

PENS-308

TRC LC3 Research Platform Fribourg

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Cursus	Sem.	Type
Projeter ensemble ENAC	BA6	Opt.

Language of teaching	English
Credits	4
Withdrawal	Unauthorized
Session	Summer
Semester	Spring
Exam	During the semester
Workload	120h
Weeks	12
Hours	4 weekly
Courses	1 weekly
Project	3 weekly

Number of positions

It is not allowed to withdraw from this subject after the registration deadline.

Summary

The UE TRC-LC3 Research Platform Fribourg will develop prototypes of structural elements in textile reinforced concrete (TRC) and Limestone Calcined Clay Cement (LC3) concrete that allow the continuation of the TRC prototype pavilion started at EPFL in 2019. The UE will take place in EPFL Fribourg.

Content

This research through making is based on the use of innovative Textile Reinforced Concrete (TRC), a material with high mechanical properties in which carbon fabric is embedded in a cementitious matrix cast with low-clinker content binders, such as LC3. The use of such binders, combined with the high efficiency of the reinforcing material, significantly reduces the ecological footprint of construction (by using less material and reducing energy consumption during production). TRC thus enables the construction of very thin, highly durable, and consequently highly sustainable structures.

The UE aims to further explore the structural, architectural, environmental, and social dimensions of TRC and its applications, particularly in the context of social construction in the Global South. Building on the TRC Prototype Pavilion, initiated in 2019 at EPFL Fribourg, and prior research on Brazilian architect Lelé's Argamassa Armada (ferrocement), we will develop TRC elements for social construction in the Global South. We will also test the use of LC3 cement for TRC, thanks to the collaboration with the LMC lab at EPFL. LC3 is a sustainable binder developed at EPFL and is already on its way to being implemented in the Global South.

Our working method is an iterative process of development through testing at EPFL Fribourg. Architecture, environmental engineering, and civil engineering students will design and build structural elements in textile-reinforced concrete, fabricate formwork in folded metal, prepare the textile reinforcement, mix and cast LC3 concrete, and conceive and test the materials, structural elements, assembly, and behavior of the TRC components.

Keywords

Textile reinforced concrete (TRC), social sustainable construction, technological and social innovation, knowledge transfer, interdisciplinarity (architecture and engineering)

Learning Prerequisites**Required courses**

Learning Outcomes

By the end of the course, the student must be able to:

- Construct a formwork system in folded metal
- Dimension a structural element in textile reinforced concrete
- Test structural and material limits
- Assemble the elements to create a fragment of a shelter
- Design structural element / system in textile reinforced concrete for a specific social context

Teaching methods

Work will take place in an atelier format, through drawing, 1:1 fabrication and collaborative discussions. It will be supported by lectures.

Expected student activities

Students will need to understand and go through the complete process of analysis, conception, execution and testing:

1. Analysis / understanding of social and technological context in the Global South (study case in Tanzania tbc).
2. Conceptual design of the structural element
3. Conception and construction of formwork in folded metal
4. Placement of textile reinforcement in the formwork
5. Mixing, casting of concrete, unmolding
6. Erection of the elements to create the structure and shelter building
7. Scientific protocol of the technical information and functional layout of the element and casting process

Supervision

Others The UE will take place in the Blue Factory in Fribourg. The train tickets will be partially reimbursed.

Resources

Moodle Link

- <https://go.epfl.ch/PENS-308>