SEAHA CENTRE FOR DOCTORAL TRAINING IN SCIENCE AND ENGINEERING IN ARTS HERITAGE AND ARCHAEOLOGY

SEAHA Studentship:

Development of a robust methodology for assessing moisture in solid brick walls

Moisture is universally acknowledged as the critical factor in almost all building problems, from deterioration of the materials and structure, to difficulties with building use (such as problems with mould and “dampness”). Nevertheless, there remain fundamental gaps in our understanding of how moisture travels into and around building fabric, and most particularly in our knowledge of the way water absorbed into and evaporated from permeable porous materials, and how it moves within the pores. Understanding this water uptake and the way it behaves is important to improving the effectiveness of all building care and conservation.

This project aims to investigate the uptake of moisture into masonry in relation to its existing moisture "conditions". The project will concentrate on solid masonry walls composed of brick and mortar: although this is a complex system, we do know from long-term observation that all such walls behave in roughly similar ways, despite the differences in materials and construction. Brick is not only a much more homogeneous material than stone (and therefore better suited to this ground-breaking research), but is also critical to the built environment of the UK, and particularly of urban buildings such as those of Georgian, Victorian, and Edwardian London, and therefore of great importance in conservation and commercial terms.

Research questions

1. How does moisture uptake in brick masonry relate to existing moisture "condition" of the wall?
2. How do we best define moisture risk for brick masonry?
3. Is there a critical point after which moisture levels suddenly increase, and uptake becomes self-driving, eventually reaching risky levels?
4. How does uptake relate to the state of the water meeting the masonry (liquid water in the form of rain, or ponding; water vapour)? Are there critical relationships with environmental conditions of temperature, humidity, and air movement?

The project will be supervised by Dr Hector Altamirano, UCL Institute for Environmental Design and Engineering and Dr Robyn Pender, Historic England. The candidate will have the opportunity to work in the IEDE Environmental Laboratory and collaborate closely with Grosvenor (industrial sponsor)

Research methodology

Working with the HEI and Heritage partners:

Investigate and assess the experimental methodologies (e.g large-scale gravimetry and thermal dual-probes) that could be used to monitor moisture uptake in full-size samples of brick masonry. Examine all parameters that could theoretically be instrumental in moisture uptake and distribution, including (but not limited to) standard parameters such as liquid conductivity, vapour diffusivity, and moisture-retention function. In the laboratory, expose full-size samples of brick mortar to controlled environmental conditions (including controlled rain and floodwater from above and from the sides) to test large-scale phenomena such as critical levels of moisture. Use the same equipment to examine in detail the impact of specific material or environmental conditions. All experimental work will be carried out using the climate chambers, equipment and associated facilities available at the UCL IEDE Environmental Laboratory.

Based on the outcomes of this, develop and laboratory-test a better methodology for assessing moisture in-situ brick walls.

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Working with the Industrial Partner:
Test and refine the proposed assessment methodology on real brick buildings.

Working with the HEI, with input from the Heritage and Industrial Partners:
Explore whether current predictive modelling tools can be improved by using the knowledge gained, especially the identification of key parameters.

Depending on the results and timescale, it may also be possible to work with the three Partners to undertake some small-scale experiments to investigate whether there are moisture levels for brick masonry at which interventions would need be undertaken to avert failure, and what these interventions might entail.

Academic entry criteria

The successful candidate will have a good first degree in a relevant discipline such as engineering, science, physics, material science, conservation or heritage science.

This project is part of the EPSRC Centre for Doctoral Training in Science and Engineering in Arts, Heritage and Archaeology at University College London, University of Oxford and University of Brighton (www.seaha-cdt.ac.uk). As a SEAHA student, you will have unparalleled access to research infrastructure and expertise across three universities and more than 50 heritage, research and industrial partners. In addition to the university doctoral training requirements, SEAHA students take part in an exciting range of cohort activities, ranging from residential events and group projects, to conferences and careers events. Please visit the SEAHA website (www.seaha-cdt.ac.uk) for details.

The SEAHA Studentship will cover home fees and an enhanced stipend of up to £17,690 per year (to be confirmed at point of offer) for eligible applicants (http://www.seaha-cdt.ac.uk/opportunities/eligibility-criteria/), and a substantial budget for research, travel, and cohort activities.

To apply, submit your online application to study on the MRes Science and Engineering in Arts, Heritage and Archaeology, via http://www.ucl.ac.uk/prospective-students/graduate/taught/degrees/science-engineering-arts-heritage-archaeology-mres

In addition, your application should include:

- A covering letter clearly stating:
    - Your motivation and how the course will contribute to your career development
    - Your residency status and eligibility for funding according to the information provided http://www.seaha-cdt.ac.uk/opportunities/eligibility-criteria/, or how you intend to sponsor your studies if not eligible for funding
    - Your academic eligibility
- Names of two academic referees (or one academic and one professional if applicable)
- Proof of meeting the UCL English language proficiency requirements where necessary. For SEAHA candidates, an advanced level certificate is normally required (details of English language proficiency requirements can be found at http://www.ucl.ac.uk/prospective-students/graduate/apply/english-language/index)

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The applications should be sent by email to the SEAHA Manager (manager@seaha-cdt.ac.uk) but you are encouraged to contact the project supervisor Dr Hector Altamirano Medina (h.altamirano-medina@ucl.ac.uk) before producing the application.

Application deadline: 2nd September 2016.

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