Title of BIP: COMBINED STRUCTURAL AND ENERGY UPGRADE OF BUILDINGS IN RURAL AREAS

General information

Objectives and Description:

The course, which, in the physical phase, will be held between Chambéry and a mountain village in Savoie, will investigate, first of all, the historical stratification of the village, the construction and strengthening techniques, the types of materials and their origin, the state of conservation of the buildings and the most frequent structural systems used. Knowledge of the characteristics of the historical buildings will highlight the main critical issues of the construction heritage. Lectures will be completed with in-depth studies on structural behavior of wooden floors, wooden roofs, vaults, arches and masonry walls topics.

Another goal of the subject will be to propose energy renovation solutions based on the use of geo and bio-based insulating materials, renewable energies such as solar energy, and innovative energy solutions such as heat pumps or polygeneration.

Hence, one of the main goals of the programme is to offer an innovative background on existing structures.

Participants, through laboratory activities, will be able to investigate real case studies refining their ability to read and interpret historical buildings, using the most appropriate intervention techniques. The intervention projects designed have the goal of guaranteeing the maintenance continuity of mountain rural architectural heritage, encouraging its reuse by improving its energy efficiency, usability conditions, and structural performance.

The remote meetings will help students in identifying critical issues related to the structural and energy efficiency perspective to be applied to real cases.

Methods and outcomes:

The BIP workload will be equivalent to 3 ECTS and will consist of a total 39 hours in which students will attend lectures, laboratory and supervised work in groups: 30 physical hours and 9 hours of virtual activity.

The following methodologies will be used during the course: challenge-based learning, participatory learning, cooperative learning, problem-based learning, flipped classroom, work group and case study presentation.

As a result, participants are expected to obtain:

- an overview of the main critical issues in existing building in rural and mountain areas, comprising materials, structural safety and energy efficiency.

- an overview of some of the advanced strategies to implement and retrofit these buildings in a combined and synergic way.

- an overview of the innovative strengthening technologies based on the use of composite materials characterized by inorganic matrices.

- an overview of technologies for improving energy efficiency of buildings.

Field of Education:

Civil Engineering, Architectural Engineering, Energy, Mechanical Engineering, Architecture

Target audience / Participants profile:

Participants profile: the course is designed for undergraduate, master and Ph.D students who are interested on building's rehabilitation from different points of view: historical, materials, structural or energy. They should be interested not only in theoretical issues but also in practical application on site. Besides, the focus is made on buildings in rural areas, in particular in a mountain village. Besides, the course is open to students from different disciplines, which provides an enriching perspective for tackling the same issues from different points of view.

No of ECTS issued: 3

The course always integrates a short duration physical mobility component (5 days without counting travel days) with an online component (2 days), with a minimum of 3 ECTS.

A certificate of attendance will be issued for students who actively participate in at least 75% of the course and develop properly the tasks proposed by lecturers.

Language of instruction and requirements:

English (minimum level B2)

Dates for physical activity:

July 6th till July 10th 2026

Location of physical activity:

Polytech Engineering School at Université Savoie Mont Blanc (6th-8th July 2026)

Mountain village (9th-10th July 2026)

Dates for virtual component:

- **29th June 2026** (Université Savoie Mont Blanc)
- **30th June 2026** (Universitad de Zaragoza)
- **2nd July 2026** (Università degli Studi di Brescia)

Virtual Component Description:

The virtual activities will be based on the analysis of historical buildings from a structural, material and energy efficiency point of view.

Theoretical fundamentals on structural aspects and energy efficiency and upgrade will be presented and discussed. Conventional, advanced techniques and practices will be also presented as a basis for the physical meeting.

Presentation and discussion of case studies will be also provided.

Organizing Board

Receiving/Host university:

Polytech, Université Savoie Mont-Blanc, France (Christel Messonnier: christel.messonnier@univ-smb.fr)

USMB team including Prof. Carmelo Caggegi and Prof. Mickaël Pailha

Sending/Partner universities:

P1. Università degli Studi di Brescia, Italy (Fausto Minelli: fausto.minelli@unibs.it)

P2. Universitad de Zaragoza, Spain (Sergio Usón: suson@unizar.es)

Detailed programme

1. Planned activities during virtual component:

USMB — 29th June 2026, 3 hours

- Opening and presentation of BIP program and modules
- Introducing people (professors and students) and getting to know each other
- One seminar on English terminology and Seminar on fundamentals of innovative materials for the rehabilitation of masonries. Strengthening technologies based on the use of Textile Reinforced Mortar (TRM)

UNIZAR — 30th June 2026, 3 hours

- Seminar on fundamentals of renewable energy and energy efficiency (general energy context, energy sources, fundamentals of energy conversion technologies and efficiency)

UNIBS — 2nd July 2026, 3 hours

- Seminar on seminars on masonry in general and applications on mountain areas (types of masonry, masonry behavior, arches and vaults, wooden floors, wooden roofs, steel ties, principal mechanisms and failure modes)

2. Planned activities during physical component:

1st day: Monday 6th July

08:30 – 09:00: Participant registration and welcome

09:00 – 09:30: Presentation of the course

09:30 – 10:00: Coffee break

10:00 – 11:00: Properties and pathologies of historical masonry (F. Minelli)

11:00 – 12:30: Mechanical behavior and failure mechanisms of historical masonry structures (L. Facconi)

12:30 – 13:30: Lunch

14:30 – 17:00: Masonry Rehabilitation - Module I (C. Caggegi)

Social event

2nd day: Tuesday 7th July

08:30 – 09:30: Terminology (C. Messonnier)

09:30 – 10:00: Coffee break

10:00 – 12:30: Renewable energy in buildings and in small villages (S. Usón)

12:30 – 13:30: Lunch

14:30 – 17:00: Masonry Rehabilitation - Module II (C. Caggegi, M. Pailha)

3rd day: Wednesday 8th July

08:30 – 09:30: Terminology (C. Messonnier)

09:30 – 10:00: Coffee break

10:00 – 12:30: Energy efficient technologies for buildings: heat pumps and polygeneration (S. Usón)

12:30 – 13:30: Lunch

14:30 – 17:00: Transfer to the village and visit-inspection of the buildings/case studies (C. Caggegi, M. Pailha, C. Messonnier, L. Facconi, F. Minelli, S. Usón)

4th day: Thursday 9th July

08:30 – 09:30: Terminology (C. Messonnier)

09:30 – 10:00: Coffee break

10:00 – 12:30: Strengthening techniques applied to case studies (F. Minelli)

12:30 – 13:30: Lunch

14:30 – 17:00: Group work / laboratory (C. Caggegi, M. Pailha, C. Messonnier, F. Minelli, S. Usón)

5th day: Friday 10th July

08:30 – 09:30: Terminology (C. Messonnier)

09:30 – 10:00: Coffee break

10:00 – 12:30: Strengthening techniques applied to case studies (C. Caggegi, M. Pailha). Energy upgrade applied to case studies (S. Usón,)

12:30 – 13:30: Lunch

14:30 – 17:00: Group work / laboratory (C. Caggegi, M. Pailha, C. Messonnier, F. Minelli, S. Usón)

Return to Chambéry

Application procedure

How: Students will apply for an Eramus+ short term mobility at their home university.

Home University will send the list of selected participants to USMB**.**

What is covered by host university:

Goodies

Welcome coffee

Welcome dinner

Closing dinner

Bus to Mountain village