
ENTPE	National Engineering School of State Public Works
EPSF	Public-sector rail safety institution
EQUIPEX	Exceptional facilities
ERT	Europe Recherche Transport (European Transport Research)
FHWA	Federal Highway Administration
FOR	Forever Open Road
FVI	File listing compensated victims
GEPEA	Food Processing and Environmental Engineering
GER	Geotechnical Engineering, Water and Risks
GES	Greenhouse gases
GIS	Scientific consortium
GNSS	Global navigation satellite system
IDDRIM	Institute for Roads, Streets and Mobility-Enhancing Infrastructure
IDEX	Initiatives in pursuit of Excellence
IEED	Institutes for Excellence in the area of Carbon-Free Energies
IM	Infrastructure and Mobility
INERIS	National Institute on the Industrial Environment and Risks
INRA	National Institute for Agronomic Research
INRETS	National Institute for Transport and Safety Research
IRSN	French Institute for Radiological Protection and Nuclear Safety
IRSTV	Research Institute on Urban Sciences and Technologies
IRT	Technological Research Institutes
LABEX	Laboratories in pursuit of Excellence
LCPC	Civil Engineering Research Laboratory
LGV	High-speed rail line
LIER	INRETS' Road Equipment Testing Laboratory
LRPC	Regional Civil Engineering Research Laboratory
MAT	Materials
DGDDI	General Directorate for Customs and Indirect Taxation
MEDDTL	Ministry of Ecology, Sustainable Development, Transport and Housing
MESR	Ministry of Research and Higher Education
NILIM	National Institute for Land and Infrastructure Management
NIMS	National Institute for Materials Science
OECD	Organisation for economic co-operation and development
PACA	French region comprising Provence, the Alps and the Riviera Coast
PARI	Port and Airport Research Institute
PCRD	Research and Development Framework Programme
PGCE	Civil Engineering and Green Building Cluster
PIA	Future investment programme
PREDITT	Research and development programme for technological innovation in land transport
PRES	Research/academic clusters
PRES UEB	Research/academic cluster at the European University of Brittany
PST	Science and technology clusters
PWRI	Public Works Research Institute
RATP	Paris' Municipal Public Transit Authority
RFF	France's railway network operator
RST	Scientific and Technological Network
SATT	Society for the Acceleration of Technology Transfer
SCOT	Regional master plan
SCSP	Subsidy for public service provision
SETRA	Roads and Motorways Design Engineering Office

SITRASS	International solidarity on transport and research in Sub-Saharan Africa
SNCF	French National Railway Company
SOA	Buildings and structures
SOERE	Observation and Experimentation System for Environmental Research
SPI	Engineering Sciences
SPIGA	Engineering Sciences, Geosciences, Architecture
STAC	French Civil Aviation Technical Centre
STIM	Sciences and Technologies in Information and Mathematics
TRB	Transportation Research Board
UN	United Nations
UPE	University of Paris-East
UPE-MLV	University of Paris-East - Marne-la-Vallée Campus
USIRF	Federation of French Road Builders Unions
WHO	World Health Organization

ABBREVIATIONS OF INRETS RESEARCH OR SERVICE UNITS

DEST	Department of Transport Economics and Sociology
ESTAS	Evaluation of Automated Transport Systems and their Safety
GRETTIA	Engineering of Surface Transport Networks and Advanced Computing
LBA	Laboratory of Biomechanics and Applications (UMR-T 24 IFSTTAR/University of Méditerranée)
LBMC	Biomechanics and Impact Mechanics Laboratory (UMR-T 9406 IFSTTAR/UCBL)
LEMCO	Laboratory of Cooperative Mobility Measurement
LEOST	Laboratory on Electronics, Waves and Signal Processing for Transport
LESCOT	Laboratory Ergonomics and Cognitive Sciences applied to Transport
LICIT	Transport and Traffic Engineering Laboratory (joint research unit IFSTTAR/ENTPE School)
LPC	Laboratory of Driver Psychology
LTN-Satory	Research unit on New Technologies
LVMT	City, Mobility and Transport Laboratory
LTE	Transport and Environment Laboratory
MA	Research Unit of Accident Mechanism Analysis
UMRESTTE	Epidemiological Research and Surveillance Unit in Transport Occupation and Environment (UMR-T 9045 IFSTTAR/UCBL)
UNEX	Experimental Safety Laboratory
SPLOTT	Production Systems, Logistics, Transport Organisation and Work - Freight unit

THE ABBREVIATIONS OF THE DEPARTMENTS AT LCPC

GER	Geotechnical Engineering, Water and Risks Department
GER 1	Seismic risk and soil dynamics
GER 2	Behaviour of soils, rocks and structures
GER 3	Design of geotechnical structures
GER 6	Hydrology and drainage
GER 7	Water and soil pollution
GER 8	Earthworks and earth structures
GER 9	Physical models in geotechnical engineering
IM	Infrastructure and Mobility Department
IM 1	LEPSIS (Laboratory for Operation, Perception, Simulators and Simulation), a jointly-managed research unit
IM 2	LIVIC (Laboratory for Vehicle-Infrastructure-Driver Interactions), a jointly-managed research unit
IM 6	EASE (Multi-Scale Approach to the Environment and Infrastructure Safety), a jointly-managed research unit
IM 7	AGIT (Transport Infrastructure Analysis and Management), a research unit
IM 8	Unité de Recherche Structures
MACS	Measurement, Nondestructive Testing and Scientific calculations Department
MACS 1	Physics and instrumentation
MACS 2	Numerical models
MACS 6	Materials, composite assemblies - Instrumented structures
MACS 7	Imaging-based nondestructive testing
MACS 8	Structures and integrated instrumentation
MACS 9	Geopositioning
MAT	Materials Department
MAT 1	Mix design and laying
MAT 2	Experimental behaviour and mechanical modelling of materials
MAT 3	Microstructure, durability and modelling
MAT 4	Physical and chemical behaviour and durability of materials
MAT 6	Aggregates and material manufacturing procedures
MAT 7	Materials for transport infrastructure
SOA	Structures and Bridges Department
SOA 1	Trialling and modelling of structures
SOA 2	Safety and durability of bridges
SOA 6	Metallic and cable structures



This document is the successful outcome of a collaborative effort.
Warmest thanks are hereby extended to all contributors.

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