

10 NEW BUILDINGS – WHAT HAVE WE LEARNED?

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ABSTRACT

Over the last 10 years Waitakere City Council has built a considerable number of public buildings, large and small, from public toilets and community centres, through four libraries, an indoor stadium, a leisure pool complex, to a brand new civic centre, all with the vision of being more sustainable in line with the Eco City brand.

We will take you on a whirlwind tour of these buildings and share our experiences, the successes, the frustrations and what we have learned along the way. Over the ten years our understanding of the solutions needed has improved dramatically and sustainable building is becoming more mainstream. However we are still tripped up frequently. There was the grassed car park where no grass ever grew and the impermeable rain garden, but also the successful installation of solar panels, showers fed by rainwater and our stunning green roof on the Waitakere Central building.

So why did some things work and others not? There are definite themes emerging that we are keen to share so others can learn from our mistakes and be inspired by our achievements.

KEYWORDS:

Lessons learned; Sustainable commercial buildings; Success factors

INTRODUCTION

Waitakere City declared itself an Eco City in 1993. In 2000 it adopted a new minimum sustainability standard for all its buildings. The Better Building Code (Waitakere City Council, 2000) specifies clauses to be included in the briefs for new buildings and requirements for the ongoing management of existing buildings. Seven years on, Waitakere City has completed a suite of new buildings, many of which have been featured in the media as examples of leading sustainability practice in New Zealand and internationally.

This paper aims to share some of the lessons learned during the design, construction and management of these buildings, with the hope that others may benefit from our mistakes and successes.

PLANNING A NEW BUILDING

The budget

Planning for a new building at Waitakere City Council is generally a political process. Residents might be demanding a new library or elected members may have decided to boost a struggling town centre by using the council offices as a catalyst for positive economic change. These are valid reasons to amend the Council's long-term capital expenditure programme, but they do put officers under pressure to quickly produce budgets for these buildings. These budgets are generally based on what similar buildings cost per square meter. Sometimes a small extra amount is budgeted to allow for

sustainability features, but often this is not the case – probably because of the mantra that sustainable buildings pay for themselves.

Once the budget is voted on management generally loathe returning to the Council seeking an increase. On occasions the site changes after the budget is set. Sometimes it takes years for the building to be built, but there tends to be limited scope to revisit the budget as more information becomes available. The argument of paying more upfront to save money on running costs is often lost when capital and operational budgets are treated quite separately – the project manager's accountability is for the capital budget only. Architects struggle to understand all this and some remain convinced that when they design a stunning building, the client will find the money. As a result, most designs come in substantially over budget and we enter into a cost cutting process. At that point it is often easiest to blame the council's ambitions around sustainability for the overrun in costs. Features are slashed, then sometimes reinstated through a drawn-out political process. When design changes are made late in the process to cut costs, the implications can be large and far-reaching, delivering a building that does not function as intended.

While we have achieved some outstanding buildings using this process it would be fair to say that it has sometimes left staff, architects and other consultants exhausted and frustrated - hardly an optimal state of mind for making innovative and well thought-out decisions.

Wouldn't it be better to set the construction budget, or at least revisit it, after the concept design is completed and the site is certain? This would allow for robust debate, considering payback periods and less tangible, but potentially much larger, benefits such as increased staff morale and productivity and enhanced public image. Decision makers would have a clearer picture of what would be delivered. It would also mean that the time between budgeting and construction is shorter, allowing for more accurate estimates in an environment of escalating construction costs.

At the same time, architects do need to design to the budget. The brief is to deliver a functioning building at a set budget. Designing a building substantially over budget and then compromising its integrity and basic function through "value engineering" should not be tolerated by the client and hardly achieves a positive outcome for the architects.

The brief

At Waitakere, briefs have commonly referred to the Better Building Code (Waitakere City Council, 2000) which is performance-based and generic, to be applicable to all commercial buildings. The intention was to allow for flexibility and innovation. To this were added a mixture of other admirable objectives relating to integrated artworks, the site, CPTED, accessibility, etc. However in hindsight a more prescriptive approach, where the main decisions about the key features and operating systems are made by the client, with help from designers, is probably preferable. This would ensure the inevitably limited budget is spent on those aspects most important to the client and that there is more clarity around expectations for the designer.

Designers need to know if the client wants a visionary model of sustainability or if the brief is to do the best possible within a very tight budget. Are only those items to be included that have demonstrable payback periods, or is the client prepared to take a leap of faith, believing that a more sustainable building will result in higher productivity and quality, even if this cannot be proven? What is the balance between risk management and innovation?

Traditionally briefs ask for performance indicators that are geared towards air-conditioned buildings. Engineers believe they know how to design and specify systems that deliver certain temperature bands and noise levels, no matter what the temperature or noise level outside is. This does not necessarily lead to increased comfort and higher productivity but satisfies the brief. More sustainable buildings tend to have more interaction with their environment, allowing for more natural ventilation, sometimes

through opening windows. It is not realistic or appropriate to expect the same narrow performance indicators to be met for such buildings. Many people in the new Waitakere Central building said they are too hot or too cold at times, when asked in a recent post occupancy evaluation. However, people overwhelmingly stated that, compared to other buildings they had worked in, they really liked Waitakere Central and productivity is estimated to be 3% higher than in other buildings as a result (eCubed Building Workshop Ltd., 2007). This suggests that people will trade accurate temperature control for overall comfort. Briefs for sustainable buildings need to acknowledge these trade-offs and need to clearly indicate what the priorities are. Is it for example more important that ventilation is natural or to guarantee very low noise levels? Is it more important to avoid over-heating or to have aesthetically pleasing floor to ceiling glazing? What is the balance between heat loss and natural light?

There is increasingly a culture where the setting of such standards is left to the relevant experts. Unless the priorities and accepted compromises are made explicit in the brief, it will be difficult to resist the demands of the acoustic expert who is accustomed to working with standards appropriate to hermetically sealed buildings. Hence, while Waitakere Central boasts some opening windows, they are actually relatively few, because it was felt necessary to protect the occupants from the low rumble of an occasional passing train a hundred metres away.

THE DESIGN

Collaborative design process

Over the last decades many buildings have been designed with little consideration for the site or the outside environment. The designer knew that a competent engineer would be able to make the building work satisfactorily by designing appropriate control systems, such as air-conditioning and acoustic controls.

This approach does not work well for sustainable buildings because the different performance aspects of sustainable buildings are much more integrated. Decisions about location and orientation can mean that the building can no longer be naturally ventilated. Changes in the location or size of a window can have impacts on natural lighting and temperature control. Many innovative solutions are multidisciplinary and most carry some risk. Joint decision-making can help reduce the risk or at least make it explicit. Waitakere has long insisted on a collaborative design process involving engineers, council staff, designers, landscape architects and local artists. This process is inevitably more time consuming and quite messy at times and good project management is vital. It is a process that is sometimes hard to justify when “on time and on budget” rules. However we firmly believe that the benefits far outweigh the cost and that our buildings show this.

The location, shape and orientation of the Waitakere Central building is the result of a collaboration involving urban designers, transport planners, architects, artists, engineers and landscape architects. The result is a building that enhances and improves access to the adjacent town centre and transport hub, is oriented to maximise energy efficiency and natural lighting, and has been awarded with the Premier Creative Places Award 2007 (<http://www.waitakere.govt.nz/WhaHap/nm/mr/jul07.asp#creativeawardwin>).

Both the Waitakere Central Civic Centre and the Central Library were built in an overheated construction market. As a result, construction tenders came in significantly over budget. Most firms were simply not prepared to invest considerable time and money in a tendering process that they may not win. Any delays were not only politically undesirable but also potentially costly when the rate of cost escalation was 8-12% per year. After review of current tendering trends in the overheated market, a business case was developed, which recommended a direct tender negotiation process following a public registration of interest. Through an ongoing and proactive value engineering programme, in

which the construction company participated, changes were made to bring costs down and to ensure build ability, ensuring that the project remained within budget.

The early design phase

To achieve sustainable buildings, key decisions need to be made early on in the design process. Having set clear priorities in the brief will help, but the design team also has valuable knowledge and experience to add. Because sustainable building is a rapidly developing field, investigating many alternative solutions can be time consuming. Eliminating some options early on will save time and money. Considerations may include (not an exhaustive list):

- Are we aiming for a naturally ventilated building? If so, the orientation and the construction method need to support this decision. A naturally ventilated building generally means orientating the building to reduce heat gain, including some thermal mass and reducing western glazing. It also means accepting the sort of temperature variations and background noise that we accepted when we didn't work in air conditioned buildings. Our experience with the Civic Centre is that in an office environment people tend to accept a temperature range of 20-24°C and we suspect that this will be similar in other office environments where people are expected to dress reasonably formally. We achieve this temperature by a mechanically assisted ventilation system, meaning that, while untempered outside air is used much of the year, the air can be heated or cooled when required.
- Is the site suited to natural ventilation? Does it allow for appropriate orientation and are noise levels acceptable for opening windows?
- How will people get to the building? This will influence the provision of facilities for pedestrians, cyclists, public transport users and motorists.
- Are there any special requirements in terms of stormwater management? This may include site runoff discharging into a sensitive receiving environment or into an already overloaded stormwater system.
- What is the cold and hot water use going to be in the building? Does this justify the investment in solar hot water or rainwater collection systems?
- Do we want to consider dealing with wastewater on site? For commercial buildings in major cities this is not generally a practicable option, yet some designers spend time investigating this option.
- Do we want to consider greywater reuse?
- Do we want to make a bold statement that is highly visible? Options include wind turbines, green roofs or solar panels.

Changes are easy and cheap to make at the beginning of the process and become more difficult and costly as the design process progresses. Robust discussion involving all key disciplines early in the process is vital.

The Glen Eden Library for example was orientated for the view to the southwest and extensive glazing on this façade allows library users and staff to enjoy stunning views. However the low afternoon sun has caused issues with glare and overheating that have been difficult to control. Small changes to the orientation would have still allowed users to enjoy the view, but may have reduced expenditure on shade sails. Because this option was not seriously discussed until late in the design process, it was not pursued.

There are lessons in this for other projects. For such projects, it is important for architects and clients to acknowledge that the form and orientation of a building will dictate its energy efficiency. While comfort levels in a poorly orientated building can be ensured through air-conditioning, ongoing running costs will be higher. For naturally ventilated buildings the implications may be that acceptable

comfort levels cannot be achieved if they face the wrong way, are the wrong shape and/or use the wrong materials.

It is also crucial that all the design team members know when changes are made. In sustainable buildings a change in one area can have unexpected consequences. Looking at the whole rather than the pieces can be challenging for disciplines specialised in one of the pieces. This is an area where Waitakere projects have at times encountered problems, highlighting just how important it is to work truly collaboratively. At the Massey Library for example, there was a desire from an Urban Design perspective for large areas of glazing to be added to the western façade, so that the public walking past could see activity in the library. This design decision resulted in significant increased heat loading that was meant to be mitigated through external shading structures. These, in turn, were cut to reduce costs. The result was a staff room that was so hot it became unusable in summer. This meant we had to address the heating problem retrospectively, which was more expensive than the initial plan. While the additional glazing 'worked' from a design perspective, the impact of the changes was costly and ongoing collaboration would have avoided this.

Independent peer review of the design can help identify problems while they can still be addressed, or it can simply give reassurance that the team is on the right track. After some concerns about the potential of the Glen Eden library to be naturally ventilated an independent peer review provided confidence that this was possible, but also recommended some changes.

Making good decisions

In a collaborative design process, decision making can be complex. Combining this with what some of our architects refer to as the multi-headed client and frustrations can be guaranteed. A clear governance structure for complex projects can ensure that decisions are made promptly and that instructions to the design team are consistent and clear.

Designers and project managers sometimes forget that many people struggle to read plans and are not able to visualise the proposed spaces and features. This can result in problems being picked up too late in the process or in people asking for things to be changed because they have incorrectly interpreted the plans. Clear communication is essential, and it is important to explain the implications of decisions.

At the New Lynn Library for example, the librarians asked for a flexible space that would allow them to rearrange the shelves if they chose to in the future. The underfloor ventilation system was designed to be compatible with this need. This was highly complex and resulted in a very high cost. The final decision to trim back the ventilation system was not made until very late in the process, causing considerable frustration that could have easily been avoided by better communication.

At Waitakere Central, managers were able to make informed decisions about the office layout because they were supplied with good information about the design philosophy of the building. The decision was made that individual offices and meeting rooms were to be located along the southern side of the building, where they would not block sunlight. As a result, the open plan areas have good access to natural light from the north and people who spend most of their day at their desks, such as admin staff, are located closest to windows.

THE DETAILED DESIGN AND CONSTRUCTION

Attention to detail

While the early high-level decisions are most crucial to the performance of sustainable buildings, attention to detail is also critical. Because many practitioners are still not familiar with sustainability, designers cannot rely on junior staff or the construction company to fill in the blanks. Covering a

thermal mass floor with carpet can undermine the thermal performance of a building and so can painting a wall a dark colour when it is meant to reflect light.

At Waitakere Central great attention to detail has resulted in a highly successful green roof with plants suitable to the harsh conditions. This success was the result of collaboration between people who knew about plants and people who knew about engineering. Either discipline on its own would have been unlikely to succeed.

The stormwater swales at Waitakere Central were less successful initially, because they proved to be impermeable. While the landscape architect had designed and specified the swales well, the implementation by the subcontractor was poor. The soil had been compacted by the site works and the wrong grading of soil had been used, meaning that water could not soak into the ground at the rate intended. The result was a big messy bog and the QA process in place for construction picked this up as requiring remediation at the contractor's expense. After the remedial work, we now have well functioning swales.

COMMISSIONING AND OPERATION

This is probably the area that we most struggle with at Waitakere. Once the Mayor has cut the ribbon and everyone has moved on to new projects, it is easy to lose interest in tidying up the loose ends. It is time consuming ensuring contractors spend the time required to resolve the final 'niggles' in the building process, once the work is 98% complete. Operation manuals and staff training required in the brief can be overlooked and as a result staff won't understand how to operate the building and, if proposed user-friendly building management systems are lost in the cost cutting process, staff will end up largely in the dark as to how to make the most of our buildings. We then rely on energy audits and external consultant's reviews to fix the problems we encounter. These reviews can be based only on the data available, which sometimes is too little.

Using a competitive tendering process may not encourage good commissioning procedures because the lowest complying tender is unlikely to allow for this. One option may be to let a separate contract for the commissioning of the building, to ensure it is done well and that the commissioning budget is protected.

At the Massey Library, staff were cold in the first winter because no-one knew how to operate the heating. After it was finally turned on it took us several years to work out that one of the causes of overheating in summer was that the underfloor heating ran all year. An energy audit commissioned during that time did not pick this up, probably because it was done in winter. Temperature control in the library also relies on librarians manually opening louvre windows. Every window has an individual lever that needs to be operated by a hand-held pole. It is therefore not surprising that louvres are opened only when it is already too hot, causing frustration and discomfort. At quite a small cost these louvres could have been automated or at least joined into one easily operated manual system.

User controls need to be simple and intuitive because most building users don't share the engineers' technical expertise or enthusiasm. The Waitakere Trust Stadium is an example of a very simple, easy to operate yet efficient building. Light switches are mounted on a floorplan of the building, making it clear which light is controlled by each switch. While complex Building Management Systems are useful in optimising the efficiency of a building, the reality is that few people understand how to run them well. The more complex the system, the fewer people are able to operate it.

The Waitakere Trust Stadium CEO has staff dedicated to running the building efficiently and as intended by the designers so that they can achieve their commercial targets and this has resulted in excellent control of its running costs.

Whose fault is it and who will fix it?

Sustainable buildings tend to have many small elements that are crucial for their successful operation. The naturally ventilated Glen Eden Library has electric controls on the high level windows and different controls on the acoustic louvres. There are light sensors and temperature sensors. Each element is supplied by a different contractor and has only a small dollar value, yet when one fails the operation of the building is compromised. It is extremely hard to get contractors to come back to the library to fix such an element and if they do they are likely to blame another contractor for the failure. In the meantime, an open clerestory window might have allowed books to get wet and staff to get cold.

It is much easier to get a contractor to respond to a complaint about a malfunctioning air-conditioning system. We believe there is a business opportunity for someone to offer comprehensive natural ventilation and lighting systems for which they take full control and responsibility.

Monitoring and evaluation

We operate a software based management system for energy and water use. This has been valuable in taking a more proactive approach to energy management. The council recently celebrated \$1 million saved through energy efficiency projects. Without monitoring, this achievement would have gone unnoticed.

We recently commissioned a post-occupancy evaluation (POE) of the Waitakere Central Civic Centre and this has rated the building as exceptional (the top rating) for occupants' satisfaction with internal conditions. The productivity score indicates that occupants think that the building boosts their productivity by 3% (eCubed Building Workshop Ltd., 2007). Increased staff productivity far outweighs any energy or water efficiency cost benefits and without such a survey the extent of the productivity would not have been known. Building managers sometimes only hear people's complaints, so undertaking a comprehensive survey is valuable in putting these complaints in context. Many people at Waitakere Central Civic Centre for example were concerned that there were too many issues with over-heating in the building. But the POE clearly shows that temperature in summer was reported as being much more satisfactory than in other buildings, many of which are no doubt fully air conditioned.

With the New Zealand Green Building Council now working towards a local rating system for commercial buildings it will also be more important to ensure that the correct documentation is kept to allow buildings to be assessed. The council attempted to have its Waitakere Central Civic Centre rated retrospectively under the Australian Green Star system. This proved costly and frustrating because critical information was not available and the cost of obtaining the missing information was not deemed to be justified. Good documentation will also help with awards entries, such as the Property Council of New Zealand Urban Design Award recently presented to us for the Waitakere Central Civic Centre.

We have trialled many innovative sustainable elements in our buildings – a green roof, permeable paving, solar panels, rainwater collection and reuse, cogeneration, a small scale wind turbine and many more. Some are being monitored, but too often there is too little monitoring and evaluation. While we know the plants on the green roof are doing exceptionally well, we still have no data on water quality. There have been few formal debriefs on innovative projects, and notes are not always kept. This paper is largely based on conversations with key people who have been involved in the council's sustainable buildings, which raises the question of who is the keeper of the knowledge.

CONCLUSION

While we believe that we have been hugely successful in building more sustainable public buildings we acknowledge that we have made many mistakes along the way. We hope that by sharing our experience, others may learn from them.

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REFERENCES

eCubed Building Workshop Ltd. 2007. "Post Occupancy Evaluation Waitakere City Council Civic Centre" Confidential Draft Report

Waitakere City Council. 2000. "The Better Building Code". Available at <http://www.waitakere.govt.nz/AbtCit/ec/bldsus/betterbuilding.asp>

Details about Waitakere City Councils Sustainable Buildings can be found at <http://www.waitakere.govt.nz/AbtCit/ec/bldsus/index.asp>