

ELASTIC DESIGN – REGENERATION OF EDUCATION THROUGH ARCHITECTURE -CASE STUDIES

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Abstract

This paper presents the results of two stand alone architectural projects, River House Mildura and Woodleigh Sustainability Centre, demonstrating an alternative process of design and construction. Each project comfortably satisfies both the pragmatic and aesthetic demands/requirements of the respective clients.

The design approach begins by challenging the client to expose the underlying components of their brief. This produces a series of fundamental needs and wants; the development of this is an education and discovery process that allows the client to understand the rationale behind the evolution of the project whilst placing them in a wider context in which to reform their priorities. This moves towards a design that has embedded sustainability rather than a pre-conceived aesthetic with bolt-on sustainability.

The inherent qualities of the unconventional approach to the design and realisation have been titled the Elastic Loop. The strength of the system draws from linkages and connections.

The elasticity as a guiding force is paramount. The relationships move with energy towards a maximum density of solutions, but relationships require all parties to come on this journey. The enquiry must extend in many directions to achieve its potential. The exploration, whilst confronting, uncovers possibilities that would be impossible to preconceive; reducing the risk of pastiche or stylistic solutions with a catalogue of bolt on sustainability. To achieve this, people are brought in and they all contribute potential energy and in all cases it is the elasticity of these relationships that keeps the project from breaking. With the gains from the learning the energy is fed back into the continuum in a loop.

The nature of the process can be described in three characteristic stages that overlap and cross-inform. The Exploration/Gathering phase engages the client in a unique exploration of their brief and how it operates within a broader context. The Harmonising/Aesthetic phase provides a creative response to the gathering to form an armature. And the Manifestation phase sees the growth of the project in a continuum that folds in new resources in the form of knowledge and craft, continuing through the life of the building.

The scalability of the Elastic Loop lies in the educative process and the living built form with perceived and measured success. The projects sit on a continuum of sustainable solutions that goes back thousands of years. Which things are we going to express? In a sense, when we acquire something from the past, we are increasing the scale of influence of that idea. Likewise, we count on our solutions to sit on that continuum. For this to happen we need to present in a clear way the qualitative and quantitative outcomes that we see as being valuable.

1. Introduction

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The Elastic Loop, a living system of overlapping and self-informing phases:

The **Exploration/Gathering** phase begins with re-evaluating the clients' initial desires; shifting the brief from a preconceived list of requirements toward a joint exploration of possibilities for engagement with the broader context. Throughout the process we asked the client to participate in the process of investigation providing them with the first stages of self-education. As a team the brief, the site and resource potential are explored for now and the future.

In the **Harmonising/Aesthetic** phase an informed and creative response to the material gathered forms an "armature", the backbone, of the design response. This is tested and must be found to have stability when challenged. In this stage we challenge the client and perceived norms, and then nurture the client through this process. As the design moves forward opportunities are explored in a problem-solving continuum. Knowing when a solution no longer belongs to that resolution and/or knowing how to integrate a new solution, is an important responsibility of ours as facilitators of this system.

Evolving from the armature, the **Manifestation** phase is a continuum beginning with the involvement of people beyond the client and designers. Information becomes available, resources present themselves and the project evolves through a dialogue with clients, contractors, science, media and so on.

Trades/craftsmen are given the performance objectives and their skills are drawn out to express their ideas and collaborate in the expression – Reviewing their practices in light of sustainable objectives and then we collaboratively research desired outcomes.

The building becomes a part of a larger process. One project informs another, an existing project is developed or its success requires interaction. Communities realise new potentials and old projects are brought up to date or existing buildings become new projects.

Resulting in a client engaged with the process of sustainable design, having a greater understanding of its relevance and the meaning behind the decisions made to create a high performing building.

This process has an organic quality that needs real world testing to remove the patina of promises; replacing it with an empirical feedback loop that substantiates the tested project and becomes part of the armature of future projects.

Whilst it is acknowledged that the two case studies are vastly different in their use and type, the **Scalability** of ideas embedded within the projects have been identified as key components of the Elastic Loop process.

Through the Elastic Loop we are able to empower clients to see the relevance and importance of sustainability, as well as the practical and fiscal benefits of a reduction in excess, and integration of sustainable elements.

Through the Elastic Loop, (in the Woodleigh classroom) on a vastly differently scaled project we are able to engage school students, teach them both the value of sustainability, and through participation, some new skills, as well as provide themselves and their school with a new and highly sustainable classroom.

The flexibility inherent within the system brings forth the possibility of utilisation within many scales of the built environment, from ground up education, to ethically constructed and designed large building projects.

2. Case Study # 1 – Woodleigh Sustainability Centre

Woodleigh School had independently decided to construct a new strawbale classroom, however the options they were shown were basic structures that satisfied material sustainability but neglected climate resources and an ongoing educative process. There was also a need to produce an aesthetically strong building that inspired a move towards environmentally responsible developments.

We saw the opportunity for the project to become a demonstration (a tableau) and a project requiring an on-going sustainable response linked in with curriculum objectives.

The Resources exploited within this project were threefold: Site Resources, Climactic Resources and People Resources.

Site resources were the use of available materials. (Quality controls meant that we had to source the materials elsewhere so the idea became metaphoric.) The site was grassland with sandy soils and indigenous trees; these were intrinsic to the construction and expressed in the finished building.

Climactic resources were an understanding of the seasonal weather patterns in order to exploit them in efficiently for primarily passive gains.

People resources was handled through the curriculum and centred around involvement in design and construction of the project. Ongoing participation encouraged by the design provides for an inclusive engagement in the efficient performance and future development of the building.

2.1 Exploration/Gathering

The elastic approach identified an opportunity to have parts of the project built by the stakeholders (students) to large benefit. Including greater appreciation and understanding of the site and surrounds, and the relationship between learning and the space in which it is conducted. Instilling a direct relationship between the decision making process in architecture and its construction and operation as well as an enthusiasm for hitherto unknown concepts and ideas.

2.2 Harmonising/Aesthetic

The gable shed vernacular was morphed to create dynamic, flexible and efficient teaching spaces that also served as an open textbook of ESD. This gable shed configuration enabled the structure to independently function as a shelter providing two things: one, a space for learning and two, a protected work site for the progressive installation of the straw wall construction. The advantage of this was to remove the anxiety associated with the projects time challenges; the building could function in its partially completed state for an extended period as required.

Feedback has shown that learning by doing has been embraced and celebrated by the students. This learning experience combined with the integration of full sustainability into the architecture becoming the armature for this project, and both provided challenges and opportunities for the clients.

The design consciously chose to avoid seductive automation systems. The objective and outcome is to maintain an active and conscious interaction between the building and its occupants. This is on-going education and it is an important feedback loop – another attribute of the Elastic Loop.

For example, the heat stack effect within the space to provide summer ventilation requires physical interaction giving the stakeholder understanding explicitly on how the system operates and the on-going finetuning of such systems”.

Robust and expressive use of natural non-toxic materials enables the continuous involvement and learning by students and staff alike. This is possible as the strength of the concept/armature removes the need for precious/pedantic and/or purely aesthetic ego. These elements of the design challenged some accepted convention (especially the total lack of need for an air conditioning unit) but meant that the students and teachers were given a much more thorough, extensive and meaningful understanding of the need for sustainability.



Figure 1 - 3 Students constructing strawbale wall, working under the shelter of the roof & the finished weatherboard clad wall

2.3 Manifestation

We found that the longer the project evolved the stronger the stakeholders understanding became and the deeper their sustainable commitments became, and the more inventive their problem solving.

For example, a small concrete retaining wall was on the plan; the students chose to replace this with old car tyres piled on top of each other, sourced from a parent's business. They considered the rate of decomposition, the land that was affected by runoff and the effectiveness of their choice. They perceived an aesthetic cost that was overshadowed by the environmental gains. In time more inventive and aesthetically successful outcomes were reached.

They students were able to interact with a variety of different people, with differing skill bases and gain insight into a large range of professions and ways of thinking. The completion and opening of the building was a great success for the school. The building has been operating in its official “classroom” capacity for twelve months. In the framework of our Elastic Loop process the continued learning blurs the traditional concept of completion. The students continue to be involved in contributing and understanding the building.

The student project received two commendations from the Order of Australia Association for its contribution to practical examples of integrating sustainability into the curriculum.

2.4 Scalability

2.4.1 Institutional change: The stakeholders have experienced a shift from the monofocus of an ideology based on a need for prestige in its built environment; the school now has institutional change. The key decision makers have undergone a quantum shift in their priorities and decision making process. The freedom instilled by the project has enabled stakeholders to leap beyond incremental change to experience a new mode of seeing educational spaces and their contribution to a sustainable future. The success of the project also became a catalyst for a general focus on the environmental performance of other buildings. With a benchmark in place, budgets were established to retrofit existing structures and challenge new architectural projects.

2.4.2 Building performance: Physical outcomes: building has operated for twelve months with no heating or cooling, providing a comfortable and inspiring space for learning. Over the next twelve months detailed performance indicators will be measured via logging thermostats, air quality meters, air movement sensors and weather data.

It continues to provide education within the school and beyond. It received an award for the Best Sustainable Commercial/Institutional Building from the BDAV.

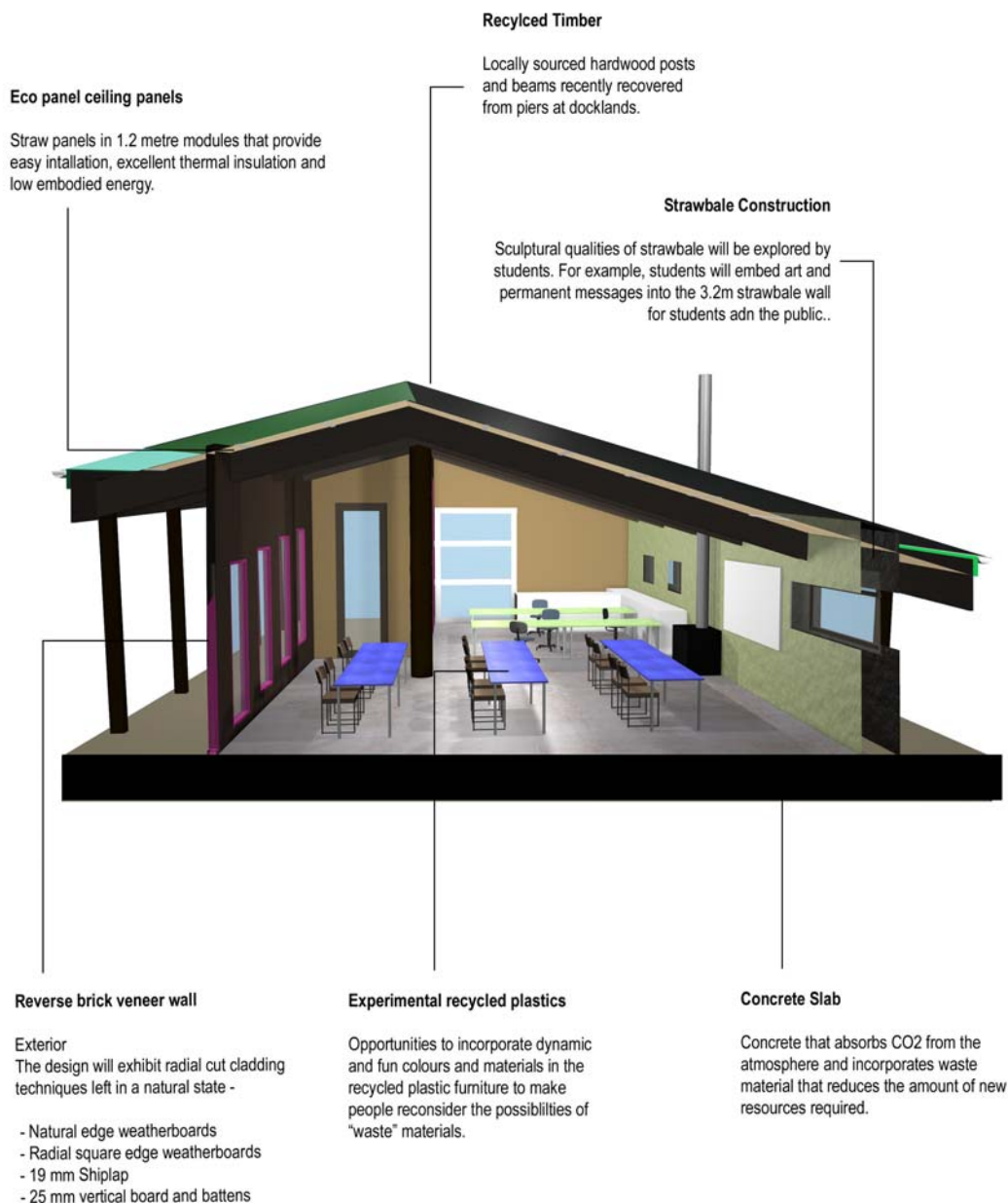


Figure 4 Sustainability Billboard – Recycled and low embodied energy products and materials are exposed and celebrated.

4. Case Study # 2 – Mildura River Home

4.1. Exploration/Gathering

We are talking about this project because the relationship with the clients respected our elastic movement. We see how the project started and we listened, analysed and so on.

For example, the clients, Kate and Lloyd, had engaged the services of a feng shui master to review the site and provide a 'matrix' that determined the layout and positioning of rooms/functions and it also highlighted specific orientations for the building, the path of entry and location of water features such as pool. This report had been tailored to the specific feng shui calendar of both husband and wife.

During the early briefing and information gathering the clients' interest in feng shui was discussed and a copy of the report was provided. The weighting placed on this by the client only became clear after the first design response that did not sit comfortably with the client or the feng shui master.

With this new understanding a revised concept evolved from the fundamental strategies within the original response; in other words an elastic change in the layout. Whilst on the face of it the requirements of the feng shui design response would appear to be completely removed from the original concept, we chose an elastic approach that enabled a completely different looking design that still achieved key components that grew from the gathering phase.



Figure 5 Mildura Residence

4.2 Harmonising/Aesthetic

Then we started to move in our direction. The client revealed information/responses etc. And we saw the link stretching so we moved in their direction. But, now the project's integrity was starting to become slack so we had to take the clients in the opposite direction until the potential energy was restored to the project. And so it went.

In the process of reviewing the brief an opportunity to reframe the brief identified potential consolidation/overlap of spaces and functions. An open dialogue with the client on the seasonal and daily patterns of use allowed for a new picture of how spaces within the home can be delineated, housed and be flexible. One such example is the layout of the guest rooms whereby we reduced the building area by allowing the client to see much of the time the additional bedrooms and bathrooms would be unoccupied and that during periods of multiple guests other spaces within the house could adopt a temporary status of accommodation.

The diagram below shows the next step within the reduction process whereby we compressed and then eliminated the second storey (stipulated in the original brief). As the feng shui guidelines insisted on a clean rectangular building and the clients' requirements for views to the river from various rooms resulted in a stretched building envelope. The shaded zone was the ideal size to accommodate the reduced area of the previously planned first floor bedrooms.

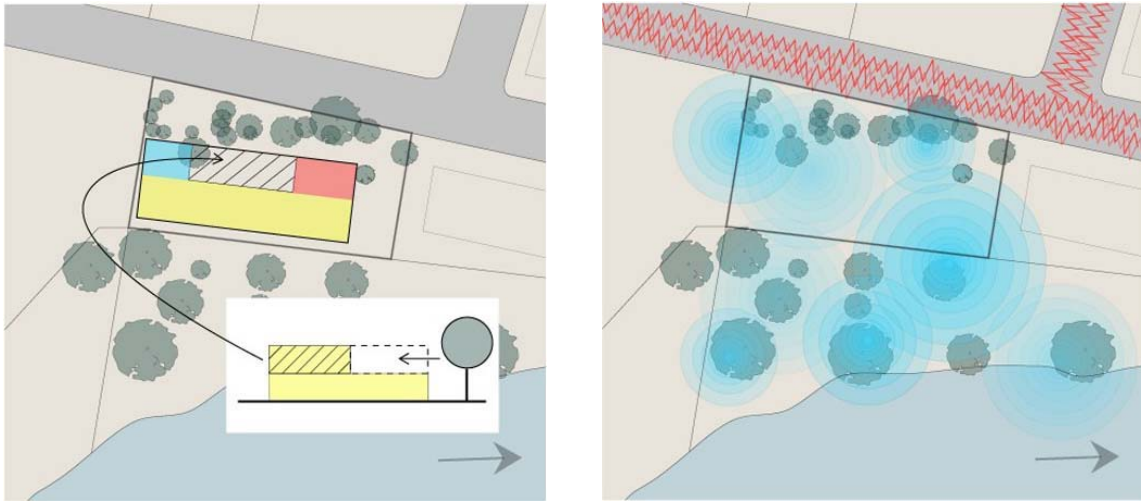


Figure 6 & 7 Diagram of early concept showing the second storey being compressed and eliminated & site analysis diagram of noise



Figure 8 & 9 Diagrams of early design and final design showing shadows cast by trees and courtyard wall

4.3. Manifestation

The builder was presented to us by the client – he was local and honest and so this is the person we were presented to work with; he was not a sustainable builder. We respect him as a craftsman although the model he works with and with which he felt satisfied, provides a different outcome. Because his model is more traditional it is easy for him to present this as the preferred method to the client. So we have a person who appears not to want to make a large shift in their practice. How did we begin the relationship?

Firstly we share our knowledge of his field then a knowledge and depth of understanding in our own field. He has to acknowledge that we are both experts. Now we need to show that whilst the objectives of the building are unconventional; the way of achieving this is not so unconventional. After we have reached agreement on how he can apply his expertise we then address that others need to be brought in to do technologies beyond his understanding.

A number of specialists were introduced to the project including a rammed earth contractor and a solar heating designer/installer.

In this way he now sees himself as a sustainable builder and is ready to accept new challenges. He now learns from the other experts. Together we all push opportunities in our shared area.

4.4. Scalability

4.4.1 Re-framing the brief: This project has become a landmark in Mildura boldly declaring that luxury does not require excessive size, under-utilized space and wasting resources. This project reframes historic norms in a positive way by reducing the floor area stipulated in the original brief by 40%.

The aesthetic desires of the client were successfully threaded into the embodied environmental components of the building thereby achieving multiple gains/solutions with no compromise.

4.4.2 Industry education: The awareness and trust built with the main contractor and his team of tradesmen provides them with a new confidence in pursuing and recommending improved sustainable built outcomes. Taking surface level sustainability and making it the embodiment of the project

4.4.3 Stakeholder education: The journey experienced by the client during the design and construction of the project lives on in their daily enjoyment, operation and engagement with the building and its passive systems. The process has seen a quantum shift in their appreciation and respect for alternative sustainable solutions. We are grateful for their continued support and cooperation that has facilitated the continuum of the Elastic Loop. This feedback is essential.

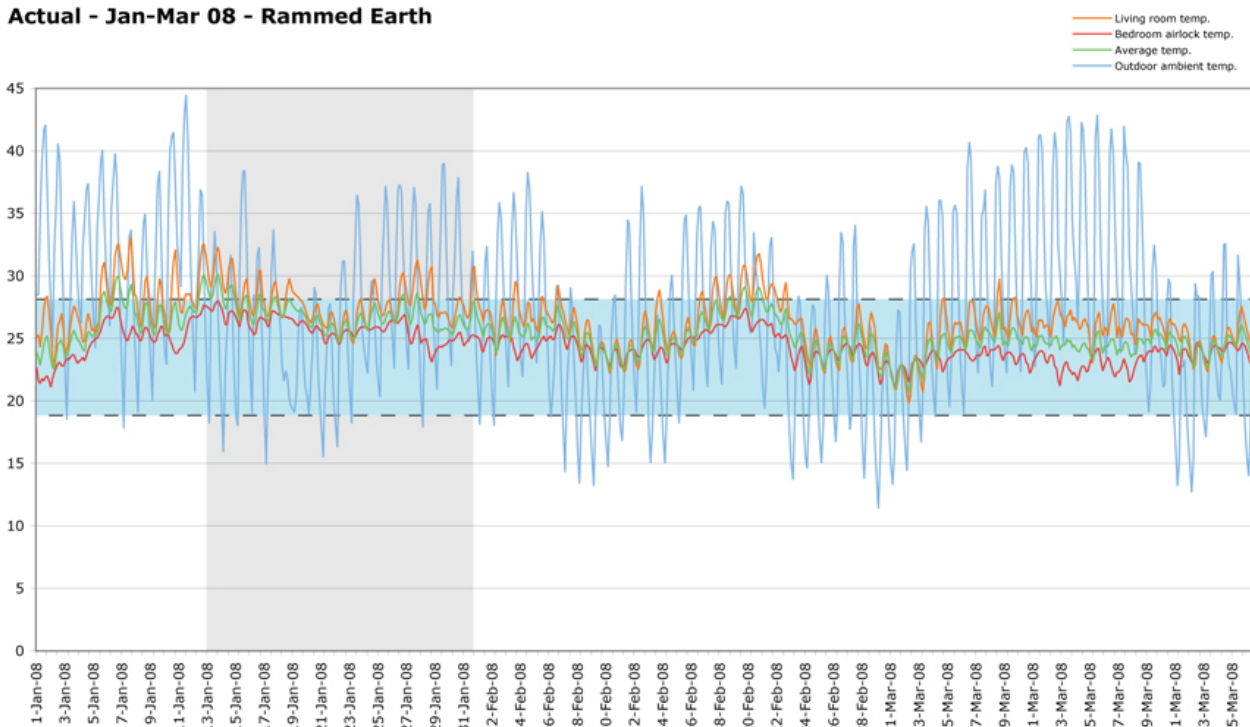
One such example is the accepted and expected design response to a client's request for maximising views is walls of glass. Through the Elastic Loop process we lead the client to a new language of strategic and framed views that frame the outside world and articulate light in a dynamic manner. At the same time this strategy improved the performance of the Eastern wall by two hundred percent.

4.4.4 Rating tools and simulation software: The monitoring of the project has enabled a detailed comparison between computer simulated performance of the building and the actual performance. – In this case the actual performance is significantly better than the simulated. Without such tests and comparisons the rating tools and modelling software will continue to mislead consumers and jeopardise the on-going self improvement of building design and systems. This project only received a five and a half star rating, however, empirical results show that its performance far outstrips other five star homes.

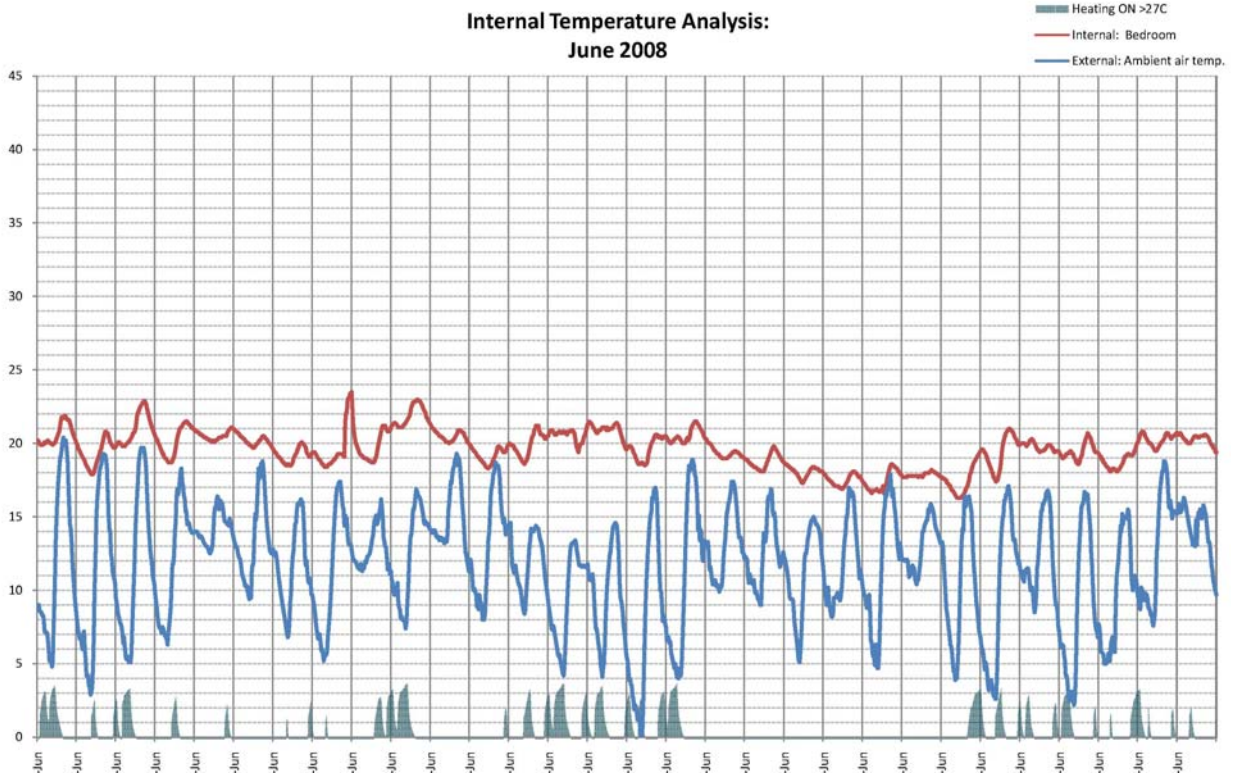
Computer modelling of passive building design has significant limitations.

Effectiveness of thermal mass and insulated thermal mass does not seem to be accessed effectively by First Rate and even the more detailed modelling capacity of EnergyPlus does not accurately predict the actual performance of this home.

Actual - Jan-Mar 08 - Rammed Earth



Figures 10 *Actual versus simulated results. Passive systems provide a greater level of comfort than predicted. The simulated model predicted the considerably higher internal temperatures and greater temperature fluctuations. Actual day to night fluctuations were generally less than 4 degrees vs the predictions of up to 7.5 degrees.*



Figures 11 Actual versus simulated results. Actual results show a higher internal temperatures (with minimal heat input) despite lower outdoor temperatures than the simulated model. The actual winter performance is far greater than predicted (the building requires around 50% less heat input during winter to maintain a comfortable internal temperature than predicted).

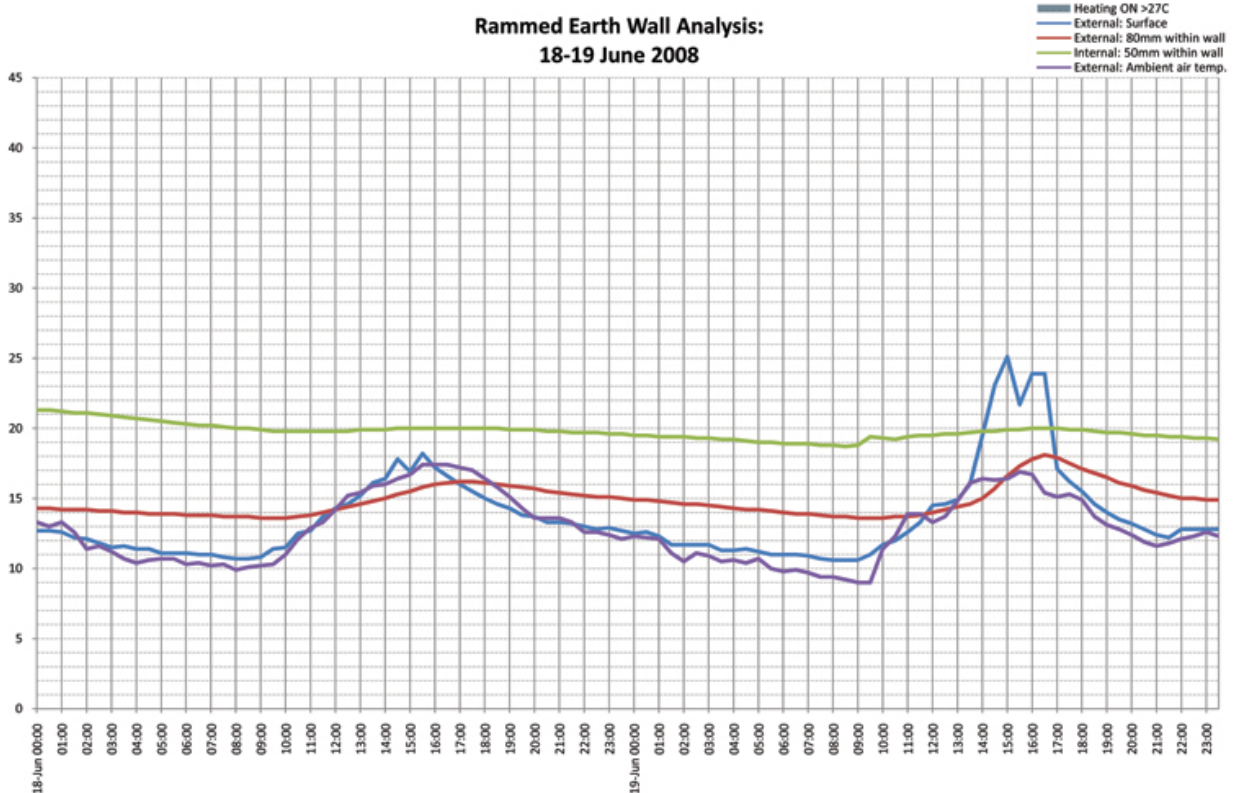


Figure 12 Rammed earth wall analysis. Graph illustrates effectiveness of 400mm thick insulated rammed earth wall and thermal lag of rammed earth material.

4. Conclusion

In the rapidly changing circumstances brought about by the effects of climate change a new approach to the design and construction of buildings is essential. The Elastic Loop serves to provide important projects that result in fundamental shifts in approach, expectations and results. The influence of these projects will radiate in the same way as ripples will radiate from a stone dropped into a pond. This process to build momentum as the on-going feedback loops and concrete results provide traction for fundamental change to take hold.

The case study projects have resulted in the following positive outcomes:

- Institutional change
- Bringing everybody along on the discovery of potential - the process educates itself
- Working intuitively but testing empirically
- Keeping a living process during design, construction and importantly use
- Keeping an open mind allowing unconventional resolutions
- Respecting and developing craft.

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