Unitec Research Committee

Final Report Template

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Project Title:	Unitec Research Houses
Project Code:	RI 12012
Date of Report:	15th March, 2013

Please delete the instructions in italics prior to submitting your report.

Executive Summary

Summarise highlights of the project, including aims/objectives, overall approach, findings, achievements, and conclusions.

Background

Internationally there is a move to more airtight buildings as a means of conserving energy. Air tightness is a measure of possible infiltration through the building envelope and is often confused with ventilation within the industry.
This project focuses on the impact on the overall internal space temperatures and humidity.
Light timber frame houses in New Zealand are not performing to recomended temperature and humidity levels.

Aims and Objectives

1) To quantify the impact of an airtight building envelope on temperatures achieved and humidity in the living areas of a residential house.

2) To make comparisons with current building code requirements and identify practical improvements to the performance of the standard Unitec house.

The goal for this project is to develop options with which to inform industry and legislative bodies. The documentation of the build process will help calculate the lifecycle analysis of the building envelope system.

3) To use research processes and data to develop teaching materials and projects for students in areas of building information modelling, buildability, building science, sustainability and industry research projects.

4) To compare actual data against computer predictions of the modifications

Methodology

This project adopts a quantitative approach to develop, test and evaluate a building design, and in the same process to evaluate the methods and devices used in the measurement process. These parallel goals follow the same path for project development and data collection, but have separate outcomes.

1. Literature review to identify:
    - Existing experimentation around air tightness of the building envelope
    - Best practice for design of sensor placement and monitoring processes

- Methods and devices currently used for measurement of moisture in timber.

2. Building Technology certificate students have installed the airtight building envelope on a standard "Unitec" house. Technical guidance from Pro clima.
3. The new test house was constructed for extension of the existing Standard House monitoring project. It has an extra cavity to the inside of the exterior frame for the fixing of electrical cables and water reticulation.
4. Air leakage test completed on overall house prior to lining and post lining. (Current NZ average 5-10 air changes per hour. European building compliance requirements ≤ 1.5 air changes per hour)
5. Monitoring and data logging equipment installed throughout the building to allow an automated and ongoing record of building performance.
6. Monitoring equipment installed to measure moisture content of timber framing..
7. Monitor the buildings for a twelve month period, to cover all seasons (July2012 – June2013)
8. Use Building Simulation tools to conduct parametric simulations of the conditions
10. Analyse monitoring data to:
    - Evaluate the performance of the modified building in terms of environmental performance and living conditions;
    - Compare data modelled using Building Simulation tools with data collected from the house.

Outcomes / findings

At this stage the building is still being monitored for temperature and humidity data.
Carpentry students successfully completed construction July 2012. An Air change rate of 1.9 Ac/hr was achieved. Compared to 6.75 air changes/hour for the control house this is a remarkable achievement for students in their first year of training and a reflection of the skill level of Building Technology tutors. It is at the top end of code requirements in most European countries.
A bachelor of construction student is currently studying parameters for the blower door testing. It is hoped this leads to establishing industry standards for this type of test.

Conclusions

Briefly summarise any conclusions that can be drawn from the research.

International standards for air tightness can be achieved with New Zealand's light timber framed construction.
The internal environment has yet to be analysed.

Implications

Indicate who will benefit from the research, how, and why. Consider the future implications of your work and how others can build on it. What are the implications for other stakeholders, for users, or for the community? What work could be undertaken to build on your research or carry it further?

This research project supports two of the four research foci identified in the Faculty Research Plan: Sustainability, and Technology Development.

It also matches well with a number of the priority areas and key actions identified in the Faculty Research Implementation Plan:
Create clusters, synergies and centres of research excellence – this project provides an opportunity for staff from departments across the faculty to work on a common project, with

more experienced researchers working alongside relative newcomers to develop skills and expertise.
Make research relevant to stakeholders and community – the intention in this project is to work with industry stakeholders to identify potential improvements to the standard house; industry advice and support will be sought, as well as opportunities for sponsorship agreements.
An improvement to the buildings internal environment has implications for improvement in productivity and health. Economic benefits follow.
Promote teaching related research – As stated in the project objectives, one of the outcomes of this project will be the development of teaching material and projects for use within courses including building information modelling, buildability, building science, sustainability and industry research projects.
Several student led projects are now attached to these Unitec experimental houses. They include passive heating and cooling systems, simulated occupancy, and wireless devices.

Recommendations (optional)

That members of the team be given time to network with industry to build on existing relationships and create new ones. There is a commitment from industry to improve our understanding of the building science of light timber frame buildings. The team has already this year organized two workshops here at Unitec with both industry and learning institutes participating. Interest in what we are doing is strong. There are possibilities of joint projects with these institutes and government bodies. Communication and negotiation of memorandums of understanding can only be completed with an understanding of the field.
This fits with the strategies of aligning with industry, the needs of the community and good business practice of sourcing outside funding.

Publications and dissemination

Article in Advance magazine 1st Quarter 2013
Presentation to NZ Carpentry Tutors Conference, ChCh, Dec 2012