Dr Paul Jaquin, MEng PhD

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Full, clean UK driving licence

I work for Integral Engineering Design in Bath as a Structural Engineer. Prior to this I worked for Ramboll in Stockholm, Bristol and Edinburgh. Before joining Ramboll I completed a PhD at Durham University studying historic rammed earth structures.

I received a 2.1 in Civil Engineering at Durham University, and was a recipient of the ICE QUEST scholarship and sponsored by Whitbybird. I have continued to work in the field of earth structures and am an expert member of ISCEAH, providing advice to UNESCO on earth buildings and a director of Earth Building UK. In 2009 I was a visiting research fellow at University of Bath and am a member of a research group at UWA in Perth, Australia. My book *Earth Building: History, Science and Conservation* was published in January 2012

Experience

Structural Engineer Integral Engineering Design **November 2011 – present**

I am working on a number of projects with Integral, including Bristol Zoo Gorilla House, a 1970s office refurbishment in Southampton and a demolition and reconstruction of a cinema in central London. I am working in steel, concrete, timber and masonry.

Design Engineer Ramboll (Whitbybird) **2008 – present**

I gained experience in structural and civil design with Ramboll. This has included analysis and design in steel, concrete and masonry to British Standards, Swedish design codes and Eurocodes. I have prepared drawings, specifications and contract documents. I liaise with architects, contractors and clients and have experience putting projects through planning and building warrant applications. I have prepared desktop studies and scoped and interpreted site investigation work. I have carried out structural dilapidation surveys on properties in Edinburgh and Glasgow. I have scoped and provided information to clients about the use of rammed earth and unfired clay bricks in projects.

I am skilled in a number of structural analysis software packages such as TEDDS, Fastrak Building Designer, SFrame and Strand 7 and geotechnical and civil analysis programs PLAXIS, PDS and Autotrack. I am a confident user of both AutoCAD and Bentley Microstation.

New Karolinska Hospital, Stockholm *Structural Design* £1.45billion	Seconded to Ramboll Sweden, working in the Stockholm office for 6 months. The largest PFI project in Sweden. I designed concrete foundations and structural elements to Swedish design codes. Coordination with M&E engineers, liaison with other offices involved in the project.
Eco Earthship, Kinross *Structural Design* *£3k*	Owner-builder sustainable cottages on a farm in Kinross. Rammed earth and tyre bale walls, timber frame and green roof. I was approached by the client and undertook all the design and detailing for the project.
Alexandra and Rochsolloch Primary School, Airdrie *Civil and Structural design* £14million	A single storey steel framed joint campus school outside Glasgow. The site has complex geology and topography and required a large cut and fill exercise and a number of retaining walls. I undertook the civil and structural analysis and design for the project.

Independent consultancy

I have consulted for a number of organisations who are interesting in the use of earth in their projects. These include: Intentional Engineering, Beijing Cultural Heritage Organisation, The Royal Government of Bhutan, Smart Shelter Foundation and Ramtec, Australia's premier rammed earth contractors. I maintain a website (www.historicrammedearth.co.uk) and regularly answer queries by email.

Research

Although working in industry, I try to keep involved in research relating to earth building. I am a reviewer for Construction and Building Materials, The Structural Engineer, Taylor and Francis and for conferences Terra 2012 and TerrAsia2011 and International Symposium on Innovation & Sustainability of Structures in Civil Engineering. I co-authored a successful $AU 450k (£300k) research application with UWA, looking at using rammed earth for Aboriginal Houses in Western Australia.

Rammed earth research group - University of Western Australia **October 2009 - Present**

I am a member of the rammed earth research group at UWA. This group comprises consulting and contracting engineers, academics and students involved in rammed earth research. The group meets regularly via video conference, and I visited Perth in May 2010.

Sir Edmund Happold Visiting Research Fellow - University of Bath **August – September 2009**

During August and September 2009 I spent 6 weeks at the University of Bath, undertaking further research into earthen buildings. I conducted research into the movement of water within earth buildings and instigated an undergraduate research project at Bristol University into the seismic behaviour of mud brick structures.

PhD Analysis of historic rammed earth construction - Durham University **2004 - 2007**

Rammed earth is a building technique common in many parts of the world. It involves constructing walls by compacting moist soil between removable formwork. The soil then dries to form a massive monolithic wall. I have visited and investigated historic structures in order to study failure mechanisms and to develop repair techniques. I performed a series of laboratory experiments and took the novel approach of treating these earth structures as highly unsaturated soil. My expertise lies in the unsaturated soil mechanics field of geotechnical engineering, but I have applied this to buildings rather than to more traditional geotechnical structures.

Education

MEng Civil Engineering - 2.1 Durham University **2000 – 2004**

Ermysted's Grammar School Skipton **1993-2000**

A Level Physics, Geography and General Studies grade A, Mathematics grade B. **GCSE** 4 A* and 6 A

Positions held and responsibilities

Director of Earth Building UK. I am a founding director of this organisation.

Expert member of ICOMOS International Scientific Committee on Earthen Architectural Heritage
This scientific committee provides guidance to UNESCO on the conservation of historic sites, carries out scientific study and promotes the sharing of information on the preservation of the world's cultural heritage. I am currently heading the effort to preserve the historic old centre of Kashgar in Western China.

Reviewer and expert member of Engineers without Borders (EWB)
EWB is a charity which provides opportunities for young engineers to make a difference around the world. I review potential student placement projects, and student applications for these placements. I also provide training courses on mud brick construction for students and professionals to learn fundamentals before going into the field.

Teaching

I am currently supervising Masters students at the University of Western Australia and have informally mentored around 17 MEng and MSc students following completion of my PhD to allow further development of research in this field. I provide courses on earth building to Engineers without Borders and other organisations. During my PhD I was a demonstrator in the civil engineering laboratory, teaching undergraduates fundamentals of engineering such as concrete design, mechanics of solids and soil mechanics.

Languages

Intermediate German, basic French, Spanish, Arabic, Russian and Swedish.

Interests and activities

I am a keen runner and I have run seven full marathons and two half marathons. I also compete in triathlons and mountain marathon events. I enjoy being outdoors and am a keen mountain biker and climber. I recently skied the Jostendals glacier in Norway and have climbed Stok Kangri in the Indian Himalayas (6121m). I have mountain biked the Tour du Mont Blanc and the Annapurna Circuit. In spring 2008 I was part of a team rebuilding a castle in Morocco and have become skilled earth plasterer. I was a Scout leader for 5th Skipton Scouts for a number of years and have organised and run a large number of Scouting activities.

Publications

PhD Thesis

Jaquin, P. A. **Analysis of historic rammed earth construction**. Durham University, 2008

Books and book chapters

Jaquin, P.A. and Augarde, C.E. **Earth Building: History, Science and Conservation**. BRE Press. 2012

Jaquin, P. A. **A history of Earth Building**, in Hall, M., Krayenhoff, M. Lindsay, R (eds) Modern earth buildings: Materials, engineering, construction and applications. Woodhead 2012 (forthcoming)

Refereed Journal

Heath, A Walker, P Jaquin, P and Lawrence, M. **Render induced cracking of earth masonry.** Structures and Buildings. Accepted

Jaquin, P.A, Augarde, C.E, 2009 **The strength of rammed earth materials**, Geotechnique. Volume 59, Issue 5.

Jaquin, PA, Augarde, CE, Gerrard, CM**,** 2008 **Rammed earth construction techniques in Spain**, International Journal of Architectural Heritage. Volume 2 Issue 4.

Jaquin, P. A. 2008 **Study of historic rammed earth structures in Spain and India**. *The Structural Engineer*. Volume 86 Issue 2. January 2008. Winner of IStructE Rowen Travel Award 2006.

Conference Proceedings

Jaquin, P. A., **Overview of Earth Building in Europe.** *International Symposium on Innovation & Sustainability of Structures in Civil Engineering. Xiamen, China*. 28-30 October, 2011.

Jaquin, P. A., Cianco, D. **Use of Rammed Earth in Aboriginal Remote Communities of Western Australia: a Case Study on Sustainability and Thermal Properties.** *International Symposium on Innovation & Sustainability of Structures in Civil Engineering. Xiamen, China*. 28-30 October, 2011.

Jaquin, P. A., **A History of Rammed Earth in Asia.** *International Symposium on Innovation & Sustainability of Structures in Civil Engineering. Xiamen, China*. 28-30 October, 2011.

Jaquin, P. A., Cianco, D. **An overview of some current recommendations on the suitability of soils for rammed earth***. International Symposium on Innovation & Sustainability of Structures in Civil Engineering. Xiamen, China*. 28-30 October, 2011.

Jaquin, P. A., **Rammed Earth Design Guidelines: Safely Preserving the Cultural Heritage of Bhutan***. International Conference on Disaster Management and Cultural Heritage. Thimpu, Bhutan.* 12-14 December 2010.

Jaquin, P.A., Gerrard, C.M., Augarde, C.E. and Canivell, J. **Damage in Historic Rammed earth structures: A case study at Ambel, Zaragoza, Spain**. *SIACOT IX. Coimbra, Portugal*. 20-23 February 2010

Canivell, J., Jaquin, P.A., Augarde, C.E. and Gerrard, C.M. **Sistemas de Reparacion en Fabricas Historicas de Tapial**. *SIACOT IX. Coimbra, Portugal*. 20-23 February 2010.

Jaquin, P.A. **Humidity regulation in earth buildings**. *Ramboll Technical Forum. London.* November 2009.

Jaquin, P. A. 2009. **How mud bricks work – using unsaturated soil mechanics principles to explain the material properties of earth buildings.** *Engineers without Borders UK research conference. The Royal Academy of Engineering.* 20th February 2009

Jaquin, P. A. 2008. **Development and spread of the rammed earth technique***. Lehm 2008, 5th International Conference on earthen architecture*, Koblenz. 9-12 October

Jaquin, P. A. 2008 **Unsaturated characteristics of rammed earth**. *Proceedings of the 1st European*

Conference on Unsaturated Soils. Durham. 2-4 July

Jaquin, P.A. Augarde, CE, Gerrard, CM, 2007 **Rammed earth construction techniques in Spain**, *International Symposium on Earthen Structures*, Bangalore. 22-24 August

Jaquin, P.A. Augarde, CE, Gerrard, CM, 2006 **Analysis of Rammed Earth**, *Structural Analysis of Historical Constructions*, New Delhi. 6-8 November

Jaquin, P.A. 2006 **Analysis of Historic Rammed Earth Construction**. *9th Young Geotechnical Engineers Symposium*, Belfast, September

Jaquin, PA, Augarde, CE, Gerrard, CM, 2004 **Analysis of Rammed Earth structures for modern use and conservation**, International Seminar, Structural Analysis of Historical Constructions, Padua.

Posters

Jaquin, P. A. **Development and spread of the rammed earth technique**. *Lehm 2008*, Koblenz, Germany, October 2008

Jaquin, P. A. **Analysis of Historic Rammed Earth Structures** *Presentations by Britain's Top Younger Scientists and Engineers*, Houses of Parliament, London, October 2006

Jaquin, P. A. **Historic Rammed Earth Construction** *Institution of Structural Engineers Young Researchers Conference*, London, September 2006. Gained second prize in the poster competition.

Popular Press

Link found between sand castles and rammed earth structures. *New Civil Engineer*. 3 June 2009

Sandcastles hold key to Great Wall of China building technique. *Daily Telegraph*. 3 June 2009

Sandcastles share secret of green construction. *Building magazine*. 3 June 2009

Sandcastle study for eco-building. *BBC News online*. 3 June 2009

'Sandcastle' key to green future. *The Scotsman*. 4 June 2009

Durham University scientists examine sandcastles. *The Northern Echo*. 4 June 2009

Rammed earth floors. *Green Building Magazine*, 17 (3) Green Building Press.

Introduction to Rock Climbing. *Living North magazine*, February 2010.

Photographs and diagrams

Checkerboard Films. Film on architect Rick Joy. December 2009

Corriere della sera. Italian magazine. July 2009.

Grains de bâtisseurs, a 5 year exhibition at Cité des sciences et de l'industrie, Paris. Interpretive panels and accompanying book. March 2009

Schmap.com interactive maps and guides. May 2008

Green Building for Dummies. Wiley. 2007 Used a diagram from my website without permission. Threatened to sue and was paid royalties.

Two historic rammed earth building photographs in *The Rammed Earth House***,** Easton, D. Chelsea Green Publishing Company. August 2007

History and development of the rammed earth technique, Interpretive panels at Desert Living Centre, Las Vegas. For Aldrich Pears. August 2007

Ancient Wisdom for the Contemporary Architect, Interpretive panels at Turtle Bay Exploration Park, Redding, California

World Heritage magazine, published by UNESCO. Feature on earthen architecture. January 2008

Abenteuer und Reisen German Travel Magazine, September 2007

Tunza magazine, published by UN Environment Program. July 2007

Presentations

How earth buildings regulate relative humidity. November 2009. *Ramboll Technical Forum*. London.

Rammed earth for engineers. 15 September 2009. *Internal Ramboll Presentation*. Bristol

The science of sandcastles. September 2009. *Orkney Science Festival.* Kirkwall

How to make mud bricks. February 2009. *Engineers without Borders Construction in Development course*. Imperial College, London.

The earth building industry around the world. January 2009. Earth *Building UK inaugural meeting*. University of Bath

Rammed earth. 6 August 2008. *Ramboll Whitbybird Technical Highlight*. London

Rammed earth. 28 July 2008. *Ramboll Whitbybird Lunchtime seminar* . Edinburgh

Unsaturated characteristics of rammed earth 4 July 2008. *1st European Conference on Unsaturated Soils.* University of Durham

School of Engineering Research Day 25 June 2007. *Soil Mechanics group presentation* University of Durham. Winner of the poster competition.

Rammed earth. 13 September 2007*. Eden Valley Green week.* Tully House, Carlisle.

Modelling rammed earth using soil mechanics principles. 23 November 2006 Advanced Mechanics Research Group seminar series, University of Durham

Analysis of Historic Rammed earth 9 November 2006 *Structural Analysis of Historic Constructions 2006* Indian Institute of Technology, Bangalore

Analysis of Historic Rammed Earth 26 June 2006 *School of Engineering Research Day*. University of Durham. Second prize poster competition

Historic Rammed Earth structures in Spain 02 May 2006 *Archaeology Department seminar series.* University of Durham

Rammed earth structures 05 April 2006 *ICE Graduates and Students Papers competition*. Newcastle. Second prize.

Analysis of Historic Rammed Earth 14 March 2006 *IStructE Young Researchers Conference*. London

Analysis of Historic Rammed Earth 13 March 2006 *House of Commons Presentations by Top UK Younger Scientists and Engineers*. London

Analysis of Rammed Earth structures for modern use and conservation 11 November 2004 *Structural Analysis of Historic Construction 2004* University of Padova.