

# conservation house

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## abstract

Conservation House sets a new benchmark for sustainable office building in New Zealand, demonstrating of the Department of Conservation's commitment to conservation. The construction involved significant demolition and refurbishment to regenerate a disused movie theatre into an environmentally sustainable head office. The resulting building is reporting early results of energy and water savings, in addition to being a functional and enjoyable workplace.

## key words

sustainable; office building; conservation house

Entrusted with the task of conserving New Zealand's natural and historical heritage, it is appropriate that the Department of Conservation's (DOC) new head office is a demonstration of its commitment to conservation. *Conservation House - Whare Kaupapa Atawhai* is an environmentally sustainable building with an efficient open-plan layout that is strongly connected to the external environment and nature. Completed in December 2006, the building sets a new benchmark for Environmentally Sustainable Design (ESD) in New Zealand, and is a key instrument in DOC's goal towards achieving carbon-neutrality by 2012.

Prior to Conservation House, DOC's management, administration and research staff were housed in four separate buildings in Wellington, but you and I are probably more familiar with some of DOC's 950 huts scattered on conservation land throughout New Zealand. These huts offer 'back to nature' accommodation in scenic settings, catering for our nation's love of outdoor recreation where much of our environmental awareness is fostered. But how would a hut work on a larger scale in the city? Well, clearly it doesn't - you can't fit 320+ staff in hut, or expect your staff to lie tucked up in sleeping bags while working under torch light. So DOC engaged property advisors Bogacki Property to develop a brief for appropriate commercial accommodation that still respects its commitment to conservation.

## project brief

DOC's vision for the building as quoted in their brief was for "an environmentally friendly building that will engender a safe, healthy, comfortable and productive work environment for staff... The building should as much as possible be a *high performance green building* with objectives being to prevent environmental degradation and avoid resource depletion of energy, water and raw materials".

The brief was organised around the following six key sustainability goals:

- optimise site potential  
consider of the reuse or rehabilitation of existing buildings; address the impact of location, orientation and landscaping on local ecosystems and energy use
- enhance the Indoor Environment Quality (IEQ)  
maximise daylighting; have appropriate ventilation and moisture control; avoid the use of materials with high Volatile Organic Compound (VOC) emissions
- use environmentally preferable materials  
specify materials that minimise life-cycle environmental impacts, such as global warming, resource depletion and human created toxicity

- minimise energy consumption  
rely on conservation and passive design measures rather than fossil fuels for its operations; meet or exceed applicable energy standards
- protect and conserve water  
reduce, control or treat site run-off; use water efficiently; reuse or recycle water for on-site use when feasible
- optimise operational and maintenance practices  
incorporate operating and maintenance considerations into the design; specify materials and systems that simplify and reduce maintenance requirements, require less water, energy and toxic chemicals to maintain, and reduce life-cycle costs

As the project pre-dated both the New Zealand Green Building Council and Green Star building rating tool, there was no overriding measurable target for the building to meet, such as the 4, 5 or 6 star Green Star rating. Rather, DOC integrated a number of specific performance criteria into their more detailed *Building Performance Specification*. The thoroughness of these criteria set an excellent foundation for development of the project. Indeed, DOC should be commended on how well their six key goals ended up aligning with the subsequently published Green Star categories and credits. The missing two categories, transport and emissions, were picked up in the detail of the *Building Performance Specification*.

Whilst the brief had a significant ESD focus, the fundamental objective was to create a supremely good work environment. In addition to sustainability qualities, this was to include other enduring architectural qualities such as functionality, flexibility and aesthetic concerns.

#### **commission**

Requests for Proposal for the base building concept design were forwarded to selected developer and design teams. This resulted in the first of two commissions, where we were engaged by building owner The Wellington Company to produce a concept design. The Wellington Company was already looking to develop an existing building into a sustainable building, and seeing DOC as a well-suited tenant readily adopted their brief. Of the returned concept designs DOC felt only two fully engaged with the brief of sustainable design. Conservation House was selected based on its central CBD location, being in close proximity to a variety of café, deli, lunch and coffee outlets, and because of its competitive pricing. Our commission with the landlord was then extended to include developed design, documentation and construction observation.

DOC's internal fitout contract was later tendered and awarded to the same consultant and construction team, comprising the second commission. Sharing consultants and contractor allowed DOC to benefit from full integration with the base building construction, and enabled them to change some aspects of base building design, such as ceilings and lighting.

The success of this project was dependent on a strong commitment to teamwork between the entire consultant team, the building owner, the tenant and the contractor, all sharing a goal to explore the possibilities of sustainable building and establish a benchmark for New Zealand. The members of this team included:

tenant: Department of Conservation  
 tenant's property advisor: Bogacki Property Consultants  
 tenant's project manager: Impact Project Management  
 building owner and developer: The Wellington Company during construction, now owned by Multiplex  
 building owner's project manager and quantity surveyor: Gill Consultants  
 main contractor: McKee Fehl Constructors  
 architect: architecture +  
 structural, fire and services engineers: Sinclair Knight Merz  
 ESD consultant: e Cubed Consulting  
 acoustic consultant: Marshall Day Acoustics  
 resource planner and surveyor: Connell Wagner  
 landscape designer: Janey Christopherson

The design, documentation and construction stages were fast-tracked by dividing the scope of works into 15 separate design and building consent packages. Although this introduced additional complexity in planning and coordination, it did allow design and construction to be completed within an 18 month time frame. There were also significant advantages in having the main contractor and key subcontractor's on board early in the design phase.

### **design response**

The site assigned was the disused Mid City building spanning between Manners and Willis Streets, Wellington. The DOC tenancy occupies the four-storey podium of the building giving 7,200m<sup>2</sup> of tenancy space, with the 10-storey tower building above remaining occupied during construction. Originally purpose built in 1986 as a cinema, the space was designed to keep the outside 'out' - specifically light, views and air. Therefore the building was constructed with blockwork street facades and deep internal spaces - not an obvious choice for a sustainable building. The design problem then became "how do we let light and air in, and create connection to the external environment?"

The solution was to break up the mass with two glazed atria that enable natural light to penetrate into the deeper spaces. The atria also deliver naturally ventilated fresh air to the tenancy floors, with air returning through double skin facades on Manners and Willis Streets. This strategy set the foundation for the sustainable design of the building, addressing DOC's six key objectives.

### **optimising site potential**

The development comprised a cradle-to-cradle urban regeneration project, recreating the disused Mid City cinema complex to resurrect what was once an active site. The existing building consisted of a four-storey podium building spanning from Manners Street to Willis Street with a tower building upon the centre. Originally constructed as a cinema, the structure contained expansive floor plates with well-spaced columns and double storey spaces. This arrangement was capitalised to create a low-rise tailor-made building typology, establishing a new paradigm for office environment in Wellington.

Located on the golden mile of the CBD, the building is highly visible demonstration of DOC's commitment to conservation, integrating green credentials into the Wellington streetscape through simple but environmentally functional facades.

### **minimising energy consumption**

The building is serviced by a seasonal mixed mode ventilation system, combining natural ventilation strategies with active mechanical systems. Mid season (autumn and spring) the manners and willis wings naturally ventilate, drawing fresh air in through the top of the glass atria and expelling stale air through operable windows in the double-skin street façades. The natural airflow is enhanced by the heating effect of the sun on the double-skin cavity, which warms the airspace causing the stale air to rise and leave the building. The *building management system* (BMS) measures temperature, humidity and CO<sub>2</sub> throughout the office space and automatically adjusts the position of the opening windows to optimise ventilation.

In peak seasons (summer and winter) the natural ventilation pathways are closed off and the space is conditioned mechanically to ensure comfortable temperatures are maintained. The mechanical system utilises active *chilled beams* to condition the open-plan office spaces, a first for office buildings in New Zealand. Hot and cold water circulates through copper pipework in the chilled beams, across which fresh air is blown to encourage induction of the air in the room, cooling or heating the air as necessary. Chilled beams provide more uniform temperature distribution, consume less energy, reduce greenhouse gas emissions, and the absence of moving fans makes them low maintenance and quiet. This was innovative technology for a country that had not used chilled beams before and, despite their successful application in the UK, required intensive investigation to convince the project team of their merits and to educate sub-contractors on their commissioning. Enclosed meeting rooms, workshops and laboratories are conditioned by on-demand fan coil units that operate automatically when the lighting presence detectors recognise a room is occupied. Heating and cooling is supplied using energy efficient heat pumps and water-cooled chillers. Hot water for plumbing is also heated with heat pumps.

The mechanical system is assisted with passive building elements, such as partially exposed concrete soffits which act as thermal mass to absorb excess heat during the day. This is then flushed from the building at night via the double-skin façade to reduce the cooling demand the next day. The double-skin façades also act to insulate the interior from excessive heat gains and losses, much like double-glazing. The solar-heated air in the cavity is captured and blown under the heat pumps to further increase their efficiency.

The lighting system utilises a *digital addressable lighting interface* (DALI) to provide energy efficient control of the lighting, including automatic daylight dimming of the perimeter lights and presence detection. This allows the fittings adjacent windows and the atria to automatically dim when there is adequate natural light, maintaining an illumination level of 400 Lux. Presence detectors to both the open plan workspaces and enclosed rooms automatically turn the lights off when occupation is not detected. The DALI system involves a data link from each fitting back to the Building Management System, enabling the arrangement and control of fittings to be easily modified in response to future changes of the interior layout, without the need for re-wiring. Energy efficient low-mercury T5 lamps and solid-state long-life LED lamps are used throughout the building, not only minimising energy consumption but also reducing the environmental impact of disposal at end of life.

Building materials and products were selected to minimise embodied energy, reducing the energy consumed in their life span throughout the stages of material sourcing, manufacture, transportation, installation and dismantling. For example, a majority of the framing is timber rather than steel stud. This included specifying New Zealand made products wherever possible, such as the Formway Life chair, to reduce energy associated with transportation.

Consideration was also given to energy efficient access to the building. The building is immediately adjacent a well-serviced bus stop on the core bus route through the city providing sustainable transportation alternatives to individual passenger vehicles. A recent survey of staff showed that public transport usage is up 35%. A bicycle storage facility and showers are also provided for staff to encourage the use of bicycles. This has proved popular and DOC is now looking to double the allocation of bicycle parks and lockers.

Inside the atrium, the main stairs were designed to be highly visible and visually appealing to encourage staff to walk between levels rather than take the elevator. Feedback from the lift sub-contractor indicates that the two glass lifts are being used less frequently than would be expected for a building of this size.

### **protecting and conserving water**

Rather than sending rainwater off the roofs into the city stormwater system, the rainwater is harvested and stored in a 65,000 litre basement tank where it is recycled for flushing toilets and urinals. This influenced the development of the unique concertina glazed roofs above the atria, where structural steel H beams at the troughs double as internal gutters. Rain sensors on the roof detect the onset of rain and flush the first few minutes of water dirtied by the roof into the stormwater system, before an automatic valve switches to the storage tank.

Separate reticulation from the city supply delivers water to the basins, showers and kitchens where potable water is required. Sanitary fixtures are low-flow to reduce water consumption, with motion detectors fitted to faucets to optimise hygiene and ensure water is not left running down the drain.

### **using environmentally preferable products**

Waste was minimised significantly by the reuse of the existing building structure. This avoided the total demolition of the original building, but also reduced the extent of new construction and associated wastage. The main atrium was designed around the intersection of the two conflicting structural grids, retaining the perimeter structural columns, beams and slabs, and giving the atrium its characteristic shape. Demolition waste was sorted on site by material and collected by salvage and recycling agencies. Waste minimisation is an ongoing goal for the tenants, with separate bins provided for paper, organic, inorganic, glass, plastic and metal waste for recycling. Rather than rubbish

bins at each workstation, staff have been issued with small desktop containers and make regular trips to the many recycling stations on each floor to separate and dispose of waste.

The existing structure was left exposed where possible, reducing the demand for linings and applied finishes, such as ceiling tiles, framing and plasterboard. The use of PVC (a plastic derived from petroleum that can release dioxins and heavy metals into the environment) was minimised by instead using Wavin AS polypropylene water piping, LSZH electrical cabling for the mechanical system and linoleum flooring to the toilets and kitchenettes in lieu of vinyl. Timbers were selected from sustainable plantations, such as Pinus Radiata, Hoop Pine and Victorian Ash. Where possible materials with recycled content were specified, such as the Burgess rubber flooring on the stairs which are made from recycled car tyres, and Pink Batts insulation which includes up to 80% recycled glass. Consideration has also been given to materials' recycling potential at end of life, such as Woven Image Echo Panels used as acoustic lining in the meeting rooms and the Formway Life chair. The Life Chair can be easily disassembled for refurbishment and over 90% can be recycled. Much of the flooring is Ontera carpet tiles which not only allow for easy replacement of individual damaged tiles, but also provides a renewal and reuse service called EarthPlus. At the end of their life the carpet tiles can be sent to Ontera for super-cleaning, re-texturing, and re-dying, then returned to DOC for re-laying.

The existing chillers were replaced with new chillers having zero ozone depleting potential refrigerant.

#### **enhancing the indoor environment quality**

The seasonal mixed mode ventilation system ensures good indoor air quality throughout the year delivering fresh air above the minimum required levels. The photocopier within the publication workspace is supplied with a dedicated extract to avoid contamination of the air. This high air quality is optimised by the selection of materials with low emissions of volatile organic compounds, formaldehyde and allergens, where possible specifying the *Environmental Choice NZ* products. Selections include Laminex E0 Medium Density Fibreboard for wall linings with an emission class of zero, low-formaldehyde hoop pine and Resene water-based paints.

The atria break up the vast floor plates into three semi-detached structures, creating visual interest and variety. Each of the three sub-structures is divided down the centre with a strip of meeting rooms, storage and utility spaces. As a result each workstation is a maximum of 8 m from either a street façade or an atria balustrade, allowing connection to and awareness of the exterior environment. The generous inter-floor heights optimise the penetration of natural light into the centre of the floor plates. The lighting system responds to this natural light and dims accordingly to provide a more comfortable and natural working environment. Manually operated blinds to the facades allow occupants to control solar glare. High-frequency lighting ensures artificial light is flicker-free.

The atria divide the internal space without the need for solid partitions, allowing visual connectivity across the atria. Office space is distributed over only three levels enabling easy travel between floors using the stairs rather than elevators. This low-rise horizontal arrangement is complemented with strong vertical elements, such as the riser walls at the ends of the atria lined with hoop pine panels staggered in a vertical array, which emphasise the generous proportions of height and space. The combination of horizontal layout, verticality and void creates easy interaction between spaces, increasing the feeling of community and encouraging communication and collaborative working.

Acoustic insulation to the exposed soffits and workstation screens, overlaid with background white noise through the speaker system, ensure a degree of acoustic privacy within the open plan interior. Well-distributed meeting rooms provide convenient spaces for conversations where more privacy is required. The double-skin facades also insulate the building interior from street noise.

The Manners Street façade is punctuated with a winter garden to the 1st, 2nd and 3rd floors, creating a breakout space where occupants can enjoy the external environment. These spaces consist of only the outer layer of the double-skin façade, containing manually operated opening windows to take advantage of natural breezes and provide connectivity to the street below. The manners wing rooftop was also reclaimed with the construction of a new café sitting within landscaped terraces, native gardens and pools. The café provides a pleasant environment for staff to enjoy their lunch or hold casual meetings, and will also cater for conferences and events.

### **optimising operational and maintenance practices**

The building provides ample flexibility to cater for future change and development within DOC. The three sub-structures created by the atria provide generously sized and well-proportioned floor plates that are easily adaptable to changes in use. Mechanical services have been reticulated to reduce their impact on the floor plan, and DALI control of the light fittings enables fittings to be adjusted without the need for re-wiring.

The completed building has been supplied with a Building Users' Manual and a Building Maintenance System (BMS). The BMS monitors and adjusts the building, mechanical, lighting and water systems by a process of continual commissioning, ensuring the building operates sustainably for any given combination of occupant load and external conditions. The BMS will produce reports on building performance, energy consumption and water usage to ensure ongoing ESD objectives are being met.

### **key achievements**

Key achievements and preliminary performance results include:

- anticipated saving in power consumption of 20%, with scope for improvement with some additional fine tuning
- anticipated saving in city water consumption of 60%
- anticipated financial saving of \$130,000 per year
- waste to landfill reduced by 50%
- informal reports from DOC management of decreased staff absence due to ill health
- staff turnover is down, and DOC is receiving more and better qualified candidates applying for vacancies
- more than 3,200 visitors have toured the building in its first eight months, from Schools, architecture and engineering practices, politicians and diplomats
- winner of the Govt3 award in the Sustainable Buildings/Fitout category
- winner of the Property Council award in the energy efficiency and an 'excellence' award in the Office category
- winner of two 'excellent' awards for energy efficiency for the foyer reception and café/roof from the Illuminating Engineering Society of Australia and New Zealand
- winner of an NZIA Resene Wellington Local Award for Architecture and NZIA Resene Local Colour Award

### **key lessons and conclusions**

As sustainability was a relatively new development for commercial building in New Zealand during the design of Conservation House, we were required to develop a new set of resources for design and specification. This involved establishing a strong consultant team, including the engagement of a sustainability consultant, to share expertise, resources and ideas. Common reference was made to a variety of sustainability guides, such as Ministry for the Environment and local Council guides. Products and materials were widely researched to establish their environmental impact, most of which did not have environmental information available as they do now. In the absence of a New Zealand sustainable building rating tool we referred to the Australian Green Building Council's version of *Green Star* for interim assessments of achievement. It wasn't easy to establish these resources from scratch, so it is encouraging to see the recent development of resources since the completion of Conservation House, such as *Green Star New Zealand* and *Green Build*. Availability to such information will be vital to the general adoption of sustainable design by the wider design industry.

Conservation House demonstrated the importance of integrating sustainability goals into the client's brief at project conception. DOC included a very detailed *Building Performance Specification* within their brief that set specific sustainability targets. These targets formed the basis of the contract specification between DOC and the developer. This provided clear targets for the developer, avoiding the temptation to take short cuts or under-specify, and ensured that the project was budgeted for appropriately. As the greatest potential for the integration of sustainable design is at project conception, this issue is best raised in the first initial briefing meeting with potential clients.

Through Conservation House we learnt that sustainable building does not require a greatly different approach to design. Many of DOC's requirements were factors that we would have considered anyway as a matter of good design - high quality work zones with maximised natural light also reduce the energy consumed by artificial lighting; exposed columns and beams that explain the structure and history behind the complex form of the atrium also contribute to sustainability through reduced materials consumption; increased amenity of the café and outdoor landscaping also improves the ecological value of the site and its contribution to the city. Sustainable design reinforces good architectural design, and with a commitment to teamwork from the project team, real results can be achieved that improve the impact of buildings on the environment.

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