<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDITORIAL</td>
<td>3</td>
</tr>
<tr>
<td>LET'S HEAR FROM</td>
<td>4</td>
</tr>
<tr>
<td>Bernard Larrouetou</td>
<td>4</td>
</tr>
<tr>
<td>Liam Breslin</td>
<td>5</td>
</tr>
<tr>
<td>HIGHLIGHTS</td>
<td>6</td>
</tr>
<tr>
<td>AWARDS AND TRIBUTES</td>
<td>8</td>
</tr>
<tr>
<td>IFSTTAR IN ITS ENVIRONMENT</td>
<td>10</td>
</tr>
<tr>
<td>INSIDE THE INSTITUTE</td>
<td>12</td>
</tr>
<tr>
<td>IFSTTAR five scientific departments</td>
<td>12</td>
</tr>
<tr>
<td>Goal and performance contract: IFSTTAR signs up for four years</td>
<td>13</td>
</tr>
<tr>
<td>HUMAN RESOURCES</td>
<td>14</td>
</tr>
<tr>
<td>PIA - FUTUR INVESTMENT PROJECT: FIRST PRACTICAL STEPS</td>
<td>15</td>
</tr>
<tr>
<td>PARTNERSHIPS AND ALLIANCES</td>
<td>16</td>
</tr>
<tr>
<td>ANCRE ALLIANCE</td>
<td>16</td>
</tr>
<tr>
<td>Allenvi ALLIANCE</td>
<td>16</td>
</tr>
<tr>
<td>“IDRRIM-IFSTTAR”: the Dream Team of mobility</td>
<td>17</td>
</tr>
<tr>
<td>IFSTTAR and IRSVTV united for the city</td>
<td>17</td>
</tr>
<tr>
<td>IFSTTAR IN THE REGIONS</td>
<td>18</td>
</tr>
<tr>
<td>Nord Pas-de-Calais: the Lille-Villeneuve d’Ascq centre is at the core of many projects</td>
<td>18</td>
</tr>
<tr>
<td>Île-de-France: welcome to Marne-la-Vallée</td>
<td>19</td>
</tr>
<tr>
<td>Rhône-Alps: mobility in the spotlight at the Lyon-Bron centre</td>
<td>20</td>
</tr>
<tr>
<td>PACA: a centre present on all fronts</td>
<td>20</td>
</tr>
<tr>
<td>The Nantes centre: a key player among regional scientific and technical communities</td>
<td>21</td>
</tr>
<tr>
<td>INTERNATIONAL</td>
<td>22</td>
</tr>
<tr>
<td>QUALITY</td>
<td>24</td>
</tr>
<tr>
<td>COMMUNICATION</td>
<td>26</td>
</tr>
<tr>
<td>SCIENTIFIC ACTIVITY - RESEARCH/ EXPERTISE</td>
<td>28</td>
</tr>
<tr>
<td>Materials and structures department (MAST)</td>
<td>30</td>
</tr>
<tr>
<td>Geotechnical engineering, environment, natural hazards and earth sciences (GERS)</td>
<td>32</td>
</tr>
<tr>
<td>Components and systems department (COSYS)</td>
<td>34</td>
</tr>
<tr>
<td>Transport, health, safety department (TS2)</td>
<td>36</td>
</tr>
<tr>
<td>Planning, mobility and environment department (AME)</td>
<td>38</td>
</tr>
<tr>
<td>AXIS 1</td>
<td>40</td>
</tr>
<tr>
<td>INVENT SUSTAINABLE MOBILITY</td>
<td></td>
</tr>
<tr>
<td>AXIS 2</td>
<td>48</td>
</tr>
<tr>
<td>EFFICIENT AND SUSTAINABLE INFRASTRUCTURES</td>
<td></td>
</tr>
<tr>
<td>AXIS 3</td>
<td>54</td>
</tr>
<tr>
<td>MANAGE NATURAL HAZARDS AND ENVIRONMENTAL IMPACT</td>
<td></td>
</tr>
<tr>
<td>AXIS 4</td>
<td>60</td>
</tr>
<tr>
<td>SUSTAINABLE PLANNING OF TERRITORIES</td>
<td></td>
</tr>
<tr>
<td>EXPERTISE</td>
<td>66</td>
</tr>
<tr>
<td>Doctoral training</td>
<td>72</td>
</tr>
<tr>
<td>Publications-DMST</td>
<td>74</td>
</tr>
<tr>
<td>Editorial policy</td>
<td>75</td>
</tr>
<tr>
<td>PROMOTING RESEARCH, INDUSTRIAL RELATIONS</td>
<td>76</td>
</tr>
<tr>
<td>Subsidiaries and holdings</td>
<td>78</td>
</tr>
<tr>
<td>Socio-economic relations</td>
<td>79</td>
</tr>
<tr>
<td>Brevets</td>
<td>80</td>
</tr>
<tr>
<td>Software</td>
<td>82</td>
</tr>
<tr>
<td>Databases</td>
<td>84</td>
</tr>
<tr>
<td>Trials</td>
<td>84</td>
</tr>
<tr>
<td>Devices</td>
<td>85</td>
</tr>
<tr>
<td>Certification</td>
<td>86</td>
</tr>
<tr>
<td>Standardisation</td>
<td>88</td>
</tr>
<tr>
<td>APPENDIX</td>
<td>90</td>
</tr>
<tr>
<td>Governance</td>
<td>90</td>
</tr>
<tr>
<td>Outgoings and incomings</td>
<td>92</td>
</tr>
<tr>
<td>Laboratories location</td>
<td>93</td>
</tr>
<tr>
<td>Cross-cutting activities: Orsi - Geri - R21</td>
<td>94</td>
</tr>
<tr>
<td>Acronyms</td>
<td>96</td>
</tr>
</tbody>
</table>
EDITORIAL

2013, a reinforced footprint at regional, national and international levels

In 2013, we had claimed we would be in a position to embark on our long-haul journey. But since a journey is never entirely predictable, in 2013 we had to adapt to the heavy headwinds and keep our course in spite of the menacing storms.

This Annual Report is all about the work jointly accomplished by our agents. Jointly but also individually, to take stock of what every one of them, in their respective units, departments or divisions has contributed to the development of our Institute.

We have reinforced both our organisation and our governance. Indeed, our European and international strategy was devised and approved by our Board of Directors. We have increased our visibility by taking part in developing the H2020 programme, by setting up two international research teams and also by contributing to regional innovation strategies based on smart specialisation (SRI-SI) through our regional presence bringing up our flag.

2013 was the first year we implemented our Institute’s Goals and Performance Contract and from the first reports it would seem that the targets were achieved overall.

In 2013 we also implemented five departments and although the scientific equipment of the Bienvenue building in Marne-la-Vallée fell behind schedule, from a scientific point of view our production was of very high standard. The laboratories and the teams continued their research projects or started new ones and produced some innovative results in the areas of mobility, sustainable cities or infrastructures, but also in the area of risks. Last but not least, we staged some large-scale scientific and technical milestone events that contribute to IFSTTAR’s repute.

Against a rather tough economic and budgetary backdrop, in which we face with many demands, our financial management is more than ever a major challenge. However, we were able to overcome these difficulties and through the commitment of all our teams succeeded in upholding the contractual research and testing business. Some 160 new agreements were thus signed, totalling more than €11.3 M, one quarter of which were from direct contracts with our partners.

The crossing was not quite as peaceful as one might have hoped but thanks to all our teams we ended the year with positive overall results. We are proud of all the men and women who have made 2013 such an intense and fruitful year as will be shown below.
LET’S HEAR FROM...
Interview conducted during Q1 2014

Bernard Larrouetrou
CEREMA Managing director

This new framework is bound to bring about certain changes, isn’t it?

Yes indeed, as a public body, just like IFSTTAR, we are now more accountable; we have to define our scientific and intellectual property policy, to evaluate our research work, etc. Our actions with IFSTTAR will continue, in the form of a partnership. Our new scientific division will thus work jointly with that of IFSTTAR to evaluate part of the research activities and on the joint launch of new theses. For the time being, CEREMA has established a first inventory of its research projects and is now about to prepare its first strategic project. As for knowledge gathering and dissemination, together we continue to organise internal seminars, colloquia, etc…

What brought about the creation of CEREMA in January 2014?

CEREMA, the Centre for Research and Expertise on Risks, Environment, Mobility, Urban and Country Planning, is the new public body bringing together the 8 CETEs (public works engineering offices) and 3 central technical departments (SETRA, CERTU, CETMEF). The merger of these 11 units under the joint aegis of MEDDE (French Ministry for Ecology, Sustainable Development and Energy) and METL (French Ministry for Territorial Equality and Housing) gave birth to a single centre for resources as well as technical and scientific expertise which the State and local governments can rely upon for their sustainable development public policies in the areas of transport, environment or urban and country planning. This will ensure coordinated activities, a comprehensive strategy and new synergies.

IFSTTAR had close relationships with these structures, in particular the CETEs. What now with CEREMA?

IFSTTAR will undoubtedly remain our primary partner. Hélène Jacquot-Guimbaud and myself have re-asserted our commitment to this most fruitful and mutually profitable cooperation. We will encourage our teams to work together and address any problems that might arise. CEREMA and IFSTTAR are truly complementary: CEREMA, responding to the needs of territorial authorities, conducts studies and expertise, relies on the findings of finalised research, in particular those conducted within IFSTTAR. CEREMA conducts some research, most of the time in conjunction with IFSTTAR, an internationally acknowledged player.

A framework convention is currently being prepared between the two organisations. Can you tell us more about it?

It will be a real strategic partnership agreement. This joint document will outline and specify our cooperation on shared themes (research, innovation, knowledge dissemination, capitalisation, metrology, certification, etc.). It will also define the various bodies such as the steering committee and people in charge for each field of activity.
The transports-related programme named Smart, Green and Integrated Transports, has been allotted € 6.3 funding. As part of this new integrated approach, I will be in charge of surface transport research, namely rail, road and maritime transportation. One of the strengths of Horizon 2020 is that it simplifies procedures for the beneficiaries of projects with uniform rules for the whole programme and fast-track procedures (with a stated objective of less than 8 months between the closing of the call for tenders and contract signing).

**So what is IFSTTAR’s role in this context?**

For me, IFSTTAR is a key partner of European research. It is one of the leading players, if not the most important one in the field of transportation among the national research bodies. IFSTTAR is particularly active in terms of infrastructures and road safety, but also in terms of socio-economic audits or surveys. The Institute is involved in a great number of projects falling under the umbrella of Horizon 2020, either as partner or coordinator. We also call on its researchers for their expertise in terms of perspectives.

MEDDE has entrusted IFSTTAR with the organisation of the Transport Research Arena (TRA2014), the next international seminar on transports, to be held in Paris-La Défense on 14-17 April, 2014. What do you expect from this conference?

**What are the areas devoted to transport research in Horizon 2020, the new European framework programme for research and innovation? And what is your role there?**

With close to € 80 billion over 7 years (2014-2020), Horizon 2020 is the largest European funding programme on research and innovation. It is articulated around three pillars: scientific excellence (fundamental science), industrial leadership (development of technologies and innovations) and seven overarching societal challenges shared by citizens on transports, healthcare, food, energy supply, safety, environment.

---

(1) ERTRAC for road transport, ERRAC for rail transport, WATERBORNE TP for maritime and river transport.
HIGHLIGHTS

■ JANUARY

Nantes: European Green capital 2013, IFSTTAR NANTES labelled.

13 TO 17 JANUARY An IFSTTAR delegation took part in the 92th TRB in Washington.

16 TO 18 JANUARY International Urban Futures Conference. Emerging interdisciplinary issues in understanding, projecting and building future cities.

21 JANUARY Opening of the MADIS portal from the Intranet. MADIS: Provision of Scientific Information.

24 JANUARY IFSTTAR received the Best Congress Awards for Acoustics 2012.

■ FEBRUARY

11 AND 12 FEBRUARY Roads Technical Days. In partnership with IDRIM, professionals of road infrastructures meet to discuss related issues.

19 FEBRUARY Launch of the new ifsttar.fr website.

■ MARCH

1st MARCH Opening of the new driving simulator in Salon-de-Provence.

This new driving simulator, amongst other things, will help study the effect of alcohol on young and more experienced drivers.

Opening of the TRA 2014 site.

Launch of a management training programme for IFSTTAR's top 100 managers Committee.

■ APRIL

2 APRIL IFSTTAR signed the "Partnership Convention for open archives and HAL mutualised platform".

AT THE ACADEMY 2013 CONGRESS, 27 AGENCIES SIGNED A PARTNERSHIP CONVENTION IN FAVOUR OF OPEN ARCHIVES TO FOSTER THE VISIBILITY OF FRENCH RESEARCH OVERSEAS

3 AND 4 APRIL OPTIMIRR seminar in Paris. Scientific and Technical feedback sessions.

15 APRIL IFSTTAR and DLR sign an agreement to set up an international research team (EIA) to study the impact of trade on transports.

■ MAY

21 MAY Hélène Jacquot-Guimbal, invited by Minister Geneviève Fioraso, takes the floor during a colloquium on France's participation in H2020.

23 AND 24 MAY Technical Days on Acoustics and Vibrations in Blois.
JUNE

5 TO 7 JUNE Young Researchers Seminar in Lyon.

5 AND 6 JUNE Sessions on engineered structures in Dijon (Journées Ouvrages d’Art 2013).

8 JUNE National scientific encounters in Bron “A Sustainable, Social and Citizen-focused City”.

JULY

2 TO 5 JUILLET IWAGPR 2013 in Nantes 7th International Workshop on Advanced Ground Penetrating Radar in Nantes.

JULY/AUGUST

Algoroute on exhibition in Green Island. As part of Nantes Green Capital 2013, IFSTTAR partnered with the Marine bioresource pavilion and promoted its Algoroute research project (plant-based binder made from microalgae biomass).

SEPTEMBER

2 TO 4 SEPTEMBER 18th Soil Mechanics Congress in Paris.

3 SEPTEMBER Signing of the Goals and Performance Contract. The State and IFSTTAR set their respective commitments for the 2013-2016 period.

9 SEPTEMBER Signing of the framework agreement for cooperation between the Casablanca Public laboratory for tests and studies in Morocco (LPEE) and IFSTTAR.

25 TO 27 SEPTEMBER IFSTTAR at ECOCITY. Hervé Andrieu, Director of IRSTV, welcomes Patrick Rimbert, Mayor of Nantes on the IFSTTAR/IRSTV booth. In partnership with IRSTV, IFSTTAR takes part in the ECOCITY World Summit in Nantes.

OCTOBER

1 TO 3 OCTOBER Geotechnical days 2013.

4 OCTOBER Colloquium on accessibility and transports in Lyon (“Recherches Handicaps et Transports - A la croisée des différentes disciplines”).

9 TO 13 OCTOBER 22nd Science festival.

17 AND 18 OCTOBER 35 years anniversary of the fatigue test track.

21 TO 25 OCTOBER Autumn school in Nantes on the theme of City and Acoustics (“Ville et Acoustique”).

NOVEMBER

4 NOVEMBER Opening of IFSTTAR’s HAL collection.

26 AND 27 NOVEMBER 26th Jacques Cartier interviews in Lyon.
AWARDS AND TRIBUTES

ROGER FRANK (NAVIER) was awarded the De Beer prize from the Groupement belge de mécanique des sols (Belgian Soil Mechanics association).

NOUREDDINE HOUHOU (CPDM) received the 3rd prize of the SMA BTP Excellence Foundation for his thesis entitled “Durability of concrete/composite reinforcements (FRP) bonded interfaces: development of a research methodology based on an innovative creep mechanism designed to be combined with hygrothermal ageing”.

THAN SONG PHAN (EMMS) received the 2nd prize SMA BTP Excellence Foundation for his thesis entitled “Digital modelling of the steel/concrete interface; application to the behaviour of structures in concrete reinforced with deformed steel strips.”

DANIEL WEISZ-PATRAULT (NAVIER) was awarded the Thesis Prize by ENPC for his thesis entitled “Research and use of inverse analytical methods for coupled thermo-elastic problems”.

ÉRIC GAUME co-author of “Hydrologie Quantitative” published by Springer, received the 26th prix ROBERVAL, in the higher education category.

MINH-NGOC VU received the Thesis prize from the European ALERT Geomaterials 2013 for his thesis entitled “Modelling of flows in fractured porous media via the singular integral equations method”.

DIDIER AUBERT (LEPSIS) received the prize for the most influential paper of the decade during the MVA Conference.

DIDIER AUBERT (LEPSIS) was nominated for the ICADAC project as part of the next Carrefour du PREDIT.

ROLAND BREMOND (LEPSIS) received the Fresnel medal awarded by the Association Française de l’Eclairage (French Lighting Association)

LAURENT CARAFFA (LEPSIS) received the prize for the best student’s article at the 4th IEEE Intelligent Vehicles Symposium (“Markov Random Field Model for Single Image Defogging”).

MOHAMED GHAZEL (ESTAS) received the PREDIT Prize for the FerroCOTS project.

ÉTIENNE HANS (LICIT) was awarded the Master Prize of the Abertis chair.

AUDE HOFLEITNER (GRETTIA) received the Abertis prize for the best thesis “Development of an urban traffic appraisal model based on the use of geotracking techniques”.

TRISTAN LE LAY (LEPSIS) received the IFSTTAR prize for the best poster at the Entretiens Jacques Cartier.

JULIETTE MARAIS (LEOST) received the prize for the best presentation at ATEC/EXPO for the CAPLOC project “Combination of image analysis and knowledge of signal propagation for position tracking”.

VALÉRIE RENAUDIN (GEOLOC) received a Marie Curie CIG European scholarship.
DOMINIC BOISCLAIR (LBA) received the Charles H. Miller prize during the Canadian Multidisciplinary Road Safety Conference for his work on motorcyclists’ whiplash protections.

LÉO FRADET (LBA) received the Oxylane Innovation prize from the Ecole Doctorale Sciences du Mouvement Humain (Human body movement science doctoral school).

ACOUSTICS 2012, an international congress organised in Nantes by LAE, in partnership with SFA, received the International Convention Prize in 2012 from the Cité Internationale des Congrès.

ACOUSTICS 2012 (LAE) received the Prix Jacqueline PIETRI for the best international convention organised in 2012 in one of the 54 French convention centres.

OLIVIER BONIN (LVMT), SAMUEL MERMET (LVMT) AND FRANÇOISE BAHOKEN (SPLOTT) received 1st prize of the Geovisualisation and Dynamic Mapping Contest for their CARTOD/MAPOD application - MAPPING Origin-Destination flow matrix - during the 6th edition of this contest at the Salon de la Géomatique (International Geography Exhibition).

BENOÎT CONTI (LVMT) received the Abertis prize for the best Master dissertation.

AGNÈS JULLIEN (EASE) is granted by the France Berkeley Fund.

MARIANTONIA LOPRETE was nominated for the Thesis prize of the Cities, Transports and Territories Doctoral School (Ville Transports et Territoires).
IFSTTAR IN ITS ENVIRONMENT

2013 was chiefly devoted to the on-going stabilisation of our organisational policy and the strengthening of the Institute’s governance and financial management. Through an internal collaborative process, IFSTTAR was able to develop a European and international strategy based on the scientific strategy endorsed by its Board of Directors. The Institute also took an active part in preparing Horizon 2020 by contributing its input to the Commission. It will coordinate the PCN Transport (nationwide contact point for transports) to elicit and facilitate the participation of all French players in the new European research programme. IFSTTAR also boosted its international mobility policy for researchers. The Institute set up its first associated international team in association with the German DLR, and its first associated international laboratory in association with several partners from Quebec within the framework of A*Midex.

2013 witnessed number of significant cooperations that further established the organization in both the national and regional landscape of research and innovation. The Institute and Vedecom share the same office building in Versailles, with the project of building a new, shared one; the IRT Railienium set up part of its teams in the Villeneuve-d’Ascq premises; in Bron, the headquarters of CEREMA moved to the campus of the City of mobilities. The organization continued to be very active within cooperative structures. For Ancre, it leads the Transport programmatic group (GP6) by taking an active part in the national debate on energy transition. Within IDRIRM, it promotes support to public policies or to innovation.

The Institute contributed to the development of each one of the regional innovation strategies for smart specialisation (SRI-SI) in its various locations. To further boost this dynamic, it takes active part in the competitiveness clusters related to transports, risks, sustainable cities and the mastery of new materials. 2013 was also the year of the establishment of the Institute’s five departments and the one of implementation of the Goals and Performance Contract. In spite of a strenuous year due to the delayed delivery of the Bienvenue building in Marne-la-Vallée and budgetary constraints, the activity of the research and support teams maintained its momentum thanks to the commitment of all the staff.

Jean-Paul Mizzi
Deputy managing director
jean-paul.mizzi@ifstttar.fr
INSIDE THE INSTITUTE

IFSTTAR’S FIVE SCIENTIFIC DEPARTMENTS

After defining its scientific strategy, the Institute reorganised its research structures into five multidisciplinary departments.

Improving the quality of life and safety of citizens in the areas of transportation as well as urban and country planning is what IFSTTAR’s ambition is about. To cover this broad scope of multidisciplinary research, the Institute has given itself a long-lasting framework to ensure continuity with respect to the research work undertaken before the merger of LCPC and INRETS and to favour renewal of competencies and knowledge. The five scientific departments (see below) created at the beginning of the year are now fully operational.

This refocusing of the research organisation into five departments fosters the Institute’s scientific coordination. It is also the culmination of a long consultation process that solicited all the laboratories in devising its 10-year scientific strategy. Approved in June 2012, this strategy sets out the Institute’s research roadmap with four top priorities: inventing sustainable mobility; adapting infrastructures; controlling natural hazards and environmental impacts; thinking and implementing city and territory planning.

AT THE CROSSROADS OF DISCIPLINES

Each department is organised with laboratories, mixed research units (UMR) and emerging teams. IFSTTAR’s main strength is that it lies at the crossroads of disciplines (engineering sciences, information and communication technologies, humanities and social sciences, life sciences) whilst systematically taking into account human factors. This overlap between challenges and competences should enable IFSTTAR to best address its long-term objectives.

Articulation between departments and the challenges of scientific strategy: a matrix-based organisation

THE 4 CHALLENGES

<table>
<thead>
<tr>
<th>Analyse and innovate for sustainable and responsible mobility</th>
<th>Build, decommission, preserve and adapt infrastructures in an efficient and sustainable way</th>
<th>Better factor in climate change, natural hazards and environmental and sanitary impacts in anthropized environments</th>
<th>Think and plan sustainable cities and territories: systemic and multi-scale approaches</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATERIALS AND STRUCTURES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GEOTECHNICAL ENGINEERING, ENVIRONMENT, NATURAL HAZARDS AND EARTH SCIENCES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COMPONENTS AND SYSTEMS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRANSPORT, HEALTH AND SAFETY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLANNING, MOBILITY AND ENVIRONMENT</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

° Degree of departmental involvement in the area, on a scale of 1 to 3

IFSTTAR’s FIVE RESEARCH DEPARTMENTS

Materials and Structures

headed by Thierry Kretz, 8 laboratories and 1 UMR, 202 agents*, research on materials, transport infrastructures and large civil engineering structures, in particular those related to power generation and transportation.

Geotechnical engineering, Environment, Natural hazards and Earth sciences

headed by Jean-Pierre Magnan, 6 laboratories, 2 UMRs, 121 agents*, research on application of geosciences to civil engineering and planning.

Components and Systems

headed by Frédéric Bourequin, 11 laboratories, 1 UMR, 272 agents*, research on the applications of information and communication technologies to transports and cities.

Transport, Health and Safety

headed by Bernard Laumon, 3 laboratories, 3 UMRs, 137 agents*, research on the safety and health of transport users.

Planning, Mobility and Environment

headed by Gérard Hégron, 6 laboratories, 1 UMR, 147 agents*, research on the economic, social and environmental impact of the various modes of transport organisation within a territory.

* IFSTTAR staff
GOALS AND PERFORMANCE CONTRACT: IFSTTAR SIGNS UP FOR FOUR YEARS

On 3 September, 2013, the Institute’s line ministries (Ecology, Sustainable Development and Energy; Higher Education and Research) signed the Goals and Performance Contract prepared by IFSTTAR. This gave the latter an opportunity to restate its priorities and reinforce its participatory approach.

“This is our first Goals and Performance Contract (COP) in the context of IFSTTAR”, underlines Jean-Paul Mizzi, deputy managing director. “A four-year commitment (2013-2016) with the ministries in charge of Sustainable development (MEDDE) and Research (MESR) for all the Institute’s missions, with detailed objectives. We were able to bring it about rapidly, as we could tap into the work done on our scientific strategy, devised mid-2012 after almost two years of reflection and consulting. This COP draws a roadmap for our activities.”

It was prepared not only with the relevant line ministries and general directorates of MEDDE and METL, but also with IFSTTAR’s teams who make commitments both in terms of outcomes and of deadlines. As for the preparation of the scientific strategy, external opinions were also solicited.

“Five strategic objectives were reaffirmed: scientific excellence in the fields of transports, civil engineering and territories; European leadership, benchmark expertise supporting public authorities and industries; opening to society; governance conducive to creativity”, quotes Jean-Paul Mizzi.

This contract details the goals in terms of research and education in line with the four 10-year challenges defined in the scientific strategy (sustainable mobility, infrastructures, natural hazards and environmental impacts, cities and territories). “We specified these in the form of 4-year objectives”, he continues, “to which should be added cross-disciplinary objectives concerning the quality of our scientific production, our contribution to doctoral training and the transfer of our results”.

As far as expertise is concerned, the Institute has made commitments in terms of certification and testing, standards and best practices elaboration. From a more cross-disciplinary perspective, objectives are also defined for support to research (management, information systems and networks) and IFSTTAR’s management. The idea is to optimise the use of resources in order to improve the quality of service provided to research.

The COP was validated by the Institute’s Scientific Council and then by its Board of Directors, early December 2012. It was then signed off by the line ministries on 3 September 2013 and will be subject to an annual report. “Internally, we have set up a dedicated organisation to follow its smooth deployment with managers appointed to oversee each of the areas”, concludes Jean-Paul Mizzi.

These Goals and Performance Contracts, introduced at the beginning of the 2000s, are commitments of institutions vis-a-vis their respective line ministries.
HUMAN RESOURCES INDICATORS

Total number of agents as of 12/31/2013

1177
Namely 1147.6 FTE

IFSTTAR gender distribution (M/F)

Male 63%
Female 37%

Agent distribution per activity area

Research 75%
Support and Assistance 25%

M/F distribution per Division/Department

IFSTTAR'S TOTAL AGENTS

Male Female
PIA - FUTURE INVESTMENT PROJECTS: FIRST PRACTICAL STEPS

A number of significant developments were made in 2013. Major agreements were entered into with ANR for IFSTTAR-related projects such as Efficacity (agreement signed on 17 October, 2013) and Vedecon (in various stages throughout 2013 until the agreement was eventually signed on 11 February, 2014). A research agreement was also signed with the SYSTEM X (Technological Research Institute), of which IFSTTAR is not a member, and a first research project was agreed upon within the Jules Verne IRT. Several collaborative research projects were launched within the Raffleum IRT and the Vedecon ITE. In terms of locations, a number of changes took place in 2013: from 1 July, 2013, the Institute and Vedecon share the same office building in Versailles and the project to build a shared centre in Satory is currently being finalised. Meanwhile, the Raffleum IRT installed part of its teams in our buildings at Villemeure-d'Ascq. Such geographical optimisation is key for the daily cooperation between IFSTTAR staff and that of the institutes established by the PIA. This will be greatly instrumental for defining and implementing future partnerships. The contract for the completion of the main equipment for Sense-City was launched. Following the call for tenders, an action was triggered with the project’s partners to optimize the programme for this operation. The prototyping equipment was acquired and the activity programme resulted in several patents. Concerning the Labex, MMCD (modelling and experimentation for sustainable construction) is now in full swing. Since 2012, scholarships for twelve theses and six post-docs were awarded to students for research projects jointly conducted with the teams of several laboratories of the Paris-Est University. Support was also given to the organization of seven workshops by researchers of Labex around the theme of multi-scale modelling and experimentation for sustainable construction.

Over the past year the Labex Futures Urbains (Laboratory of Excellence for Urban Futures) has fostered the steady emergence of cross-disciplinary groups aiming at promoting scientific capitalisation of the various actions undertaken and involving a maximum number of researchers. To this day, a dozen groups are active and enable the participation of 150 researchers and research professors (out of a total 250). IFSTTAR has now joined the Labex IMU. Contacts with the SATI Ile-de-France Innov resulted in several subjects being selected so that SATI may further explore their deployment prospects. Lastly, internal work was conducted to study the conditions for better involvement of the staff in the PIA institutes (IDEX now is ITE and IRT) in association with employee representatives. This process made it possible to establish the modus operandi, which was since approved by the public body’s technical committee in December 2013.

The various involvements of IFSTTAR in the PIAs

<table>
<thead>
<tr>
<th>EQUIPEX Facilities of Excellence</th>
<th>LABEX Laboratories of Excellence</th>
<th>IRT Technological Research Institutes</th>
<th>IDEX Initiatives of Excellence</th>
<th>ITE Energy Transition Institutes</th>
<th>SATT Transfer of Technology Acceleration Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>SENSE-CITY</td>
<td>FUTURS URBAINS</td>
<td>RAILLEUM Railway infrastructure and its interfaces</td>
<td>A*MIDEX Virtual human</td>
<td>FRANCE ENERGIE MARINE</td>
<td>ILE-DE-FRANCE IRRD Ile-de-France</td>
</tr>
<tr>
<td>Nanosensors for cities</td>
<td>Planning, architecture, environment and transport</td>
<td>Nord-Pas-de-Calais</td>
<td>PACA</td>
<td>Marine energy</td>
<td></td>
</tr>
<tr>
<td>and the environment</td>
<td>Ile-de-France</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ile-de-France</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IVTV</td>
<td>CELYA</td>
<td>JULES VERNE Composite and metallic materials and hybrid structures</td>
<td></td>
<td>GEDENERGIES Geothermal energy, CO2 sequestration Centre</td>
<td>PACA-CORSE PACA</td>
</tr>
<tr>
<td>Engineering of ageing</td>
<td>Acoustics, health, cognitive sciences, Rhone-Alpes</td>
<td>Pays-de-la-Lorraine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>for living issues</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rhone-Alpes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RESIF-CORE</td>
<td>OSUD2020</td>
<td>SYSTEMX</td>
<td></td>
<td>VEDECOM Vehicles and transport services</td>
<td></td>
</tr>
<tr>
<td>French seismological</td>
<td>Climatology, hydrology, seismology, Rhone-Alpes</td>
<td>Digital engineering of future systems at the heart of transportation, communication, digital security and energy areas</td>
<td></td>
<td></td>
<td>Ile-de-France</td>
</tr>
<tr>
<td>and geodesic network</td>
<td></td>
<td></td>
<td>Ile-de-France</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rhone-Alpes</td>
<td>NANO IMAGE</td>
<td>MMCD</td>
<td></td>
<td>EFFICACITY Sustainable cities</td>
<td>Ile-de-France</td>
</tr>
<tr>
<td>Nanotomography</td>
<td>Materials for sustainable construction Ile-de-France</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ile-de-France</td>
<td></td>
<td>PRIMES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physics, radiobiology, medical imaging and simulation Rhone-Alpes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IMU</td>
<td>Urban world intelligence Rhone-Alpes</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PARTNERSHIPS AND ALLIANCES

ANCRE ALLIANCE

Energy transition: anchoring a national strategy
The ANCRE alliance, whose founding members are CEA, IFPEN, CNRS and CPU, aims to coordinate national research in the area of energy. Its work provides a basis for National Strategy for Research and the ANR’s programming. ANCRE relies on ten theme-based programmatic groups handling energy sources (biomass, fossil-geothermal, nuclear, solar, marine-hydraulic-wind), networks and storage, prospective and uses (industries-agriculture, building, transport).
IFSTTAR is one of the fifteen associate members and is in charge of the Transport programmatic group (GP6) since 2009 (before which it was led by INRETS). The Institute is a member of the thematic deployment committee (CVT), which on ANR’s funding mutualises the strategic analysis and economic intelligence capacities in order to identify strong deployment potential projects. In 2013, ANCRE took part in the nation-wide discussion on energy transition by devising three scenarios: The first one, Sobriété renforcée (enhanced sobriety), aims at improving individual responsible behaviours to significantly reduce energy demand, enhanced energy efficiency and develop renewable energies.
The second scenario, Décarbonisation par l’électricité (decarbonisation by electricity), is based on the combination of boosted energy efficiency and a larger share of decarbonated electricity in various uses.
The third one, Vecteurs diversifiés, bets on energy efficiency and is aimed at a diversification of sources and energy carriers.

ALLENVI ALLIANCE

Established in 2010, AllEnvi, the National Alliance for Environmental Research, aims to coordinate the various French research efforts in order to successfully manage the ecological transition and address the major societal challenges of food, water, climate and territories.
It pools together the expertise of research agencies, universities and schools in the area of environmental sciences by assembling a community of some 20,000 scientists. IFSTTAR is one of the 12 founding members of this alliance, which also includes 16 associate members.
AllEnvi hinges upon 13 theme-based groups, which gather some 300 scientific experts, and 6 cross-disciplinary groups. IFSTTAR is represented in some of these groups according to its relevant competences. For instance, the Institute co-chairs a theme-based group entitled “Cities and Mobility”. A new cross-disciplinary group on prediction was set up in 2013, in which IFSTTAR is also present. This group acts in support of the Alliance’s scientific steering committee. Prediction is indeed useful in informing strategic decisions, facilitating multidisciplinary scientific interaction, identifying and anticipating questions for which Society will expect answers from Research and generating a collective dynamic for anticipating and sharing possible futures.
2013 was particularly rich in events and requests. Amongst other things, AllEnvi provided some input to the National Research Strategy, at the request of the Ministry of Higher Education and Research, and produced a guidance document for the ANR’s 2014 programming, commissioned by the Government (June 2013). In the area of environmental transition, AllEnvi also contributed to the inter-alliance report for a French initiative in the area of environment-healthcare research (Toxicology, Ecotoxicology, Epidemiology and social sciences), in July 2013. IFSTTAR was involved in all of these projects. www.allenvi.fr
**IDRRIM-IFSTTAR**: THE DREAM TEAM OF MOBILITY

IFSTTAR’s missions, whether in the arena of knowledge production and dissemination, supporting public policies or to innovation, are naturally articulated with IDRRIM objectives, one of its major partners. IDRRIM’s operational committees offer a stage for brainstorming and consulting, thus providing a key asset for channelling the Institute’s work to all of the French stakeholders involved in transport system issues. Represented by its director, IFSTTAR sits on the strategic council and board of the association, also acting as secretary for the latter. The qualification-certification operational committee is chaired by Thierry Kretz, director of the Materials and Structures department of IFSTTAR. The specific agreement under which IFSTTAR supports the operation of IDRRIM, via the part-time availability of IDRRIM’s technical affairs manager, was renewed in 2013. IFSTTAR’s agents actively contribute to IDRRIM’s working groups, committees and events. For instance, they were involved in the drafting of several guidebooks, information memos or reference documents published by the latter, such as the white paper on innovation, published in October 2013. This document contains a set of proposals intended to facilitate innovation-related actions in transport infrastructures. Both institutes share the same vision on the evolution of transport systems (a theme addressed by the R5G project within IFSTTAR). The many national events organised by IDRRIM – some of which in partnership with IFSTTAR, such as the Roads Technical Days in Nantes, the Torquedost colloquium in 2013 or the seminar on urban road systems optimisation associated with TRA 2014 – are essential fora to promote this new shared vision on tomorrow’s mobility.

www.idrrim.com

philippe.tamagny@ifsttar.fr

**IFSTTAR and IRSTV UNITED FOR THE CITY**

Cities are home to 50% of the world’s population, they consume 75% of the power generated and are responsible for 80% of CO₂ emissions. Therefore, our societies’ sustainable development very much depends on how we can foster sustainable urban development. IFSTTAR contributes very actively to the IRSTV’s scientific project (Institute for Research on Urban Sciences and Techniques). This research federation founded by CNRS (French National Centre for Scientific Research) and France’s Ministry of Research brings together some twenty laboratories of the greater west of France with the aim of proposing methods and tools conducive to sustainable urban planning. The researchers and engineers of IFSTTAR’s GERS and AME departments are involved in many federative IRSTV research projects, some of which they are actually in charge of steering. Amongst these is the ONEVU, Nantes Observatory of Urban Environments dedicated to the long-term monitoring of water, pollutant and energy flows in various environments (air, water, soil, etc.) and to the urban remote detection on several watersheds, urban micro-climatology and energy (MUE), urban soils (SOLURB) or urban sound environment (ESU).

Two major projects funded by the Sustainable Cities ANR programme were completed in 2013: INOGEV, coordinated by Véronique Ruban, from GERS, and VegDUD, coordinated by Marjorie Musy, from CERMA/ENSEA.

The VegDUD project addresses the role of vegetation in towns by studying the climatic, energetic, hydrological and ambiances impacts and by evaluating revegetation techniques planned for the cities of the future. The densification of towns and intensification of urban soil use leave little room for vegetation and may gradually deteriorate environmental quality. New vegetal forms have been developed such as on buildings and it is not quite clear yet whether these new surfaces will be a valuable alternative to more traditional forms such as trees, lawns, gardens, greens, etc. After a survey of traditional and new forms of urban vegetation, the research then focussed on five options: planted roofing and façades; grass-planted surfaces versus mineral surfaces; alternative rain water management systems using vegetation; trees; soil-less plantations. The digital models developed in the area of climatology, hydrology, acoustics and energy performance of buildings were adapted in order to be used with these alternatives. Field experimental campaigns and small-scale experiments (wind tunnels, planted banks, vegetal façades) were conducted to improve knowledge about the physical processes at play. The VegDUD project thus makes it possible to simulate today’s situation versus tomorrow’s densified urban environment based on various scenarios of revegetation (systems, space management and distribution) and urban development, and finally allows to compare their respective climatic, hydrological, energetic and ambience impacts.

IRSTV settled into its new premises on the campus of Nantes’ Ecole Centrale and new projects were initiated (urban biodiversity, urban micro-climatology and energy modelling, geographical information for territories planning).

www.irstv.fr

herve.andrieu@ifsttar.fr
marjorie.musy@cerma.archi.fr
IFSTTAR IN THE REGIONS

NORD PAS-DE-CALAIS: THE LILLE/VILLENEUVE D’ASQC CENTRE IS AT THE CORE OF MANY PROJECTS

As part of the new regional governance for Higher Education and Research (ESR), IFSTTAR is now co-leading the theme-based research network on transports and mobility, a 133-member strong knowledge parliament that formulates recommendations on regional ESR policies. This body taps into the findings of a prospective and strategic think-tank which analyses major trends. The Institute plays a central role in the regional innovation strategy for smart specialisation (SRI-SI, adopted in June) in the area of transports and ecomobility, one of the six strategic areas of activity. This SRI-SI features five specialised streams: railway infrastructures and systems, vehicle materials and engines, performance of industrial processes, safety and assistance to mobility, mass customisation of logistic flows. IFSTTAR also took part in the mobility cluster of the regional Master Plan “3rd Industrial Revolution” devised by Mr Jeremy Rifkin at the request of the Region and the regional CCI. Also, the Nord Pas-de-Calais centre is at the heart of three regional actions:

- CISIT (International Campus on Safety and Intermodality in Transportation), a leading project of the CPER 2007-2013. The ELSAT 2020 programme (ecomobility, logistics, safety and adaptability in transports, 2014-2020) follows up on the actions conducted between 2007 and 2013, from a broader and more multidisciplinary perspective, including SHSs. A project for a CISIT research federation is currently underway.
- The i-Trans competitiveness cluster implementing its 2013-2018 strategic plan. Seven theme-based project management circles have been established. The i-viaTIC innovation platform project, defined under the aegis of IFSTTAR within the cluster, has secured the support of several partners including the Lille Métropole urban community. The idea is to promote an ecosystem for mobility innovation within the smart transport system industrial stream.
- The Railenium technological research institute (IRT), centred around railways, signed an agreement with ANR (€ 7.1 million in 2013-2014, with 14 projects) and set up its teams: ten people are now running the structure while twelve researchers were assigned on the campuses of Valenciennes and Villeneuve-d’Ascq. The December board of directors acknowledged the findings of the public consultation on the project of a European railway testing centre in Val de Sambre and approved the contractual framework between the IRT and each one of its members.
ILE-DE-FRANCE: WELCOME TO MARNE-LA-VALLÉE

In spite of the extremely adverse practical conditions resulting from the delayed delivery of the Bienvenüe building, IFSTTAR remained fully dedicated to the setting up of its headquarters and many laboratories at the heart of the Cité Descartes, in Marne-la-Vallée. After a challenging year, a number of missions could not be resumed because of the building delays, but by and large the level of activity of the research and support teams was upheld thanks to the commitment of all the staff.

For instance, the teams worked on the Labex Urban Futures (planning, architecture, environment and transport for sustainable cities) and MMCD (Multi-Scale Modelling & Experimentation of Materials for Sustainable Construction). The Institute also provided leadership for the Equipex Sense-City team, located at Cité Descartes. Cooperations with other academic teams of the same site were initiated in 2013 and should materialize in different forms in 2014 (ERC, research federation, etc.). The existing, and already quite strong, exchanges with the economic partners of the Paris-Est University were further intensified.

Furthermore, the major regional and local stakeholders (regional services of the State, Regional Council, Société du Grand Paris...) were approached in order to better comprehend their expectations and further extend the Institute’s footprint in Ile-de-France region.

For instance, IFSTTAR got involved alongside INRA, IRSTEA and AgroParisTech in rolling out the multidisciplinary PSDL programme which gathers a number of researchers as well as social and political stakeholders working for the sustainable development of rural and outer-suburban territories. Within the context of the Move’o and Advancity competitiveness clusters, IFSTTAR took charge of the governance structures and some projects. It supported teams set up in Ile-de-France region by the “investissements d’avenir” programme (investment in the future), in particular the SystemX IRT (Technology Research Institute) and the Vedecom and Efficacity ITEs (Energy Transition Research Institutes).

Efficacity is still in the process of being set up since the convention was signed with ANR at the end of October 2013. It includes 28 public and private partners who share their competencies on energy, environment, materials, economics, town-planning, sociology, etc. to address the European commitments for a 20% reduction of energy consumption and of GHG emissions by 2020, by targeting energy efficiency in towns.
RHÔNE-ALPS: MOBILITY IN THE SPOTLIGHT AT THE LYON-BRON CENTRE

In 2013, CEREMA installed its headquarters in several waves at the Cité des mobilités. MEDDE requested IFSTTAR to release some twenty offices for this purpose. CEREMA was thus relocated to a building separate from IFSTTAR's premises and spaces were optimised in the same process.

To address a request from the European Commission as part of the transfer to regions of the FEDER management programme, IFSTTAR, alongside the LUTB cluster, was heavily involved in the drafting of the smart specialisation innovation regional strategy (SRI-SI). This work resulted in seven specialisation domains being defined, one of which (smart mobility uses, technologies and systems) is essentially inspired by IFSTTAR's research. Another one, amongst other things, deals with planning in mountainous areas.

The Rhône registry of road accident victims, established in 1995 by INRETS, has now been geographically and thematically expanded as part of the Observatoire Rhône-Alpes du traumatisme. 2013 was marked by the launch of the same registry in the Ain department: all victims of road accidents, labour or domestic accidents are recorded in the emergency departments of hospitals or clinics. This system now encompasses all of the department's emergency services and should in due course cover all the region's departments.

2013 also saw the partnership between IFSTTAR's TS2 department and IFRH come to fruition with the joint organisation of their first scientific colloquium: Research on Disabilities and Transports – At the crossroads of various disciplines, in Bron on October 4, 2013.

More than a simple scientific information forum, this event demonstrated the complementarity of both departments, through the exchanges among all the players and stakeholders around the theme of "disabilities and transports," whilst also highlighting the respective contributions of the various disciplines involved and showing how such research can further our knowledge and form the basis for proposed improvements (prevention, technical assistance, management, accessibility, etc.).

A website is dedicated to this colloquium: http://handicaps-transports2013.ifsttar.fr/

PROVENCE- ALPS-CÔTE D'AZUR (PACA): A CENTRE PRESENT ON ALL FRONTS

2013 was another momentous year at IFSTTAR's Marseille-Salon-de-Provence centre with scientific activity as buzzing as ever. Following are some highlights. Some prestigious prizes received, reference papers and books published, contribution to European think-tanks such as the Road Safety Data Collection.

The centre was heavily involved in training and research within the doctoral schools and further strengthened its supervision capacity through the HDRs obtained by several of its researchers.

Co-supervisions were developed for international theses, in Canada with Polytechnique Montréal and with the CASR of the University of Adelaide (Australia). Partnerships were consolidated or broadened, at the regional and the international level, from an academic as well as economic point of view, so that the centre may become a front-line player in its areas of competency. With its partners from Quebec, IFSTTAR was thus granted labelling and a subsidy from the Amilcar Foundation of the Aix-Marseille University for the establishment of an associate international laboratory for orthopaedic and traumatological biomechanics of the spinal column (BSIP), which also further locally anchors the project with CNRS, AP-HM and AMU.

National or international conferences were also co-organised such as in Montréal, with the International French-speaking colloquium 2013 for pedestrians, entitled “La ville sous nos pieds” (the city under our feet), on knowledge and best practices pertaining to pedestrian mobility.

Cooperations with businesses (Toyota, Salomon or Cochlear) were either launched or consolidated.

For the first time, CORPACA (an agency coordinating the action of research bodies in PACA) was hosted in the Institute's premises.

Scientific assets were reinforced through the development of new research platforms: experimental research in Biomechanics-Acoustics and ENT and also a volunteer testing platform.

A new driving simulator was inaugurated in Salon-de-Provence. This simulator will be used to help research take human factors into account in driving activities.
THE NANTES CENTRE: A KEY PLAYER AMONG REGIONAL SCIENTIFIC AND TECHNICAL COMMUNITIES

IFSTTAR, A KEY PLAYER AMONG REGIONAL SCIENTIFIC AND TECHNICAL COMMUNITIES

As the governance of an interregional COMUE is being established between Brittany and the Loire valley regions (UBL), IFSTTAR has developed links with the players of this region and the neighbouring ones, which should facilitate its inclusion in the new scientific landscape.

In the Loire valley region, public R&D agencies (EPST, EPIC) have joined under the umbrella of the OPAL association, which is like COREB in Brittany region; the work started in 2012 on a 2014-2020 regional plan for higher education, research and innovation (ESRI) continued in 2013 with the preparation of the future FEDER European programme, which calls for a number of “smart specialisations” to be selected and defined, such as for marine renewable energies (EMR). In parallel, various actions are being developed combining research, training and innovation (RFI): acoustics (Le Mans University), marine activities (under preparation), as well as city and environment. Also, the Institute is supervising several students from three PRES UNAM doctoral schools: SPIGA, STIM and 3MPL.

SOME SIGNIFICANT ACTIONS

IFSTTAR is keen to develop preferred bilateral partnerships: IRECVY in Nantes (organisation of a day of technical exchanges), INRIA in Rennes (creation of a joint research team), the Institute of Materials in Nantes, IMN (partnership framework agreement), and the regional centre for resources in ecoconstruction (Novabuild).

Partner with the Jules Verne IRT since its creation, IFSTTAR made an official commitment as an associate member for 2013 and 2014. Also, an R&D project on marine wind-energy structures, conducted in conjunction with Alstom company, was selected to be funded by the IRT (Everest project).

With the Laboratory of planetology and geodynamics (LPG) and the Observatory for the Sciences of the Universe (OSU) of Nantes University, IFSTTAR started the Vibris research project (2013-2016), funded by the Loire valley region: using seismic noise to monitor a geological region (Armorican massif range) or coastal defence facilities.

In conjunction with the XLIM-SIC laboratory of the Poitiers University, IFSTTAR steered the development of a prototype of an operational device for 3D stereoscopic reading of roadway surface textures (Texture 3D project), under the leadership of CEREMA (Diter Ouest/Cecp Angers).

IFSTTAR CONTRIBUTES TO REGIONAL SCIENTIFIC DISSEMINATION

In 2013, the most prominent events were:

- the JTRs (technical days on roads), with IDRIM, on 6 and 7 February: nearly 400 participants,
- the international IWAGPR seminar on georadars, 2 to 5 July, with CEREMA (Diter Ouest) and IETR (Rennes Electronics and telecommunications institute);
- over 100 experts from 22 countries,
- the 50th anniversary of the fatigue test track, 17 and 18 October,
- the autumn school on Cities and Acoustics, 21 to 25 October, with IRSTV, the GdR CNRS 3372 Ville silencieuse durable (sustainable silent city; VISIBLE), and the French Acoustics society (SFA),
- Nantes European green capital: communications on research activities, including the Algoroute project,
- Science festival, already an established annual event.
INTERNATIONAL

INTERNATIONAL STRATEGY: THE INSTITUTE IS NOW FULLY OPERATIONAL

IFSTTAR has now developed its European and international strategy through an internal collaborative process. This strategy is inspired by the Institute’s scientific strategy unanimously endorsed by the board of directors on 15 October, 2013. Five top priorities were thus identified and European and international correspondents were appointed within each department to ensure the implementation of this strategy jointly with DAEI.

IFSTTAR FULLY INCORPORATES THE INTERNATIONAL COMPONENT INTO ITS MODUS OPERANDI

The Institute has actively promoted its international mobility policy for researchers. The GERS department thus welcomed Mr Kenji Watanabe, a researcher at RTRI, the Japanese rail transport research institute. Laetitia Van Schoors (Mast department) started a one-year assignment in Casablanca on issues related to geosynthetics and polymers, as part of an agreement between IFSTTAR and the Moroccan LPEE (public laboratory for testing and studies). IFSTTAR also organised a joint workshop with CDAC (Centre for Development of Advanced Computing) in India on new technologies, scientific computing, use and acceptance of driving aids. Lastly, our experts took an active part in the technical committees of PIARC.

IFSTTAR NOW FOCUSES ITS ACTION ON CLOSE PARTNERSHIPS

IFSTTAR set up its first associate international team, “Distrans - Distributive Trade and Transport” with the transport research institute of the German DLR (national centre for aeronautic and space research). The memorandum of agreement, initiated under the aegis of the French and German ministries of research, placed a dual French-German management at the head of Distrans with its own budget, and established an independent scientific evaluation mechanism. A first International Associated Laboratory (IAL) has been created in 2013 with spinal column modelling and biomechanics (lesions and pathologies) as its unifying area of research. This brings together the teams of the Paris-Saclay University and the University of Applied Sciences of the Region Alsace. The IAL also links collaborations with the Public Welfare - Hospitals of Marseille (Imagery, neurosurgery, general surgery and digestive units) and the Center for Magnetic Resonance in Biology and Medicine (UMR 7339, CNRS/AMU). An agreement was also established with the American VTTI (Virginia Tech Transportation Institute). In June a seminar held in Marne-La-Vallée confirmed the benefits of working together on several themes including "connected vehicles" or driving in real-life situations ("naturalistic driving") for which VTTI is an acknowledged world leader.

Also, IFSTTAR boosted its cooperation with the prestigious Centre for Advanced Research on Mobility at the Tokyo University during the ITS World congress on smart transports in Tokyo (October 2013). Last but not least, we renewed our agreement with the University of Adelaide in Australia for research on biomechanics and human body modelling as well as on the simulation of road user behaviour.

EUROPE REMAINS A PRIORITY OF IFSTTAR’S INTERNATIONAL ACTION

2013 was a pivotal year between the end of the 7th framework programme for research and development (FP7) and the Horizon 2020 programme. IFSTTAR again recorded very good results with 18 new European projects and in all 46 projects were in progress with € 2.8 M of funding secured for the year. The Institute was actively involved in the preparation of Horizon 2020 by contributing to the Commission’s discussions. Several internal seminars helped brief the relevant departments about the new administrative rules and the European guidelines now placing greater emphasis on societal expectations.

The Institute also strengthened its presence in the structures that construct a Europe of research with the election of IFSTTAR’s managing director as vice-chair of FEHRL. IFSTTAR also accepted the line ministries’ proposal that it should coordinate the Transport NCP (National Transport Contact Point), which aims at fostering and facilitating the participation of all French players, whether academic, or business, in Horizon 2020. This mission further cements the role of IFSTTAR as a pillar of transport research in France.

IFSTTAR TAKES FRENCH ECONOMIC INTERESTS ON BOARD AND NOTABLY IN ITS INTERNATIONAL ACTION

Leveraging its global view of applied research in transports in the US, IFSTTAR assisted some businesses in their development strategy in the American market. The Institute also organised a “scanning tour ITS” in May 2013 on the theme of connected
vehicles, in which the TOPOS-Aquitaine cluster on satellite-based applications also took part to prepare for the world congress on smart transportation which it will be hosting in 2015 in Bordeaux. The Institute also participated in the Greencity conference, organised by the Advancity competitiveness cluster in Marne-La-Vallée. The COSYS and AME departments were thus able to initiate a collaboration with the World Bank on the theme of the urbanisation of megalopolises. The technical workshop on heavy vehicles and light utility cars in conurbations, organised by the French committee of PIARC in December 2013, attracted over 60 participants. This committee is hosted by IFSTTAR and its activities can be shared by the whole French technical road community. The Institute also made funds available for one-off actions requested by French businesses, in particular dealing with Chinese counterparts in the field of roadway testing with our subsidiary Certifer, which resulted in the commissioning of the Budapest metro.

FOR EMERGING COUNTRIES, IFSTTAR INTERCEDES ACCORDING TO THE STAKES AND RESOURCES AVAILABLE

IFSTTAR also strives to elicit funding which helps maintain exchanges with southern countries. In this respect, the ECOS-NORD cooperation programme supported a project with Colombia (University of Los Andes in Bogota) to study the effect of climate change on the stability of foundation structures. Our experts thus organised training sessions on new road technologies such as a seminar at the national laboratory Labogénie (Cameroon) on road testing equipment and how to interpret the findings, and another seminar on roadway sizing, materials and earthwork in Antananarivo (Madagascar) funded by the World Bank.

INTERVIEW WITH BOGDAN CAZAUTIL
ON HIS EXPERIENCE OVERSEAS

"Our complementarities will enable us to continue to progress together"

Invited in the context of a French chair by the polytechnic school of the São Paulo University (EPUSP, state of São Paulo, Brazil), Bogdan Cazautil, head of the GPEM laboratory (MAST), took part in research work on the mixing of concrete and mortars, between May and August 2013.

"I had been in touch with this civil engineering laboratory for three years on topics which very few teams actually work on. And yet these are issues with high environmental stakes: it is our view that with an improved mastery of the concrete-making process, up to 10% could be saved in terms of resources. Brazilian industries have taken an interest in this field and channel significant funding to relevant universities, which are also heavily supported by public funds. The local dynamic is quite impressive: teachers equip vast premises with the latest experimental facilities and attract many well-organised young researchers (post-docs, doctoral students, masters students, etc.), whom they have been following sometimes for up to ten years. This total immersion allowed us to develop more in-depth cooperation. We are going to publish papers together and pursue our joint research work, for instance part of a thesis that IFSTTAR proposes to fund. This sojourn also enabled us to realise how much convergence there was in our fields of interest: one of our GPEM doctoral students will soon spend two months at EPUSP working on heat exchangers; we have jointly proposed an ANR project on accelerated carbonation and we are trying to work together on recycled aggregates. Although this was never going to be easy from a personal point of view – my family found it hard to adapt and was only able to stay for one month – this proved to be a very rewarding experience for everyone. We shall all benefit from continuing such exchanges where there is so much complementarity of competence."
QUALITY

Because of its nexus with LCPC -- the first EPST, and for many years the only one to be ISO 9001 certified for its quality management system -- IFSTTAR has inherited a quality policy tradition that dates back to the 1980s.

In 1979, LCPC was one of the five founding laboratories of the RNE, which then became COFRAC in 1994 (hence its accreditation number 1-0005).

Following a public tender, LNE was selected as certification body for the period extending from 1 November, 2011 to 31 October, 2014.

IFSTTAR’S THREE QUALITY CERTIFICATIONS

IFSTTAR’s Quality Management System (QMS) has been ISO 9001 certified since October 2002, The certification was renewed in 2005, 2008 and 2011.

IFSTTAR is accredited by COFRAC Essais as per ISO 17025, for eight testing programmes.

Accreditation
N° 22230-3 for the Marne-la-Vallée (CPDM), Nantes, Satory (LIVIC) and Villeneuve-d’Ascq sites

Accreditation
N° 1-0005 (Paris site)
N° 1-0535 (Nantes site)
N° 1-2361 (Lyon-Bron site)
For scope see www.cofrac.fr

IFSTTAR is accredited by COFRAC for products certification as per EN 45011 (since May 1, 2006) for the CE marking of aggregates (directive 89/106 and policy 305/2011 Building Products), organisation notified No. 1165, for audits on aggregate quarries factory production control, as per system 2+.

Accreditation
N° 5-0533
For scope see www.cofrac.fr

patrick.menanteau@ifsttar.fr

The last workrooms in the Physical-Chemical Behaviour and Durability of Materials Laboratory, based in Marne-la-Vallée, can resume its COFRAC trials.
HIGHLIGHTS

ISO 9001 certification extended to the Villeneuve-d’Ascq site in November 2013

Our Goals and Performance Contract having planned to extend the ISO 9001 certification of the QMS to all sites by the end of 2016, we proposed that the Villeneuve-d’Ascq site be audited in November 2013.

The surveillance audit on the Marne-la-Vallée, Nantes and Satory sites was therefore complemented by an extension audit for the two laboratories of Villeneuve-d’Ascq: ESTAS and LEOST, both under the COSYS department. The outcome was positive thanks to the commitment of the two managers, their quality correspondents and all the agents of the site.

COFRAC Essais accreditation re-awarded to CPDM laboratory of the Marne-la-Vallée site after their relocation in November 2012

The suspension on the COFRAC testing accreditation of the CPDM laboratory (physico-chemical behaviour and durability of materials) of the Materials department was effectively lifted in May 2013. The work was completed in time so that the six-month suspension deadline was not exceeded. The testing operations are conducted, like before, under temperature and hygrometric conditions compliant with applicable standards. The strong commitment of all agents made it possible to restore the accreditation in spite of the very tough conditions.

The process of the quality management system

In order for the quality management system to function properly according to the organisation’s strategy (four-year contract) and quality policy, the following processes are required:

- Four MANAGEMENT processes focused on the organisation, for deploying and piloting the strategy;
- Three activity IMPLEMENTATION processes focused on clients, with a final goal of end-products for external use;
- Five activity SUPPORT processes focused on means, with the goal of guaranteeing means suitability and availability.

Each of these processes are placed under the aegis of a leader who will ensure goal and indicator tracking, as well as reporting to IFSTTAR’s annual management review.
COMMUNICATION

IFSTTAR SWITCHING TO 2.0 COMMUNICATION

In 2013 the Institute’s new website was launched. IFSTTAR is now equipped with a powerful tool based on one of the best content management systems available, to help roll out its web communication strategy. Special care was given to the interoperability with the other tools of our information system so as to make our resources available to cybernauts.

IFSTTAR WEBSITE’S EDITORIAL POLICY
An editorial management in touch with the latest events and use of social media enhances one’s visibility on the web (which has an important impact for referencing) and goes beyond the mere “showcase” function of our site in order to offer a real platform of exchanges and interaction with our communities. To this end, “badges” have been placed at the bottom of pages which prompt the cybernauts to relay information and join us on social media.

IFSTTAR ON SOCIAL MEDIA
In a context where communication actions must reach out to uphold the Institute’s ambitions, developing web communication and social media was particularly strategic for IFSTTAR. Establishing one’s presence on social platforms is not a trivial matter. It allows you to search for new targets, not easily accessible via conventional media, and to involve and federate your teams. Not only does it allow us responsiveness on the news, it helps us to set up a lasting relationship with our «fans» and nurture exchanges and interactions with our communities.

SCIENTIFIC CULTURE

SCIENCE FESTIVAL
The teams of the Institute have also been involved in the 22nd Science Festival, a nationwide event held from 9-13 October 2013 and around the theme “from the infinitesimally large to the infinitesimally small.”
In Bron we thus offered school students 4 workshops on road safety. In Nantes, the work conducted on the water cycle and issues related to earthworks and soil treatment was presented to the public at large. In Salon de Provence, researchers presented the scientific approach used for their research on the psychology of driving behaviour: observation, hypotheses, experimentation, findings, interpretation.

11 VISITS OF THE NANTES SITE
Whether students, private partners or territorial institutions, in 2013 the researchers of the Nantes centre welcomed some 400 visitors to whom they presented the impressive facilities of the site. The fatigue test track and the geotechnical centrifuge were some of the great hits among visitors.

THE GEOTECHNICAL CENTRIFUGE IS AN OUTSTANDING PIECE OF EQUIPMENT ATTRACTION MANY VISITORS

848
Facebook fans

58
On line documents 9 subscribers

321
1st-level connections (Network: 5,015,922 professional members)

926
Twitter followers
TRAJECTOIRE

THE MAGAZINE OF IFSTTAR’S RESEARCH, EXPERTISE AND PROFESSIONS

This magazine, launched in 2011 as soon as IFSTTAR was established, aims at publicising the research work conducted within the institute and showing how useful it is. Each new issue focuses on several research projects and a 4-page feature covers a special theme which most of the time reports on the work performed jointly by research departments. For instance, in April 2013, issue No. 5 devoted its special feature to “Urban water and soil, the new environmental challenge”; while No. 6 published in November was headlined “Making our cities more sustainable.”

PRESS RELATIONS

Like every year, the PR activity started with the Press lunch with the General Directorate and the Scientific Directorate. This lunch was held on 10 January, 2013 and hosted some 20 journalists from both the specialist press and mainstream media. Represented were magazines such as Le Moniteur, La Vie du Rail, Auto Plus, national daily newspapers such as Libération or La Croix but also leading media with programmes such as “Circulez y a le monde à voir” broadcast on France Info or “Turbo”, a popular TV programme aired every Sunday noon for over 20 years on channel M6. Various topics organised around the 4 pillars of scientific strategy were presented during this lunch: the virtual human, Algoroute, composites in civil-engineering, dykes monitoring and testing, as well as the MetroFreight project for freight transport in urban environment.

Following this press operation and throughout the year, IFSTTAR was given outstanding exposure in all types of media: the Turbo programme devoted two features on driving aids and traffic congestion. Newspaper Le Figaro devoted its Page 2 to the LMA and LBA activities (“With road experts”, 12 March edition) and the “Transportez-moi” (“Carry me”) programme broadcasted on the LCP/Public Senate channel came to the Versailles-Satory site for a special report on the 40-year anniversary of the road safety policies.

The year closed successfully with the 35-year anniversary of the roadway test track in Nantes. Autoroute Info, France 3 Estuaire, TéléNantes, Ouest France and Presse Océan reported on this event, and RGRA did a special feature about it. The track-record and future prospects of this major facility are covered in the 914-915 issue of September-October 2013.

communication@ifsttar.fr
SCIENTIFIC ACTIVITY – RESEARCH/EXPERTISE

For IFSTTAR’s research structures, 2013 was marked by the establishment of the five departments Materials and Structures (MAST), Geotechnical engineering, Environment, Natural hazards and Earth sciences (GERS), Components and Systems (COSYS), Transport, Health and Safety (TS2) and Planning, Mobility and Environment (AME), all of which also comprise laboratories. These departments bear witness to the broad scope of the Institute, shaping its identity and underlying its strength. Each one of these five departments is involved in momentous academic cooperation with universities, schools and research institutions, in particular in the context of joint research units or mixed teams (some of which were initiated in 2013). With their laboratories, every one of the five departments is also a leading player in domestic and European research. It is within these departments that the expected renewal of specialised competences required for both the individuals and the research structures (laboratories and departments) is being organised.

This reorganisation did not prevent the laboratories and staff from pursuing their research, producing innovative results and launching new projects, as we shall see in the following pages. Note in passing that 2013 is also the first year of the Goals and Performance Contract for the Institute. The projects, whether on-going or newly launched, will be presented along the following four axes: analysing and innovating for sustainable and responsible mobility (axis 1); building, decommissioning, preserving and adapting infrastructures efficiently and sustainably (axis 2); better taking into account climate change, natural hazards and environmental and health impacts in anthropic surroundings (axis 3); thinking and developing sustainable cities and territories: systemic and multi-scale approaches (axis 4). The very labelling of these 4 axes gives a good idea of how the Institute’s research teams strive to address society’s challenges and their developments.

And to conclude we should mention the launch of MADIS document portal at the beginning of 2013 (now open to the public), the definition of an evaluation procedure for departments and laboratories in conjunction with AERES, the intranet launch of the Pictolab digital photo library (6000 photos and videos), the launch of 80 new theses... which will allow researchers and engineers to further their research work and promote their results.

Henri Van-Damme
Scientific director
henri.van-damme@ifsttar.fr

Dominique Mignot
Deputy Scientific director
dominique.mignot@ifsttar.fr
MATERIALS AND STRUCTURES DEPARTMENT

The Materials and Structures department (MAST) employs 230 agents within eight laboratories based in Marne-la-Vallée and Nantes. It also includes the Navier laboratory, a joint research unit bringing together IFSTTAR, CNRS and Ecole nationale des ponts et chaussées.

INTERVIEW WITH THIERRY KRETZ, DIRECTOR

What are your relationships with the other economic or scientific players?

We develop partnerships with the major project owners, businesses and university laboratories in this area, including of course the scientific and technical network (RST), now CEREMA. We also have an active policy of involvement in the Instituts d’Investissement d’Avenir (Investments in the future), in particular the Jules Verne institute in the area of composites and the Ralentium IRT for railways and with the Loire Valley research cluster for renewable marine energies.

What are the department’s areas of research and expertise?

Actually they cover a very broad scope but aligned with a common objective: managing and building for sustainable development. Our activities revolve around materials, transport infrastructures and large civil engineering structures, such as for the generation and transmission of energy. They partake of actions for the sustainable management of the existing structures and a sustainable design aiming at low environmental impact and better resistance to risks. The complementarity of our laboratories allows us to address issues at several levels, from fundamental to applied research and eventually deployment, from the nanoscopic scale of the material to that of infrastructures. Our researchers are physicists-chemists, experts of solid mechanics, of structures and engineering sciences. They have important experimentation means at their disposal. These competencies also mean we are experts in several areas (bridges, roads, linear infrastructures or nuclear civil engineering): we are often called upon by public institutions and private economic players.

What are your lines of research concerning infrastructures and risk control, what are you main focuses?

Our teams work on testing of materials and structures (sensors, monitoring methods), designing innovative materials and structures (composite, bio-sourced, energy- and resource-saving materials, innovative structures), sustainable asset management, decommissioning and recycling processes, life-cycle analysis or ecodesign methods. We study the vulnerability of infrastructures to natural hazards, develop solutions to mitigate it and inversely reduce the impacts of infrastructures on the environment. These activities are all in line with the Institute’s objectives.
In 2013, the Nantes centre celebrated IFSTTAR’s fatigue test track 35-year anniversary. This facility, which includes three 40-m diameter rings, can be used to test heavy-duty vehicle axles at speeds of up to 100 km/hr and is one of the world’s largest traffic simulators. Designed in 1978 and commissioned in 1984, the test track has since then been used to test some 130 roadway structures and covered the equivalent of 1.6 million kilometres.

To celebrate this anniversary, LAMES, the laboratory in charge of this facility, organised a seminar in Nantes on 17 and 18 October, 2013. The event featured presentations of the main experimentations conducted on the test-track and new projects as well as a tour of the installations. The seminar attracted about 130 participants, many industrial partners amongst them. A special issue of RGRA (No. 914, September 2013) was also published on this occasion, containing 17 articles devoted to the fatigue test track and illustrating the diversity of experimentations carried out.

Over the 35 years, the test track has been modernised and still stands out as a reference facility to check road innovations. The objectives of these experiments have also evolved towards new aspects (recycled materials, urban roadways) or evaluation of innovations in the framework of the 5th Generation Road project (instrumentation solutions, systems for energy recovery or powering of electric cars through the pavement).

pierre.hornych@ifsttar.fr
GEOTECHNICAL ENGINEERING, ENVIRONMENT, NATURAL HAZARDS AND EARTH SCIENCES

The GERS department numbers 120 agents across five laboratories, two joint units and one development unit based in Bouguenais, Marne-la-Vallée, Bron and Grenoble.

INTERVIEW WITH JEAN-PIERRE MAGNAN, DIRECTOR

What work is GERS involved in?

Our teams conduct research on geosciences in the broad sense as applied to civil engineering and urban planning, with four main sectors: geotechnical engineering, natural hazards, urban pollution and nuisance, and finally monitoring and imaging. More practically speaking, for instance we carry out research on soil behaviours, soil treatment for earthwork and railway geotechnics, etc. For natural hazards we would be looking at landslides, sudden floods or the vulnerability of structures to earthquakes. In cities, we study the influence of vegetation, sewerage systems, waste-to-energy recycling, etc. We also do monitoring for cliffs, foundations, concrete structures or cables for civil engineering structures.

In what type of scientific cooperation projects do you take part?

We work with the regional laboratories of the former CETEs, now CEREMA, many other scientific partners, design and engineering consultants, State agencies and territorial authorities. In partnership with businesses, the department will help develop new technologies: structure monitoring methods, earthwork techniques, soil treatment or foundation design, radar data processing for the management of urban sewerage systems. More broadly speaking, our scientific and technical activity is designed to provide background material for public policies and enterprises in the field of public works, infrastructures and engineering. We also take part in domestic or international standardisation efforts. Both activities are paramount in ensuring the dissemination of knowledge and helping new research problematics come to the fore. Finally, the agents of GERS have a leadership role at the national level on certain themes through their coordination of observation networks: urban environment observatory network, permanent accelerometric network.

How does this department contribute to IFSTTAR's core missions?

Amongst its core missions, IFSTTAR must conduct, outsource or evaluate research and developments in the areas of urban engineering, civil engineering, infrastructures and natural hazards: GERS actively contributes to all these. Our department's ambition is really to support the "civil engineering and environment" axis of the Institute, just like the Anglo-Saxon "Civil and Environmental Engineering" departments which combine the two. Last but not least, GERS contributes to three of the four key challenges of the Institute's 10-year scientific strategy, and in particular the third one: "controlling natural hazards and environmental impacts".
FOCUS ON GERS
Falling rocks: impacts and consequences

The Montagnole testing station is one of the RRO laboratory’s large facilities. It is used to replicate full-scale falls of massive rocks with energies reaching up to 13,500 kJ. It ran almost non-stop throughout 2013 with over 30 tests conducted. In addition to the conventional tests for rock-shield net protections, two new studies were initiated: high-energy impacts on various types of structures and energy dissipation in impacted soils.

To cater for these new research projects, the station’s metrological equipment was upgraded with a larger selection of sensors dedicated to rapid dynamic measurements and with an additional acquisition system. Specific equipment was designed such as the dynamic platform to measure pressure under the impacted soils, in cooperation with the Rouen CER, or the device to measure stresses transmitted to impacted structures.

Soil testing was for the most part conducted for research purposes on behalf of the GERS’ SRO and RRO laboratories, while structure tests were made in the context of contracts, in particular for EDF, in order to evaluate the impact of extreme climatic phenomena on certain facilities.

Tests on net protections were carried out as per ETAG 27 to secure CE marking. The station’s reliable operation was further enhanced through the effective contribution of former CETEs’ operation team, now CEREM.

chutesbiocs@lists.esf.fr

GERS LABORATORIES

AI — Dir: Xavier Derobert
Assessment and Imaging Laboratory

EE — Dir: Claude Joannis
Water and Environment Laboratory

ISTERRE — Dir: Philippe Cardin
Institute of Earth Sciences

NAVIER — Dir: Karam Sab
Navier Laboratory

RRO — Dir: Jean-Pierre Rajet
Rockfall Hazards and Design of Geotechnical Structures Laboratory

SRO — Dir: Christophe Chevalier
Soils, Rocks and Geotechnical Structures Laboratory

SV — Dir: Jean-François Semblat
Earthquakes and Vibrations Laboratory

TC — Dir: Luc Thorel
Earthworks and Centrifuge Laboratory
COMPONENTS AND SYSTEMS DEPARTMENT

The Components and Systems department (COSYS) boasts 300 agents, among whom is an average of 90 doctoral students, distributed across five sites. It features twelve laboratories including two mixed research units (LICIT/ENTPE, SATIE/LTN), a joint project team with INRIA (I4S) and two joint research teams (NACRE with Ecole Polytechnique, CARMIN with CEA-LETI). The branch located in Marne-la-Vallée alone numbers 130 people.

INTERVIEW WITH FRÉDÉRIC BOURQUIN, DIRECTOR

What is this department’s ambition?

We do research on NICTs applications in transports and urban life. The concepts and tools we develop will help improve efficiency and safety whether in terms of mobility (road, rail, airborne, river and seaborne transport), infrastructure networks (transport, electricity, gas, drinking water) or urban systems. They aim to reduce the carbon footprint and impacts on environment and health. We produce basic knowledge, methods, technologies and tools that can be instrumental for our industrial partners. By assessing the transformations induced by these innovations, our work informs public policies. Our researchers come from diverse scientific disciplines: modelling, scientific computing, physics, computer sciences and software engineering, automation, imaging, perception, information sciences, electronics, experimentation sciences and engineering. They rely on many experimental platforms: multimodal transport, driving simulators, observation drones, charging points, climatic chamber, railway fatigue test-track, etc.

Where do these research projects fit in IFSTTAR’s scientific strategy?

Our projects are cross-cutting and straddle all research axes and many deliverables expected under the Goals and Performance Contract. More generally speaking, our research work should help address the growing demand for mobility in Europe (both passengers and freight) whilst placing the emphasis on low-carbon transports. For this purpose, transport systems should be upgraded, integrated, interoperable and compatible with electric mobility.

Who are your partners?

We work with businesses of all sizes in the fields of transports, infrastructures, energy or telecommunications. In France, we take part in the Railenium, Jules Verne and SYSTEMX IRTs, the Vedecon and Efficacity ITEs, Equipex Sense-City and SATT Ile-de-France Innov. At the international level, we are involved in excellence networks (EURNEX, NEARCTIS, HYCON2) and technological platforms (ECTP, ERTRAC).
The I4S team (Statistical inference for Structural Health Monitoring) was initiated early 2013 to study the deterioration of structures (wind farms, bridges, buildings, rails...), on an on-going computerised basis using stand-alone wireless low-cost sensors. In order to improve the inspection methods (most often one-off eye inspections), these sensors record vibrations, which make it possible to characterise the structure’s condition and evolution.

Besides the intrinsic improvement of models (accuracy, computing time), the team’s ambition is to make these sensors “smart” by allowing them to do part or all of the computing.

I4S has engineers and researchers from IFSTTAR (Vincent le Cam, Jean Dumoulin, Dominique Siegert, Ivan Guéguen, Mathieu Le Pen), two INRIA researchers and doctoral student (CIFRE Dassault scholarship). I4S provides a formal structure to foster close links between these experts of measurement and computing systems applied to civil engineering on the one hand, and experts of mathematic and algorithmic modelling to optimise the processing of millions of data on the other hand. By combining physical models and statistical methods, researchers strive to design robust, accurate and quick-response methods.

Since 2013, the team, in association with Nantes University, has been working on organising the 7th EWSHM, European Workshop on Structural Health Monitoring, scheduled in 2014 in Nantes. In parallel it also took part in many calls for projects (ANR, H2020...).

vincent.le-cam@ifsttar.fr
TRANSPORT, HEALTH, SAFETY DEPARTMENT

The TS2 department employs 280 agents within three laboratories and three mixed research units located in Lyon-Bron, Marseille and Salon de Provence.

INTERVIEW WITH BERNARD LAUMON, DIRECTOR

What are your department’s areas of competency?

As its name suggests, the TS2 department conducts research to improve the safety and health of transport users. Our approach is centred around human beings and their ability to interact with their environment (vehicle, infrastructure, new technologies, etc.), but also in its multiple dimensions: physiological, pathological, biomechanics, behavioural, cognitive, etc. This explains why one of TS2’s specificities is its multidisciplinarity with research streams delving into “hard” sciences (mechanics, biomechanics, ergonomics, accidentology) as well as social sciences (psychology, cognitive sciences, political sciences) or life sciences (biomedicine, epidemiology). TS2 is now the French leader for road safety research and an acknowledged player at the international level.

What links do you entertain with other research players in France and overseas?

All of our laboratories are involved in European projects, in particular the Humanist and ISN Virtual centres of excellence. Therefore, we are fully in line with our Institute’s commitment that “Europe remains a natural priority for IFSTTAR’s international action.” Our teams have also established relations with many other European (ECTRI, FERSI, VPH) and international (GHBMC, OpenLab BSIP, ISO groups, WHO-CC) networks. At the national level, some of our laboratories are involved in Labex, Idex and Equipex. Taking advantage of the mixed composition of the UMRs, our department closely works with the Lyon and Aix-Marseille universities.

Where does it fit in IFSTTAR’s scientific strategy?

Among the four major challenges assigned by the ten-year scientific strategy, that which our TS2 department most contributes to is of course the first one, “Analysing and innovating for sustainable and responsible mobility.” More precisely to the research objective that aims to reinforcing safety and comfort in transports and minimising health impacts. But the TS2 teams are also involved in four other research challenges: “Observing and analysing the behaviours and mobility of goods and people, as well as uses in order to anticipate tomorrow’s mobility,” “Managing, optimising and evaluating transport systems,” “Designing policies, solutions and services for innovative mobility” and “Evaluating and quantifying interactions between people and their surroundings and any associated vulnerabilities.”
FOCUS ON TS2

Disabilities and transports: for universal design and equal access

2013 sealed the partnership between IFSTTAR and IFRH, through the joint organisation of the first scientific colloquium: Research on Disabilities and Transports – at the crossroads of the various disciplines, in Bron on 4 October, 2013.

IFSTTAR, a member of the IFRH network as part of its involvement in GERI Situations de handicap et transports (a structure working on disabilities and transport which chiefly comprises three laboratories: LESCOT, UMRESTTE and LBMC from the TS2 department), was behind the organisation of this event.

More than simply an opportunity to share scientific knowledge, this event demonstrated the complementarity of these two organisations on the issue of disabilities and transports. In France, research on these issues has spurred many projects spanning several disciplines: humanities and social sciences, life sciences and engineering sciences. These are all complementary disciplines that reflect the sheer complexity and diversity of handicap situations. These sessions highlighted the input of the various disciplines, showed how the various research streams expand our knowledge and also pointed to potential areas of improvement (prevention, technical assistance, management, accessibility, etc.).

Chaired by Mrs Marie Prost-Coletta, ministerial delegate for Accessibility, this session attracted some 122 attendees: researchers, practitioners, manufacturers, carers and rehabilitation workers, institutional representatives.

A website is dedicated to this colloquium: http://handicaps-transport2013.ifsttar.fr

The TS2 department is henceforth the IFSTTAR’s administrative arm in partnership with IFRH. This organisation will be a way to extend existing collaborations.
PLANNING, MOBILITY AND ENVIRONMENT DEPARTMENT

The AME numbers 240 agents across six laboratories of its own and one mixed research unit based in Marne-la-Vallée, Bouguenais, Bron, Satory and Villeneuve d’Ascq.

INTERVIEW WITH GÉRARD HÉGRON, DIRECTOR

What type of research work is your department involved in?

We look at all issues related to spatial territorial planning from the angle of mobility and transports, and more precisely at interactions between transport and spatial planning, mobility of people and goods, and finally at the effects of mobility, transports and infrastructures on the environment in its multiple dimensions: ecosystems, built and technological environment, social and economic milieu. Its seven laboratories straddle a diversity of competences which is quite original if not unique: social and political sciences, humanities, economics, engineering and environmental sciences. They can thus combine political, sociological and economic approaches with other more technological ones to address the key challenges of sustainable territorial planning.

Where does your department fit in the French and European research landscape?

At national level, our laboratories participate in various Labex, Equipex, competitiveness clusters, and networks such as AllEnvi, the "Urban modelling" and "Citizen participation, decision-making and participatory democracy" GIS scientific panels, the Visible and MEGVEH GDR think-tanks, OEET, CEREMA... Our teams are involved in European networks on the City (JPI Urban Europe and the UERA alliance) and transport (ECTRI, FEHRL, ETRA and CEDR). It is crucial that we take part in these various domestic and European bodies, as this is where scientific programming and calls for projects are being initiated. With this in mind, we also intend to bolster our partnerships and attract more researchers from other bodies or overseas: mixed research teams and/or units, delegations of professors-researchers from universities, guest researchers, chairs...

How does it contribute to IFSTTAR’s global strategy?

Among the four challenges assigned by the Institute’s 10-year scientific strategy, the AME department essentially works on the first axis of sustainable mobility and the fourth i.e., sustainable town and country planning, by developing systemic and multiscaled approaches. AME’s position within IFSTTAR is quite unique insofar as by studying the interactions existing between natural systems (ecosystems) and man-made systems (vehicles and transport infrastructures, technologies and services) as well as stakeholder systems (project owners, main contractors, users, inhabitants, enterprises), our research allows in fine to better comprehend and assess the social, economic and environmental consequences of transport and territorial planning projects and policies.
FOCUS ON AME

Retail trade, distribution and transport: a joint reflection between France and Germany

The SPLOTT laboratory and IVF, its German DLR counterpart, have established IFSTTAR’s first associate international team (EIA). This groundbreaking setup will further boost cooperation between the two laboratories and place them in a long-term perspective.

Organised around a joint multi-year scientific project, this team will look at the role of retail trade in generating transport flows and structuring supply chains. The scientific agenda will focus on the following themes, with a comparative outlook between France and Germany:

- How does the location of retail trade points of sale and distribution centres impact transport?
- What are the decisive factors in terms of transport for such retail outlets?
- What is the impact of certain changes and policies on the organisation of distribution circuits and transport?

The memorandum of agreement for the creation of this international team was signed on 15 April 2013 during the French-German week of Science and Alumni, in the presence of the French and German ministers in charge of research. The final convention establishing the team was signed at the end of 2013.

Therefore, the DISTRANS team is now fully operational and has pooled its researchers and resources to work on this essential theme in connection with urban logistics-related issues.

Email: corinne.blanquart@ifsttar.fr

---

AME LABORATORIES

<table>
<thead>
<tr>
<th>Lab</th>
<th>Director</th>
<th>Research Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEST</td>
<td>Dir: Francis Papon</td>
<td>Economic and Social Dynamics of Transport Laboratory</td>
</tr>
<tr>
<td>EASE</td>
<td>Dir: Agnès Jullien</td>
<td>Environment, Planning, Safety and Eco-design Laboratory</td>
</tr>
<tr>
<td>LAE</td>
<td>Dir: Judicaël Picaut</td>
<td>Environmental Acoustics Laboratory</td>
</tr>
<tr>
<td>LPC</td>
<td>Acting Dir: Jean-Marie Burkhardt</td>
<td>Mobility and Behaviour Psychology Laboratory</td>
</tr>
<tr>
<td>LTE</td>
<td>Dir: Serge PéliSSier</td>
<td>Transport and Environment Laboratory</td>
</tr>
<tr>
<td>LVMT</td>
<td>Dir: Jean Laterasse</td>
<td>City, Mobility and Transport Laboratory</td>
</tr>
<tr>
<td>SPLOTT</td>
<td>Dir: Corinne Blanquart</td>
<td>Production Systems, Logistics, Transport Organization and Work Laboratory</td>
</tr>
</tbody>
</table>
AXIS 1

INVENT SUSTAINABLE MOBILITY

MORE SUSTAINABLE AND RESPONSIBLE MOBILITY

transport technologies and services, and in the development of models for an ever more efficient and sustainable management of mainstream transportation systems. The research conducted within the COSYS, AME and TS2 departments significantly contributed to this aim in particular through their strong involvement in the framework of collaborative projects (regional, national and European) with the academic and the industrial world. In addition, three cooperation projects with CEREMA, completed in 2013 (SERRES, PREVER and I2V), made it possible to federate efforts around themes such as eco-driving, the assessment of the use of communication technologies, localisation and perception, management of road and rail infrastructures integrating environmental or energy criteria and the prevention of risks for vulnerable users. A striking example in terms of expertise is the participation of IFSTTAR’s researchers in the work of the experts committee with the CNSR to devise a “strategy to halve the number of fatalities or serious injuries by 2020”, on the roads of our country. In 2013, IFSTTAR also got involved in international networks (ITN-Marie-Curie ADAPTATION, EURNEX network and the Hycon2 and NEARCTIS excellence networks) and spearheaded structures derived from the “investment for the future” projects such as IRT-Railenium or IEED-Vedecom.

Axis 1 of IFSTTAR’s objectives contract aims at making transport systems more environmentally friendly, safer and ever more adapted to the mobility of people and goods. This ambition is cascaded into four main research objectives: observe and analyse the behaviours and mobility patterns of people and goods to better anticipate tomorrow’s mobility; strengthen safety and comfort in transports and trim down impacts on health; manage, optimise and evaluate transport systems; design innovative policies, solutions and services for mobility.

One of the strengths of this axis is to combine various angles such as engineering sciences, humanities, social sciences and life sciences in the observation of transport systems, mobility behaviours and practices, in the design or evaluation of new

| (1) www.adaptation-itn.eu |
| (2) www.eurnex.net |
| (3) www.hycon2.eu |
| (4) www.nearctis.org |
| (5) www.railenium.eu |
| (6) www.vedecom.fr |
RAIL VEHICLES: BETTER EQUIPPED TO WITHSTAND TERRORIST BOMBINGS.

The SecureMetro European project (2010-2013), in which partake eleven partners from four countries (Great-Britain, France, Spain and Italy), has developed an array of technologies and systems with a view to designing a new generation of metros capable of withstanding the impact of a terrorist bombing. This groundbreaking project focuses on two fundamental aspects: containing blast damage and reducing debris, which are the main causes of fatalities and injuries in such cases. These studies have demonstrated that it is possible to make fairly simple and inexpensive modifications to the existing rolling stock, which could prove to significantly curb the toll of terrorist bombings. These improvements could save lives and make our rail vehicles less attractive to terrorists as potential targets. During a full-scale test conducted on a scrapped metro train, the team of the SecureMetro project evaluated the behaviour of the structure in the event of a blast and were thus able to assess how the internal structure would respond to the explosion. The results were used in designing and developing an explosion-resistant prototype, which was in turn also submitted to the same test. After the research work and tests had been completed, the SecureMetro project team presented its recommendations and solutions to rail industrialists with the approaches liable to improve the resilience of rail vehicles in case of explosion.

etrisks

TRAINS: PASSENGER ACCESS SYSTEM UNDER TIGHT SCRUTINY

Launched in September 2010, the SurFer project, funded by the single interministerial Fund (FUI) and certified with the labels of i-Trans and Advancity competitiveness clusters, was completed in November 2013. Its objective was to develop an innovative active surveillance solution for mobility-impaired passenger access (with systems comprising doors and steps), in order to improve its availability and the maintenance cost. The project gathered various players: IFSTTAR’s GRETIA laboratory, the Bombardier Transports manufacturer (project leader), the Valenciennes university, the Hiolle Industries group and Prosysy company.

In 2013, a predictive diagnostic demonstrator was launched into operation across the Paris-Ile de France network, with its onboard part comprising a rack-mounted industrial PC sending data to ground stations over the air. The ground part of the demonstrator integrates algorithms developed by GRETIA’s Diagnosis and Maintenance team: they will thus detect any malfunction or faulty setting on passenger access and issue alerts whenever values go beyond critical thresholds. Based on the resulting diagnoses, an optimisation software demonstrator was also developed for passenger access maintenance so that maintenance plans may be adjusted to respond to any drifting of the degradation dynamics.

etrisks
RAIL SIGNALLING SYSTEMS: FOR A SIMPLIFIED CERTIFICATION

The SIRSEC project unfolded between 2009 and 2013. It defines the architecture of an information distribution system as the foundation upon which to develop applications whose operating security may be subjected to certification procedures. This novel approach is based on the notion of certified patterns, i.e., software constructs whose properties are known and can therefore be evaluated. The technological windfalls can be of paramount importance for manufacturers of rail signalling systems: it would not only cut down the certification process cost and lead-time but also make it possible to use software bricks in different products. This project is targeting the market of distributed information system engineering, which forms the IT foundation of surface guided transportation systems. It provides an information exchange platform architecture for distributed applications that need to meet exacting operating security conditions. The project also defines the array of methods and tools that can be used to organise and implement these systems in an industrial context. It was funded through the FUI 7 call and involved both academic and industrial partners: Alstom, Thales, Serma Ingénierie, Prismtech, CEA, IRIT and IFSTTAR.

christophe.gransart@ifsttar.fr

SMART TRANSPORT SYSTEMS: EVALUATING THEIR ENVIRONMENTAL IMPACTS

Intelligent Transport Systems (ITS) follow a sustainable development approach by offering potential reductions of transport-related nuisance. However, there still lacks a standard methodology to assess such effects, which makes it difficult to compare and transfer the results. A standardised evaluation methodology was developed in an international context between Europe, the United States and Japan. At European level, this work was conducted within the ECOSTAND project. Launched in 2010 for a three-year period, the ECOSTAND project aims at defining a standardised framework between the EU, the US and Japan with a shared evaluation methodology to determine the impacts of ITSs on energy efficiency and CO₂ emissions.

Funded by the European Commission, this coordination action made it possible to formulate advice in terms of policies:

the recommendations were based on a roadmap and a joint research programme with a view to identifying the blind spots in terms of understanding and bringing forward methodological solutions.

This objective was achieved through a series of international colloquia held in all three regions and which featured some key experts and served as fora to exchange information. The process was crowned with the publication of a methodological guide for all three types of players: decision-makers, industrials and researchers.

nour-eddine.atlaoui@ifsttar.fr
matthieu.canaud@ifsttar.fr
BLUESOLUTIONS SUPERCAPACITOR: THE SOLUTION

This research stream concerns supercapacitors and their integration modules for trams. The purpose of this type of equipment is to recover the vehicle’s braking energy so it can be transferred to its acceleration and make the vehicle energy self-sufficient over short distances (removes the need to use the catenaries throughout, simplification through ground-powered infrastructure). The supercapacitors studied (Bluesolutions, 9000 F, whereas current cells would range from 3000 to 5000 F) combine high-energy storage capacity and power compatible with urban rail traction (1 kWh, 300 kW) with the benefit of safety and lifetime constraints. Our work was aimed at identifying the performance of such supercapacitors as well as their ageing and failure patterns. We were able to characterise the reliability and safety of the various 9000 F components, plus potential constraints in terms of use and integration into a vehicle. Besides, we implemented specific metrology in the methodological approach, in particular for short-circuit testing (with risks of accidents in mind). The resulting system had no failure after 10 short-circuit incidents at power reaching up to 45 kA. The Bluesolutions supercapacitors feature very low series resistance, electrochemistry with controlled ageing and great robustness. This type of industrial solution will be offered on the new family of rail vehicles from Alstom Transport.

HOW TO IMPROVE THE MOTORCYCLISTS’ CONSPICUITY FOR MOTORISTS?

Funded by Foundation MAIF, this project aims at addressing two of the main perception errors of motorists interacting with motorcyclists. Indeed, most motorcycle accidents occur at intersections and in most cases when the motorcyclist has the right of way.

In addition to detection errors, the motorist’s poor perception of the approach speed and time gap needed for the motorcyclist to reach the intersection is often a cause for accidents. Various innovative configurations of front lights to make the motorcycle more perceptible were tested. Two experiments on driving simulators, using state-of-the-art techniques of contrast visual rendition (High Dynamic Range), enabled to study with a fairly good level of verisimilitude the impact of light sources (motorcycle lights and distraction caused by car lights) in daytime, dusk and night-time conditions. The findings would indicate that a configuration combining colour-coding (yellow lights for motorcycle) and accentuation of the motorcyclist’s vertical dimension (by adding a light on his helmet) would potentially greatly enhance motorcyclists’ perceptibility. Note in passing that concurrently switching on the daytime running lights (Leds) and low beam headlamps is especially harmful to motorcycles’ detectability.
COMMUNICATION-ENABLED VEHICLES: TOWARDS GRADUAL DEPLOYMENT BY 2017

The SCORE@F project, funded by the single interministerial Fund (FUI), has as its objective to prepare the deployment of safety, mobility and comfort services based on the interchange of information between vehicles, onboard road equipment, management centres and vulnerable users. Among the many services fitted: alerts reporting potential danger (e.g.: vehicle at a standstill, pedestrian on roadway, vehicle driving against traffic), onboard signage (speed limits, points of interest, variable messaging systems), position-tracking and availability of charging stations for electrical cars, carpooling, etc. The architecture and communication protocols comply with ETSI standards, which guarantees interoperability at European level. The latter was demonstrated with crossmatch tests carried out as part of the European project DRIVE-C2X which SCORE@F is a partner of.

This project, which lasted 42 months, was rolled out in different phases: specification, development, technical testing and validation, and evaluation with a panel of drivers in both controlled and natural driving situations.

The project was completed in September 2013 and was concluded with a day of conferences and on-road demonstrations with a dozen vehicles. IFSTTAR (LVIC/LEMCO) played a very active role in this project and took part in most of the phases: specification, test definition, development of software components, tests and validation, final demonstrations.

jacques.ehrlich@ifsttar.fr

PEDESTRIAN SAFETY: IMPROVEMENTS IN SIGHT

Funded by the French road safety foundation, the Improving pedestrian safety project mobilised several teams of the TS2 department (LBA, LBMC, UMRESTE and UNEX), the Strasbourg University, Claude-Bernard University in Lyon, Plastic Omnium and Faurecia. IFSTTAR’s researchers boasted multiple outcomes upon completion of this project.

The epidemiology of pedestrian victims was analysed according to the typology of vehicles and was extended to victims of head traumas. Multibody simulation campaigns have demonstrated the lack of relevance of certain criteria used in evaluating and certifying pedestrian protection mechanisms. The influence of the vehicles frontend design on the nature of lesions and the understanding of the knee’s tolerance levels were complemented with experimental tests (fragmented and full-scale) and digital simulations (in part conducted jointly with the Torino School of Polytechnics). New typologies of leg injuries, compounding shearing and lateral bending, were proposed and transposed into a new physical model of the leg.

The results obtained open up real perspectives both in terms of evaluation criteria and tools for protection levels and in terms of the technological improvement of vehicles’ front-end.

pierre-jean.arnoux@ifsttar.fr
DRIVING AND THE IMPACT OF ATTENTION LAPSES

Due to the substantial gains achieved in terms of road safety on factors such as alcohol and speed, the comparative share of accidents due to attention lapses has been rising. If many studies have focussed on distraction resulting from multiple activities behind the wheel, little has been done about mind roaming. The aim of the ATLAS project is to assess the additional risks of accident linked with these lapses in attention and better comprehend their causes or origins as well as their consequences on car driving. Epidemiological findings (from a survey carried out in hospital environment) showed that about 20% of accidents are linked with the drivers’ mind wandering. Attention lapses while driving are therefore a potential avenue of road safety to further lower the number of victims on our roads. Experimental results help better understand the adaptations operated by the driver (at the attention, emotional and behavioural levels). Various strategies for cognitive effort regulation have been described and real-time detection of degraded attentional states now seems to be a possibility. This project confirmed there was a serious public healthcare issue on this theme. A critical inventory was established on the methods liable to overcome new technological hurdles.

STUDY ON THE MULTIPLE CONSEQUENCES OF ROAD ACCIDENTS ON VICTIMS AND THEIR FAMILIES IN THE ESPARR COHORT

The ESPARR cohort followed some 1,372 accident victims of the Rhône region for one, two, three and five years. It was thus possible to highlight the repercussions impacting victims in their daily lives and that of their families, to describe the physical, mental and social consequences of such accidents, and identify the factors liable to forebode reintegration problems.

The data collection process, based on questionnaires (as well as a medical check and neurocognitive and functional evaluation for MAIS3+ injuries), has now been completed. Results analysis is still ongoing. ESPARR confirmed the fact that an accident, even of little severity, is never without consequences (impact on daily life and work amongst other things). An in-depth analysis of certain pathologies was made possible: whiplash, head and facial traumas... The study confirmed that very early on should one take into account the importance of post-trauma stress in the reintegration process and the extent of social and economic vulnerability to better assess the victims’ recovery prospects.

Owing to its unique characteristics, ESPARR provides fundamental scientific support to tailor practical measures and guidance for prevention in the best possible environment. Funded by PHRC, Predit, ANR, the Fondation sécurité routière and the French Ministry of Health, ESPARR has been the subject of several publications and communications, including a conference.

martine.hours@ifsttar.fr
MOBILITY SURVEYS: TECHNOLOGY AT THE SERVICE OF HARMONISATION

Over the last four years, the DEST Laboratory presided over the Action COST SHANTI to harmonise nationwide data production and processing for mobility and proceed with international comparisons. 36 laboratories from 21 countries (Europe, but also Australia) joined forces, with 20 meetings and 4 working groups. Taking on board the latest developments of new technologies (GPS, GSM, RDS, etc.) these studies on corrections for methods-related biases between surveys of different countries eventually delivered some reliable and consistent estimators of daily mobility. This action provided a forum of discussion to bring about new projects based around data (with Eurostat and DG Move), on continuous data collection and the standardisation supported by these new technologies. It also resulted in the publication of scientific articles and communications: e.g. for the special issue of INSEE’s Économie et Statistique magazine on transportation surveys (issue 457-458, released in July 2013, which was coordinated, and to a large extent nurtured by DEST) or for the future 2014 conferences of TRB (some twenty communications), and later of ISCTSC (thirty-some communications). A summary report is currently being prepared.

ROADWAYS: OPTIMISING THE TEXTURE PROFILE

In a first stage, the behaviour of the different elements coming into play in the tyre/road contact was analysed (the aggregate, the rubber tire wall, etc.). In a second stage, these elements were assembled to form a complete finite element model for tyre/road, taking into account the various texture elements. Various experiments were conducted in lab, on track and on road to confirm the model. One of the outstanding results of this project was that in fine a piece of software was developed to assist road engineers in optimising roadway texture in the formulation phase and in actually producing the surface courses. This tool enables to define the variable maximum speeds according to surface condition. The tool may also contribute to improving harmonisation techniques for the various grip measurement devices used across Europe. Besides, an innovative tribometer, SR-ITD, was developed during the project. It helps improve in-lab characterisation of aggregates and coated materials (finer, quicker and more realistic). This new device is quite promising in terms of potential uses: it would be wise to waste no time in exploring all of its possibilities and in particular see if it could be used for another surface property, i.e. rolling resistance.

"ALCOLOCKS": ALCOHOL IGNITION INTERLOCK DEVICES TO PREVENT REPEAT DRINK-DRIVING OFFENCES

Alcolock programmes aim at preventing drink-driving offenders from relapsing via a device which forces the driver to blow into a breathaliser coupled to his car ignition. These devices appeared in Europe in the 1990s. This research studies their efficaciousness in reducing repeat offences and analyses the factors contributing to a positive impact. This is based on a 5-year follow-up of 175 participants in the Alcolock programme and a control group of 234 people. The data collected provide a description of these “alcohol offenders”, about whom very little is still known (whether for the participants to the alcolock programme or members of the control group). Two features stand out: extra risk for male drivers and very high alcohol levels when arrested (between 1.5 and 2.5 g/l). Five years after removing the device (which is the legal time period defined for a repeat offence), the reoffending rates observed are 26% for the experimental group and 35% for the control group. An analysis of the change process for the self-evaluation of alcohol problems shows that the programme will tend to trigger an awareness earlier than through an environmental re-evaluation (i.e., an understanding of the negative impacts of alcohol consumption on one’s social setting) or the fact of understanding that one may reach one’s objectives otherwise than through heavy drinking as a strategy.
THESSES

COSYS-LEOST
Jorge AVELLA CASTILLANCO. Electromagnetic modeling to specify and optimise the positioning of buried antennas, of any shape, meeting the electromagnetic constraints of rail transports.

COSYS-GRETTIA
Ines AVULDI. Multicriteria optimisation in temporal probabilistic graphic models: application to the setting of maintenance parameters.

TS2-LBMC
Jeanne BULLE. Experimental study on intra- and inter-individual variability for the prediction of driving posture.

AME-DEST
Giulio CERCONIOI. Decisions of a household in cases of uncertainty and dynamics of its automobile behaviours.

COSYS-GRETTIA
Nicolas CHEFETZ. Detection and classification of ADC time signatures as an aid to the maintenance of mass transportation system components.

AME-LVMT
Clément COLLIN. Present assets, foundations and limitations. Power generation equipment in the Loire and Rhône valleys.

TS2-LBMC
Julian DEVAVUX. Analysis and kinematic simulation of arm motion when handling an object for ergonomic simulation using a digital test dummy.

COSYS-GRETTIA
Yann DUJARDIN. Multi-objective and multi-mode adaptive regulation at traffic light intersections.

AME-LVMT
Matias GARRETON. Mobility discrepancies in Grand Santiago and Île-de-France region. Housing policies, transports and metropolitan governance.

TS2-LESCOT
Charlène HALLETT. Development of an unbiased evaluation test for distraction while driving.

TS2-UMBRESTE
Nhac Vu HONG THY. Contribution to a better understanding of future prospects for injured victims after road accidents: evaluation of consequences after one year in the ESPARR cohort.

AME-LVMT
Peng Yen HONG. Daily mobility and socialization of young rural in Île-de-France region.

COSYS-LEPSIS
Utku Gorkem KETENCi. Agent-based modelling of limited human perception as applied to the simulation of drivers' behaviours at intersections.

COSYS-LTN-SATORY

COSYS
Feirosz KOUTINTI. Behavioural modelling and simulation of traffic in urban and suburban environment: simulation of behaviours at road interchanges and at the centre of intersections taking account of mixed flows, evaluation of CO2 emissions.

AME-LTE
Felicius MENSING. Energy optimisation of the use of conventional, electrical and hybrid vehicles respectively. Application to eclouding.

COSYS-LTN-SATORY
Jean-Pierre OUSTEN. Study of the ageing behaviour of heat interfaces for power electronic modules dedicated to transport applications.

COSYS-LIVIC
Steve PECHBERT. Modelling and simulation of electromagnetic sensors applied to automobiles for the prototyping driving aid systems. Applications to radars and telecommunication systems.

ERA
Yadu PRABHAKAR. Detection of two-wheelers by laser-range scanning telemetry.

AME-DEST
Tony RANDRIJASOLO. Plane-based inference in estimating small domains.

AME-LVMT
Mahdi SAMARZAD. Disaggregation of space in transportation-mode and itinerary computing models: method and application to Île-de-France region.

MAST-LAMES
Nicolas TRONSON. Detection of two-wheelers by fixed video sensors.

AME-LVMT
Elisabeth WINDISCH. Potential of electrical vehicles for passenger transport. Economic and territorial analysis for Île-de-France region.

COSYS-ESTAS
Jing YANG. Formal specification and testing of COTS-based onboard command/control architectures for railways.

HABILITATIONS

COSYS-LTN
Denis CANDUSO. Contribution to experimentation on PEM-type fuel cell generators for transport systems.

TS2-LBA
Catherine MASSON. Experimental characterisation of human body tolerance through a multi-scale approach.

COSYS-LIVIC
Marianna NETTO. Contributions to road safety: from obstructions and control theory to real solutions, discussion and evaluation.

TS2-LMA
Hélène REGNIER. Paving the way for urban quality. Governing territories, governing driving behaviours and new forms of domination in the neocitizen city.

COSYS-LEOST
Charles TAKTEK. Contribution to the study and implementation of new transmission and reception techniques for radars and communications applied to land transportation.
AXIS 2

EFFICIENT AND SUSTAINABLE INFRASTRUCTURES

Infrastructures (bridges, roads, railways, buildings, urban networks, energy production and transmission structures...) offer development prospects for territories. They are now, however, faced with growing constraints: climate change, depleting resources, increasing urbanisation, ageing legacy structures. How can one make sure that these infrastructures will continue to meet the needs of populations and particularly in terms of safety and comfort, this is what IFSTTAR is looking at under axis 2 of its objectives contract:

I by monitoring and testing them and striving to control their lifecycle
I by optimising existing structures through a refined assessment of their residual lifetime and with tailored maintenance and repair strategies
I by developing new materials and structures.

Whether it be through joint research operations with the CETEs (AGREGA, ECOSURF, ORSI ageing and maintenance of sewerage networks and structures), projects with SMEs (Actility), consortia (NBT and TERDOUEST projects) or major industrial groups (EDF), cooperation with other professionals or research organisations (DIOGEN database), State agencies (technical department of civil aviation), IFSTTAR works everyday on aspects linked with infrastructures.

chantal.de-la-roche@ifsttar.fr  kristel.hermel@ifsttar.fr
ROADWAY SURFACE: FOR A GOOD CONTACT

Road surfaces must fulfil several key functions: the optimisation of which remains a challenge: ensuring a high level of safety (grip) while reducing vehicles’ energy consumption (low rolling resistance), curbing environmental nuisance (low rolling noise generated), and meanwhile in a resource-saving and sustainable way. Optimising these functions requires evaluating and modelling road and tyre contact.

The ECOSURF (2010-2013) research operation has developed such physical models for road/tyre contact applied to grip prediction, noise and rolling resistance. The evolution of these properties was studied in laboratory and in situ and models were proposed. In parallel, measurement tools were developed, tested or upgraded. Finally, this operation made it possible to evaluate particularly innovative coating techniques in terms of use properties (micro-inserts for better grip of new road, silent poro-elastic coatings) or in terms of sustainable development (re-use of coated aggregates, use of local materials). ECOSURF contributed to several national (CLEAN) and international (SKIDSAFE, TYROSAFE, PERSUADE, OSsurf, MIRIAM) projects, released 15 scientific articles, produced 3 measurement devices (TRIBOROUTE, TEXROAD3D, SRT-ITD) and allowed two nationwide databases to be updated (CARAT, Bruit).

fabienne.anfosso@ifsttar.fr

---

DIOGEN, A BARREL PACKED WITH DATA FOR CIVIL ENGINEERING

Adapting impact data to the context of French civil engineering is the aim of DIOGEN, a database established under the aegis of AFGC. Accessible on the website Diogen.fr, this database offers downloadable cards with data on environmental impacts as per standard NF P 01 010 (and soon 15804) for materials used in making civil engineering structures (concretes, steels for reinforced concrete, cements, aggregates, metal sections, sheet metal, timber...):

- Energy consumption (MJ)
- Resource depletion (kg Sb eq.)
- Water consumption (l)
- Solid waste (kg)
- Climate change (kg CO₂ eq.)
- Atmospheric acidification (kg SO₂ eq.)
- Air pollution (m³)
- Water pollution (m³)
- Destruction of the stratospheric ozone layer (kg eq CFC)
- Photochemical ozone formation (kg ethylene eq.)

By the end of 2013, 42 such data cards were available.

DIOGEN can be queried at all phases of a project; it is intended for all civil engineering players (engineers, technicians, architects, teachers or students), whether they are contractors, designers, researchers or in charge of implementation. This work is conducted by a group jointly led by SETRA and IFSTTAR, and including representatives of materials producers, businesses, design and engineering consultants as well as institutional bodies.

christian.tessier@ifsttar.fr
UNHEALTHY CONCRETES: TOWARDS A BETTER UNDERSTANDING OF THE PATHOLOGY

Internal sulfate attacks (ISA) is a pathology whereby concrete starts expanding which results in cracks and a degradation of mechanical performance. The structures suffering from this pathology may subsequently develop structural and/or functionality integrity problems and must be treated accordingly.

Keen to provide structure managers with diagnosis and prognosis tools for such ailing structures, between 2006 and 2012, IFSTTAR, in partnership with EDF, conducted a groundbreaking experimental programme aiming to improve the understanding of the mechanical effects of ISA (possibly combined with the alcali-aggregate reaction) at both the material and structure levels. The results achieved allowed a quantification of the highly harmful nature of this pathology: influence on bearing capacity, physical-chemical couplings, increased transfer properties conducive to the penetration of aggressive substances, etc.

All of the results collected so far have been brought together in a database available to research teams on request and free of charge. The results should make it possible to develop and/or confirm the computing models, such as RGB of the CESAR-LPC code which is used to predict the behaviour of affected structures over several dozens of years.

SEWERAGE NETWORKS: A NOXIOUS RELATIONSHIP

The research operation on the ageing and maintenance of sewerage networks and structures subjected to bio-physico-chemical processes was eventually completed in 2013 after four years of work.

This research stream on the biodeterioration of materials in presence of hydrogen sulfide involves several scientific areas. Its purpose is to study phenomena related to the coupling between materials and micro-organisms generating biogeneric sulfuric acid (H2SO4) noxious to materials.

Besides IFSTTAR and several CETEs, materials manufacturers and sewerage network management companies took part in this research operation. Amongst other things this operation helped define the parameters involved in the global biodeterioration mechanism of cement-based materials, to analyse behavioural differences according to the type of cement and thus propose the best choice of material. A test campaign was carried out in situ to confirm the findings of laboratory research. An accelerated test was devised from the bulk of this research and should be submitted for validation in 2014. A biodeterioration model for cement-based materials was also designed.

Studies in this complex field of research will continue with several actions currently underway at French and international level.
TRANSPORT INFRASTRUCTURES: REDUCING THE ENVIRONMENTAL FOOTPRINT OF AGGREGATES

The economic vitality of a country to a large extent depends on the quality of its transport infrastructure network. In France, this network essentially comprises roads and railways and their construction and maintenance produce waste, while they also consume large quantities of aggregates, 95% of which are extracted from natural resources, and generate heavy traffic which is harmful both for the transport infrastructures themselves and their environment. In partnership with industrials and other research organisations, the research operation AGREGA, initiated by IFSTTAR in 2009 and concluded in 2013, focused on these issues with the aim of reducing the environmental footprint related to the construction and maintenance of road or railway infrastructures. This operation made it possible to develop or enhance tools and methods to evaluate at best the aptitude of aggregates for a given use, to model the influence of their usage specifications on the properties of a grain mixture, to re-evaluate through experimentation the relevance of some of their specifications vis-à-vis the performance of road materials and finally to build environmental criteria into the cost of procurement of such aggregates by using the concept of transportability. The main learnings were presented during the closing seminar and all papers are now accessible on the IFSTTAR website (www.ifsttar.fr).

HIGH-SPEED RAILROADS: CONCRETE MAKES ITS WAY

The NBT FUI’s purpose is to develop a French railway solution for mixed heavy freight/high-speed traffic solution using concrete slabs. It aims to design a profitable and reliable alternative to existing ballasted tracks which cause several problems for high-speed traffic (beyond 320 km/hr) such as ballast pickup; increased rail wear and degradation of the coupling developing more rapidly than expected; frequent maintenance (tamping) operations impacting scheduled train traffic; consumption of a noble resource: ballasts.

Bringing together several partners between 2007 and 2013 such as Railtech (rail clip systems), Alstom (rolling stock and construction equipment), RFF (contractor), CEF (railway instrumentation), Vossloh (railway equipment) and IFSTTAR (sizing), the project resulted in the completion of a 1-km long prototype on the Serqueux-Gisors line, near Sérifontaine. In the longer run the construction rate would cruise at 1,000 m/day. IFSTTAR was involved in several aspects of this project: it proposed and pre-sized the track concept based on the previous experience gained in road building; it confirmed the concept with a full-scale model; it provided advice to enterprises during the prototype’s construction and instrumentation.

RUNWAYS: NOW AT THE RIGHT SIZE!

This new rational dimensioning method for runways, developed by a joint taskforce from STAC-RST-IFSTTAR, has now been awarded an official status. The method was published in the form of a guidebook on the STAC’s website as of end of 2013. For its development, the team was able to tap into the previous work done on the dimensioning of bituminous pavements by LCPC-SETRA, to which significant adaptations and extensions were added. In particular the fact that specific account was taken of the geometry of aircraft landing gears, their speed and whisk-broom, which will be different whether they are on the landing runway, taxing or parking.

The data produced by PEP AIRBUS on flexible pavements (1997-2001) were essential in fine-tuning the new dimensioning model which was validated by a panel of experts including several French players in this area (project owners, main contractors and businesses). In order to facilitate its practical deployment, a new aeronautical model was implemented in parallel by IFSTTAR within the Alizé-LCPC software. They are now considering an extension of this rational approach to the dimensioning of rigid airport pavements. This work echoes the actions currently conducted by ICAO for the development of a rational approach to the computing of ACN-PCN coefficients.
SMARTGRIDS: SMART ENERGY MANAGEMENT

The ramping up of smartgrids is drastically changing the landscape of energy distribution by improving the management of intermittency in production through real-time demand adjustment. The ACTILITY company, which was recognised as a young innovative business (OSEO) and awarded ADEME’s innovation prize 2012, ambitions to become a major player in this sector. As part of its cooperation with this company, IFSTTAR focussed on two themes:

- Development of drivers: one of the technological challenges consists on the one hand to implement the ACTILITY/IFSTTAR know-how (i.e. computing codes) on the ACTILITY box, which is physically deployed in the building (individuals, businesses, tertiary sector...), and on the other hand to interface this box with industrial sensors and actuators (temperature, humidity, presence, etc.). IFSTTAR took charge of the full development of three of these drivers under ETSI specification M2M.

- Thermal modelling of buildings: the thermal energy used in heating buildings forms a substantial stock of energy and it is possible to shift consumptions over time without adverse effect in terms of thermal comfort. To do this one needs to better understand the building’s behaviour so as to anticipate the evolution of its thermal state thanks to a predictive model, amongst other things. This project focussed on the development of such models, whose parameters can adjust automatically via inverse methods based on low-cost field measurements, which considerably minimises forecasting uncertainties.

EARTHWORK: SOILS TREATED AND RE-USED

On 18 and 19 June 2013 in Marne-la-Valle, was held the colloquium reporting on the outcomes of the research work carried out as part of the ANR TerDOUEST project with 12 academic and institutional partners. The agenda focussed on a better understanding of the mechanisms liable to improve soils with poor characteristics by incorporating lime and/or hydraulic binders. The objective is to significantly enhance the reusability of heavy clay soils in earthwork projects, as such soils are currently thought of as unsuitable, and broaden the field of application of treated materials to flood-prone areas.

Exploratory laboratory work at atomic scale, the testing of older structures and later the construction and remote monitoring of an instrumented backfill, used as a performance observatory on the Héricourt (RD 438) deviation in the Haute-Saône region, made it possible to upgrade the knowledge of the mechanisms that govern the triggering and subsequently the stabilisation of the hydraulic setting.

During the meeting attended by almost 160 researchers, scientists and practitioner engineers from all countries, presentations were given with relevant data to control the technique, the cost and environmental impact in the context of climate change. Future research will look at the long-term performance of the treated soils according to the aggressiveness of its environment and service-related stresses.

THESES

COSYS-LIVIC
Cindie ANDRIEU. Functional modelling of a reference speed profile adapted to the infrastructure.

MAST-MIT
Mariane AUDG. Evaluation of the rheological potential of silts extracted from microaggregates for application to substitution materials used in lieu of bitumen.

AME-LVMT
Vincent BENZECH. Stochastic modelling of users behaviour in a mass transportation network.

MAST-NAVIER
Sébastien BOUTEILLE. Analysis and prediction of the behaviour of concretes subjected to freeze-thawing cycles in the presence of de-icing salts.

TS2-LESCOT
Mercedes BUENO GARCIA. Impact on an anticollision system on information processing and driver behaviour.

AME-EASE

COSYS-LEPSIS
Laurent CARAFFA. New approach for the 3D reconstruction of road environment.

GERS-NAVIGR
Benoît CARRIER. Effect of water on short- and long-term properties of swelling clays: experiments on self-supporting films and molecular simulations.

MAST-NAVIER
Laurent CHARPIN. Cement matrix breaking towards the aggregates in case of alkali-reaction and assessment of associated dimensional variations.

MAST-NAVIER
Thibaud CHEVALIER. Injection of non-Newtonian fluids into porous media.

SETRA
Jerome CHRISTIN. Foundation system using timber piles: an age-old technique for a lasting future.

GERS-NAVIGR
Jo Cai DONG. Study on the effect of aggregates size on the stiffness of thin soils treated with lime and/or cement.

MAST-MIT
Raelize DU PLOUT. Development and combination of non-destructive electromagnetic techniques to evaluate coating concrete prior to corrosion.

COSYS-LEOST
Stephen DUDOYER. Contribution to the detection and recognition of electromagnetic noises targeted according to their effects on GSM-R transmissions.
GERS-NAVIER
Trong Vinh DUONG. Study of the hydro-mechanical behaviour of materials from older platforms with a view to reinforcing them through 'soil-mixing'.

GERS-NAVIER
Ngoc Trong GIANG. First approach to the digital modelling of frictional viscouspelastic run-off.

MAST-NAVIER
Vinh ESNAULT. Understanding and modelling of cement clinker behaviour during compression crushing.

COSYS-LEOST
Beaua FALL. Performance evaluation of a track-guided transportation vehicle position-tracking system based on the combination of a UWB radio technique and a time reversal technique.

MAST-FM2D
Amélie FAVIER. Setting and rheology mechanism for model geopolymer binders.

ERA
Gil GUILLEMIN. Deformable constrained models in non-linear tomography image reconstruction by artifical time.

MAST-FM2D
Guillaume GRAMPEIX. Vibration of modern concretes.

TS2-LESCOT
Jonathan GROFF. Cognitive processing of graphic animations adapted to transport signage.

GERS-SRO
Antoine GUIMOND-BARRETT. Influence of implementation and dosing conditions on the durability of soils treated with hydraulic binders for reinforcement of foundations or infrastructure platforms.

MAST-CpDM
Jean-Marie HENULAI. Methodological approach in evaluating the performances and durability of distributed deformation measurement systems. Application to a fiber optic cable embedded in concrete.

MAST-FM2D
Julie HOT. Influence of superplasticizer-type polymers and air entraining agents on the macroscopic viscosity of cement materials.

MAST-CpDM
Clément HOUZE. Study of slag reuse in the iron and steel industry and the production of silico-manganese alloys - responsiveness, durability, environmental evaluation.

MAST-NAVIER

MAST-SDDA
Nadia KAGHO et Christiana GOUGAIDIO. Study of the vulnerability and robustness of structures.

MAST-NAVIER
Huy LE DANG. Multi-wire modelling of rolling processes.

MAST-NAVIER
Louise LOULOU. Durability of mixed wood-concrete assembly bonded under hydraulic loading.

MAST-NAVIER
Claire MARILIEUX. Study of hydraulic transfers in porous media in presence of water-retaining polymers for application to mortar.

MAST-NAVIER
Romain MEJE. Analytical solutions in non-linear dynamic fluid-structure coupling.

MAST-FM2D
Antoine MONTANEAU. Modelling of the atmospheric carbonation of cement materials with factoring in of flying ashes.

GERS-SRO
Eloise NAUFE. Shallow geothermal energy: thermal properties of materials, potential modifications over time.

GERS-SRO
Xuan Phu NGUYEN. Chemical-hydro-mechanical behaviour of stiff clays in the context of geological storage of radioactive waste.

MAST-NAVIER
Van Tuan NGUYEN. Multiphase modelling contribution to the analysis of the macroscopic behaviour of fibre-reinforced materials.

MAST-NAVIER
Florian OSSELIN. Thermochemical and poroelastic modelling of salt crystallisation, and new experimental device for multiphase flow: how to predict the evolution of injectivity for CO2 storage in deep aquifers?

AME-LPC
Blaise PALAT. Declarative and behavioural (simulator) studies of drivers decision-making at traffic lights: interactions between socio-psychological and context-based factors.

GERS-NAVIER
Guillaume PERRIN. Random fields and associated inverse statistical problems for uncertainty quantification. Application to the modelling of railway track geometry in order to evaluate the dynamic response of high-speed trains and risk analysis.

AME-EASE

MAST-NAVIER
Sahar RADIFAR. Modelling of reinforced concrete structure elements strengthened by bonded FRPs: application to peeling-off type rupture.

UFJ GRENOBLE
Giuseppe RASTIELLO. Influence of cracking on concrete structures' sustainability.

MAST-NAVIER
Mathieu RIVAILLAN. Study of the aid to decision-making via multi-criteria optimisation of sequential energy rehabilitation programmes for existing buildings.

GERS-NAVIER
Simona SABA. Different hydromechanical behaviour of engineered barriers made out of swelling clay.

AME-LVMT
Stadie SADEGHIAN. The electric mobility system: from player-level projects to territory-wide projects.

MAST-SDDA
Ngoc Thanh TA. Study of the durability of engineered structures in a sustainable development context. Application to mixed bridges.

MAST-CpDM
Ines Leina TCHETNGNA NGASSAM. Study of the durability of repair materials used in fixing concrete structures.

COSYS-LT-SATORY
Benich THOLLIN. Electrothermal characterisation tools and methodologies for the analysis of power electronics interconnection technologies.

COSYS-LT-SATORY
Thamara VIAIRA DA ROCHA. Quantification of errors associated with the use of simplified trajectories, as derived from traffic models, in computing fuel consumption.

COSYS-LT-SATORY
Xianyan XIE. Study and modelling of dynamic bus lanes.

MAST-CpDM
Hailong YUAN. Modelling of concrete degradation due to biogenic acid attacks.

GERS-AI
Yuxiang ZHANG. Integrated health check for materials and structures by ultrasound CQDA analysis.

MAST-SDDA
Xiao yi ZHOU. Evolution and statistics on the effects of loads of heavy-duty vehicles on engineered structures.

MAST-MIT/MAST-LAMES
Leyla ZITANI. Study of physico-chemical phenomena at the emulsified asphalt/mineral substrate interface. Application to the formulation of emulsion-based bituminous concrete.

HABILITATIONS
COSYS-LTIS
Emmanuel BOURJEOIS. A few considerations related to the digital modelling of geotechnical structures.

MAST-SMC
Lamine DIENG. Drops and bubbles: from a single object to concentrated suspension.

MAST-NAVIER
Elise LORENCEAU. Sustainability of metal and cable structures: contribution to increased lifetime.
MANKIND AND THE ENVIRONMENT

Based on the principle that prevention is better than a cure, IFSTTAR has decided to organise research work on analysing the interaction between mankind and the environment, as part of Phase 3 of the goals and performance contract. These problems are complex and require, first of all, an analysis of the impact that mankind impose on its environment through its activities. In common language, this is often expressed using terms such as pollution, toxicity, a reduction in biodiversity, harm to the environment, etc. The work in this phase aims to measure, predict and offer solutions in order to reduce these effects.

Moreover, the changes experienced in our environment also require perceptible modifications in our everyday life. It is important to analyse these interactions in order to anticipate what may be necessary adaptations in our lifestyles. As a result, key terminology will be centred on expressions such as adapting to climate change, resilience to natural hazards, and so on. The work to be done will mainly be directed towards fine-tuning tools used towards decision-making, which are necessary to build and adapt to this changing environment.
WASTE MANAGEMENT: GEOSYNTHETICS TO THE RESCUE

To limit the environmental impact of waste disposal, the DURAGEOS project (2009-2013), coordinated by IFSTTAR, provided estimates regarding leak-proof barrier durability in non-hazardous waste storage facility. Seven partners were included: four public laboratories involved in research on non-hazardous waste and geosynthetics (IFSTTAR, IRSTEA, LTHE and ENTPE), and the two largest French commercial groups in this domain (Suez Environnement and Veolia Propreté). Using a multi-scale approach, DURAGEOS completed a non-empirical kinetic model for predicting polymer life span, simultaneously taking into account chemical, biological and mechanical degradation. This enabled better prediction of superficial weakening of a high-density polyethylene geomembrane (GM) in a honeycomb unit.

Transfer quantification shows that, for all phenolic compounds tested except for bisphenol A, using GM configurations is the same as the regulatory configurations. The obtained values contributed to better scoping and quantification of external elements. Quantifying the Eco toxicity of these transfers does not demonstrate an absence of health or environmental hazards.

Environmental and socio-economic considerations applied to various geomembranes should contribute to improved social acceptance of geosynthetics in leak-proof barriers for non-hazardous waste.

fabienne.farcas@ifsttar.fr

ONAMAZU ANR: QUANTITATIVE EVALUATION OF NONLINEAR SOIL BEHAVIOUR

On March 11, 2011, a subduction-thrust, mega-earthquake (Mw 9) occurred off the coast of the Tohoku region in Japan. Japanese seismic networks were able to record top-quality data suggesting nonlinear behaviour across the first 100 metres of the subsurface. IFSTTAR, together with its Japanese (DPRI, SHIMIZU Corporation and NIED) and French (BRGM) partners, studied recordings from various sites to answer fundamental questions about strong seismological movements: at what depth(s) did the nonlinear behaviour occur? Is there recovery of elastic mechanical properties after nonlinear events? They tracked changes in the predominant frequency and they reversed soil mechanical properties (Figure 1). According to their time-frequency analyses, it appears that these membranes do not fully regain their elastic properties after being subjected to strong movements.

After they generated 1D inversions of accelerometer well data, behaviour of nonlinear soils could occur all along the soil column, even down to the sedimentary rock layer. During the ONAMAZU project, two masters theses, five international conference articles (two of them with reviews) and three articles in peer-reviewed journals were published. The project was started in October 2011 and lasted eighteen months. ANR grants totalled € 60K.

fabian.benilla@ifsttar.fr
URBAN STORM WATER POLLUTION: A TOXIC BLEND

The INOGEV ANR project, lasting four years, aimed to help urban planners and local government officials define effective pollutants flow management in urban areas through analysing how knowledge was transferred between research results and operational application. This work was done in three French urban hydrology observatories (ONEUV in Nantes; OPUR in the Paris region; and OTHU in Lyon), grouped under the observation system for urban environment research and experimentation (SOERE) URBIS. In this context, 77 micro pollutants (trace metals, polycyclic aromatic hydrocarbons, pesticides, alkyl phenols, bisphenol A, polybrominated biphenyl ethers) were tracked – many of which had never been researched in urban storm water. High levels of several toxic elements such as strontium, bisphenol A or alkyl phenols were detected. Regarding presence of micro pollutants in storm water, there were few land occupation differences: the same elements were detected in all three sites researched. However, concentrations of zinc, strontium and polybrominated biphenyl ethers varied significantly from site to site. These differences could result from varying levels of automobile traffic, more dense in some sites than in others.

veronique.ruban@ifsttar.fr

FLOODING IN URBAN AREAS: TECHNOLOGIES FOR EFFECTIVE, ECONOMICAL PROTECTION

FloodProBE is an FP7-ENV European project completed in October 2013 after a four-year research programme. It brought together 14 partners and linked numerous managers and end-users.

The project’s main goal was to provide effective, economical means to reduce hazards related to flooding in urban areas. This would be accomplished by developing adaptive and innovative technologies, methods, concepts and tools diagnostic, for current and future infrastructures.

In the section devoted to protection against floods, IFSTTAR and CETE-Normandie-Centre conducted action on geophysics, including an international workshop organisation at IFSTTAR in Paris in March 2011. This led to the 2013 publication of a methodological guide: Rapid and cost-effective dyke condition assessment methods: geophysics and remote sensing (1). Its goal was to help wastewater systems managers in Europe to use these technologies.

FloodProBE’s final presentation took place in Aix-en-Provence and Arles in October 2013, together with the international Levee Handbook (ILH) project. The two communities shared results and identified the challenges for transferring existing knowledge and the barriers for future research work.

sergio.lopes@ifsttar.fr

(1) http://www.floodprobe.eu/partner/assets/documents/Floodprobe-03.2_V1.4_April_2013.pdf
FREIGHT TRANSPORT: PERSPECTIVES ON REDUCING CO₂ EMISSIONS

This research has two goals: to quantify the volume of CO₂ in freight transportation, and suggest solutions to reduce these emissions. The research, financed by the DGTIM and developed in concert with the CETE Nord-Picardie, was completed in April 2014. CO₂ emissions are calculated using the ECHO survey on goods transportation in French establishments, which allows for tracking transport from their point of origin to their destination. After significant finalisation work on the routes database, we calculated the CO₂ for each shipment and estimated the CO₂ emitted by the shipping company. To verify the results, all emissions calculated in this way were compared with the results of the national transportation accounts. Different approaches were tracked to analyse ways of reducing shipping emissions; more than half of these emissions came from shipping with low or very low carbon efficiency.

The model developed to understand the impact of logistics decisions shows notably that by reducing the annual frequency of shipments to the same client, we can very markedly reduce CO₂ emissions. This hypothesis, like other different scenarios sketched out, would strongly upset economic activity: a significant reduction in freight emissions cannot be accomplished without added expense for shipping.

chrstoph.rietz@ifsttar.fr

ATMOSPHERIC POLLUTION FROM VEHICLES: THE PARTICLES IN QUESTION

Emissions from vehicles are partly responsible for atmospheric particulate pollutants. They lead to the population being overexposed to atmospheric particles in urban areas and have recognised effects on health. The total contribution of transport-related emissions to atmospheric particle concentrations is not well known, due to the diversity of emissions and difficulty in quantifying them. In particular, there is little known about exhaust emissions (wear, abrasion, resuspension by traffic).

Two projects – MOCoPo and PM-DRIVE – are gleaning knowledge about motorised vehicle emissions and their contribution to atmospheric particle concentration. In this context, a major campaign to measure atmospheric pollutants was conducted with regard to traffic proximity and the urban background, related to detailed traffic measures (MOCoPo campaign of September 2011). Amongst numerous results obtained, some showed that vehicle emissions in traffic proximity areas contributed 34% to PM10 particles and up to 57% during rush hours. The total average contribution to PM10 particles by all vehicle emissions (exhaust and non-exhaust) is double the contribution of exhaust alone (about 17%), in general, the only one that has been quantified.

aurelie.charron@ifsttar.fr
NOISE POLLUTION NEAR BODIES OF WATER: DESIGNING PREVENTIVE MODELS

Outdoor noise propagation can be considerably influenced by micrometeorological effects (wind, temperature, humidity, atmospheric turbulence, etc.). Therefore, for all impact studies (noise mapping, for example), these phenomena must be described appropriately and the related challenges in urban and peri-urban contexts evaluated. All work conducted at the Environmental Acoustics Laboratory (LAE) consists in developing prediction models, which requires having referential experimental databases available.

The goal of this work is to deepen understanding on the physical phenomena in question in order to improve acoustical calculation tools to predict noises near large expanses of water, regardless of the acoustic sources (road or rail infrastructures, off-shore wind farms, nuclear power plants, etc.).

In this context, an original experimental campaign took place from April 2-11, 2013, at the Fouché wetlands in the community of Armay-Le-Duc (Côtes d’Or), in partnership with the regional civil engineering laboratories of Blois, Clermont-Ferrand, Strasbourg and Autun. This enabled simultaneous acoustic and micrometeorological measurements, in order to better understand the physical phenomena related to acoustic propagation above large expanses of water with regard to thermal profiles, atmospheric turbulence, rough surface, etc.

Contact: benoit.gauvreau@ifsttar.fr

TRAIN BRAKING SYSTEMS: MODELLING NOISE POLLUTION TO REDUCE IT

The AcouFren project, completed at the end of 2013, was one example of research aimed at reducing squeal noises emitted by railway vehicles – noises that are often intense and especially troublesome for people exposed to them. The means of reducing these noises had long remained theoretical, due to the difficulty in creating models of the physical phenomena that cause them.

The goal of this project, financed by ADEME and piloted by SNCF, was to develop tools to help specify and produce quieter linings for HST and AGC brake discs. This required fine-tuning high-level digital methods for calculating the self-sustaining vibrations produced by friction. The Environmental Acoustics Laboratory (LAE) was particularly involved in this task.

2013 was the year when these methods were applied to industrial braking systems and when simulations were compared to in-situ trials on the HSN SNCF rolling stock. Comparisons were possible based on spectrum vibrations from non-linear temporal calculations, a great scientific leap forward. Several lines were found through the model, with acceptable differences in frequency and amplitude. These results allowed for the simplified software tool, for industrial usage, developed by the software company SDTools.

Contact: olivier.chiello@ifsttar.fr
RECYCLING MATERIAL FOR ROAD CONSTRUCTION: PROVIDING AN ASSESSMENT

Using alternative materials in roadwork technology is an age-old practice, having emerged notably in industrialised areas during the post-war boom. It enabled the large amounts of production residue being produced, with interesting mechanical characteristics (slag, fly ash, etc.) to meet growing transportation infrastructure needs. In this way, knowledge about these materials' characteristics and how they could be used increased progressively, until norms regarding their use were developed in the early 1980s. More recently, environmental characteristics have begun to be investigated, due to social awareness about this topic. However, there is still some reticence about using these alternative materials, generally due to a lack of knowledge about their properties and applications.

Since 2003, the OFRIR observatory has been providing national road players with the latest developments in use of recycled or local materials as well as feedback on their usage.

In 2013, the OFRIR2 internet site (http://ofrir2.ifsttar.fr/) was upgraded in terms of technical expertise and the existing normative framework, with the addition of new materials and an improved ergonomy. In addition, a lifecycle analysis phase provides more general environmental knowledges, allowing for appraisal of different technical choices in materials/resources for infrastructure building or maintenance. Finally, a geographic access will allow the site to be supplemented with different feedback on material production sites or construction sites.

agnes.jullien@ifsttar.fr, laurence.lumiere@ifsttar.fr

THESIS

AME-LTE
Cézanne BRUTTI-MAURESA. Thoughts on the environmental evaluation methods of measures for the management of travel and traffic: critical analysis and proposal for a new contextual framework.

TS2-LBA
Lée FRADET. Virtual spinal traumatology from accident to surgical repair.

TS2-LBMC
Xavier GASPARUTTO. Articular modelling for the kinetics and dynamics of the lower limbs.

AMÉ-EASE
Amandine GINOT FARGIER. Change in local and global environmental effects regarding road crossing work for railways.

TS2-LBMC
Clémence HELFENSTEIN. Super-fast ultrasound and dynamic elastography for studying stomach reaction under shock.

GERS-NAVIER
Elías RANA. Evaluating dynamic system characteristic modifications.

GERS-SV
Viet Anh PHAM. Effects of interstitial pressure on soil seismic response: 1D/3 element digital model.

HABILITATIONS

MASTER-LAMES
Armelle CHABOT. Tools for analysing multilayer mechanical behaviour.

GERS-EE
Fabrice RODRIGUEZ. Contribution to urban area hydrological modelling through a distributed approach and utility of perennial observations for understanding city hydrological assessments.
Phase 4 of IFSTTAR goals and performance contract aims to suggest solutions to improve territory planning according to sustainability. More precisely, it concerns working on the relationships between territories and public policies, on logistics and productive systems, analysing urban phenomena and interactions with the natural world and finally improving models that address hazards and safety over large areas. The goals are to analyse, model and evaluate the links between territories, networks, mobility and public policy; interactions between city, networks and natural areas; the link between logistics and productive systems and territories; but also to categorise, evaluate and manage crises, hazards and safety on a large territorial scale. In this report we will present work related to the first three objectives:

- two projects on multicriteria evaluation of an urban project's sustainability (Impetus) and on creating urban development scenarios (VILMODes), and a project on improving GPS in the city (Interurb),
- a project on the impact land occupation has on water and energy streams modelling (Rosenthy), a project on pollution representation (Immanent), another on improving recognition of a water source's hydraulic condition (Smart Water Network) and a GERI with the CEREMA on management of storm water in urban areas (GDEP),
- a project on the relationship — in logistics and urban planning terms — between a city and its port (FLUIDE), and another on the impact of a HST station on local development.

Far from dividing the space into isolated sectors or view it as unchanging, the studies presented rather sought to be systemic, multicriteria and multiscale. Particularly, they integrate interactions between cities and network, infrastructures and economic development, city project and energy cost, support space and pollution, as well as between a mineralised urban area and hydric phenomena.
ENERGY AND WATER STREAMS: TAPPING DATA AT THE SOURCE

The Rosenhy project studied the impact of soil occupation in urban and peri-urban areas on energy and water stream models, from three ONEVU (Nantes) and OTHU (Lyon) observatory sites. The urban area of Pin Sec, which had been using permanent hydro meteorological tracking since 2006 and was subject to an experimental campaign (FluxSAP 2012) on measuring latent and sensitive heat flows; and two peri-urban watersheds (La Chêzine and Yzeron), which had implemented permanent hydro meteorological tracking for, respectively, ten and fifteen years.

On these three sites, data on soil occupation at different resolutions are available: various vectorial geographic databases and multi and hyper spectral teledetected data. The use of the latter raises new questions for implementing models: the data obtained could require knowledge of additional physical properties, which we still do not possess. In addition, urban planning now lends towards alternative techniques for storm water management, changing energy and water stream assessment. These techniques are currently not identifiable in the available remotely sensed or geographical data. Developing adapted data sources will allow us to take these strategies into account much better in hydro meteorological models.

katia.chancibault@ifsttar.fr

STORM WATER IN THE CITY: SOLUTIONS FOR SUSTAINABLE MANAGEMENT

The Grenelle Environment Forum had underscored the need to favour quantitative and qualitative management of storm water in urban areas. The GDEP operation, which ended in 2013 with a review symposium organised in Nantes and open to professionals, explored management methods for this storm water and impact on communities. Scientific and technical advances have been made on understanding hydrological and pollution processes for traditional or plant-based urban planning, as well as on the conditions for developing usage of storm water, and handling territorial strategies in storm water management. There was also an evaluation of bio-indicators for the impact of urban waste on aquatic environments. This work is mostly based first on environmental observation to better qualify hydrological behaviour of storm water management work at the source (green roofs); second on observing practices, whether it concerns capturing rainwater or territorial strategies for managing storm water. The development of hydrological modelling tools that also include alternative storm water management strategies should, in the medium term, allow for better simulation of environmental effects of urban expansion, in the context of climate change.

fabrice.rodriguez@ifsttar.fr
URBAN POLLUTION: HEAD IN THE CLOUDS
The IMMANENT project of the Paris-East PST is an example of research on the digital city. It unites IFSTTAR, the ESIEE, the LNE, the ENPC, the IGN and the CSTB. The project has two parts, one on thermal performance of buildings and the other on urban chemical pollution. The latter part consisted of surveys in a polluted territory (LNE), surveying the scene's contextual elements (IGN), using measurements to deduce a field of pollution (ENPC/CEREA) and proposing a graphic representation of the polluted areas (IFSTTAR). At the same time, the ESIEE and IFSTTAR were progressing on creating micro chromatography that would enable chemical surveys to be made using miniaturised tools (William César's thesis).
For IFSTTAR, one of the challenges was to propose a model that would enable viewing pollution data in a geographical environment (figure). This web site would allow a pollutant to be chosen and a view of its theoretical propagation from a source. Calibrating these data on a geographical reference is important, as it allows for pinpointing the areas impacted by pollution. This work requires structuring in the form of geographic and pollution databases to which information is added to facilitate their understanding. The main difficulties are due to a lack of interoperability of pollution calculation software, which do not tend to read and generate data in CMO-type standards.

POTABLE WATER NETWORK: REDUCING LEAKS
In France today, potable water network managers note that 30% of the water is lost between the treatment plant and homes. In the Smart Water Network project, we have developed inverse models to improve knowledge of the hydraulic state of the potable water network. It is based on a mathematical modelling of physical phenomena (i.e., partial differential equations in fluid mechanics) and on measures implemented in the network. We have studied the influence of the choice of model and the numerical discretisation on the accuracy of the flow field reconstructed through inverse modelling. This study was conducted on a connector pipe (see Figure 1), which is a major element of the potable water network. For water run-offs with low Reynolds measures (in the range of cm/s), present in residential areas, we demonstrated that the Stokes simplified flow model was sufficient to reconstruct the velocity field with an error margin less than 5%. These studies, conducted at IFSTTAR, resulted in three articles in international publications (one accepted, two submitted) and two international conferences' proceedings.
This FUI-type project was created in partnership with Suez-Environnement, Advitam (Vinci), EFS, A3IP and ESIEE Paris.

frederic.bourquin@ifsttar.fr
patrice.chatellier@ifsttar.fr
julien.waeysens@ifsttar.fr
GPS IN THE CITY: OVERVIEW OF PROGRESS

Urban positioning using GPS is still partly ineffective due to reflection and diffraction of the signal, called multipath signals, caused by urban canyons. These changes the positioning resolution problem by adding distances covered between the satellites and the receiver. Research under the national French project Inturb covered two phases: a simple 3D geometric modelling of the city, called "Urban trenching", was proposed and created manually using data from three different cities (Nantes, Paris and Toulouse). The improved detailed positioning was quantified when the model could be applied. Then the model was automated from the national cartographical database called BD Topo®, with promising results and widespread applicability everywhere. Geometric modelling allows data from LOS (line-of-sight) satellites to be treated separately from NLLOS (non-line-of-sight) ones. A correction of pseudo-distance measurements in the latter case is also calculated and applied when computing the solution. Precision is improved while availability is maintained at maximum. The two 3D models, manual and automatic, are detailed and implemented on the same experimental campaigns on a large scale. For example, in Paris the median 3D error is halved compared to the standard solution.

Inturb is a project financed by the Ministry of Ecology in charge of transportation (DGITM), conducted in cooperation with IFSTTAR and the Mathematical Calculation Society of Paris.

SUSTAINABILITY OF AN URBAN PROJECT: BRINGING TOGETHER ALL THE PLAYERS INVOLVED ON AN EVALUATION

The IMPETUS project was financed by the ANR and uniting EGIS, ICADE, EIVP, the CSTB and the LVMT. Its goal was to fine-tune a method and a tool for evaluating an urban project’s sustainability before it begins and to evaluate the effect of its different programming options. IMPETUS proposes round-table discussions with all the players involved in a project, from the developer to the local community, including planners, user associations or transportation operators. It proposes a financial evaluation of the project, as well as estimations of the expected energy consumption, greenhouse gas emissions and, finally, production of renewable energy ENR. This estimate is based on the use of census detail documents at the community level and the IRIS. Thus, according to localisation of the project and its programming (number and surfaces of housing units, shops, services and offices, presence of solar panels, etc.), IMPETUS supplies an estimate of energy consumption for the future residents for construction and mobility services, as well as the costs of energy and housing. It allows quantifying expected gains and the costs of creating public transportation, or possibly a better energy performance. This tool is in the final phases of development and will be tested in 2014 on real projects in Sarcelles, Paris, Bordeaux and Pessac.

olivier.bonin@ifsttar.fr
SUSTAINABLE CITIES AND MOBILITY: EXPANSION OR DENSIFICATION?

For many years, urban expansion has been named as one of the principle factors opposing sustainability of cities. Indeed, this kind of urban growth consumes agricultural land and natural spaces, and the inhabitants of neighbouring areas are deemed responsible for increased automobile traffic, consumption of fossil fuels and the associated pollutants emission. The classic response has been to encourage development of a dense, compact city. However, some authors have expressed doubts about the efficacy of these policies, showing that a compact city often has consequential hikes in land prices, a rise in congestion on highways and reduced access to green and natural spaces.

VILMODes, a project financed by the PREDIT GO6, uses simulation with LUTI models (transport, land use) to study the projected effects over 20 years of the densification of centres, as well as an alternative policy of development for public transportation.

A particular emphasis has been put on territorial diagnostics and the manner of implementing the planned policies. The scenarios are closely scrutinised for sustainability, with consideration typically given to economical, social and environmental aspects. They reveal the differentiated social and spatial effects, beyond reducing automobile use, which is an outcome in all cases.

olivier.bonin@ifsttar.fr

A SAFE HARBOUR FOR RIVER TRANSPORT

Spearheaded by the SPLOTT laboratory, the Fluide project took place from 2010 to 2013 under the aegis of the Sustainable Cities ANR. Provided a budget of € 750K, its goal was to evaluate potential logistics of water supply for metropolitan areas, from large international flows to urban distribution. With the support of the port authorities and local urban agencies, in-depth studies were conducted in four French cities (Paris, Lyon, Lille and Strasbourg). The first result was to update knowledge on river transportation which is currently limited with fragmentary scientific production, and a discussion generally led by waterways promoters. Expanding the proposal to subjects not often addressed in the domain (work conditions, market economic structure) provided a useful rounded-out analysis of the logistics for sectors already acquired to inland navigation (construction, waste, energy) and emerging markets (containers, urban distribution). Finally, the study shed light on the elements required to reconnect a city to its port, by detailing the conditions and necessary tools for successful integration of port logistic functions and urban planning. The results are accessible online and a summary of their conclusions were published in the form of a reference work.

antoine.beyer@ifsttar.fr
RAIL FACILITIES: WHAT DOES THE HST PROVIDE?

This project's aim is to provide new knowledge on how a high speed rail (HST) service can participate in sustainable and local development, and to renew an analysis of support strategies provided by players in the territory. The analysis is based on a bibliography of theoretical and empirical documentation, creating a database that brings together all the French urban units (served by HST or not) that were subjects of statistical studies, and an in-depth analysis (60 interviews) of eight cities served by HST. The results show there is a remaining gap between the expectations of public players in the areas served, as revealed in the grey literature, and the highly controversial character of the effects of served areas, as revealed in the academic literature. In addition, the statistics show a lack of systematic effects of HST service in terms of economical dynamics. Finally, a diversity of appropriation strategies were observed, according to the interviews conducted in the eight served cities. The question of HST service challenges must analyse not only how the infrastructure will round out the resources already in the territory, but also how it will fit into the social relationship systems that define the territory. This study thus calls for a multi-criteria analysis of investment choices that allow for enhancement of qualitative criteria, the only ones that can directly define this social structure.

corinne.blanquart@ifsttar.fr

Can the local economy be impacted by having a high-speed rail line?

THESES

AME-SPLOTT

Amélie GONCALVES. Are new forms of distribution in short supply chains factors in sustainable development?

AME-DEST

Thanh To NGUYEN. Developing a mobility data collection method using GPS sensors, comparable to classic surveys and applicable in southern countries.

AME-SPLOTT


HABILITATIONS

AME-DEST

Ariane DUPONT. The search for hybrids – when understanding and acting combine in the economy.
EXPERTISE

EXPERTISE: A MISSION INGRAINED IN IFSTTAR’S GENES

One of IFSTTAR’s main missions is expert evaluation. It works to benefit relevant ministries, other administrations and organisations related to them, territorial communities, European and international institutions, professional associations, companies and user associations. In this activity report, examples of IFSTTAR expertise areas are presented involving: transportation infrastructures (Nantes tramway); energy production works (Vercors project, Salanfe dam); transportation materials (automated vehicle project, gondola breakage, taking ergonomics and the human factors into account in a train traffic control system), road safety (participation in the panel of experts chaired by the National Council on Road Safety), and the hazards (developing hazard maps and flood hazards in Croatia), etc. These examples illustrate the institute’s desire to support its partners by encouraging the expert evaluation activity of its researchers and engineers. A mission statement on this subject (definition, framework, encouragement, etc.) was formally launched at the end of 2013.

dominique.mignot@ifsttar.fr
jean-michel.torrenti@ifsttar.fr

IFSTTAR ACTIVE IN CIVIL NUCLEAR ENGINEERING!

A scientific council organised by EDF met in May 2013 to help develop a large-scale experimental validation of confinement efficacy ensured by double-walled vessels in nuclear plants, to extend their service life. Bruno Godart, Jean-MichelTorrenti and François Toullemonde of the IFSTTAR MAST department provided the council with their expert evaluation, which concluded in the scientific and technical advantages of building a 1/3-scale model, called VERCORS. While retaining realistic a representation of civil engineering materials and technologies (concrete, prestressing), this reduced model notably enabled accelerating drying and creep, the main culprits in loss of the container’s impermeability. Through their in-depth knowledge of concrete and functions of civil engineering works, the MAST experts contributed to confirm, amend or complete detailed conceptual elements of the experimental work, the shipment programme simulating ten-year tests and the planned instrumentation, so a maximum amount of knowledge could be gained from the experience and its modelling. Construction of the model began early in 2014 on the Renardières EDF site near Fontainebleau, and IFSTTAR will take part in some aspects of the research programme.

bruno.godart@ifsttar.fr
jean-michel.torrenti@ifsttar.fr
francois.toullemonde@ifsttar.fr

POWER PLANT COMPOUND IN CIVUX
REHABILITATING DAMS: REPAIR SOLUTIONS FOR AN INSTALLATION AFFECTED BY ALKALI AGGREGATE REACTIVITY

The Swiss consultancy Stucky asked IFSTTAR to help in a rehabilitation project for a gravity dam affected by alkali aggregate reactivity (AAR). This condition causes swelling in the structure’s cement and the blocking of the dam by the surrounding environment transforms these chemical expansions into internal constraints. Diamond-wire saw cuts are used to relieve stress on the structure. The study, conducted with the help of CESAR-LCPC finite element analysis software, has two objectives. On one hand, model the state of stress on the dam after fifty years of AAR, and then the stress relief provided by the saw cuts. On the other hand, evaluate the dam’s behaviour through accelerograms under earthquake resistance rules and verify that the saw cuts do not degrade resistance in terms of seismic risk. The study also contributed to the design of the rehabilitation project (thickness, depth and spacing of the saw cuts) and to its approval by the supervisory authority. It also enabled adding value to CESAR-LCPC’s latest developments in ISP (Internal Swelling Processes of cement) and DYNI (dynamic information) modules: cement creep and contact elements specially adapted to simulate saw cuts. Finally, the study showed the benefits of calculation software dedicated to civil engineering and equipped with several complementary modules: static chemical-mechanical coupling, series of statistical and dynamic calculations.

GONDOLA EVALUATION

The BEA-TT of the Ministry of Energy, Ecology and Sustainable Development asked IFSTTAR SMC laboratory, via the STRMG, to determine why a piece of bogie No. 2 broke, causing a gondola to fall in the Gourette ski resort, in the Pyrénées-Atlantiques region. The first step was to understand how the gondola’s moving elements functioned and to recreate the series of events. The broken elements were studied to determine if there were signs of wear or abnormal deformation. In the laboratory, the fracture surfaces were characterised by microscopic analyses under binocular and micrographical SEM. The metallographic nature and chemical composition of the steel and the metal plating were also determined. The breakage of bogie No. 2 was the result of a fatigue process. The crack started at the edge of a welding seam, then the crack travelled across the sheet until final breakage occurred. This was the result of a misalignment of the bogie beam with the cable.
FLOODS: APPLYING THE EUROPEAN FLOOD DIRECTIVE IN CROATIA

European twinning with Croatia began in January 2013 on developing hazard and flood risk maps under the IPA programme. This project, organised in 17 thematic missions mobilising experts from three partner countries (Austria, France and the Netherlands), aims to facilitate the application of the European flood directive in Croatia. In October 2013, a mission was dedicated to developing flood prediction. Coordinated by France, which sent two experts from CGDD and IFSTTAR, it allowed for examination of the current state of flood management in Croatia, from a technical point of view but also organisational, to provide suggestions for future flood prediction developments. During the mission, a work seminar was organised in order to share the experience of neighbouring countries on the topic and help the Croatian sector progress in its thinking. France is also taking part in another twinning European programme with Turkey on this same theme of floods. In 2014, a new mission with IFSTTAR on the development of a hydrometric measurement network in Turkey is planned.

olivier.payrastre@ifsttar.fr
TRAMWAY TRACKS: ANALYSIS OF SLAB CRACKING AND REPAIRING WITHOUT STOPPING TRAFFIC

As requested by the Nantes urban area transportation society, in 2013 IFSTTAR conducted an evaluative assessment on a section of the tramway pavement (250 m) also open to road traffic, and showing cracking of cement slabs on the surface, following an almost semi-periodic pattern, with strong swinging. Windows were cut into the slabs. Deflection measures were taken when the trams and a weight-calibrated lorry passed. There was also modelling of the pavement structure’s finite elements – relatively complex on this section (superimposition of two layers of cement slabs on a layer of lean concrete, itself placed on antivibration plots). All this allowed for comprehension and pinpointing the structure’s function in its healthy and damaged areas.

Only the top slabs cracked under road load and curvature caused by drying shrinkage of materials and by daily variations in pavement temperature.

Following this evaluation, the Freyssinet company proposed and built a light repair solution, avoiding any interruption of tramway traffic. This work consisted in bringing back together the pieces of disjoined slabs. Carbon-fibre studs, spaced 20 cm apart, were inserted into grooves cut into the surface at the pre-existing cracks, then flooded in a resin. The effects and grip of this mode of repair is still satisfactory today, having eliminated the risk of material fragmentation, which was a concern over the short term. A new campaign of deflection measurements, planned for 2014, should allow for better understanding of the flexion behaviour of this reinforced segment of tramway pavement.

PERCEPTION FOR THE DRIVING DELEGATION ENABLING AUTOMATION AND RECOVERY OF A ROAD VEHICLE

In its work on developing driving aids, Renault requested IFSTTAR (COSYS-LVIC), in the form of an eight-month evaluative study, to develop an automated vehicle for delegated driving. The work accomplished by the LIVIC teams consisted in proposing and implementing, in a prototype vehicle, the necessary environment detection platform to allow automation of driving and recovery of a vehicle in case of difficulties. The perception algorithms, under a licensing agreement, included detection and robust tracking of road markings for lane tracking, obstacle detection using a radar supplied by a manufacturer, as well as implementation of a target selection module allowing for following a lead vehicle. To achieve these objectives, the LIVIC implemented its most recent and innovative detection, prediction and data fusion methods, thus revealing these methods’ applicability to the needs and strong constraints of automobile manufacturers. Many tests were conducted in adverse meteorological and environmental conditions (low-angled sun, rain, deteriorated road markings). This evaluative assessment ended with a week of demonstration through Renault’s Inno’days initiative. LIVIC researchers and engineers participating in the evaluative assessment were congratulated by the project head (Renault) for the quality of the results obtained, enabling the success of these demonstrations.

dominique.gruyer@ifsttar.fr

Delegated driving requires taking into account many factors revealed in the study conducted by LIVIC.
IMPACT OF NOISE ON HEALTH: IFSTTAR PARTICIPATES IN ANSES EVALUATION

More and more studies are showing the effects of environmental noise on health: noise pollution, sleep disruption, effects on the cardiovascular system, learning problems at school. These effects can notably arise with close proximity to transportation or industrial infrastructures. However, even though noise is one of the population’s major concerns, its effects are still not considerably taken into account when the impact of infrastructure planning projects are studied; this is because the current regulatory criteria are not adapted to the irregular character of the noise events under consideration.

Proposing indicators that enable a better grasp of the health effects tied to irregular noise events in these projects is the task that ANSES assigned to a multidisciplinary work group (acoustic engineers, epidemiologists, chronobiologists, social and human science specialists) based on a referral by the ministries of public health and the environment.

With the current state of knowledge, the experts believe it is not possible to determine indicators that would answer the problem in a sufficiently satisfactory manner. Rather, they suggested an evaluation method, to be used at the local level in a mediation-dialogue process, to take into account the impact on health of environmental noise in industrial or transportation infrastructure planning projects.

To go further: https://www.anses.fr/en/content/anses-recommends-greater-consideration-be-given-all-effects-noise-health

anne-sophie.evrand@ifsttar.fr

RAIL SIGNALLING: STUDYING THE FUTURE EUROPEAN SYSTEM’S ERGONOMICS

The first level of the European Train Control System (ETCS1) consists of train detection from track circuits and transmission of dashboard data via standard beacons (Eurobeacons) on interfaced tracks, thanks to lateral signal coders, and following an outline close to the current speed control by beacon (KVB). ETCS1 will be installed in the national network via two priority European corridors crossing France, based on superimposing cabin signalling (ETCS1) and classic ground signalling (KVB), in the context of the European Rail Traffic Management System (ERTMS) deployment.

IFSTTAR (LPC and ESTAS) conducted an evaluation for the French Rail Network that aimed to ensure the SNCF engineering evaluation with train conductors covered all the ergonomic and human factor problems linked to introducing ETCS1 on the conventional network. The evaluation covered the study’s structuring and implementation and generation of recommendations. In conclusion, a portion of these problems were covered by the study, with nevertheless some points to watch, such as attention-based tropism when closely tracking the target speed or expanding and applying rules and procedures to guarantee safety – especially under adverse conditions or inhabitable driving. These are points for further study.

el-miloudi.el-koursi@ifsttar.fr
francoise.paras@ifsttar.fr
ROAD SAFETY: GOAL OF LESS THAN 2000 FATALITIES IN 2020

CNRS is comprised of 17 experts, of whom 6 from IFSTTAR are charged with the mission to develop a strategy to halve the number of people killed or seriously injured in traffic accidents on French roads by 2020, using quantifiably efficient measures and satisfactory social acceptability. A report was submitted in November 2013. According to this committee’s analysis, amongst the “acceptable and realistic” effective measures up to 2020, none taken by itself would allow for the hope of roadside mortality being less than 2000 people. Putting four actions together, and without delay for some, would provide hope for such a change. Two of these measures relate mostly to user behaviour, targeting the two main factors for unsafe roads in France for drivers and others: high speeds and driving under the influence of alcohol.

A third measure aims to reduce secondary hazards (in other words, accident severity) by eliminating the most threatening obstacles at the edge of some roads. Finally, a more general measure aims to optimise the numerous actions conducted by all the players by reinforcing road safety management. Many other measures deemed relevant in a more general and long-term approach are planned in a separate report.

jean-pascal.assailly@ifsttar.fr
pierre.van.elslande@ifsttar.fr
marie-line.gallenon@ifsttar.fr
sylvain.lasserre@ifsttar.fr
bernard.laumon@ifsttar.fr
dominique.mignot@ifsttar.fr
DOCTORAL TRAINING

During 2013, the definition of “IFSTTAR doctoral candidates” was clarified; the intense effort to reduce thesis length continued; and the process of monitoring young doctors’ outcomes was fine-tuned.

IFSTTAR DOCTORAL CANDIDATE
IFSTTAR doctoral candidates must fulfill the following criteria:
- a topic related to IFSTTAR goals and performance contract
- a minimum of 50% of doctoral supervision must be ensured by one or several members of an IFSTTAR laboratory team, which must include at least one IFSTTAR personnel member
- at least 50% presence on an IFSTTAR laboratory site
- a scientific selection procedure by an auditing commission
- three-year financing for the thesis
- registration in a French doctorate school.

Doctoral candidates registered in a doctoral school in France, received or partially supervised at IFSTTAR who do not meet all 6 criteria will be qualified as “IFSTTAR associate doctorate candidates.”

THE OUTCOMES OF 2012 IFSTTAR DOCTORATE CANDIDATES

A report on the “Outcomes of 2012 doctorate candidates 1 year later” was established in 2013. It involved 86 doctorates, regardless of financing obtained during the three years of their theses.

81 of them (91%) were employed by December 31, 2013, 64% of them with an open-ended contract (two-thirds of them in the private sector) and 36% on fixed-term contracts (a great majority in the public sector).

Compared to the previous year, the percentage of permanent positions is the same; but this year, the public/private sector division is reversed, with a strong employment rate in the private sector.

antoinette.charpenne@ifsttar.fr
jean-luc.clement@ifsttar.fr

LENGTH OF THESIS
(2013 THESIS PRESENTATION)

The median timeframe of a thesis (3.16 years) and their average time (3.36 years) continue to drop. Even if these values hide a certain heterogeneity sometimes linked to the disciplines, the great majority of researchers have great interest in a thesis lasting three years, in particular for two reasons: ease entry into the profession and justify the Institute’s strong involvement at the research piloting level through a large number of new theses begun in 2013, with subsidy financing.
80
new IFSTTAR doctorate candidates, including

29
doctoral contracts with grants, of which 6 were regionally co-financed (Provence-Alpes-Côte d’Azur and Loire region)

10
doctoral contracts on research contracts

2
IFSTTAR co-financing of exterior doctoral contracts (INRA, IRSN)

2
double-doctorates with IFSTTAR co-financing (Quebec)

32
other financings, including 5 civil servants (ITPE, IPEF), 3 industrial PhD programmes with IFSTTAR accompaniment contracts, 1 scholarship, 28 others in UMRs: Navier, LBMC, LVMT, LBA, LICIT

94
thesis defences with a median timeframe of 3.16 years and

11
defences for authorisations to direct research (HDR)

32
IFSTTAR contractual doctorate candidates accomplished:

29
teaching missions

2
evaluation missions (Valéo, Toyota)

1
deployment mission (TRA 2014)

24
distinctive awards were obtained during 2013 by IFSTTAR doctorate candidates and researchers
PUBLICATIONS – DMST
SCIENTIFIC AND TECHNICAL
MULTIMEDIA DOCUMENTATION

DOCUMENTATION

Scientific publications: ensure influence of the research
In order to contribute to increase the visibility of IFSTTAR’s scientific publications, the Documentation Department is pursuing its policy of delivering the Institute’s productions to the documentary portal Madis, directly augmented by researchers, enriched by documentalists and interfaced with the HAL national open archives.
A protocol of exchange dedicated to the open archives (harvesting module using the OAI-PMH protocol – Protocol for Metadata Harvest) allows for publishing the researchers’ products and opening documentary resources to catalogues in schools, universities or research centres using the same protocol. For example, this is the case with the university portal of Université Paris-Est, of which IFSTTAR is a founding member.
Scientific publications are also added to TRID, the international database in the area of transports, managed for the OECD by the Transportation Research Board in the United States.
2013 is also the year the HAL-IFSTTAR collection opened, dedicated to consulting products of the Institute’s laboratories and the various research units linked to it, present in the HAL open archive.

The Hal-IFSTTAR collection: http://hal.archives-ouvertes.fr/IFSTTAR/en

A NEW INFORMATION MONITORING SERVICE

As of 2013, the Documentation department offers a new information monitoring service in the form of a Netvibes portal centred on the problems being debated in public research regarding scientific publication (open access), evaluation research, and the institutional environment.
This service is rounded out with a monthly information letter that reiterates the main information garnered from different sources.

The Netvibes Research and Publications portal: www.netvibes.com/ifsttar-documentation

michele.bidal@ifsttar.fr
corinne.broque@ifsttar.fr
sylvie.legret@ifsttar.fr
EDITORIAL POLICY

CAPITALISE ON DIFFUSING AND PROMOTING THE RESEARCH

Editorial activity helps spread knowledge, promote research and capitalise on scientific production. Different editorial products allow IFSTTAR to direct knowledge of its different research and expertise fields to the relevant audience. All catalogues of IFSTTAR collections can now be consulted in the library space of the Online Resources area on its internet site. The most recent works are available for sale. Orders can be placed with the help of a form available on the website or by sending an email to the following address: diffusion-publications@ifsttar.fr

At the same time, IFSTTAR initiated the digitalisation of its documentary resources and placed them online. More than 500 works are currently available for download free of charge, under the Creative Commons CC BY-NC-ND licensing. This availability aims to promote dissemination and utilisation of the Institute's research results. During 2013, IFSTTAR published two editions of Bulletin des Ponts et Chaussées (Bulletin of Civil Engineering) and seven works, two in the French National Research Institute for Transportation Systems collections and five in the LCPC collections.

In 2013, the publisher Necplus, which specialises in publishing and distributing French reviews in human and social sciences, became the new publisher for the review Transport Safety Research (RTS). The summary of 2013’s four editions can be consulted at the following address: www.necplus.eu/action/displayJournal?id=RTS

diffusion-publications@ifsttar.fr

The Documentation department responded to around
1500 documentary requests, nearly
200 of which were public requests.
Internally it supplied nearly
700 article searches and exchanged more than
150 borrowed works with different university libraries
There are two pre-requisites to answering the expectations of society and the economy and achieving leadership in competency areas: anticipating technical support needs in national and local public authorities as well as control authorities, and making a very high level of expertise available to industrial players. Indeed, the knowledge or savoir-faire developed during research programmes and targeted action, as well as the availability of material means and scientific equipment (some of which unique to France or Europe), have enabled researchers to produce important results that are the subject of a proactive promotion strategy, ensuring a continuum from research to innovation. IFSTTAR has thus strengthened its visibility in the economic world through its partners, certifications, patents, etc. This relationship to the socioeconomic world enables IFSTTAR to respond appropriately to the needs of society while enriching its research programme. To prolong and heighten this impetus, IFSTTAR is heavily involved in competitiveness clusters tied to transport, sustainable cities and managing new materials. At the intersection of scientific, technological, economic and social challenges, IFSTTAR aims to simultaneously accompany the players involved on the road to sustainable, responsible mobility by adopting infrastructures in an effective manner, while keeping in mind the city of tomorrow – rich in both ethical and economic promise – and taking an active part in national competitiveness.

Brigitte Mahut
Director in charge of partnerships and resources
brigitte.mahut@ifsttar.fr
SUBSIDIARIES AND HOLDINGS

This was a year with a less difficult economic context than in 2012. The entrepreneurial initiatives accompanied by IFSTTAR took advantage of this improvement to rebalance their profit and loss accounts and structure their development. 2013 was indeed a vintage year.

After having been directly affected by the economic crisis in 2012, LIER SA’s activity has ramped up again, supported by the renewed economic stamina of its clients. Both the testing and digital simulation activities confirm this recovery with an increase in the company’s total turnover greater than 33%, reaching € 1.75M. The company has become profitable once more. This growth is equally based on the sustained efforts of the LIER SA team in pursuing their international expansion. The latter is based on two LIER branch offices created in 2011 in Poland and Turkey, but also on the results of intense prospecting.

The new activity is called ErgOptim, an extension of IFSTTAR’s LBMC and LESCO laboratories, dedicated to the ergonomics of transportation means. ErgOptim joined LIER towards the end of 2011 and picked up its first industrial contracts. The team achieved its growth objectives.

IFSTTAR holds 45% of the subsidiary TRANSPOLIS SAS (a shared innovation platform founded by players in the industrial vehicle and bus national affiliate), which is dedicated to the creation, fine-tuning and validation of urban mobility solutions for tomorrow. TRANSPOLIS has made great advances in building its activities, notably: hiring a director of development; looking for new private investors; acquisition of the Fromentaux territory by the CGO1; acceptance by the major regional partners; consolidation of the works programme and launch of sales activity. The next step in 2014 will be the merging of LIER SA and TRANSPOLIS SAS.

The start-up CIVITEC, a subsidiary 75% owned by the IFSTTAR since the end of 2008, continues its development action amongst parts suppliers in the automobile, aeronautic and defence sectors. The simulation and validation software offering for environmental detection, mounted in Pro-SIVIC® vehicles, meets the fast-growing, emerging market expectations. Pro-SIVIC® provides very significant gains in productivity, since one to two months of simulation can save two million kilometres of actual trials. An active search for industrial partners familiar with conquering simulation markets is currently under way, so that the company’s next development phase can be piloted by these players capable of accelerating the industrialisation and global distribution of IFSTTAR technology.

IFSTTAR owns a 15% share in CERTIFER, a rail expert and certifying body that is continuing to grow. Its 2013 revenues stand at the historical € 8M figure, once again an 11% increase over 2012, and the net income for that financial year was € 690K, an increase of 10%. CERTIFER pursued its development in 2012 by purchasing a company specialising in urban rail certification: Trames urbaines. This new subsidiary completed the acquisition of the Italian STEAMCART company, at the end of 2012, and CERTIFER’s participation in creating a new specialised company in Algeria at the end of 2011.

CITILOG was founded in 1997 from the research of the National Institute for Transport and Safety Research, today called IFSTTAR – leader in automated road incident detection through image processing – and for the second year in a run, it confirmed its economic recovery. CITILOG has two subsidiaries abroad, in Hong Kong and Philadelphia. This 32-employee company showed revenues over € 5M for 2012-2013, and maintained its profitable results. CITILOG’s strength lies in two algorithms which it continually improves. The first enables detection of incidents in tunnels and allows for opening traffic on emergency stopping lanes on crowded roads as long as a vehicle is not disabled. The second measures the length of a line of vehicles in order to manage intersections by adapting traffic signals to real-time traffic. China became the country with the largest number of systems deployed: 170 tunnels out of a total 800 delivered worldwide. In the future, CITILOG will equip the Moscow ring road and the public transportation system for the Rio Olympic Games in 2016.

IFSTTAR RECENTLY PARTICIPATED IN CREATING TWO START-UPS: LUXONDES AND LOGIROAD

LUXONDES uses an IFSTTAR patent protecting the Gyroscanfield invention. This measuring instrument can visualise, in 3D and real time, the electromagnetic field emitted by any electronic device: smartphone, motors, aerrals, etc. After considerable investment to manufacture the product line, and implementation of a commercial partnership with the company NEXIO, LUXONDES pursued its promotional activities with, amongst other measures, participation in several expos in 2013: Versailles, Paris la Défense, Valenciennes, Lille, Rouen, Calais. These activities bear the promise of revenues with billing for 2014: measurement services, common laboratory of the CETIM/INERIS. A new internet site is online: www.luxondes.com.

Created at the end of 2012, the young company LOGIROAD already employs six people. It cashes in on the developments and savoir-faire of IFSTTAR as well as the MEDDE scientific and technical network in infrastructure management and help in road network maintenance. LOGIROAD uses GIRR software and ODT technology for trajectory recognition through image processing and automatic identification of their Origins-Destinations. After taking off like a shot with more than € 115K in contracts, the business settled down in 2013. It should be noted nonetheless that LOGIROAD has over ten clients in France and the same amount in Africa. Efforts engaged on the export front will already generate revenues in 2014. New cooperation topics are currently under review between the LOGIROAD and IFSTTAR laboratories teams.
SOCIO-ECONOMIC RELATIONS

CONTRACTING WITH OUR PARTNERS: TOWARDS OPTIMISATION

In 2013, IFSTTAR recorded €11.3M in revenue on research contracts, and an additional €4.1M in services. 160 new conventions were signed for a total of €11.3M, a quarter of which came from direct contracts with partners. In spite of a depressing economic picture for Europe and especially France, and temporary difficulty in maintaining the contractual research and trial activity of the Bienvenue laboratory (delivery delays), this is a positive assessment. The year marked IFSTTAR’s operational involvement in the Future Investment Projects. This constitutes a new structural phase towards closer cooperation with a sector’s industries and a territory. A “contracts” action plan was launched to optimise contract implementation and management. Amongst other qualities, this plan enabled revising the contractual management mode (the departments have a view of the resources they can use to manage their contracts). It also allowed for developing operational tools to facilitate contract preparation tasks (template documents, cost estimate spreadsheets, reference documents, etc.).

This on-going progress plan will continue in 2014. In addition, as setting up projects have become more and more complex and demanding, a decision was made to create a team of professionals dedicated to supporting agents in project building and coordination operations. At the same time, the Institute continues developing direct partners through setting up new outline contracts with major industrial partners.

Two large events were also organised in 2013:

- The anniversary of the fatigue test track (130 road structures tested, nearly 14 million rotations completed, etc.).
- The 18th International Conference on Soil Mechanics and Geotechnical Engineering, in which IFSTTAR participated to a great extent. Through their visibility and success, these events strengthen industrial partners’ confidence from the related sectors.

philippe.dupuy@ifsttar.fr
PATENTS

BITUMEN MADE FROM MICRO-ALGAE

The unavoidable scarcity of oil and the anticipation for energy transition necessitates the discovery of a substitute material for bitumen that will not affect pavement durability. This is the central goal of the Algoroute project, where the possibility of producing a future biomass bonding agent, micro-algae (more precisely, residues from a first retrieval) was evaluated. For this, IFSTTAR brought together different competencies from the university and private domains: process engineering, chemical, specialists in exploiting micro-algae. These partners were united around a scientific challenge, a project (2011-2014) co-financed by the Loire Valley region at 250,000 euros, for a total cost of 320,000 euros, the remainder mainly supported by IFSTTAR (financing a doctorate). The Institute provided leadership for the project and produced physico-chemical trials, traditionally used for bitumen.

The principal result is a fine-tuning of a procedure transforming the micro-algae biomass through hydrothermal liquefaction. This procedure produced a material rheologically comparable to petrol bitumen. The patent for this invention was submitted in France on September 26, 2013 under number 13,59293 and the name ALGOSOURCE, by IFSTTAR, the University of Nantes, the CNRS, ONIRIS, and the Ecole des Mines of Nantes.

emmanuel.chailleux@ifsttar.fr

A “GREEN” ELECTRICITY GENERATOR ALONG RAILWAYS

Strengthening railway transportation’s resilience regarding its exterior environment as well as its efficacy is a major challenge. For this goal, it is necessary to develop an intelligent rail network, already recommended by several international bodies. This development requires installing a network of sensors all along this critical infrastructure. Considering that the rail network of the primary European corridors covers several thousand kilometres, the problem lies in providing electrical power to these sensors that consume little energy but still need to be powered all along the infrastructure, independent of any available mains supply. A patent application was submitted on March 1, 2013 by IFSTTAR entitled “Electrical energy generator, electric power, sensor containing such electrical power” (IFSTTAR patent application no. 13-51857 filed with the INPI), invented by Marc Heddebaud, Virginie Derieu, Jean Rioult (COSYS/LEOST). The patent describes a “green,” low-power, self-standing electrical energy generator, operational all along electrified rail lines, without consuming energy.

It uses low-frequency stray radiation from the magnetic loop consisting of the cable and the return traction current rails to convert, and then store, the radiated energy into electrical energy, enabling the sensors to be powered.

marc.heddebaud@ifsttar.fr
DRIVING AIDS: A MATTER OF SENSORS

Active driving aids are more and more common in vehicles. They go all the way to delegating part of the actual driving. Currently, data capture is mainly accomplished through RADAR-style sensors. The SiRadEM patent proposes a system enabling simulating these electromagnetic sensors in a real environment. The system proposes to simulate the transmitting and receiving antennae, the propagation channel and processing of the related signals. In modelling the propagation channel, physical characteristics of objects (geometry, materials, electromagnetic properties) are integrated in the SIVIC environment. Optimisations allow for determining, at every moment, a finite number of dominant wave paths, leaving a transmitting/receiving RADAR antenna connected to a vehicle and reaching one or several points in the area before returning to the antenna. Every wave path returning to the receiving antenna produces the following information: strength of the received signal, distance travelled, the phase, the frequency shift due to the Doppler effect, the direction of incoming waves returning to the antenna and signal polarisation. These data therefore allow reconstructing the received signal through the electrical treatment of the RADAR device. Several hypotheses are made in this modelling to obtain realistic results in pseudo-real time: monochromatic plane wave at a sufficiently far distance from the antenna; local surface plane at the interaction point of the wave front; use of the scene’s materials metadata for their response to the electromagnetic fields; monostatic system. This model thus allows the scene to be illustrated and for complex interactions with the environment to be taken into account.

dominique.gruyer@ifsttar.fr
steve.pechberti@ifsttar.fr

ON-BOARD MEASUREMENT FOR WATER HEIGHT ON ROADWAYS

The numerous safety systems on modern vehicles have greatly contributed to reducing the number of road accidents, or at least reducing their consequences. To perform reliably, these systems require an exact estimation of adherence: they thus require a knowledge of the tyre/road contact conditions, and especially the height of water.

IFSTTAR and Renault have fine-tuned an on-board sensor for measuring water depth, which had a joint patent registration issued in December 2013. This sensor, developed through a CIFRE thesis, enables measuring water height on the roadway via water spray generated by the vehicle passing through, with a margin of 0.1 millimetre. The process was validated on the IFSTTAR Nantes tracks, which offer a great variety of road surfaces. This work represents a first phase and other research is currently underway to improve the adherence prediction level.

veronique.cerozo@ifsttar.fr
minh-tan.do@ifststar.fr
SOFTWARE

ROAD NETWORK MANAGEMENT: MODERNISING SOFTWARE TOOLS

Current road network tracking tools (collecting surface degradation information, operating software, databases) were developed at a time when the management of the roads was chiefly run by the State. Today, these tools are no longer adapted to all road managers, and some are no longer even maintained. This was the context for new line of software, “GSR,” to be developed with a dual goal of simplifying and modernising. It was tested in France (by county councils, communities, etc.) and abroad and should soon be approved and distributed. The line consists of four pieces of software:

- GDR Measure, on-board in a vehicle, helps the driver detect and record deteriorated conditions on the road. The road environment can also be filmed simultaneously (HD webcam). It is plotted on a curvilinear abscissa and georeferenced by GPS with metric precision.
- GSR Edition enables a mapped or itinerary model of measurements taken with GSR Measure or other MLPC-type devices to be viewed.
- GSR Exploitation ensures re-referencing all monitoring measurements to a reference source, applying processing (aggregation, combination of indicators, etc.) and exporting the results in database format.
- GSR Base enables creating a road database, managing the road framework, importing GSR Exploitation results, and making requests and showing them in a cartographic manner.

Jean-Marc.Martin@ifsttar.fr

OBJECT DETECTION: FOCUS ON UNCERTAINTIES

In aiming to reduce collision risk or, as a last resort, reduce the gravity of impact, it is necessary to detect the presence of an obstacle and estimate its dynamic. For the majority of methods and approaches to object detection using primitive grids (i.e., laser impacts), there is no temporal link between detections made at consecutive moments. In order to manage this temporal aspect to estimate detected objects’ dynamics, a prediction module that includes a change model needs to be added. For this model, command and measurement noise matrices must be added to model the uncertainties. According to the configuration of all these values, temporal tracking occurs more or less functionally. FOCus proposes an alternative approach without preconceptions on the evolution of an object, based on the propagation of blurred obstacle fronts using previous information’s persistence and propagation. Impact data from a laser rangefinder is used just as much as primitive data from image processing. For modelling this data’s imperfections, FOCus uses an innovative concept of fuzzy measurement space. Propagating uncertainties to model the effect of enduring data is also a completely innovative approach and has an intrinsic ability to absorb occasionally aberrant and/or insufficient data. This results in object detection that can withstand measurement noise.

Dominique.Gruyer@ifsttar.fr
ECO-DRIVING:
A SMARTPHONE APPLICATION

Eco-driving aims to reduce energy consumption without adversely affecting safety or traffic, but remains difficult to learn and maintain as its implementation is dependent upon the road environment, the driver and the vehicle. Smartphones' ability to calculate and observe is one solution to help drivers in a personalised way, no matter what the vehicle.

An Android application for smartphones to help eco-driving was thus developed at LIVIC. It assists the driver before, during and after driving, by using the vehicle's data (OBD2), accessible without contact. In real time, the application posts eco-driving advice according to past events (over-acceleration, too high revs, etc.) as well as future events (curves, hills, intersections, speed limits). These advisories are calculated using self-learning methods and depend on the vehicle type. The application also shows:

- an ideal speed range,
- ideal gear ratio and an eco-driving level that characterises driver behaviour.

The human-to-machine interface was created with ergonomists and psychologists from TNO (Netherlands) and the Leeds University (England) so that messages could be transmitted safely to the driver. After driving, the driver can follow his tracked route to strive for improvement.

In 2014, this application was tested for six months with ten individuals in their own vehicles. Finally, the application was part of the results presented during the closing week of the SERRES research operation (May 20, 2014) and will be part of the final demonstration of the ecoDriver project in Satory in 2015.

PROMOTING RESEARCH.
INDUSTRIAL RELATIONS

CESAR-LCPC
CODE: A VERSION INTEROPERABLE WITH OTHER CODES

DIGITAL MODELS: FOR BETTER CESAR INTEROPERABILITY

Developed by IFSTTAR, the finite element solver CESAR allows digital models from the Institute's research units to be more future-proof. It is also being marketed by the ETECH company, which is developing a graphic interface (CLEO) dedicated to its utilisation. The CLEO interface allows the user to choose data graphically and see the resulting calculations.

In this way, the solver CESAR eliminates communications document management:
- writing the text document containing the calculation data,
- reading the binary document containing the calculation results.

However, a study conducted by the IFSTTAR laboratory LISIS identified a number of needs that were not met with the current functions of the CESAR/CLEO combination, notably concerning interoperability between CESAR and other finite element modelling tools. The Pilote language was developed to alleviate these limitations. It enables:
- launching the CESAR solver, in other words, generating its data file, launch execution and read its results file, through a Python script using language commands.
- interfacing the CESAR solver with meshing and results visualisation tools. Currently, interfacing with the GMSH free software and the MED format (thus also with the SALOME open platform) are available.
- exporting a study's data to a finite element solver other than CESAR. Today, exporting to Code_Aster is partially available.

philippe.leveque@ifsttar.fr
Databases

Driving Aids: Better Perception

Estimating dynamic attributes of objects in the environment is an important task in building driving aid systems. This function is obtained from processing data from cameras, radar, or laser rangefnder scanning. The main problems involved are: collision avoidance, vehicle following, and distance regulation. Using the SiVIC platform, we created two databases using data from on-board sensors (VeLaSCa and FROSI) in an environment that virtually reproduced the test tracks at Satory and Versailles virtually. VeLaSCa proposes data provided by frontal grey scale camera, a SICK-type laser rangefnder, two reference sensors for every vehicle containing its dynamic parameters and inter-vehicular data. This database simulates the route of an individual vehicle travelling more than three kilometres on a highway-style road, with five obstacle vehicles in its close environment. FROSI is dedicated to evaluating road sign detection algorithms in adverse conditions (diurnal fog). This second database contains 504 imagery sets with various types of signs at different angles, sizes and distances. A reference is supplied in the form of a depth map. For every imagery set, seven types of uniform fog are generated with visibility distances ranging from 50 to 400 metres.

Trials

Large-Scale Trials for Determining a Dock’s Foundations

The methane terminal in Dunkirk is France’s second largest industrial site, with a € 1B investment and project management handled by EDF. Together with RINCENT BTP, IFSTTAR participated in producing dock pile load trials, allowing the world’s largest methane carriers to be accommodated. The results obtained for TSLING – an international entity comprised of the Italian TECHINT and the Spanish SENER companies – allowing for reliable conceptualising of these piles. These trials used open driven piles (hollow steel tube) 1.20 m in diameter and 50 metres long. The first 23 metres were isolated form the terrain by a steel tube casing, allowing simulation of pier behaviour in the sea. The need to measure normal load variations in the pile in order to determine its peak resistance and unitary axial friction, led to use of IFSTTAR’s detachable extensometer. It is the only device that allows for equipping such long piles, making it original and high-performing. The analysis of the results allowed, in the context of international project management, different calculation methods to be compared. Such experiences enrich IFSTTAR’s database of pile load trials, allowing for calibrating calculation models for pier load and their use in French standard calculations.

sebastien.buron@ifsttar.fr
alain.ekouby@ifsttar.fr
DEVICES

THE UNIBOX, AN ECONOMICAL DEVICE FOR TRACKING THE LONGITUDINAL EVENNESS OF PAVEMENT

Infrastructure managers must take in account increasingly strict economic constraints. The challenge facing them is clear: maintain the roads with a stricter budget.

In the area of monitoring road condition, this problem has opened the door to a new generation of so-called low-cost systems, offering interesting operational possibilities, notably for tracking the road network. Less expensive to buy and use, more widespread, they allow for gathering information that is certainly less precise, but more frequently, in greater number and over the entire network. Utilised at the first level of intervention, they can quickly and effectively target the appearance of defects, thus optimising the deployment of heavier means.

The UniBox prototype, created and developed by the LAMES (MAST department), is part of this new generation of tools. It enables defects in longitudinal evenness to be detected and estimated (profile irregularities for wavelengths between 0.7 and 45 metres). Apart from offering an excellent compromise between metrological performance and economic demands, the UniBox is a contactless device, very easy to use and, what’s more, can be integrated in all kinds of vehicles. Thanks to the GSR software line, the data collected by the UniBox can be utilised and analysed on-site, immediately after collection.

ROAD STRUCTURE:
THE HUNT FOR INTERNAL DEFECTS

Colibri is the outcome of collaboration among the civil engineers technical network (IFSTTAR and CEREMA). It finalises transfer of research results towards the operational domain by providing engineering access to a robust, autonomous device capable of utilising the trial method of dynamic surveying pavements. This new measuring technique is for evaluating short lengths of pavement. It provides information about the presence of internal defects. This information is essential for optimising road maintenance and lengthening their life cycle.

At every measuring point, Colibri applies a medium-frequency-range shockwave to the pavement and measures the response with three accelerometers. After this brief trial of about one second, the device automatically moves by itself to the next measurement point. Analysis of the signals allows for a pavement structure map to be constructed, including a damage indicator that can detect internal defects like cracks and interface disbonding.

jean-michel.simonini@ifsttar.fr

jean-marc.martin@ifsttar.fr
fabien.menant@ifsttar.fr

Colibri measurement device developed at LAMES
CERTIFICATION

RAILWAY SIGNALS: FRANCE IN STEP WITH EUROPE

At the end of 2013, the expertise-technical assistance-safety evaluation team of the ESTAS laboratory (COSYS department) submitted final reports on the ERTMS certification work for rail signals with the aim of a first application on the Eastern European high-speed line (LGVEE). ERTMS is one of the elements enabling the interoperability of the European rail network and free circulation of trains between EEC member countries with no technical or operational constraints. Now it is progressively being deployed in Europe. In 2014, the LGVEE, in use since 2007 with the French signal system TVM 430, will become the first French line interoperable with Germany. Working together with the French Rail certification agency CERTIFER in technical assistance, the team work consisted of verifying equipment conformity with the interoperability technical specifications (STI) as ordered by the European Commission and as per European and French safety requirements. The certification provided by CERTIFER and based on work by ESTAS is of a generic character; the necessary certification work for future interoperable French lines will thus be reduced to configuration problems unique to each adaptation.

francois.baranowski@ifsttar.fr

COFRAC ACCREDITATION OF UNEX

UNEX (Experimental Testing Unit) is part of the Transport-Health-Safety department. In 2011, this unit obtained its accreditation for ISO 17025, which is the reference for testing laboratories. This accreditation was renewed in 2012 and 2013 by the certification body COFRAC. It is applicable in two types of collision testing: destructive tests and simulated non-destructive collision.

Apart from the important aspect of recognition, this quality development enabled clear progress in the metrological area (calibration, defining measurement uncertainties, etc.) as well as in tracking sensors, devices and software utilised in the measurement chain. In addition, precise testing traceability was implemented for IFSTTAR laboratories for outside users: manufacturers or public organisations. This quality approach was applied to all testing conducted in the laboratory and recently for collision resistance testing for electric vehicles.

To be consistent with the other accredited IFSTTAR laboratories, UNEX internal documents for tracking this process were integrated into the GEDQO database during 2013. This action was strongly supported by the DQMN and with the support of the Nantes Metrology unit. The experience gained over the last few years will serve to extend certification to other laboratories.

alain.maupas@ifsttar.fr
CERTIFICATION: 
THE IFSTTAR-CEREMA DUO TAKES ITS PLACE

For several years, IFSTTAR and CEREMA (through the CETE network) together contribute to the certification of products and processes, which is different from the certification of services in terms of management (ISO 9001 or ISO 14001) or personnel certification (welding, painting, etc.). This organisation is competent and legitimate in certifying products and processes in a highly technical domain with little competition. It is the inspection and testing body, the preferred partner of certification bodies and, sometimes, even a certification body itself to deliver the CE mark.

In 2013, no less than 1,100 audits and numerous related product tests were carried out by 165 auditors in about 20 laboratories (at IFSTTAR and in the CETEs). The domains covered are widely varied: ready-mixed concrete (NF BPE), reinforcing bars for concrete (NF AFCAB), joints or anchorage for concrete reinforcing bars, steel rebar installation (AFCAB), reinforcements and prestressing procedures (ASQPE), aggregates (NF aggregates and CE), road equipment (ASCQUER), anticorrosion systems (ACQPA), construction steel (NF steel), warning devices, concrete additives, hydraulic binders (NF), pavement materials and falling rock protection kits (CE).

The founding of CEREMA confirmed the importance of this fruitful partnership.

bertrand.philippot@ifsttar.fr

EXAMPLE OF STEEL BEAMS CERTIFIED BY IFSTTAR AND CEREMA

BUDAPEST SUBWAY: WHEN SAFETY COMES WITH COMPLEXITY

In the last few years, the number 2 line of the Budapest subway (built in 1970) has undergone a complete renovation. Its electronic driver assistance now uses the latest functional and technical technologies. The system was created and developed by Siemens France and is part of the CBTC family of electronic assistance automation. The functional concepts make it possible to achieve very high levels of utilisation performance, but at the cost of a complexity requiring substantial safety verification efforts. Equipment technical integrity is obtained through highly secure calculators (data and instructions arithmetically coded) and through software generated according to formal development methods (mathematical proof of the programming). The equipment also meets the most stringent European standards.

CERTIFER came in as an Independent Safety Assessor, and the ESTAS laboratory Expertise-Technical Assistance-Safety Evaluation team, as subcontractor, submitted its Final Safety Report on the line’s automated driving equipment safety levels. Commercial operation was granted by the Hungarian authorities in November 2013, notably thanks to ESTAS’s positive report.

francois.baranowski@ifsttar.fr

BUDAPEST SUBWAY CERTIFIED AFTER RENOVATION
STANDARDISATION

ROCK-SHED PROTECTION: A NEW REGULATORY BODY

Since July 1, 2013, the construction products directive (CPD) has been replaced by the construction products regulation (CPR). This led to modification of the European technical reference concerning dynamic rock fall net fences (ETAG 027), as the idea of European technical approval guidelines has disappeared.

In this context, a specific work group on rockfall protection equipment in the Commission for Standardisation of avalanche barriers and rockfall protection equipment, for which IFSTTAR handles the secretariat, was ratified by the Bureau for standardising transports, roads and their planning.

The group brings together associated contracting authorities: interdepartmental road managers, general councils, SNCF, etc.; design consultants; manufacturers; resellers; and technical support bodies (CEREMA, RTM, IRSTEA). The group’s activities were marked by two events in 2013: the MEDDE standardisation policy officer presented the new construction products regulation; and a work group for writing recommendations in specifications for rockfall net fences was set up. These events marked the group’s activities in 2013. 2014 will be devoted to the future of ETAG 027.

marion.bost@ifsttar.fr

GEOTECHNICAL CALCULATIONS: EUROCODE 7, A STANDARD SERVING RELIABILITY AND ECONOMY OF WORKS

Since 2005, Eurocode 7, which deals with geotechnical works calculations, is applicable in France and in the rest of Europe. Its publication marks the finishing touches on work started in the 1980s in a technical committee, to which the LCPC and then IFSTTAR have constantly been linked.

Since 2009, five standards required for applying Eurocode 7 in France have been published. They concern specific works: shallow foundations (NF P. 94-261), deep foundations (NF P. 94-262), engineered soils (NF P. 94-270), retaining walls (NF P. 94-281) and retaining structures (NF P. 94-282).

One last standard relating to earthworks (NF P. 94-290) remains to be fine-tuned. Together with the CEREMA, IFSTTAR acts as secretary for the Commission for standardisation and justification of geotechnical works as well as coordinating the writing of these national standards. For each, the work consists in amassing and unifying dimensioning habits and methods which, for some, have not yet been examined regarding standards and recommendations. Particular attention is paid to validating these calculation models in order to guarantee the reliability of geotechnical works. Optimisation and economic possibilities are still allowed in order to leave a significant place for research and innovation.

sebastien.buron@ifsttar.fr
GEOPositioning: Performance Standardisation Expands Its Boundaries Thanks to IFSTTAR

The GEOLOC laboratory in the COSYS department has built itself a solid expertise in evaluating the quality of geopositioning systems since the GPS service was put into service twenty years ago. This expertise, long known in France, enabled the lab’s director, François Peyret, to be chosen by MEDDE and CNES at the end of 2011 to host a new standardisation group for the National Bureau of Aeronautics and Space (BNAE), on evaluating GNSS receptor performance for road transport.

As standardisation in this area only makes sense on a European scale at the very least, the French delegation of the Space Technical Committee (TC5) of CEN-CENELEC proposed, at the end of 2012, that France should host a CEN group on the same topic. Experts from six countries (France, Germany, Spain, Italy, Finland and the Netherlands) are working on it today, under the direction of François Peyret.

The first European standard, targeted for early 2015, will set a framework for evaluating transport system performance based on a major utilisation of geopositioning and will define the principal metrological concepts. Two others will follow, dedicated to standardising test procedures for evaluating GNSS terminal performance in road or urban contexts via truly broad testing.

francois.peyret@ifsttar.fr
APPENDIX

GOVERNANCE

Hubert du Mesnil,
Chair of the board of directors

Jacqueline Lecourtier,
Chair of the scientific board

Ministry in charge of transports
Christine BOUCHET (full member),
Ministry of Ecology, Sustainable Development and Energy
Xavier DELACHE (deputy member),
Ministry of Ecology, Sustainable Development and Energy

Ministry in charge of the environment
Philippe GUILLARD (full member),
Ministry of Ecology, Sustainable Development and Energy
Thierry HUBERT (deputy member),
Ministry of Ecology, Sustainable Development and Energy

Ministry in charge of research
Maria FAURY (full member),
Ministry of Higher Education and Research
Frédéric GETTON (deputy member),
Ministry of Higher Education and Research

Ministry in charge of higher education
Alain BERNARD (full member),
Ministry of Higher Education and Research

Ministry in charge of the budget
Anthony FARISANO (full member),
Ministry of Economy, Finance and Foreign Trade

Ministry in charge of industry
Michel FERRANDÉRY (full member),
Ministry of Production Recovery
Catherine BELLANCOURT (deputy member),
Ministry of Production Recovery

Ministry in charge of healthcare
Frédérique COUSIN (full member),
Ministry of Social Affairs and Health
Corinne DROUGARD (deputy member),
Ministry of Social Affairs and Health

Ministry in charge of interior affairs
Manuelle SALATHE (full member),
Ministry of the Interior
Jérôme AUDHUI (deputy member),
Ministry of the Interior

Ministry in charge of defence
Thierry BRETHEAU (full member),
Ministry of Defence
Michel SAYEGH (deputy member),
Ministry of Defence

QUALIFIED INDIVIDUALS
Dorothée BRIAUMONT, Sollal
Eric CONTI, SNCF
Rémi CUNIN, Egis
Patrick DIENY, CGEDD
Geneviève FERONE, Casabée
Guy LE BRAS, Gart
Brigitte MARTIN, IFP Energies nouvelles
Hubert DU MESNIL,
Institut de la gestion déléguée

EMPLOYEE REPRESENTATIVES
CFDT Joël LELONG (full member),
Jean-Michel MESCAM (Deputy member)
CGT Paul MARSAC (full member),
Nathalie BOURBOTTE (Deputy member)
Force ouvrière Marion BOST (full member),
Séverine SOMMA (Deputy member)
Sud Recherche EPST-Solidaires
Christine BUISSON (full member),
Daniel OLIVIER (deputy member)

QUESTS IN AN ADVISORY CAPACITY
Laurent ALAPHILIPPE, accountant
Bernard BACHELIERE,
controller general, Ministry of Ecology, Sustainable Development and Energy
Hélène JACQUOT-GUIMBAL,
managing director
Jacqueline LECORTIER,
chair of the scientific council
Henri VAN DAMME, scientific director
SCIENTIFIC BOARD AS OF 12/31/2013

Chairwoman: Jacqueline LECOURTIER
Vice-chairman: Reinhard GRESSEL

SCIENTIFIC AND TECHNICAL INDIVIDUALS
Philippe BISCH, Syntec Ingénierie
Daniel CLEMENT, Ademe
Marc DUVAL-DESTIN, Thales Avionics
Olivier GAGEY, Bicêtre University Hospital
Pierre-Étienne GAUTIER, Inexia
Antonio GOMES CORREIA, do Minho University (Portugal)
Valérie ISSARNY, Inria
Vincent KAUFMANN, EPFL
Corinne LARRUE, Tours University
Barbara LENZ, DLR
Philippe MARTIN, Sciences Po
Jérôme PERRIN, VedeCom
Jean-Eric POIRIER, Colas

EMPLOYEE REPRESENTATIVES
CFDT Frédérique LARRARTE and Gilles VALLET (full members),
Erik BESSMANN and Hugues CHOLLET (deputy members)
CGT Reinhard GRESSEL and Olivier BURBAN (full members),
Fabien CHIAPPINI and Charles TATKEU (deputy members)
Force ouvrière André ORCESI (full member),
Florent BABY (deputy member)
Sud Recherche EPST-Solidaires Sébastien AMBELLOUIS (full member)
and Thomas ROBERT (deputy member)

GUESTS IN AN ADVISORY CAPACITY
Hélène JACQUOT-GUIMBAL, managing director
Henri VAN DAMME, scientific director

PERMANENT GUEST
Patrick CHABRAND, chairman of the Researcher Evaluation Committee

EXECUTIVE BOARD AS OF 12/31/2013

MANAGING DIRECTION
Hélène JACQUOT-GUIMBAL, managing director
Jean-Paul MIZZI, deputy managing director
Vincent MOTYKA, deputy managing director
Claire SALLENAVE, director of the office and communication manager
Thierry FRAGNET, head of the office

DEPUTY DIRECTORATE
Jean-Marc BLOSEVILLE, deputy director of Versailles-Satory site
Michel BOULET, deputy director of Nantes site
Jean-Paul MIZZI, deputy director of Marseille-Salon de Provence site
Vincent MOTYKA, interim deputy director of Marne-la-Vallée site
Philippe RIGAUD, deputy director of Villeneuve d'Ascq site
Daniel TINET, deputy director of Bron site

OPERATIONAL DIRECTORATE
Directorate for European and International Affairs
Patrick MALLEJACQ, director

Directorate for Partnership and Resources
Brigitte MAHUT, director

Scientific Directorate
Henri VAN DAMME, director
Dominique MIGNOT, deputy director

Secretary General
Anne-Marie LE GUERN, secretary general
Eric GELINEAU, head of legal affairs and governance bodies

DEPARTMENTS
Materials and Structures (MAST)
Thierry KRETZ, director
Bruno GODARD, deputy director for Marne-la-Vallée site
Philippe TAMAGNY, deputy director for Nantes site
Jean-Michel TORRENTE, Research and Development deputy director

Geotechnical engineering, Environment, Natural hazards and Earth sciences (GERS)
Jean-Pierre MAGNAN, director
Eric GAUME, deputy director

Components and Systems (COSYS)
Frédéric BOURQUIN, director
Marion BERBINEAU, deputy director

Transport, Health, Safety (TS2)
Bernard LAUMON, director

Planning, Mobility and Environment (AME)
Gérard HEGRON, director
Anne AQUILERA, deputy director in charge of scientific programming
Michel ANDRE, deputy director in charge of partnership and dissemination
Michel BERENGIER, deputy director in charge of organisation and quality
# OUTGOINGS AND INCOMINGS

## FINANCIAL RESOURCES AND EXPENSES EXCL. DEPRECIATION

<table>
<thead>
<tr>
<th>Revenues</th>
<th>Euros</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Ecology, Sustainable Development and Energy</td>
<td>87,612,139 €</td>
<td>83.5%</td>
</tr>
<tr>
<td>Grant for public services costs</td>
<td>87,612,139 €</td>
<td></td>
</tr>
<tr>
<td>Contracts and Support for research activities</td>
<td>11,357,022 €</td>
<td>10.8%</td>
</tr>
<tr>
<td>Research contracts with public or private third parties</td>
<td>3,164,729 €</td>
<td></td>
</tr>
<tr>
<td>Grants for project or research programmes</td>
<td>8,192,293 €</td>
<td></td>
</tr>
<tr>
<td>Incomes generated from research activities and service provision</td>
<td>4,177,087 €</td>
<td>4.0%</td>
</tr>
<tr>
<td>Fees for patents and licences</td>
<td>460,419 €</td>
<td></td>
</tr>
<tr>
<td>Service provision</td>
<td>3,546,136 €</td>
<td></td>
</tr>
<tr>
<td>Product sales</td>
<td>170,532 €</td>
<td></td>
</tr>
<tr>
<td>Other grants and revenues</td>
<td>1,830,192 €</td>
<td>1.7%</td>
</tr>
<tr>
<td>Other grants</td>
<td>828,558 €</td>
<td></td>
</tr>
<tr>
<td>Financial revenue and other daily management income</td>
<td>968,057 €</td>
<td></td>
</tr>
<tr>
<td>Extraordinary income</td>
<td>32,494 €</td>
<td></td>
</tr>
<tr>
<td>Financial operations – Capital assets</td>
<td>1,043 €</td>
<td></td>
</tr>
<tr>
<td><strong>Total Revenues</strong></td>
<td>104,976,400 €</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Total Resources</strong></td>
<td>104,976,400 €</td>
<td>100%</td>
</tr>
</tbody>
</table>

## AUTHORISED EXPENSES

### Breakdown of Authorised Expenses per Destination

<table>
<thead>
<tr>
<th>Expenses</th>
<th>Euros</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activities performed by research units</td>
<td>74,813,370 €</td>
<td>66.3%</td>
</tr>
<tr>
<td>Sustainable mobility</td>
<td>25,113,651 €</td>
<td></td>
</tr>
<tr>
<td>Preserving and Adapting infrastructures</td>
<td>17,047,956 €</td>
<td></td>
</tr>
<tr>
<td>Climate change, Natural hazards</td>
<td>14,536,949 €</td>
<td></td>
</tr>
<tr>
<td>Cities and Regions</td>
<td>18,114,014 €</td>
<td></td>
</tr>
<tr>
<td>Joint activities</td>
<td>7,427,288 €</td>
<td>6.6%</td>
</tr>
<tr>
<td>Major research facilities</td>
<td>40,418 €</td>
<td></td>
</tr>
<tr>
<td>Research dissemination</td>
<td>690,014 €</td>
<td></td>
</tr>
<tr>
<td>Information exchanges</td>
<td>1,153,356 €</td>
<td></td>
</tr>
<tr>
<td>Scientific and technical information</td>
<td>3,043,793 €</td>
<td></td>
</tr>
<tr>
<td>Scientific partnerships</td>
<td>1,805,135 €</td>
<td></td>
</tr>
<tr>
<td>Continuous training</td>
<td>694,492 €</td>
<td></td>
</tr>
<tr>
<td>Support activities</td>
<td>30,569,681 €</td>
<td>27.1%</td>
</tr>
<tr>
<td>Social action</td>
<td>1,040,755 €</td>
<td></td>
</tr>
<tr>
<td>IT shared resources</td>
<td>4,930,270 €</td>
<td></td>
</tr>
<tr>
<td>Real estate – maintenance</td>
<td>411,862 €</td>
<td></td>
</tr>
<tr>
<td>Real estate - major renovations, acquisitions, constructions</td>
<td>4,267,100 €</td>
<td></td>
</tr>
<tr>
<td>Head office overheads</td>
<td>8,969,482 €</td>
<td></td>
</tr>
<tr>
<td>Research units overheads</td>
<td>9,444,772 €</td>
<td></td>
</tr>
<tr>
<td>Financial operations</td>
<td>1,505,440 €</td>
<td></td>
</tr>
<tr>
<td>Other general expenses</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Expenses</strong></td>
<td>112,810,259 €</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>112,810,259 €</td>
<td>100%</td>
</tr>
</tbody>
</table>

### Breakdown of Authorised Expenses per Type

<table>
<thead>
<tr>
<th>Expenses</th>
<th>Euros</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staff expenses on subsidy for public services</td>
<td>79,813,184 €</td>
<td>70.7%</td>
</tr>
<tr>
<td>Other staff expenses (expenses on research contracts)</td>
<td>4,550,543 €</td>
<td>4.0%</td>
</tr>
<tr>
<td>Unprogrammed operating and investments</td>
<td>28,161,170 €</td>
<td>25.0%</td>
</tr>
<tr>
<td>Programmed investments</td>
<td>285,362 €</td>
<td>0.3%</td>
</tr>
<tr>
<td><strong>Total Expenses</strong></td>
<td>112,810,259 €</td>
<td>100%</td>
</tr>
</tbody>
</table>
LABORATORIES LOCATION

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

GRENOBLE
Maison des géosciences
1381 rue de la Piscine
F-38400 Saint Martin d’Hères
Research unit: ISTerre

LYON-BRON
25 avenue François Mitterrand, Case 24
Cité des Mobilités
F-69675 Bron Cedex
Tel.: +33 (0)4 72 14 23 00
Fax: +33 (0)4 72 37 68 37
Research units: RRO, LICIT, LBMC, LESCOT, UMRESTTE, UNEX, LTE

LILLE-VILLENEUVE-D’ASCQ
20 rue Élisée Reclus
BP 70317
F-59666 Villeneuve-d’Ascq Cedex
Tel.: +33 (0)3 20 43 38 43
Research units: ESTAS, LEOST

MARNE-LA-VALLÉE
IFSTTAR HEADQUARTERS
14-20 boulevard Newton
Cité Descartes, Champs-sur-Marne
F-77447 Marne-la-Vallée Cedex 2
Tel.: +33 (0)1 81 66 80 00
Research units: CPDM, EMMS, FM2D, SRO, SV, GRETTIA, LEPSS, LISIS, SIMU, DEST, LVMT, SPLOTT

NANTES-BOUGUENAILS
Route de Bouaye
CS4
F-44344 Bouguenais Cedex
Tel.: +33 (0)2 40 84 58 00
Fax: +33 (0)2 40 84 59 99
Research units: MIT, LAMES, GPEM, SMC, TC, AI, EE, GEOLOC, MACSI, SII, EASE, LAE

MARSEILLE
Faculté de médecine secteur Nord
Boulevard Pierre Dramard
F-13916 Marseille Cedex 20
Tel.: +33 (0)4 91 65 80 00
Research unit: LBA

SALON-DE-PROVENCE
304 chemin de la Croix Blanche
F-13300 Salon-de-Provence
Tel.: +33 (0)4 90 56 86 30
Fax: +33 (0)4 90 56 25 51
Research units: LBA, LMA

VERSAILLES-SATORY
25 allée des Marronniers
F-78000 Versailles
Tel.: +33 (0)1 30 84 40 00
Fax: +33 (0)1 30 84 40 01
Research units: LEMCO, LTN, LPC

SECOND ADDRESS
IN VERSAILLES
77 rue des Chantiers
F-78000 Versailles
Tel.: +33 (0)1 40 43 29 01
Fax: +33 (0)1 40 43 29 30
Research unit: LIVIC
## CROSS-CUTTING ACTIVITIES:
ORSI - GERI - R2I

### LIST OF ORSIS

<table>
<thead>
<tr>
<th>AXIS</th>
<th>ACRONYM</th>
<th>NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ECSR</td>
<td>Changing behaviors in road safety: planning, environment and institution</td>
</tr>
<tr>
<td></td>
<td>ObAmo</td>
<td>Mobility observation and analysis</td>
</tr>
<tr>
<td></td>
<td>MGSoT</td>
<td>Modeling and simulation for a sustainable transportation system</td>
</tr>
<tr>
<td></td>
<td>PREVER</td>
<td>Risk prevention and evaluation, particularly for powered two-wheelers (ex 11K102)</td>
</tr>
<tr>
<td></td>
<td>IZV</td>
<td>Impact of visual information on road user behaviours (ex 13K101)</td>
</tr>
<tr>
<td></td>
<td>SERRES</td>
<td>Solutions to ensure environmentally friendly road operation (ex 11K2P2)</td>
</tr>
<tr>
<td>2</td>
<td>POP</td>
<td>Post-Oil Pavement</td>
</tr>
<tr>
<td></td>
<td>MABIOMAT</td>
<td>Bio-based and natural materials for sustainable construction</td>
</tr>
<tr>
<td></td>
<td>MBDO</td>
<td>Sustainable and Ecological Bituminous Materials</td>
</tr>
<tr>
<td></td>
<td>MATEOP</td>
<td>Materials and Energy for OPTimising civil engineering structures (ex 11L101)</td>
</tr>
<tr>
<td></td>
<td>Géothermie</td>
<td>Impact of low temperature geothermal energy on soils, watersheds and structures (ex 11L100)</td>
</tr>
<tr>
<td></td>
<td>AGREGA</td>
<td>Aggregates for transport infrastructure construction with a reduced environmental impact (ex 11L091)</td>
</tr>
<tr>
<td></td>
<td>APPLID</td>
<td>New materials and predictive tools for low-environmental impact and highly sustainable structures: Integrated experimental/numerical multilevel APPROach for sustainable development</td>
</tr>
<tr>
<td></td>
<td>EPEES</td>
<td>Evaluating and forecasting the environmental impacts of transportation infrastructure (ex 11L092)</td>
</tr>
<tr>
<td></td>
<td>Infrastructure and Sustainable Works (ex 11L094)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RSI</td>
<td>Risks of internal swelling reactions in structural concrete strategic works (ex 11N102)</td>
</tr>
<tr>
<td></td>
<td>APBS</td>
<td>Testing for safe structures (ex 11R1P2)</td>
</tr>
<tr>
<td></td>
<td>Fissures</td>
<td>Detection of defects on works and pavements (ex 11R121)</td>
</tr>
<tr>
<td></td>
<td>DEBIR</td>
<td>From the design to the sustainable maintenance of roads infrastructures (ex 11R2P22)</td>
</tr>
<tr>
<td></td>
<td>MCV</td>
<td>Controlling the life cycle of structures (ex 11R2P25)</td>
</tr>
<tr>
<td></td>
<td>AIPAD</td>
<td>Innovative approaches for improving the durability of structures</td>
</tr>
<tr>
<td></td>
<td>Ageing and maintenance of drainage networks and facilities exposed to biophysico-chemical processes (ex 11N101)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EGO-SURF</td>
<td>Study of tyre-pavement contact to achieve optimal and sustainable road surfacing properties (ex 11L102)</td>
</tr>
<tr>
<td></td>
<td>InEEOG</td>
<td>Impacts of Eurocodes on the reliability, durability and economy of Geotechnical structures (civil engineering and construction)</td>
</tr>
<tr>
<td></td>
<td>PLATIF</td>
<td>Railbeds and track-guided transport systems (ex 11S104)</td>
</tr>
<tr>
<td></td>
<td>VIF</td>
<td>Track for railways and track-guided transportation (ex 11P101)</td>
</tr>
<tr>
<td></td>
<td>MOD-FAB</td>
<td>Modelling the manufacture of granular civil engineering materials (ex 11P102)</td>
</tr>
<tr>
<td></td>
<td>Contribution of modeling in sustainable construction</td>
<td></td>
</tr>
<tr>
<td>2/3</td>
<td>FIAMEEBAT</td>
<td>Reliability of Measurement for Energy Efficiency of Building</td>
</tr>
<tr>
<td></td>
<td>ECOdem</td>
<td>Non-destructive evaluation and controls of dispersive environment in civil engineering by Electromagnetic wave propagation</td>
</tr>
<tr>
<td></td>
<td>Terra Nova</td>
<td>Building techniques and new materials in levelling</td>
</tr>
<tr>
<td></td>
<td>CERI</td>
<td>Pairing eco-use and risks linked to infrastructure</td>
</tr>
<tr>
<td></td>
<td>New applications of composite frames for internal and external strengthening of reinforced concrete structures</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Géodépoll</td>
<td>Depolluting geosynthetic: alternative to infrastructure drainage systems</td>
</tr>
<tr>
<td></td>
<td>STOC02</td>
<td>Geological storage of CO₂</td>
</tr>
<tr>
<td></td>
<td>DOFEAS</td>
<td>Dykes and waterway facilities: erosion, scour and earthquakes (ex 11M103)</td>
</tr>
<tr>
<td></td>
<td>Séismes</td>
<td>Forecasting and mitigating the effects of earthquakes</td>
</tr>
<tr>
<td></td>
<td>PRECAS</td>
<td>Risk prevention of collapse of underground cavities (ex 11R2P24)</td>
</tr>
<tr>
<td></td>
<td>CCLERO</td>
<td>Reducing the impact of climatic conditions on road infrastructure (ex 11L1P3)</td>
</tr>
<tr>
<td></td>
<td>Sécheresse 2</td>
<td>Effect of drought on buildings and infrastructure</td>
</tr>
<tr>
<td></td>
<td>PLUME</td>
<td>Predicting noise in urban areas, from the region to the city (ex 11M101)</td>
</tr>
<tr>
<td></td>
<td>Vibren</td>
<td>Manage the environmental vibrations</td>
</tr>
<tr>
<td></td>
<td>CalBaroc</td>
<td>Characterization and design of structures in rock</td>
</tr>
<tr>
<td></td>
<td>Urban heat island</td>
<td>Urban micro-climatology on the urban heat island</td>
</tr>
<tr>
<td>3/4</td>
<td>Post-Crue</td>
<td>Rethinking preventive action on flood risk on a territorial scale integrating post-flood actions</td>
</tr>
<tr>
<td></td>
<td>HYDROISQ</td>
<td>Towards a comprehensive consideration of hydrological risk: characterisation, monitoring and management</td>
</tr>
<tr>
<td>4</td>
<td>LOPRODI</td>
<td>Logistical and transport stakeholders of new production and distribution practices</td>
</tr>
<tr>
<td></td>
<td>GDEP</td>
<td>Sustainable Management of Rainwater (ex 11M102)</td>
</tr>
<tr>
<td></td>
<td>COMET</td>
<td>Weather-sensitive characterizations of the state of the road and traffic conditions</td>
</tr>
</tbody>
</table>
### LIST OF 2013 GERIS

<table>
<thead>
<tr>
<th>CONTINUATION</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2RM</td>
<td>Motorised 2 wheelers</td>
</tr>
<tr>
<td>Anim@tic</td>
<td>Collection and analysis of spatio-temporal data for the study of mobility and driving behaviour</td>
</tr>
<tr>
<td>BDR SR</td>
<td>Databases for road safety research</td>
</tr>
<tr>
<td>COPIE</td>
<td>Pedestrian behaviour in his/her environment (organization of the 2013 symposium)</td>
</tr>
<tr>
<td>DYNAVE</td>
<td>Vehicle dynamics</td>
</tr>
<tr>
<td>ITURG</td>
<td>Integration of urban and regional guided transports</td>
</tr>
<tr>
<td>SMRT</td>
<td>Modelling of transport networks seminar</td>
</tr>
<tr>
<td>RRT</td>
<td>Road risk and work</td>
</tr>
<tr>
<td>STIC ITS</td>
<td>Information and communication sciences and technologies for intelligent transport systems</td>
</tr>
<tr>
<td>TEMIS</td>
<td>Techniques and stakes for modeling and scientific computing</td>
</tr>
<tr>
<td>TERRITOIRE</td>
<td>Local territories, spatial planning and organisation of transport and mobility networks</td>
</tr>
<tr>
<td>TTI</td>
<td>Instrumentation techniques</td>
</tr>
<tr>
<td>TISIC</td>
<td>Information processing, signal, image and knowledge</td>
</tr>
<tr>
<td>VE</td>
<td>Electrical vehicles</td>
</tr>
<tr>
<td>VELO</td>
<td>Bicycles</td>
</tr>
<tr>
<td>RSG</td>
<td>5th Generation Road</td>
</tr>
</tbody>
</table>

#### CONTINUATION WITH PERIMETER ENLARGEMENT

| GNSS et LITS | Localisation Indoor |

#### CREATION

| ASTO         | Auscultation of woody structures |
| EPI          | Evaluation of infrastructure projects |
| STAR         | Safety in transports, planning and networks |
| SUN          | Sustainable urbanization via nanosensors |

### LIST OF 2013 R2IS

#### CREATION

| BEEF         | Energy and environmental balances of production chains of materials for civil engineering |
|--------------| "Smartphone" Technologies’ Exploration for the analysis of road infrastructure |
| Solar roadways | Design of pavements with heating surface, autonomous for energy |
| EpheMeRe     | Use of photovoltaic cells for the road and its equipment |
| DEUP | Morpho-anthropometric, structural and mechanical studies of the entire spleen |
| SYRUSCANFIELD | Dual ultrasonic ultrasound to observe the interactions between abdominal organs during an impact |
| Bike simulation platform | Design and manufacturing of a triaxial antenna card with constant gain |
| MEDEP         | Creation of a dynamic bike simulation platform for analysing the behaviour of cyclists |
| IBS | Contactless capture of dynamic energy for electrical vehicles |
| IMAGES        | Microscopic metrology of pedestrian strips in urban areas |
| Impact of additives and chemical compounds extracted from peomembranes on ecosystem functioning |

#### CONTINUATION

| TRANSCOM     | Quantitative analysis of trade transport streams and their determinants (geography of retail chains in France and in Germany) |
| Alzheimer     | Alzheimer's disease, slight cognitive problems and safety when crossing the streets |
| The virtual human | The virtual human |

#### CONTINUATION/VERONESE

<p>| SAPIEN        | Study for the implementation of SAPIEN as a simulation open source platform |
| Living lab train | Change driving behaviours to reduce fuel consumption |
| Fib3D         | 3D microscopic observations of fibrous soft biological tissue |</p>
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADEME</td>
<td>French Environment and Energy Management Agency</td>
</tr>
<tr>
<td>AERES</td>
<td>French Evaluation Agency for Research and Higher Education</td>
</tr>
<tr>
<td>AFGC</td>
<td>French Association of Civil Engineering</td>
</tr>
<tr>
<td>ALLEVI</td>
<td>French National Alliance for Environmental Research</td>
</tr>
<tr>
<td>AMO</td>
<td>Project Management Support Association for Energy Research Coordination</td>
</tr>
<tr>
<td>ANR</td>
<td>French National Research Agency</td>
</tr>
<tr>
<td>ANRT</td>
<td>French National Research and Technology Agency</td>
</tr>
<tr>
<td>BRGM</td>
<td>French Institution for Geological Survey</td>
</tr>
<tr>
<td>CCRT</td>
<td>French Joint Research Centre on Transport</td>
</tr>
<tr>
<td>CCRD</td>
<td>French Regional Advisory Committee on Technological Research and Development</td>
</tr>
<tr>
<td>CEEP</td>
<td>French Centre for the Study and Design of Prototypes</td>
</tr>
<tr>
<td>CEDR</td>
<td>Conference of European Directors of Roads</td>
</tr>
<tr>
<td>CEREMA</td>
<td>Centre for Studies and Expertise on Risks, the Environment, Mobility, and Urban Planning</td>
</tr>
<tr>
<td>CERTIFER</td>
<td>French Railway Certification Agency</td>
</tr>
<tr>
<td>CERTU</td>
<td>French Centre for Studies of Networks, Transport, Urban Planning and Public Buildings</td>
</tr>
<tr>
<td>CER</td>
<td>French Centre for Road Education</td>
</tr>
<tr>
<td>CETE</td>
<td>French Public Works Design and Research Office</td>
</tr>
<tr>
<td>CFR</td>
<td>French Committee for Road Engineering Techniques</td>
</tr>
<tr>
<td>CIFRE</td>
<td>Industrial Agreements for Training through Research</td>
</tr>
<tr>
<td>CIRAD</td>
<td>French Centre for International Cooperation in Agricultural Research for Development</td>
</tr>
<tr>
<td>CNES</td>
<td>French Agency for Space Research</td>
</tr>
<tr>
<td>COFRAC</td>
<td>French Accreditation Committee</td>
</tr>
<tr>
<td>COP</td>
<td>Goals and Performance Contract</td>
</tr>
<tr>
<td>CPER</td>
<td>Project Contract State-Region</td>
</tr>
<tr>
<td>CSTB</td>
<td>French Scientific and Technical Centre for Building</td>
</tr>
<tr>
<td>DGITM</td>
<td>French General Directorate for Infrastructure, Transport and Maritime Affairs</td>
</tr>
<tr>
<td>DRI</td>
<td>French Directorate for Research and Innovation</td>
</tr>
<tr>
<td>DSCR</td>
<td>French Road Safety and Traffic Delegation</td>
</tr>
<tr>
<td>ENPC</td>
<td>French National Civil Engineering School</td>
</tr>
<tr>
<td>ENTPE</td>
<td>French National School for State Public Works</td>
</tr>
<tr>
<td>EPIC</td>
<td>French Public Industrial and Commercial Institution</td>
</tr>
<tr>
<td>EPSF</td>
<td>French Public Institution in charge of Railway Safety</td>
</tr>
<tr>
<td>EPSIT</td>
<td>French Public Scientific and Technical Institution</td>
</tr>
<tr>
<td>EQUIPEX</td>
<td>Facilities of Excellence Europe Research Transport</td>
</tr>
<tr>
<td>ERT</td>
<td>Rhône Département on Road Traffic Casualties Population Follow-Up</td>
</tr>
<tr>
<td>ESPARR</td>
<td>European Framework Programme for Research and Technological Development</td>
</tr>
<tr>
<td>FIT</td>
<td>Ifstar Research and Discussion Group Greenhouse gas</td>
</tr>
<tr>
<td>FP</td>
<td>European Framework Programme for Research and Technological Development</td>
</tr>
<tr>
<td>GERI</td>
<td>High Speed Train International Associated Laboratory</td>
</tr>
<tr>
<td>GES</td>
<td>French Institute for Roads, Streets and Infrastructure for Mobility</td>
</tr>
<tr>
<td>GIS</td>
<td>Initiatives of Excellence Federative Institute for Research on Handicap</td>
</tr>
<tr>
<td>HAL</td>
<td>French Institute of Science and Technology for Transport, Development and Networks</td>
</tr>
<tr>
<td>HDR</td>
<td>French National Institute for Information on Geography and Forests</td>
</tr>
<tr>
<td>IDEX</td>
<td>French National Institute for Environmental Protection and Industrial Risks</td>
</tr>
<tr>
<td>IFRH</td>
<td>French National Institute for Agricultural Research</td>
</tr>
<tr>
<td>IDRRI</td>
<td>French Ministry of Ecology, Sustainable Development and Energy</td>
</tr>
<tr>
<td>INRETS</td>
<td>French Institute for Transport and Safety Research</td>
</tr>
<tr>
<td>INRIA</td>
<td>French National Institute for Research in Computer Science and Control</td>
</tr>
<tr>
<td>IRSN</td>
<td>French National Institute for Radiological Protection and Nuclear Safety</td>
</tr>
<tr>
<td>IRSTEA</td>
<td>French National Research Institute of Science and Technology for Environment and Agriculture</td>
</tr>
<tr>
<td>IRSTV</td>
<td>French National Institute for Research on Urban Sciences and Techniques</td>
</tr>
<tr>
<td>IRT</td>
<td>Energetic Transition Institute Intelligent Transportation Systems</td>
</tr>
<tr>
<td>ITE</td>
<td>Laboratories of Excellence</td>
</tr>
<tr>
<td>ITS</td>
<td>French Civil Engineering Laboratory</td>
</tr>
<tr>
<td>LABEX</td>
<td>INRETS Road Equipment Test Laboratory</td>
</tr>
<tr>
<td>LNE</td>
<td>French National Metrology and Testing Laboratory</td>
</tr>
<tr>
<td>LRPC</td>
<td>French Regional Civil Engineering Laboratory</td>
</tr>
<tr>
<td>MEDDE</td>
<td>French Ministry of Ecology, Sustainable Development and Energy</td>
</tr>
<tr>
<td>MEDDTL</td>
<td>French Ministry of Ecology, Sustainable Development, Transport and Housing</td>
</tr>
<tr>
<td>MESR</td>
<td>French Ministry of Higher Education and Research</td>
</tr>
<tr>
<td>METL</td>
<td>French Ministry for Territorial Equality and Housing</td>
</tr>
<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
</tr>
<tr>
<td>ONEVU</td>
<td>Nantes Observatory of Urban Environments</td>
</tr>
<tr>
<td>PACA</td>
<td>Provence-Alpes-Côte d'Azur (French region)</td>
</tr>
<tr>
<td>PIA</td>
<td>Investment for the Future Programme</td>
</tr>
<tr>
<td>PIARC</td>
<td>World Road Association Programme of Research, Experimentation and Innovation in Land Transport</td>
</tr>
<tr>
<td>PREDIT</td>
<td>Research and Higher Education Clusters</td>
</tr>
<tr>
<td>PRES</td>
<td>French and Technological Cluster</td>
</tr>
<tr>
<td>PST</td>
<td>Powered Two-Wheelers</td>
</tr>
<tr>
<td>Acronym</td>
<td>Full Name</td>
</tr>
<tr>
<td>----------</td>
<td>-----------</td>
</tr>
<tr>
<td>RATP</td>
<td>Paris Public Transport Authority</td>
</tr>
<tr>
<td>RFF</td>
<td>France’s Railway Network Operator</td>
</tr>
<tr>
<td>RNE</td>
<td>French National Directory of Institutions</td>
</tr>
<tr>
<td>RST</td>
<td>Scientific and Technical Network</td>
</tr>
<tr>
<td>SATT</td>
<td>Technological Transfer Acceleration Company</td>
</tr>
<tr>
<td>SCSP</td>
<td>Grant for Public Service Costs</td>
</tr>
<tr>
<td>SETRA</td>
<td>French Research Department for Transport, Roads and their Development</td>
</tr>
<tr>
<td>SNCF</td>
<td>French National Railway Company</td>
</tr>
<tr>
<td>SNDD</td>
<td>French National Strategy for Sustainable Development</td>
</tr>
<tr>
<td>SNRI</td>
<td>French National Strategy for Research and Innovation</td>
</tr>
<tr>
<td>SOERE</td>
<td>Environmental Research Monitoring and Experimentation Systems Engineering Sciences and Architecture</td>
</tr>
<tr>
<td>SPI</td>
<td>Engineering Sciences, Earth Sciences and Architecture</td>
</tr>
<tr>
<td>SPIGA</td>
<td>Regional Research and Innovation Strategies for Smart Specialisation</td>
</tr>
<tr>
<td>SRI-SI</td>
<td>French Civil Aviation Technical Centre</td>
</tr>
<tr>
<td>STAC</td>
<td>Science and Technology of Information and Mathematics</td>
</tr>
<tr>
<td>TRA</td>
<td>Transport Research Arena Transportation Research Board</td>
</tr>
<tr>
<td>TRB</td>
<td>Research Unit</td>
</tr>
<tr>
<td>UMR</td>
<td>Jointly Managed Research Unit</td>
</tr>
<tr>
<td>UN</td>
<td>United Nations University of Paris-Ést Marne-la-Vallée</td>
</tr>
<tr>
<td>UPE-MLV</td>
<td>Research Unit</td>
</tr>
<tr>
<td>UR</td>
<td>French Union of French Road Industry Associations</td>
</tr>
<tr>
<td>USIRF</td>
<td>World Health Organisation</td>
</tr>
</tbody>
</table>

**IFSTTAR’S DEPARTMENTS AND LABORATORIES**

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>AI</td>
<td>Assessment and Imaging Laboratory</td>
</tr>
<tr>
<td>AME</td>
<td>Planning, Mobility and Environment Department Components and Systems Department Physical-chemical behaviour and durability of materials Laboratory</td>
</tr>
<tr>
<td>COSYS</td>
<td>Economic and Social Dynamics of Transport Laboratory</td>
</tr>
<tr>
<td>CPDM</td>
<td>Environment, Planning, Safety and Eco-design Laboratory</td>
</tr>
<tr>
<td>DEST</td>
<td>Water and Environment Laboratory</td>
</tr>
<tr>
<td>EASE</td>
<td>Experimental and Numerical Analysis of Materials and Structures Laboratory</td>
</tr>
<tr>
<td>EMMS</td>
<td>Evaluation of Automated Transport Systems and their Safety Laboratory</td>
</tr>
<tr>
<td>ESTAS</td>
<td>Mix-design, Microstructure, Modelling and Durability of Building Materials Laboratory</td>
</tr>
<tr>
<td>FM2D</td>
<td>Geotechnical Engineering, Environment, Natural Hazards and Earth Sciences Department</td>
</tr>
<tr>
<td>GERMEL</td>
<td>Aggregates and Materials Processing Laboratory</td>
</tr>
<tr>
<td>GERMET</td>
<td>Engineering of Surface Transportation Networks and Advanced Computing Laboratory</td>
</tr>
<tr>
<td>ISTerre</td>
<td>Institute of Earth Sciences Environmental Acoustics Laboratory</td>
</tr>
<tr>
<td>LAE</td>
<td>Laboratory for Modelling, Experimentation and Survey of Transport Infrastructures Laboratory of Biomechanics and Application Biomechanics and Impact Mechanics Laboratory</td>
</tr>
<tr>
<td>LAMES</td>
<td>Laboratory of Biomechanics and Application</td>
</tr>
<tr>
<td>LBA</td>
<td>Cooperative Mobility Measurement Laboratory</td>
</tr>
<tr>
<td>LBAC</td>
<td>Laboratory on Electronics, Waves and Signal Processing for Transport Laboratory for Road Operations, Perception, Simulators and Simulations Laboratory for Ergonomics and Cognitive Sciences Applied to Transport Transport and Traffic Engineering Laboratory on Instrumentation, Scientific Informatics and Simulation Laboratory for Vehicle Infrastructure Driver Interactions Laboratory of Accident Mechanism Analysis Mobility and Behaviour Psychology Laboratory Transport and Environment Laboratory</td>
</tr>
<tr>
<td>LEMCO</td>
<td>Laboratory for Transportation Infrastructure Laboratory</td>
</tr>
<tr>
<td>LEOST</td>
<td>Navier laboratory</td>
</tr>
<tr>
<td>LEOB</td>
<td>Rockfall Hazards and Design of Geotechnical Structures Laboratory</td>
</tr>
<tr>
<td>LEOC</td>
<td>Safety and Durability of Structures Laboratory</td>
</tr>
<tr>
<td>LEPSIS</td>
<td>Structures and Instrumentation Laboratory</td>
</tr>
<tr>
<td>LICIT</td>
<td>Metallic Structures and Cables Laboratory</td>
</tr>
<tr>
<td>LESCOT</td>
<td>Production Systems, Logistics, Transport Organization and Work Laboratory</td>
</tr>
<tr>
<td>LISM</td>
<td>Soils, Rocks and Geotechnical Structures Laboratory</td>
</tr>
<tr>
<td>LIVIC</td>
<td>Earthquakes and Vibrations Laboratory</td>
</tr>
<tr>
<td>LTM</td>
<td>Earthworks and Centrifuge Laboratory</td>
</tr>
<tr>
<td>LTN</td>
<td>Transport, Health, Safety Department</td>
</tr>
<tr>
<td>MACSI</td>
<td>Epidemiological Research and Surveillance Unit in Transport, Occupation and Environment Experimental Testing Unit</td>
</tr>
</tbody>
</table>