JOB TITLE: Research Associate
Modelling and measuring moisture risk in solid masonry walls
Job Ref: REQ171259

As part of the University's ongoing commitment to redeployment, please note that this vacancy may be withdrawn at any stage of the recruitment process if a suitable redeployee is identified.

About the School of Architecture Building and Civil Engineering
Research and teaching in the School of Architecture Building and Civil Engineering is driven by 63 academic staff, 34 technical and clerical support staff, 40 contract researchers and over 120 doctoral students. The School benefits by having academic staff from a wide variety of backgrounds, with a resulting rich diversity of perspectives.

In October 2017 the School will launch an architecture programme which will benefit from the technical capability of existing School staff and new design staff. The School will be renamed the School of Architecture, Building and Civil Engineering.

The undergraduate programmes include Civil Engineering, Construction Engineering Management, Commercial Management and Quantity Surveying, Architectural Engineering and Design Management, Air Transport Management, and Transport and Business Management.

At MRes level we train the next generation of multi-disciplinary researchers in energy demand. At MSc level, we offer programmes in Low Energy Building Services Engineering and Low Carbon Building Design as well as in Water and Waste Engineering, Construction Management, Transport Policy and Business Management. These programmes are all accredited by the Professional Institutions. The EPSRC Centre for Doctoral Training in Energy Demand will support over 50 PhD students.

In all courses the academic content is directly aligned to the needs of the industry and there is a high level of sponsorship in our portfolio of programmes. Our record of graduate employment is second to none and we have been ranked 1st or 2nd in the National Student Survey for the last 6 years.

Further information may be found from - http://www.lboro.ac.uk/departments/abce/

In the 2014 Research Excellence Framework, the School was ranked fifth in the Architecture and Built Environment Unit of Assessment with 87% of the work judged as either "world leading" or "internationally excellent". Importantly, this was achieved whilst still returning 100% of staff; world class research pervades the School. The research environment was ranked first overall; Loughborough is the best place in which to build a career in energy research.

The international standing of our research is exemplified by our growing portfolio of collaborations with other leading universities and research institutes worldwide. These include: the UNSW Sydney, University of California at Berkeley, MIT, Chongqing, Hong Kong, Iowa State, Oklahoma State, RMIT, Georgia State and Penn State.

We are equally proud of our collaborations with industry where we count organisations such as Willmott Dixon, Electricite de France, The BRE, Honeywell, Anglia Water and Biffa. Built Environment research is increasingly informing government policy through, for example, the Department for Business, Energy and Industrial Strategy and The Committee on Climate Change.

For more on our research go to: http://www.lboro.ac.uk/departments/abce/research/

Built Environment Research: Lead the Way
Built Environment research is one of Loughborough University's strengths, with world leading activity in a number of areas: building energy demand; indoor environments; and urban infrastructure. The activity is supported strategically and financially through the Built Environment Beacon, which is led by Prof Kevin Lomas. This core

area of endeavour is pursued through research that spans from the fundamental to the highly applied and is conducted, as appropriate, through collaboration between academics from science, engineering, the social sciences and economics.

The Building Energy Research Group

Energy research in the School has, for over 40 years, been led by the Building and Energy Research Group (BERG) which focusses in areas such as building energy efficiency, the impact of occupants on energy demand, energy systems integration, air quality, energy modelling at the urban and building scale, performance monitoring, and the impacts of climate change.

New staff will join a research active, expanding, collegiate group, which is supported by an excellent research environment, and which has a strong and growing international reputation. The BERG has expanded rapidly over recent years and now has 12 academic staff and 10 Research Associates (RAs) who, together with others, supervise around 40 PhD students. The Group has excellent Test Houses and laboratory facilities, including the Hygrothermal Test Facility: a pair of climate chambers that sandwich a full-scale wall construction to replicate indoor and outdoor environment with full control of air temperature, relative humidity, air velocity and pressure difference.

Methods and Metrics for Moisture Risk Assessment - Solid Wall Insulation (MRA-SWI)

If the significant numbers of dwellings with solid masonry walls (SMWs) are to be insulated, there will have to be a paradigm shift in the way that moisture risk is assessed. Methods must be developed to clearly demonstrate that insulation solutions are effective, robust and resilient to moisture even when considering the vagaries of our future climate and the way that people choose to live in their homes. This research will result in new methods and metrics, backed by rigorous scientific evidence, that enable moisture risk assessment of SMWs to be carried out routinely, new insulation materials to be developed and more homes to be insulated.

Insulating the UKs existing housing stock will be an essential step in achieving greenhouse gas reduction targets and alleviating fuel poverty. The highest levels of heat loss occur in the c30% (8 million) homes that have SMWs. Insulating these walls offers significant potential for fuel savings but may cause moisture problems. Water accumulates within SMWs when it is raining outside or humid inside and diminishes with drier conditions. This water can pass from one face of the wall to the other as there is no cavity to act as a capillary break. Applying insulation to either the inside or outside face of the wall changes the temperature of the masonry, the rate of wetting and drying at each face and the locations where water vapour might condense and accumulate. This moisture can lead to mould growth, interstitial condensation and freeze thaw damage. These problems can cause severe damage, are expensive to repair and can affect the health of occupants.

Current guidance in the UK Building Regulations (approved document C) and related standards is not adequate for assessing moisture risk when insulating SMWs. The simplified steady-state vapour diffusion model is not appropriate because dynamic liquid moisture conduction is the dominant moisture transport mechanism when SMWs are exposed to rainfall. There is a distinct lack of guidance on how to use more advanced transient heat and moisture simulation software, what inputs should be used for the boundary conditions and how the results translate into moisture risk. Straightforward design principles, based on many years of practical experience and research, have led to contradictory advice e.g. there is no clear consensus on how permeable the insulation material should be to water vapour. Thus only a small handful of hygrothermal experts might ever attempt a quantitative risk assessment for insulating SMWs and fewer SMWs are being insulated as a result.

This research project will address these problems. Firstly, a framework will be developed for using advanced heat and moisture simulation software to carry out moisture risk assessment. This will include guidance on the boundary conditions to be used at the inside of the wall, and outside especially for wind driven rain exposure. It will also identify appropriate criteria to minimise risk from moisture accumulation within the wall, mould growth at the indoor surface and freeze/thaw at the outside surface. A number of insulation materials will be compared to understand which can best reduce the risk of moisture damage when insulating SMWs. Secondly, probabilistic modelling methods will be used to understand how robust different insulation solutions are to moisture damage given that there is considerable uncertainty in boundary conditions and material properties. Thirdly, new approaches to moisture risk assessment will be explored. A ‘moisture safety factor’ might describe how resilient an insulated SMW is to extreme events such as flooding. It may be possible to develop a completely new laboratory test for assessing insulation solutions. The underlying strength of this research comes from the collection high quality primary data, in the new state-of-the-art Hygrothermal Test Facility, for validating the results from the models.

Job Description: Modelling and measuring moisture risk in solid masonry walls

Job Grade: Specialist and Supporting Academic Grade 6

Job Purpose

The Research Associate will be responsible for developing and testing a framework for modelling the risk of moisture damage to solid masonry walls, with and without solid wall insulation. They will also devise and run experiments using the instrumented wall specimens in the Hygrothermal Test Facility in order to verify the modelled results.

Job Duties

Research

- To assist with developing and testing new methods and new metrics for moisture risk assessment in solid masonry walls.
- To determine appropriate boundary conditions for modelling solid masonry walls in the UK climate.
- To define pass/fail criteria for the risks of mould growth, interstitial condensation and freeze/thaw damage.
- To run deterministic and probabilistic simulations of the hygrothermal behaviour of solid masonry walls with and without insulation.
- To carry out measurements in the Hygrothermal Test Facility in order to calibrate the hygrothermal models.
- To use the calibrated models to carry out sensitivity and uncertainty analysis of the hygrothermal risk.
- To explore the possibility of new laboratory test methods to measure moisture risk.

General, technical

- To formulate detailed work plans based on broad guidance from Dr Allinson.
- To maintain a sound and up to date knowledge of research methods relevant to the post.
- To feed back to Dr Allinson on progress, to make recommendations for next steps and to prepare project reports.
- To maintain and enhance relationships with project partners, and to establish new relationships with UK and overseas collaborators.
- To write research papers suitable for publication in high quality academic Journals.
- To attend and present work at meetings and contribute papers and presentations to scientific conferences.
- To package all data sets and models in a form suitable for open-access sharing.
- To contribute to project promotion and public engagement events.
- To ensure health and safety requirements are met for all activities.

Teaching

- To assist the academic staff at Loughborough with the supervision of undergraduate, MSc and PhD project work and day-today supervision and support of other researchers.
- Where appropriate, to deliver lectures, tutorials and laboratory sessions to students.

General and administrative

- To work effectively with relevant administrative, technical and academic staff in the School and across the University.
- To represent the project and the University at UK and overseas events.
- To engage in training programmes in the University (e.g. through Staff Development) which are consistent with your needs and aspirations and those of the project team and the host School.
- To carry out specific other duties as may be reasonably requested by the project leaders and that are commensurate with the nature and grade of the post.

Points to Note

The purpose of this job description is to indicate the general level of duties and responsibility of the post. The detailed duties may vary from time to time without changing the general character or level of responsibility entailed.

Special Conditions

All staff have a statutory responsibility to take reasonable care of themselves, others and the environment and to prevent harm by their acts or omissions. All staff are therefore required to adhere to the University's Health, Safety and Environmental Policy & Procedures.

All staff should hold a duty and commitment to observing the University's Equality & Diversity policy and procedures at all times. Duties must be carried out in accordance with relevant Equality & Diversity legislation and University policies/procedures.

Successful completion of probation will be dependent on attendance at the University's mandatory courses which include Respecting Diversity and, where appropriate, Recruitment and Selection.

Organisational Responsibility

Reports to: Dr David Allinson

Person Specification

Your application will be reviewed with respect to meeting the essential and desirable criteria listed below. Your application will be reviewed against the essential and desirable criteria listed below. Applicants are strongly advised to explicitly state and evidence how they meet each of the essential (and desirable) criteria in their application. Stages of assessment are as follows:

1 – Application
2 – Test/Assessment Centre/Presentation
3 – Interview

Essential Criteria

Area	Criteria	Stage
Experience	Background in engineering, science or mathematics.	1
	Research work in modelling buildings.	1,2,3
	Production of academic papers, technical reports and / or guidance materials on engineering or science topics.	1
Skills and abilities	Excellent building modelling skills.	1,2,3
	Knowledge of boundary conditions for inside and outside of houses.	3
	Excellent written and oral communication skills.	1,2,3
	Self-motivated with ability to meet deadlines.	3
	Ability to work independently and as part of a team.	3
	Excellent interpersonal and organisational skills.	2,3
Training	Willingness to undertake appropriate further training and to adopt new procedures as and when required.	1
Qualifications	A good educational profile up to and including first degree.	1
	A PhD and/or postgraduate research experience in a relevant field or equivalent industry expertise.	1
Other	Commitment to observing the University's Equal Opportunities policy at all times.	1
	Willingness to travel within the UK.	3

Desirable Criteria

Area	Criteria	Stage
Experience	Hygrothermal modelling of buildings.	1,2,3
	Relevant experimental work and data analysis.	1,2,3
	Validation or verification of the results from models.	1,2,3
	Authoring original work for academic journal papers.	1,3
	Teaching and / or supervision of students in relevant areas.	1
	Securing research and / or project funds from external / company sources.	1
Skills and abilities	Setting up and running experiments.	1,2,3
	Probabilistic modelling techniques.	1,2,3
	Use of High Performance Computing.	1,2,3

Conditions of Service

The position is full-time and fixed term until 31 March 2019 with an anticipated start date of 1 April 2018. Salary will be within Specialist and Supporting Academic Grade 6, £29,799 to £32,548 per annum, at a starting salary to be confirmed on offer of appointment. Subject to annual pay award.

The appointment will be subject to the University's normal Terms and Conditions of Employment for Academic and Related staff details of which can be found here.

The University is committed to enabling staff to maintain a healthy work-home balance and has a number of family-friendly policies which are available at http://www.lboro.ac.uk/services/hr/a-z/family-leave-policy-and-procedure---page.html.

We also offer an on-campus nursery with subsidised places, subsidised places at local holiday clubs and a childcare voucher scheme (further details are available at: http://www.lboro.ac.uk/services/hr/a-z/childcare-information---page.html

In addition, the University is supportive, wherever possible, of flexible working arrangements.
We also strive to create a culture that supports equality and celebrates diversity throughout the campus. The University holds a Bronze Athena SWAN award which recognises the importance of support for women at all stages of their academic career. For further information on Athena SWAN see http://www.lboro.ac.uk/services/hr/athena-swan/

Informal Enquiries

Informal enquiries should be made to Dr David Allinson, Senior Lecturer in Building Physics: Measurement and Modelling, by email at D.Allinson@lboro.ac.uk or by telephone on (01509) 223643.

Applications

The closing date for receipt of applications is **20 February 2018.**