Course code: ENPC 15

Course title: Developing and understanding building materials

Institution: École des Ponts ParisTech

Course address: École des Ponts ParisTech 6-8 av. Blaise Pascal Champs sur Marne

City: Marne la Vallée (Champs sur Marne)

Minimum year of study: 2nd and 3rd year

Minimum level of English: Good

Minimum level of French: None

Key words: Building materials, Sustainable Development

Language: English

Professor responsible: Xavier Chateau

Telephone: 01.81.66.84.69

Fax

Email: xavier.chateau@enpc.fr

Participating professors: Lucile Couvreur (amàco), Xavier Chateau (École des Ponts ParisTech)

Number of places: Minimum: 10, Maximum: 40, Reserved for local students: 0

Objectives: To theoretically and experimentally try out ways to transform a raw material into a building material complying with sustainable development requirements.

The emergence of the sustainable development concept has considerably tightened the criteria that materials and processes should satisfy. Materials should be thermally insulating, light, easily workable and recyclable in environmentally friendly processes. The only way to meet these new challenges is first to combine multidisciplinary approaches in engineering and then to disseminate knowledge regarding their application.

This course provides an introduction to these problematics by working on a particular material: raw earth reinforced by vegetal fibers.

Even if mixing raw earth and vegetal fibers allows to design a material with low environmental impact and interesting hygro-thermal properties several issues need to...
be addressed to optimize the characteristics and the use of the material.

- How to decrease the viscosity of a clay paste without adding water?
- How to avoid cracking during drying?
- How the flowing properties of an earth paste change when fibers are added?
- How to design an insulating material with good thermal inertia?
- How to use the ability of hygroscopic porous materials to exchange vapor with ambient while avoiding material damage and building pathology?
- etc

This workshop aims at gathering people interested in seeking solutions to these problems by combining experimental approaches and modeling tools.

Programme to be followed

The first three days (Monday, Tuesday and Wednesday) will be devoted to presentation of the amàco innovation processes: interdisciplinary, technology transfer, re-engineering of traditional techniques and inspiration from living systems. Real case studies (research projects and architectural achievements) and educational experiments highlighting physico-chemical phenomena specific to some materials (physics of granular media, rheology of clay sludge, etc) will be presented. Then the key issues around construction cycle and supply chain using local products and bio-based material will be addressed.

During the last two days (Thursday and Friday) students will address issues related to the production of building materials, their properties in use and their durability by conducting bibliographic research, implementing models or designing experiments.

Students will work in small groups (4-5) on a particular issue. Each group will realize a teaching tool (experiment, poster, …) about a phenomenon or a behavior important for the use of the studied material.

Materials and equipments will be provided. Bibliographic researches can be conducted at the Lesage Library of École des Ponts ParisTech.

Prerequisites

Good scientific skills

Course exam

Students will present the result of their work (poster, one to two page article, experimental device, …) on Friday afternoon.