BRANZ

Life cycle assessment

Press Hall case study

80 Willis St, Wellington

Press Hall (previously 84 Willis Street) resulted from the refurbishment of an existing 6-storey commercial office building originally constructed in 1923, located in the heart of Wellington's CBD.

The refurbishment retained much of the original building's structure and seismically strengthened it to meet current Building Code requirements.

A new mezzanine level was added in addition to a new office floor area on the 4th level. The façade was entirely reglazed, and two skylights were installed for the atria. Press Hall is now an A grade mixed-use commercial/retail building with ground floor and mezzanine retail tenancies, and office tenancies on levels 1 to 4. A small car park is located on level 1.

Building LCA tool:	LCAQuick v3.3
Available at:	www.branz.co.nz/buildinglca
Assessment year:	2018

Project team

Tenant:
Various

Developer:
McKee Fehl Constructors Ltd

Assessor/BIM modelling:
McKee Fehl Constructors Ltd

Energy modelling:
Jason Quinn (COR Associates)

Building information

Number of storeys:	6
Building height:	24.5 m
Gross floor area:	5,538 m^2
Net lettable area:	4,825 m^2
Other use floor area:	1,360 m^2
Internal car parking:	236 m^2
Assessment service life:	60 years
Energy use intensity: (whole building, simulated)	84 kWh/m^2 GFA/year

Version 1.1

Building life cycle results (rounded)

Environmental indicator	Per NLA/year	Absolute (60 years)	Benefits/loads beyond building life cycle		Unit
			Per NLA/year	Absolute (60 years)	
Climate change	17.7	5,132,806	-0.47	-135,102	kg CO_2eq
Ozone depletion	0.0000004	0.13	-0.00000001	-0.0025	kg CFC 11eq
Soil and water acidification	0.11	30,663	-0.0018	-532.3	kg SO_2eq
Eutrophication	0.037	10,657	-0.0003	-81.2	kg PO_4^{3-}eq
Photo-oxidant formation	0.007	1,970	-0.0003	-80.2	kg C_2H_2eq
Abiotic resource depletion (non-fossil fuels)	0.00007	19.4	0.000006	1.66	kg Sb eq
Abiotic resource depletion (fossil fuels)	108.9	31,538,399	-4.43	-1,283,473	MJ, NCV
Total primary energy	379.5	109,860,830	-5.11	-1,480,087	MJ, NCV
Total primary energy (non-renewable)	111.6	32,300,412	-4.39	-1,269,874	MJ, NCV
Total primary energy (renewable)	267.9	77,560,418	-0.73	-210,213	MJ, NCV

Presented results represent the sum of all life cycle stages including both base build and tenant energy use. Reported separately are the potential benefits or loads beyond the building's life cycle. For example, this may be due to waste materials from construction that are recycled. This can provide secondary materials that substitute for new (primary) materials. A benefit is shown as a negative number, and a load is shown as a positive number.

What did the refurbishment involve?

New materials were required for the seismic upgrade and new construction works and included:

- new reinforced concrete shear walls at north, south and west (back) elevations
- additional shotcrete to existing unreinforced brick walls
- fibre-reinforced polymer (FRP) wrapping of non-ductile columns
- additional gravity floor supports (steel columns) along east elevation (front)
- a new mezzanine floor between the existing ground floor and level 1 (after removal of the old mezzanine floor)
- the top floor (level 4 is predominantly new construction).

The rectangular building form is adjoined on three sides by neighbouring buildings. The streetfront façade retains its existing column/beam concrete structure, which was designed to be strengthened with new steel columns, beams and tension rod cross-bracing.

Existing glazing areas were replaced with new high-performance systems, and new light wells were opened up.

A new heating, ventilation and air conditioning (HVAC) system was installed consisting of three two-pipe Mitsubishi VRF (variable refrigerant flow) R2-series condenser units for the office tenancies. These units pipe chilled and heated refrigerant to the fan coil units on the office floors, which then provide the tempered air to the office zones. Heat recovery is used on ventilation air. Variable-speed ventilation serves the rest of the building.

The domestic hot water (DHW) set-up is a heat pump water heater for the shower bathroom block on level 1 with WELS 6 star taps and 5.5 L/min showers. Additionally, the showers have shower timers set to 3 minutes of hot water.

Comparison with a reference building

Assessment scope

The Press Hall assessment includes new materials used in the refurbishment for the structure and enclosure of the building. Material quantities were obtained from a building information model (BIM). Retained materials are not included in the assessment.

The reference building assessment includes materials in the structure and enclosure derived from a BIM.

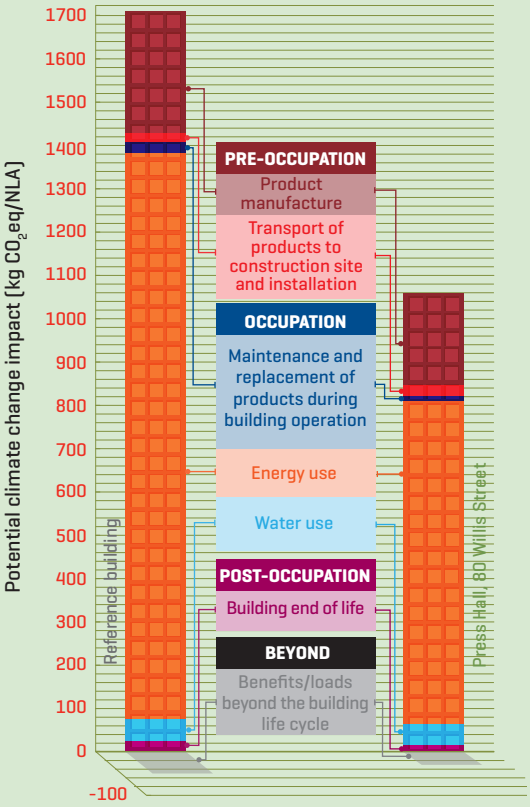
About the reference building

A reference building provides a comparator for the designed building. In this case, it is a mixed-use commercial office building located in Christchurch but with energy use simulated as if located in the Wellington climate. Characteristics of the selected reference building are:

- GFA of 6,373 m^2 and NLA of 5,446 m^2
- office space comprises 86% of the building gross floor area
- structural system is post-tensioned LVL frames and walls.

The reference office building is modelled based on the materials specified in the consent documentation and simulated (rather than actual) energy use.

Any timber or engineered wood products used in the reference building and designed building are assumed to be derived from wood from sustainable forestry.



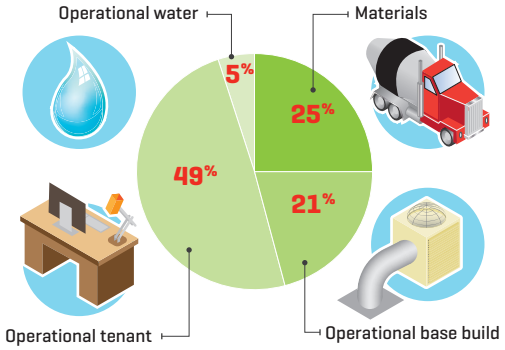
Refurbishment – good for the environment?

Refurbishing 84 Willis Street to create the Press Hall building has saved approximately 3,100 tonnes of carbon dioxide-equivalent emissions, assuming a new building for the site would have resembled the reference building used in this study. This estimate excludes the additional greenhouse gas emissions that would have resulted from demolishing the old building.

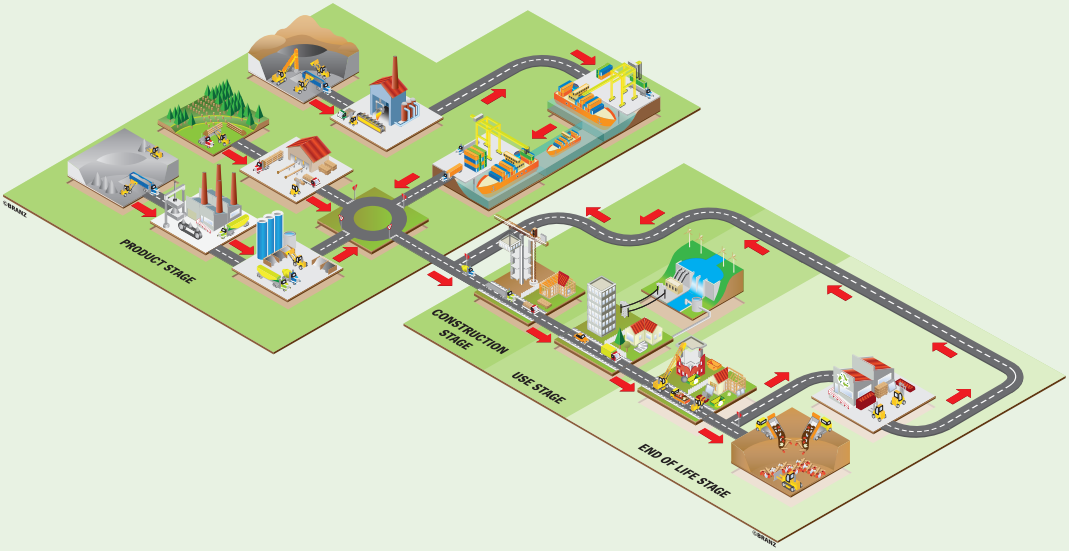
This diagram shows the split between the materials-related carbon footprint (excluding potential benefits/loads beyond the building life cycle), energy-related carbon footprint and water-related carbon footprint of Press Hall over a 60-year estimated service life.

About half of the calculated Press Hall climate change impact is predicted from tenant energy use (for lighting and plug loads) and a quarter from materials manufacture, transport, installation, maintenance and replacement. About a fifth of the calculated climate change impact is from non-tenant energy use, including HVAC, elevators, plug loads and lighting in communal areas.

The materials that contributed most to the Press Hall carbon footprint are in situ reinforced concrete and structural steel.



What is building life cycle assessment (LCA)?



Building LCA is a tool for quantifying the potential environmental impacts of a building through its use of resources and energy across the life cycle. The assessment is systematic and requires making an inventory of the activities that are collectively needed to produce, operate and ultimately dispose of the building being investigated.

Application of building LCA early in design helps the design team understand the potential environmental impacts that may arise because of choices being made, such as building orientation and form, window-wall ratio and where windows are located, type of structure and thermal performance of the building envelope. This information can be used to consider, test and evaluate alternatives and quantitatively track the environmental performance of the design.

The approach can also be used by clients to set quantified environmental targets in a design brief against which the design team can demonstrate the design's performance.

The indicators in this case study are in accordance with the building sustainability standard EN 15978:2001. For further information about these indicators, please refer to BRANZ Study Report SR293, available for download at www.branz.co.nz.

Acronyms

GFA	Gross floor area
kg eq	Kilogram equivalent
LCA	Life cycle assessment
MJ	Megajoules
NCV	Net calorific value
NLA	Net lettable area

Contact

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