INTERNSHIP

Research Assistant – **Towards Reliable Characteristic Compressive Strength for Rammed Earth Structures**

Type of contract: Internship (6 months)
Planned start date: April 2025
Working languages: French, English
Location: Grenoble
Bonus: in accordance with current French legislation

Keywords: Low-tech, Rammed Earth, Experimentation, Compressive Strength, Material Science

Figure 1 - La Maison pour Tous, 2018, Four (38080, France). Client: Municipality of Four; Project Manager: Onsite Architecture; Construction: Atelier Kara (Timur Ersen)

BACKGROUND

The urgency prompted by the climate crisis and its harmful impacts on health and life necessitates swift action. Buildings are a key leverage point in decreasing greenhouse gas (GHG) emissions, yet the embodied emissions linked to their construction, primarily stemming from extensive cement and steel usage (1), often remain a concealed challenge to any ambitious mitigation strategy (2).

As locally available, unprocessed, and potentially low-tech, raw earth is a promising construction material providing both low embodied carbon and favourable indoor comfort while fostering positive social impact (3). Rammed earth (RE) is one of the most prominent earthen building materials, employing as an in-situ construction technique. RE involves compressing dynamically layers of moist earth within formworks using a rammer.

French structural engineers design RE structures based on design compressive design strength to comply with Eurocodes, which aim to ensure structural reliability. In this framework, the design compressive strength is derived from a characteristic compressive strength to account for uncertainties through a semi-probabilistic approach. Currently, characteristic compressive strength is defined as the 5th percentile value of the assumed statistical distribution of compressive strength, selected to ensure a low probability of failure throughout the structure's lifespan (4).

To date, few studies (5–7) have addressed the characteristic strength of earthen materials, leading to a gap of knowledge in the statistical distribution of RE performance. Developing accurate values for characteristic compressive strength would allow for optimised wall designs, simplifying the structural design process and reducing associated costs. Overall, this would significantly enhance the economic competitiveness of RE construction.

AIM

This study aims to develop and implement a method for accurately determining the characteristic compressive strength of RE within the Eurocode framework. Additionally, it seeks to identify key factors influencing this statistical distribution (sample size, quality, grain size).

Figure 2 - Unconfined compression test on rammed earth cylindrical specimen equipped with extensometer sensors.

METHODOLOGY

The investigation will rely on a large set of compression tests with various raw materials.

MISSIONS

1. **State-of-the-art**

Gather comprehensive knowledge based on leading papers relevant to the topic, on-site investigations, interviews and then contextualise the findings to justify the aim of your research.

2. **Experimental training**

Familiarise yourself with the experimental materials, tools and set-up with guidance from technicians and supervisors, in preparation for the testing campaign.

3. **Experimental campaign**

Carry out the planned experimental tests, ensuring accurate data collection.

4. **Analysis of results and recommendations**

Analyse the experimental results, and draw key conclusions.

PROFILE OF THE PERSON WE ARE LOOKING FOR...

- You have advanced training in mechanics of materials or civil engineering.
- You are deeply interested in sustainable construction.
- You thrive on experimentation.
- You are rigorous, proactive and have a strong capacity of synthesis.
- You can work independently.

RECRUITMENT PROCESS

- a 30-minute phone call,
- a meeting with the team.

To apply: We look forward to receiving your application by 17 March 2025 at Mathieu.Lecaille@entpe.fr. Please include your CV, along with a way to demonstrate your motivation —this doesn't necessarily need to be a cover letter.

CONTACTS

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