Univ. Grenoble Alpes
Université de l'innovation

FICHE NAVETTE: DOCTORANTS IDEX

SECTOR **:** Higher Education Institution

LOCATION: France, Grenoble

RESEARCH FIELD: **RISK MODELLING, ASSESSMENT AND MANAGEMENT, vulnerability of Civil Engineering structures**

RESEARCHER PROFILE:

□ *First stage researcher (Master Degree level required)*

INSTITUTION: Univ. Grenoble Alpes, University of Innovation

One of the major research-intensive French universities, Univ. Grenoble Alpes[1] enjoys an international reputation in many scientific fields, as confirmed by international rankings. It benefits from the implementation of major European instruments (ESRF, ILL, EMBL, IRAM, EMFL[2]). The vibring ecosystem, grounded on a close interaction between research, education and companies, has earned Grenoble to be ranked as the 5th most innovative city in the world. Surrounded by mountains, the campus benefits from a natural environment and a high quality of life and work environment. With 7000 foreign students and the annual visit of more than 8000 researchers from all over the world, Univ. Grenoble Alps is an internationally engaged university.

A personalized Welcome Center for international students, PhDs and researchers facilitates your arrival and installation.

In 2016, Univ. Grenoble Alpes was labeled «Initiative of Excellence ". This label aims at the emergence of around ten French world class research universities. By joining Univ. Grenoble Alpes, you have the opportunity to conduct world-class research, and to contribute to the social and economic challenges of the 21st century ("sustainable planet and society", "health, well-being and technology", "understanding and supporting innovation: culture, technology, organizations" "Digital technology").

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Key figures:

- + 50,000 students including 7,000 international students
- 3,700 PhD students, 45% international
- 5,500 faculty members
- 180 different nationalities
- 1st city in France where it feels good to study and 5th city where it feels good to work
- ISSO: International Students & Scholars Office affiliated to EURAXESS

1 Univ. Grenoble Alpes

2 ESRF (European Synchrotron Radiation Facility), ILL (Institut Laue-Langevin), IRAM (International Institute for Radio Astronomy), EMBL (European Molecular Biology Laboratory), EMFL (European Magnetic Field Laboratory)

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MANDATORY REFERENCES:

CDP TITLE: **RISK@Univ. Grenoble Alpes**
SUBJECT TITLE: Horizontal seismic bands in masonry wall**: characterisation, behaviour and modelisation to improve housing resilience to earthquake**
PRIMARY SCIENTIFIC DEPARTMENT (LABORATORY'S NAME): **3SR**
SECONDARY SCIENTIFIC DEPARTMENT (LABORATORY'S NAME): AE&CC
PRIMARY DOCTORAL SCHOOL (where the candidate will be registered): **IMPE2**
SECONDARY DOCTORAL SCHOOL: SHPT
SUPERVISOR NAME*:* ***Yannick Sieffert***
CO-SUPERVISOR NAME: ***Philippe Garnier, Dominique Daudon, Didier Georges***

SUBJECT DESCRITION: This PhD stands on the foundation of multidisciplinary knowledge, experience, and skill developed by the 3SR and AE&CC research unit over the last decade, in the areas of prevention, risk management and reconstruction, through the promotion of local building cultures and development dynamics, in particular in Haiti and Nepal.
The main objective of this PhD is to improve the knowledge on the traditional stone masonry building culture using seismic resistant solution through the inclusion of horizontal shear bands in a final goal to give useful and relevant scientific recommendations for reconstruction guidelines. Use of shear bands is very common in areas prone to seismic hazards all around the world and are present in different kind of typology. Due to a lack of scientific knowledge, the use of shear bands in masonry construction is often forgotten and even not allowed in some guidelines with the consequence of this knowledge and technical skills fading away quickly. However it could a very efficient and relevant option for construction in seismic areas meeting social and cultural needs as well, being accessible to communities and local population, improving their resilience and reconstruction capacities. The scientific impact of shear bands in masonry is not known as it requires specific tools which has not so common or easily accessible in the world. The main challenges are both the dimension of a full scale building to take into account local damage/dissipation (shear band, masonry and mortar) with the global structural effect and the dynamical loading that requires a large number of time steps discretization (i.e. small time step). These challenges are present both in numerical modeling and experimental aspect. For numerical, a specific modeling should be developed to represent the local dissipation with a limited number of elements to describe the building in line with the time consuming with seismic loading. For the experimental aspect, different apparatus should be made available to test a structure at the full scale with seismic loading. Fortunately, the 3SR laboratory is developing high level numerical modeling with macro-element in Atlas platform (F.E.M.) or brick element in Yade platform (D.E.M.) coupled to a shake table with adequate capacity. In addition, the full scale experimental capacity is actually under development thanks to a shear wall apparatus with a quasi-static cyclic loading and at the building scale the global behavior with a pseudo-dynamic with sub-structuration technical. Then 3SR laboratory is well positioned to answer to the high challenges of increasing resilience and development strategies for vernacular construction re-appropriation. One of the goals of this PhD will be to compare different methods to give recommendation for future work in evaluation of structural vulnerability. The shear wall apparatus is well dimensioned for a parametric study as the sample could be at a small dimension, i.e. a representative part of the wall (which needs a preliminary investigation but should be near 1m by 1m). This parametric study will be on the material used for shear band, masonry and mortar. The impact of build quality in the real project of reconstruction will be also analyzed in the laboratory. At this first art of the PhD, the local dissipation between shear bands and masonry will be investigate in relation with the propagation and the opening of cracks in masonry. The displacement at the interface and the opening of cracks will be calculated by a Digital Image Correlation process with a handmade 3SR software (Tracker). Numerical investigation will be made with Finite or Distinct Element Method. For increasing efficiency, a post-doctoral position will be added to this PhD for the modeling development. Then, a multi-criteria analysis will be used to take into account the mechanical results, the cost of materials, the gap between appropriation by local population and government. At the end of this first stage, two kinds of typologies will be chosen. Then, the wall scale will be investigated (3m by 2m) with an earthquake

solicitation for both cases of shear wall and out-of-plan bending wall direction. A real wall will be tested on the new sake table of the 3SR laboratory for two main advantages for numerical modeling: first to estimate the real damping ratio, second to evaluate predictive capability of the model. The last scale during the PhD will be the building scale with the structural dimensions (opening, storey, roof). A pseudo-dynamic method with sub- structuration will be develop for this scale in order to used real constitutive law coming for the wall scale and numerical model to represent storey and roof impact (mass and stiffness). The last step of the PhD will be to give recommendations to improve guidelines and also knowledge in the field. Two kind of movie medias will be edited with the experimental tests and numerical visualization. One will be for civil engineers who work for government agencies of reconstruction. The second for masons, carpenters and people who work in the field. Then the PhD will be "feed" of information coming on the field and at the end, the PhD will be give the results of his work accessible to the field. The geographic area concerned is Nepal as cooperative work on reconstruction project is on going with various partners (local stockholders, construction companies and peoples, humanitarian association).

Multidisciplinary

The PhD which is presented here is built on an existing core team of researchers who have already collaborated within a variety of activities (research projects, master level training) following the spirit of mutual enrichment through interdisciplinary between STI and SHS.

The PhD student will meet every weeks its directors who come from STI and SHS. Then he will have many opportunities to interact in a multidisciplinary approach with them. He will also have the opportunity to join evaluation mission or construction site visit on the field with them. The PhD student will join the "doctoral days of the CDP Risk@Univ. Grenoble Alpes" and if relevant he will participate to the organization of a conference on topic of prevention, risk management and reconstruction, through the promotion of local building cultures and development dynamics.

ELIGIBILITY CRITERIA

Applicants must hold a Master's degree (or be about to earn one) or have a university degree equivalent to a European Master's (5-year duration)

APPLICATION PROCEDURE

Applicants will attach a file including:

- Their CV
- A cover letter / letter of motivation
- A summary of previous work done/publications in Master 1 and Master 2
- A record of the grades of Master 1 and Master 2
- A copy of their last diploma

Address to send their application: **yannick.sieffert@3sr-grenoble.fr**

SELECTION PROCESS

Application deadline: **March 20, 2018 at 17:00 (CET)**

Applications will be evaluated through a three-step process:

1. Eligibility check of applications on **March 20, 2018**
2. 1st round of selection: the applications will be evaluated by a Review Board on **March 23, 2018**.
3. Results will be given on **March 26, 2018**.

TYPE of CONTRACT: temporary-3 years of doctoral contract
JOB STATUS: Full time
HOURS PER WEEK: 35
Salary: 1768.55 € gross per month