



Future Proof the Past?

IAN STANDEN



Permeable Insulation & Power

STRIDE TREGLOWN LIMITED

SPECIFIC / TATA STEEL / SWANSEA UNIVERSITY

CARDIFF METROPOLITAN UNIVERSITY

Why this proposal?

PIP Permeable Insulation and Power

- ▶ Sensitive thermal improvement of traditional buildings (often built pre 1919)
- ▶ Utilising 'breathable/permeable' lining to existing cold walls
- ▶ Combined with low powered electrical heating to improve energy performance and reduce building running costs



Key challenges fit for purpose

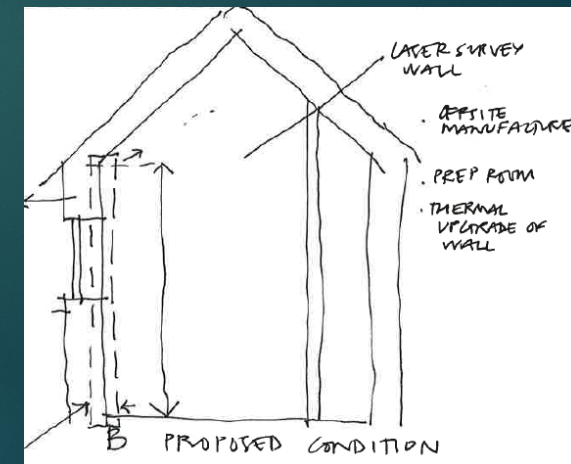
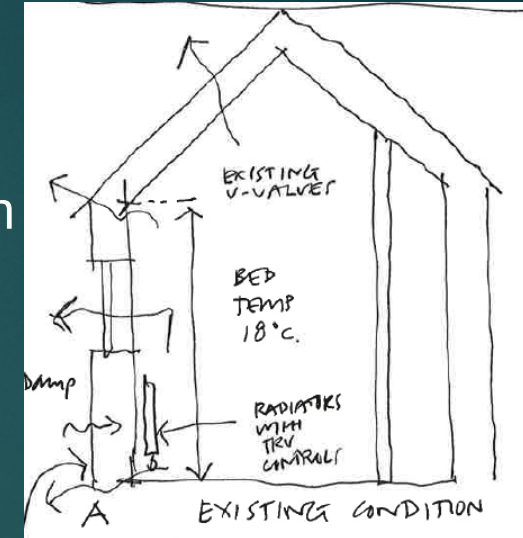
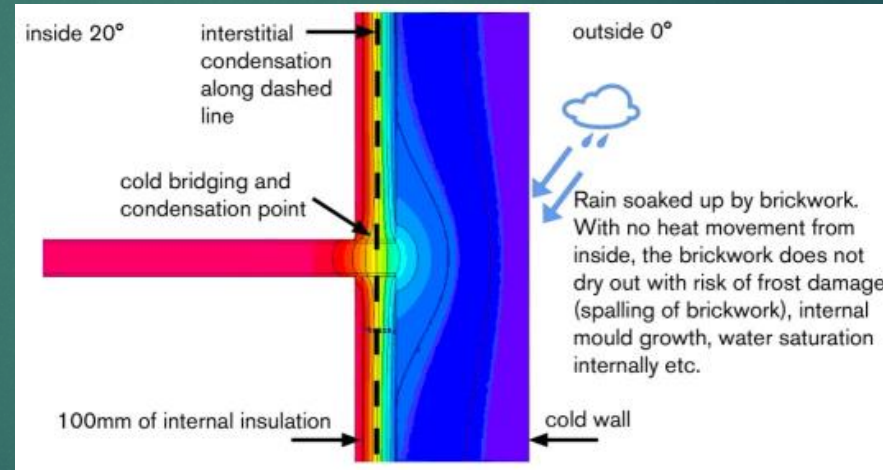
- ▶ Appropriate breathable wall lining that is available in the market to match performance criteria necessary with historic buildings
- ▶ Integration with low powered conductive panel LHCP innovative electrical technology



Key challenges - fit for purpose

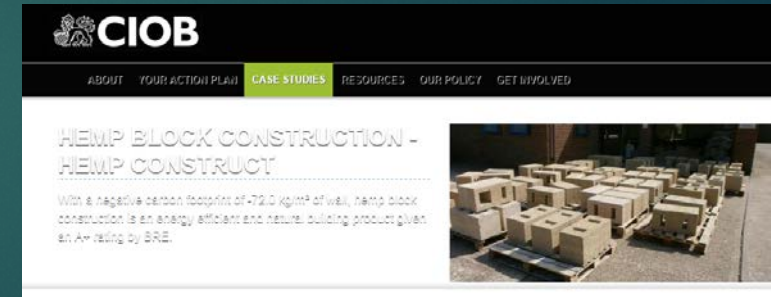
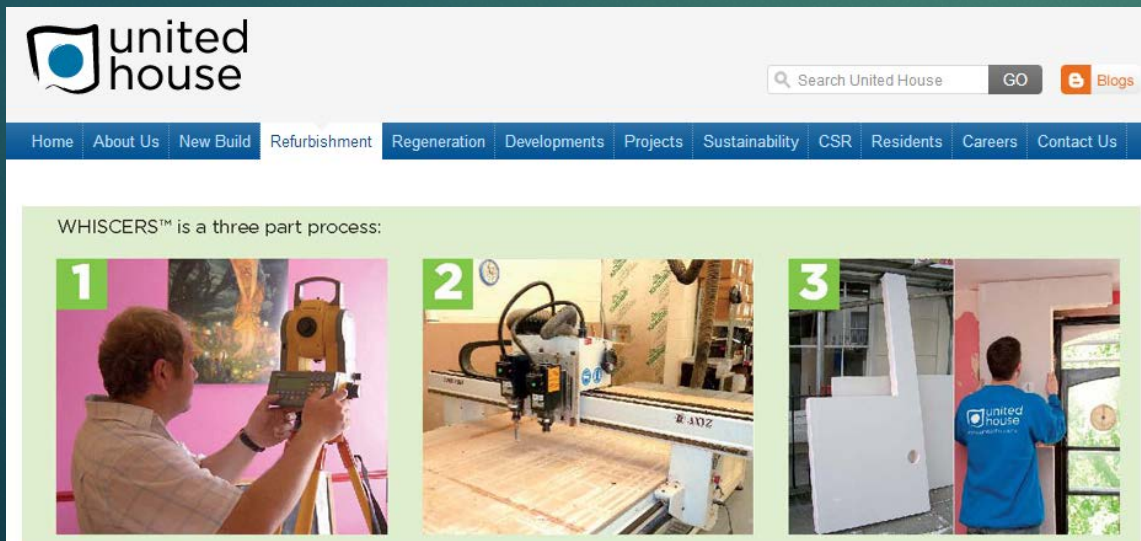
Understanding the building's anatomy and performance

- ▶ Building fabric condition survey –understand method of construction
- ▶ Existing energy use profile
- ▶ Thermographic survey
- ▶ Computer simulations (Wufi/Heat3/Therm)
(added value to client)
- ▶ Laser survey
- ▶ Air pressurisation testing



Key challenges visually sympathetic intervention

- ▶ Demonstrable scalability and appropriateness
- ▶ Thickness of panels – from 50mm upwards - precast offsite reduce waste
- ▶ Minimise disruption (“clean installation”) and space loss to rooms
- ▶ Survey, site preparation and careful consideration of panel interfaces

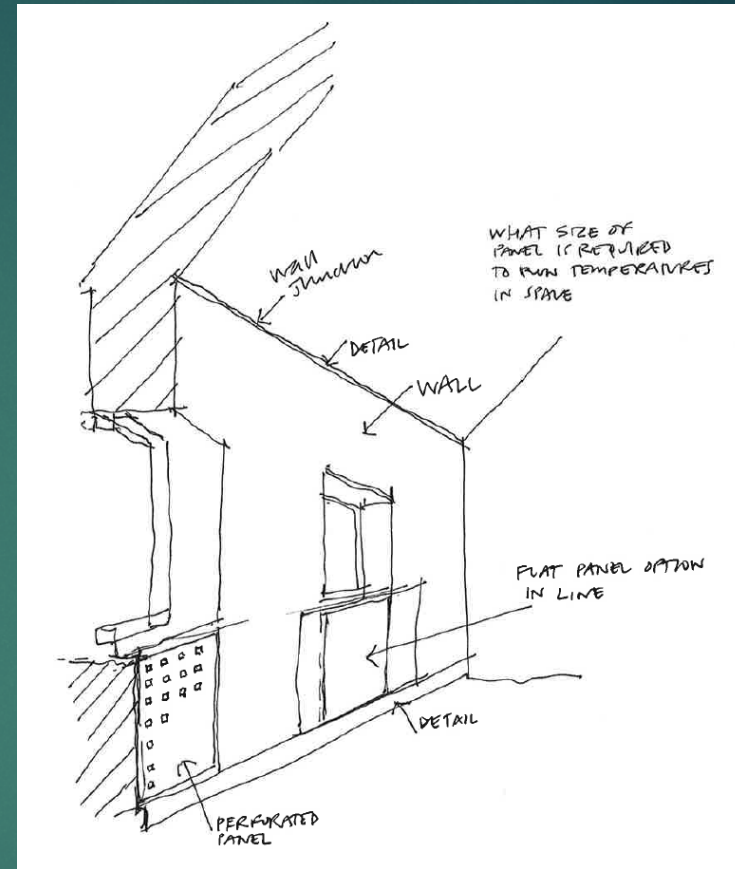


WHISCERS
Challenges similar to
internal wall insulation

Key challenges fit for purpose



- ▶ Thermal bridging
- ▶ Detailing at openings and reveals
- ▶ “Lecompte found that the U value of a 2m high masonry cavity wall construction increased from a calculated value of 0.35 to a value of 0.65 (a 93% increase) where a continuous 10mm gap was left between the insulation and the top, bottom and inner leaf of the wall. Even small gaps can be detrimental to performance – a 3mm continuous gap resulted in a 58% increase in U-value” ref in bid doc



Key challenges increased energy performance

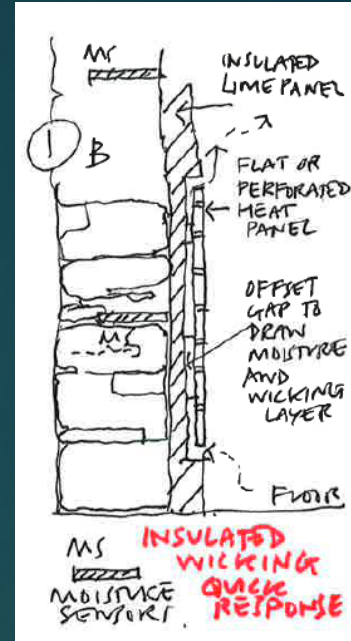
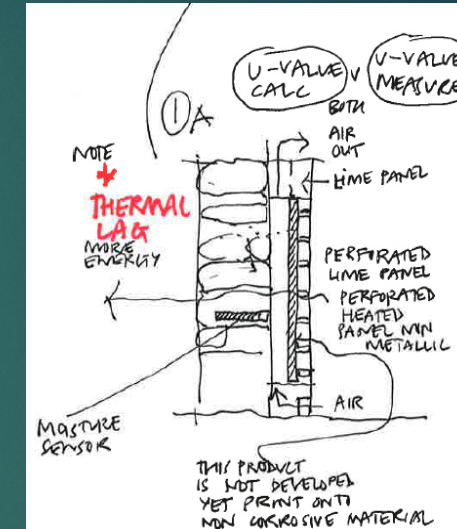
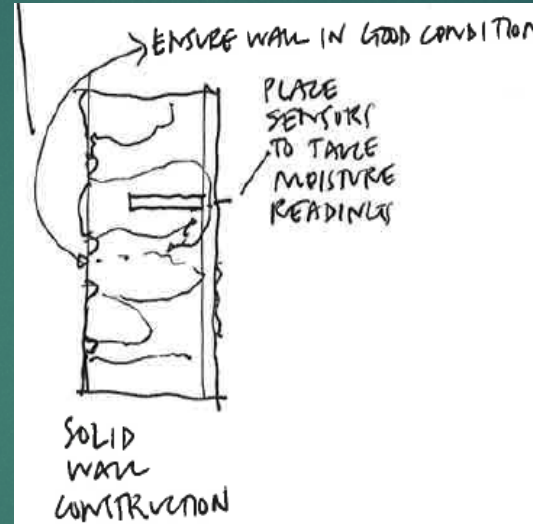
► Insitu solid wall U Values

THE SPAB RESEARCH REPORT 1.

U-VALUE REPORT

OCTOBER 2010.

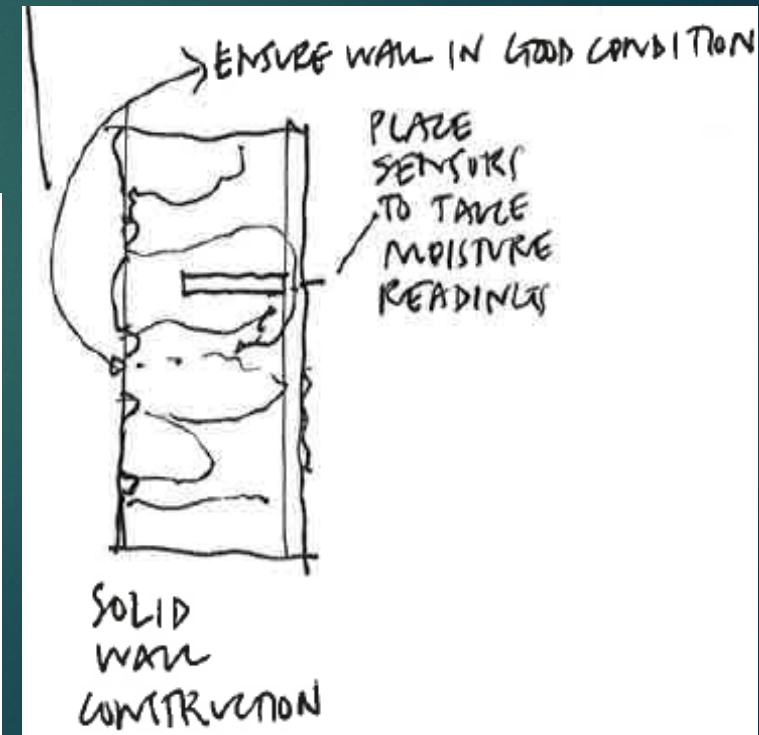
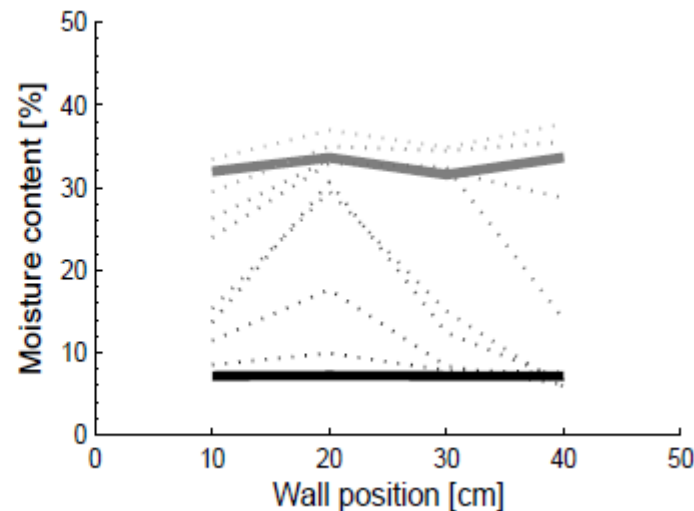
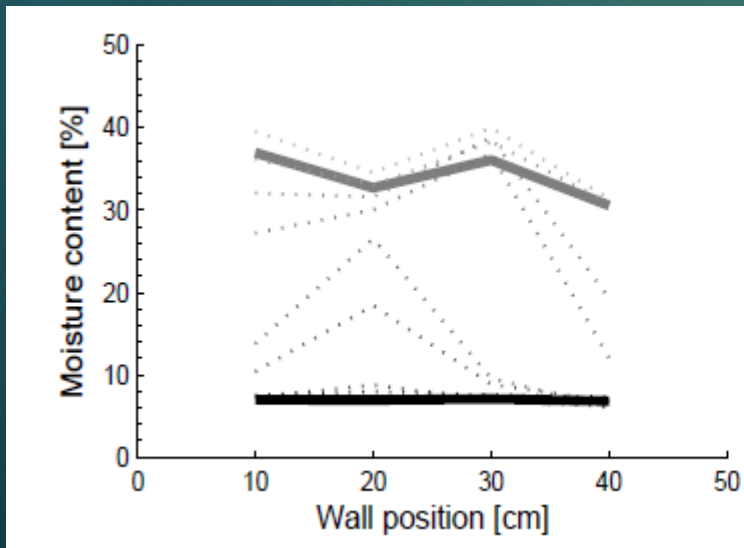
Dr Caroline Rye



8a	11 BELCOMBE PLACE Bradford on Avon Office - north wall	Stone	Lime plaster skim Limestone (ashlar)	5 170	175	2.01	3.01	0.800 1.100	BS/EN 12524 BS/EN 12524	Soft Limestone
9a	FARINGDON Oxfordshire Bedroom - south wall	Stone	Lime plaster Limestone (ashlar)	15 415	430	1.62	1.77	0.800 1.100	BS/EN 12524 BS/EN 12524	Soft Limestone
9b	FARINGDON Oxfordshire Bedroom - east wall	Stone	Lime plaster Limestone (rubble)	15 465	480	1.05	1.64	0.800 1.100	BS/EN 12524 BS/EN 12524	Soft Limestone

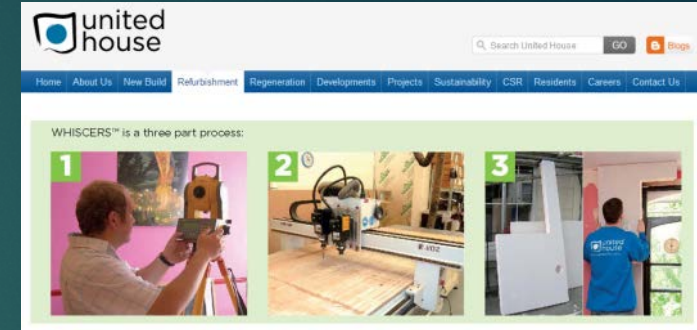
Increased energy performance of historic and traditional buildings

- ▶ Reduced reliance on grid based energy consumption
- ▶ Target enhanced insulation level to solid wall with 50mm lime panel
U value 0.6 –1.0
- ▶ Reduced infiltration by precision fit
- ▶ More regularised moisture levels



Key challenges additionality

- ▶ Streamline time intensive process via precision survey to manufacture
- ▶ Value Added – time, cost and minimising disruption
- ▶ Improved indoor air quality
- ▶ LHCP Heating panels advantages – can be retrofitted, modularised, thermostat controllable, quick to install, integrated cabling, can complement other systems, link to BMS potential, minimise impact on historic fabric, thin based low profile larger surface area, patented solution works well from DC source





AERIAL VIEW

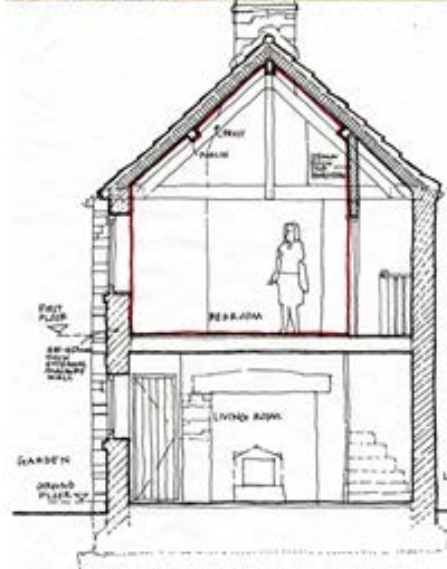


The experimental chamber will be set up within an existing 18th Century Cottage in Penallt, Monmouthshire utilising a first floor bedroom.

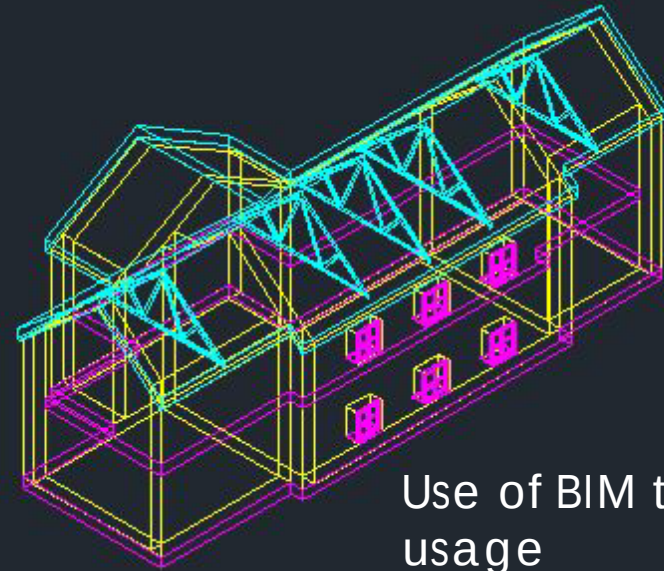
The building dates from the 1740's and was extended in the 1980's and in 2002 and has typical conditions of buildings constructed pre 1919. The original walls are in solid masonry construction and the extensions are formed in cavity wall construction with and without cavity insulation.

The study will focus on the original fabric of the historic property and the conditions resulting from solid wall construction.

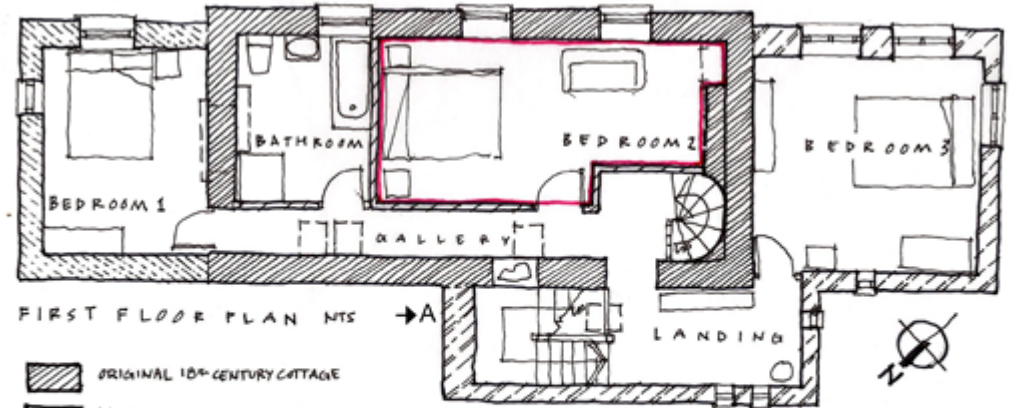
By close monitoring of the building utilising the proposed technology we hope to gain first hand knowledge as to how these conditions can be modified using the technology indicated in the proposal and the resulting energy use profile.



SECTION A-A



Use of BIM to assess energy usage



FIRST FLOOR PLAN NTS → A

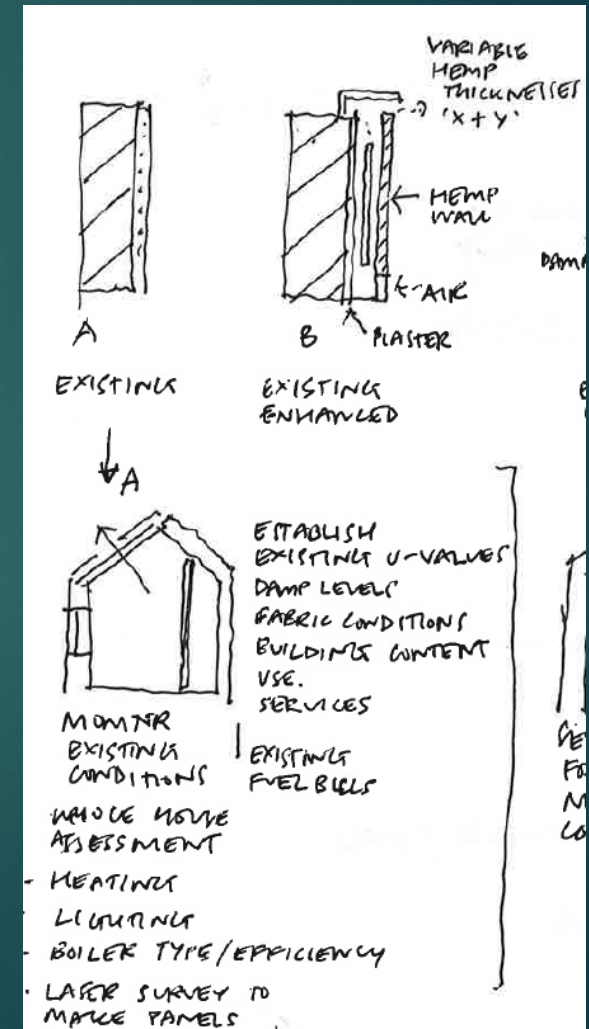
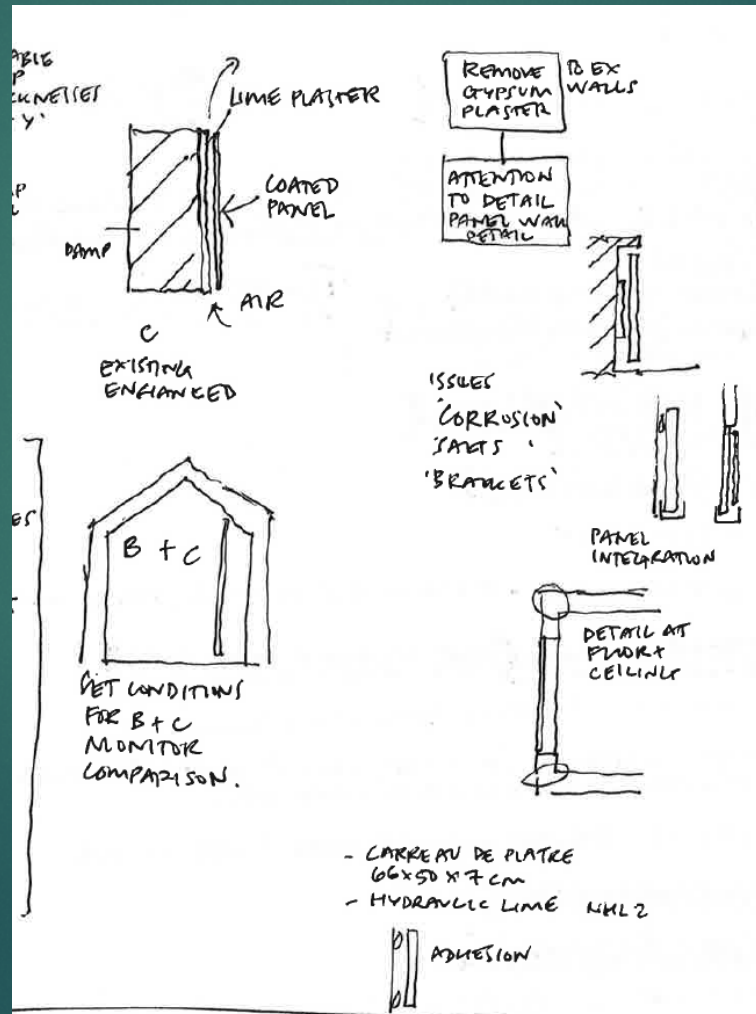
- ORIGINAL 18th CENTURY COTTAGE
- 1980's EXTENSION
- 2002 EXTENSION
- BEDROOM 2 ROOM CHosen FOR STUDY / EXPERIMENT

LANE END COTTAGE
MRS C FAREK

LANE END COTTAGE, PENALLT, MONMOUTHSHIRE.
18th Century Cottage - mass stone external wall

Project and risk management (wet trade walls vs factory panels)

- ▶ Production risks
- ▶ Commercial risks
- ▶ Environmental risks



Innovation - Material mix potential

► Fibre/lime/ pozzolan - aggregate

The main aim of the short experiments was to find a lime mix that has good workability and that can produce representative test samples. In addition, density, water-binder ratio and lime-hemp ratio were considered. The experiments helped determine how to produce the test samples for the moisture property experiments.

The materials used were as follows:

- Slaked lime ($\text{Ca}(\text{OH})_2$, Nordkalk SL LA)
- NHL5 (St Astier natural hydraulic lime)
- Fly ash (Emineral fly ash Type B4)
- Hemp (Grästorp, Sweden)
- Bentonite (Weber cement, Malmö, Sweden)
- Wet-slaked lime (Kalkmörtel)



Material Properties and Full-Scale Rain Exposure of Lime-Hemp Concrete Walls

Measurements and Simulations

Paulien de Bruijn

Faculty of Landscape Planning, Horticulture and Agricultural Science
Department of Rural Buildings and Animal Husbandry
Alnarp

Doctoral Thesis
Swedish University of Agricultural Sciences
Alnarp 2012

Innovation

1.1 Objectives

The main aim of this thesis was to investigate the possibilities of using exterior walls of LHC in a cold, wet climate, as well as to investigate possibilities to increase its load-bearing capacity. Specific objectives of the studies reported in Papers I-IV were to:

- Identify mechanical properties of different hemp concretes using both shiv and fibres in combination with various binders. (Paper I)
- Investigate whether compressive strength could be increased so that LHC can be used without a load-bearing structure. (Paper I)
- Identify moisture fixation and moisture transport properties of the material over the complete moisture range. (Paper II and III)
- Evaluate moisture fixation and moisture transport in a full-scale wall subjected to rain. (Paper IV)
- Investigate whether simulations performed using the above mentioned material data correspond with moisture levels measured in the full-scale wall. (Paper IV)
- Determine a suitable LHC mix in combination with a render system that is durable in a cold, wet climate. (Paper IV)



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Porous structure and water vapour sorption of hemp-based materials

Florence Collet *, Marjorie Bart, Laurent Serres, Jacques Miriel

*Laboratoire de Génie Civil et Génie Mécanique, Equipe Matériaux et Thermique de l'Habitat, IUT Génie Civil
BP 90422, 35704 Rennes Cedex 2, France*

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Moisture fixation and thermal properties of lime–hemp concrete

Paulien de Bruijn

Material Properties and Full-Scale Rain Exposure of Lime-Hemp Concrete Walls

Measurements and Simulations

Paulien de Bruijn

*Faculty of Landscape Planning, Horticulture and Agricultural Science
Department of Rural Buildings and Animal Husbandry
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Doctoral Thesis
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Demonstration / proof of concept

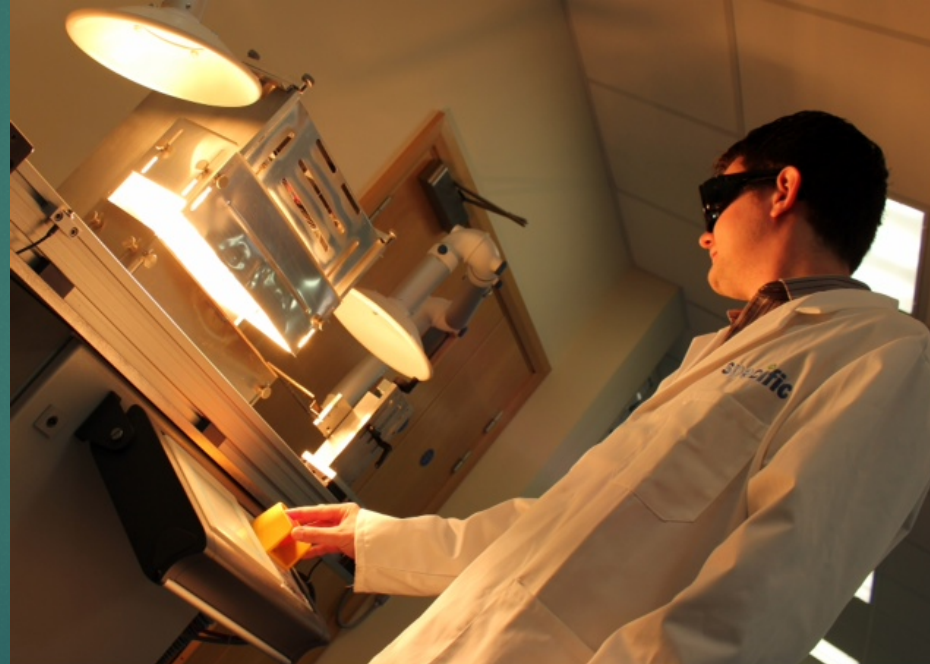
- ▶ SPECIFIC (Tata / Swansea University) model (LHCP Panels)
- ▶ Universities support for spinouts
- ▶ Licencing model (fibre/lime/pozzolan/aggregate)
- ▶ Utilising existing construction skills, not new ones!
- ▶ Training and education (Swansea & Cardiff Met)
- ▶ Required POE & CPD

 **specific**



Further Developments

- ▶ Non- corroding substrate for bonded heating element
- ▶ Factory production of permeable lime based panels



Dependencies

- ▶ Choice of appropriately exemplary trial building / room / construction
- ▶ Costs of alternative demonstration site to be determined
- ▶ Availability of weather station / external data for additional monitoring

Thank you

