



## Job description

Researcher of 2<sup>nd</sup> class  
of sustainable development

CR2

(registration closure : March 27<sup>th</sup> 2018)

**French Institut of Science and Technology for transport  
development and network  
(IFSTTAR)**

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<b>Job title :</b>	Researcher in « <b>Geotechnical earthquake engineering</b> »
<b>Institut :</b>	<b>IFSTTAR</b> , <a href="http://www.ifsttar.fr/">http://www.ifsttar.fr/</a>
<b>Discipline(s) :</b>	Geosciences, Civil engineering, Geotechnic
<b>Spécialité(s) :</b>	Physical modelling, geotechnical earthquake engineering
<b>Structure de recherche :</b>	Departement « Geotechnic, Environnement, Natural Hazards and Earth Science » (GERS), Laboratory Earthquake and Vibrations
<b>Localisation :</b>	Ifsttar – Nantes site – Bouguenais (44)
<b>Contact(s) :</b>	Luca Lenti, acting director of the laboratory « Earthquake and Vibrations » (SV), e-mail : <a href="mailto:luca.lenti@ifsttar.fr">luca.lenti@ifsttar.fr</a> Sandra Escoffier, researcher, e-mail : <a href="mailto:sandra.escoffier@ifsttar.fr">sandra.escoffier@ifsttar.fr</a> Eric Gaume, director of the department « Geotechnical engineering, Environment, Natural Hazards and Hearth science », e-mail : <a href="mailto:eric.gaume@ifsttar.fr">eric.gaume@ifsttar.fr</a>

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## Context

IFSTTAR, the French Institute of Science and Technology for Transport, Development and Networks, is a major player in the European research on the city and the territories. It is a Public Institution of a Scientific and Technical Nature. IFSTTAR's role is to carry out and commission, direct, lead and appraise research, development and innovation in the areas of transport, infrastructure, natural and city hazards in order to improve the living conditions of our citizens and more broadly to promote sustainable development of our societies. IFSTTAR is organized in 5 departments that are structured in laboratories and joint research units.

The heart of activity of GERS department is the geoscience applied to civil engineering and development. The main field of application of the research and expertise developed within the department concerned the design, the construction of sustainable infrastructures and their monitoring, the control of natural risks and pollution and the management of water in the city. The mobilized skills within the GERS department are multiple: geotechnic, geology, hydrology, environmental chemistry, geophysics and auscultation.

Within the department, the activities of the laboratory “Earthquakes and Vibrations” (SV) in the field of seismic risk are grouped under two priority themes “ dynamic soil –structure interaction and vulnerability” and ‘ Seismic motion for engineers and non-linear response of soils” (see in the Annex the priority themes of the IFSTTAR that are led by the GERS department). The specificity of the laboratory is its location on three sites: Paris, Grenoble and Nantes. Its researches concern the field of seismology for engineers, earthquake geotechnical engineering, soil dynamic and seismic risk. The main part of the activities is made possible by the presence of six researchers and two technicians that are hierarchically attached to the laboratory SV and four technicians that are hierarchically attached to the laboratory Geomaterial and Geotechnical Modeling (GMG).

On the Nantes site, the activities of the Earthquakes and Vibrations laboratory concern with dynamic centrifuge physical modeling on reduce scale models. More specifically the works concern the priority theme of dynamic soil structure interaction and non linear response of soils including liquefaction phenomena but also more generally seismic behaviour of geotechnical structures. In particular these researches require investment in the development and testing of new experimental equipment dedicated to dynamic centrifuge tests. All the activities are performed in close collaboration with the technical staff of the GMG laboratory.

The researcher will be involved in the research activities of the site of Nantes and the main activity will be experimental and based on the embarked shaker. In addition he/her will be involved in numerical works on soil structure interaction in the framework of research programs (national and international), private contracts or supervision of students (PhD, master).

It is expected from the researcher to have an activity of production, supervision and to participate to project set up at different level (regional, national, European, international). His/her works should be published in high-level international journals. He/her will also participate to the collective scientific life of his/her laboratory, department and institute.

His/her work will focus more especially on the support and the development of the activities in the domain of soil structure interaction under seismic loading. He/she will reinforce the research staff actually composed of one researcher with geomechanical and geotechnical skills and a technical staff composed of 4 technicians of the GMG laboratory. The researcher will help to perform work with a strong experimental component. In this framework he/she will be in charge of experimental programs in macrogravity from the design of the experimentations to the publication of results in scientific articles. For complementarity purpose of the actual staff, the researcher will also have numerical modeling activities that will be useful for the experimental program design and in the exploitation of the experimental results. In addition, the researcher will be involved in the improvement and the development of experimental tools in close collaboration with the technical staff.

In addition to his/her research activity, the researcher should developed a diversify activity as in the following :

- Education and research training (education, supervision of trainees, PhD students post doctorates, participation in juries and bodies or committees related to teaching).
- Administrative activities and research animation (team animation, project coordination, staff management, management of testing facilities).
- Valuation and transfer activities (research and industrial contracts, expertise and consulting activity, transfer of research results to the socio-economic world contribution to public policy development, dissemination of scientific culture).
- International activities (participation in European projects, international collaboration, contribution to the international visibility of the institute).
- Scientific outreach (member of scientific committee, editorial committee,...)

## Requested profile

The position is open to holders of a doctorate in civil engineering and more specifically in the thematic of geotechnical earthquake engineering, or he/she should justify an equivalent level especially for foreign applicants. The candidate should have knowledge and strong interest for experimental research, an experience in dynamic physical modelling will be very much appreciated. For complementary purpose with the actual team in Nantes, the candidate must also have good knowledge of numerical modeling in the field of geotechnical engineering and in particular in the modeling of dynamic soil response.

The candidate is expected to propose a project for the position in his/her application and for this reason it is strongly recommended to contact the persons indicated

## Annex

### Priority theme of IFSTTAR supported by the department GERS

The department has 4 priority research areas

#### 1° - Geotechnical Engineering

The geotechnical axis is focused on three priority themes, while reaffirming the importance of continuing to develop fundamental cross-functional geotechnical skills related to the characterization of sites, structures and geomaterials.

##### 1.1 – Design of foundations, retaining structures and anchorages

Innovations (soil reinforcement, reduction of the use of shotcrete, heat exchanger piles, underground storage of waste, etc.), the generalization of new types of construction (wind turbines for example), the improvement of standards, regularly lead to Ifsttar to get involved in scientific and technical developments to better understand and model the behavior of structures in their environment and thus help to establish the rules for designing geotechnical structures (foundations, supports, anchors, etc.) or parts of structures in interaction with the site . IFSTTAR wishes to consolidate its status as a reference body for research and expertise in the field of interactions between buildings and soils (soils and rocks). New works will concern deep foundations, superficial or composite, and anchors and retaining structures.

##### 1.2 – Earthwork, levelling works and treated soils

The body of knowledge in levelling works and design of earthworks must be completed and adapted to the increasing environmental constraints (scarcity of resources, aging of structures) and to potential new applications of road techniques (rail, embankment reinforcement). The GERS Department will develop its activities in the coming years around the three major issues: 1) design, sustainability and renovation of earthworks, 2) evolution of earthworks techniques for sustainable management of resources, 3) development of unsuitable soils by treatments of various types (lime, cement, geopolymers) and materials (exploitation of waste, by-products, dredging sludge).

##### 1.3 Design and resilience of structure subjected to impact

The control of the rocky risks and the resilience of the structures under load of impact for the security of the infrastructures, or the construction at the back of protections, require progress in the understanding of the behavior of the geotechnical works of protection (merlons, galleries, notches, block nets, etc.) under impact. For dynamic problems, experimental tests are still unavoidable and Ifsttar has an exceptional range of equipment (Montagnole block drop station, hydraulic catapult of high capacity in Bron, geotechnical centrifuge in Nantes) to advance the knowledge and techniques on this theme.

#### 2° - Natural Hazards

The natural risks axis currently groups research activities on seismic risk and flood risk for reasons of simplicity of display. Other axes also include research related to the theme of natural and anthropogenic risks: rocky risk, auscultation of dikes and scour and erosion, detection of underground cavities. Interactions should progressively develop between these themes (at least on the aspect natural hazards, tools of prevention and cartography ...).

### 2.1 Seismic movement for engineers and non-linear response of soils

The characterization of the seismic movement is a major stake to ensure the maintenance of the works of Civil engineering to the seismic aggressions. The work carried out at Ifsttar contributes to the improvement of knowledge of the soil response during earthquakes and thus the damage caused (variability of movement, influence of non-linearities, liquefaction).

### 2.2 Soil structure interaction under seismic loadings and vulnerability of structures

The dynamic interaction between the soil and the structures takes place via the foundations (soil-foundation-structure interaction). The seismic response of the constructions results from the complex interactions between the ground, the foundation, the neighboring foundations and the structure. The vulnerability analysis of structures must therefore take into account these complex interactions. This subject is located at the interface between earthquakes, geomechanics and structures.

### 2.3 Knowledge and forecast of flash floods

Flooding floods are the most destructive type of natural disaster in France and worldwide. Improving forecasting tools is one of the most relevant actions to reduce their effects, especially for flash floods, which are a potential hazard for all urbanized areas. They have been the subject of original research at Ifsttar for about ten years, in complementarity with IRSTEA.

## **3° - Cities and Environment**

This theme is essentially carried by the Water and Environment laboratory, which is part of a network of active regional and national cooperation, particularly through ONEVU (Nantes Observatory of Urban Environments)

### 3.1 Urban water management and adaptation to global changes

This theme will aim at the following objectives:

- progress in integrated modeling of water, pollutants (especially metals) and heat fluxes at the neighborhood and agglomeration scales, and test their operational applications,
- perform precise and complete assessments of the flow of water and pollutants in order to optimize the performance of decentralized stormwater management structures, in their different functions (storage, infiltration, retention of pollutants),
- to deepen our knowledge on the phases carrying metallic pollutants and on the dynamics of their transfers in the urban systems (in particular coming from the atmospheric compartment),
- address the impacts of certain chemical or physical stresses (temperature, current speed, erosion, sedimentation ...) on the ecological status of certain aquatic environments (peri-urban rivers), or even on human health.

### 3.2 Environmental assessment of urban soils and recycled materials

The explosion of urban agriculture and the societal demand for green spaces are repositioning the soil as plantation support. On the other hand, does not the incentive to

infiltrate urban water or to use it for watering or washing will lead to a degradation of soil quality and potentially to that of groundwater? In this context, the GERS (LEE) department is committed to answering three issues: diagnosis of low-cost soil pollution integrating the heterogeneity of urban soils, soil and groundwater preservation, recycling of recycled materials by verifying their harmlessness. It is at the initiative of the creation of a regional consortium in Pays de Loire on urban anthropogenic soils and its involvement in national and international networks is being consolidated.

#### **4° - Geophysics and non-destructive evaluation**

Auscultation of the near underground and the non-destructive evaluation of civil engineering structures are related themes on which Ifsttar will continue to invest, making the link with other work in non-destructive evaluation (monitoring of structures, etc.).

##### **4.1 Auscultation of the subsoil**

Geophysical methods are currently widely used for the auscultation of soils/sites and the monitoring of various civil engineering works in their environment (earthworks, foundations, environment of the tunnel excavation zone). Ifsttar contributes to the extension of their field of application through methodological and material developments. The development of marine renewable energies, among others, creates new needs for adapted monitoring solutions and new opportunities, which will have to be addressed despite the potential weakening of the team.

##### **4.2 Non-destructive evaluation of civil engineering works**

Ifsttar is positioned in the nationally relatively unique niche of developing non-destructive evaluation methods for detecting and locating defects in slender civil engineering structures (cable, tie-rod, rail) and for characterization mechanical and physical-chemical concrete structures (coupling techniques, obtaining property gradients, early detection of damage), very consistent with its fields of expertise.