



BRANZ Appraised
Appraisal No. 1058 [2019]

GREEN PRECAST 'LIVIN MODULAR' SYSTEM

Appraisal No. 1058 [2019]



BRANZ Appraisals

Technical Assessments of
products for building and
construction.



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Product

- 1.1 The Green Precast 'Livin Modular' System is a modular, precast concrete building system for use in the construction of residential and light commercial buildings. The system comprises of 5-sided modular precast units which are made to order. The modular precast units are available in a range of sizes and multiple units can be configured to achieve various layouts and building designs. Modular precast units can be manufactured to include window and door openings and conduits for plumbing and electrical services cast integrally into the modules where required. All Green Precast modules are subject to Specific Engineering Design in accordance with NZS 3101 by a Chartered Professional Engineer [CPEng].

Scope

- 2.1 The Green Precast 'Livin Modular' System has been appraised for use as a specific design structural wall and floor/ceiling system for buildings within the following scope:
 - with a maximum building height from the ground to eaves of 10.0 m; and,
 - maximum three storeys; and,
 - with a floor plan area limited only by seismic and structural control joints; and,
 - situated in NZS 3604 Wind Zones up to, and including Extra High.

Building Regulations

New Zealand Building Code (NZBC)

- 3.1 In the opinion of BRANZ, The Green Precast 'Livin Modular' System if designed, used, installed and maintained in accordance with the statements and conditions of this Appraisal, will meet or contribute to the following provisions of the NZBC:

Clause B1 STRUCTURE: Performance B1.3.1, B1.3.2 and B1.3.4. The Green Precast 'Livin Modular' System meets the requirements for loads arising from self-weight, imposed gravity loads, earthquake, wind, impact, and creep and shrinkage [i.e. B1.3.3 (a), (b), (f), (h), (j) and (q).] See Paragraphs 7.1 - 7.3.

Clause B2 DURABILITY: Performance B2.3.1(a) not less than 50 years for the structure. Green Precast 'Livin Modular' System meets this requirement. See Paragraphs 8.1 - 8.3.

Clause E2 EXTERNAL MOISTURE: Performance E2.3.3. As a supporting substrate to a cladding system, the Green Precast 'Livin Modular' System contributes to meeting this requirement. See Paragraphs 12.1 - 12.4.

Clause E3 INTERNAL MOISTURE: Performance E3.3.1. As a substrate to an impervious and easily cleaned lining system, the Green Precast 'Livin Modular' System contributes to meeting this requirement. See Paragraphs 13.1 – 13.4.

Clause F2 HAZARDOUS BUILDING MATERIALS: Performance F2.3.1. The Green Precast 'Livin Modular' System meets this requirement and does not present a health hazard to people.

Clause G6 AIRBORNE AND IMPACT SOUND: Performance G6.3.1 and G6.3.2. The Green Precast 'Livin Modular' System contributes to meeting these requirements. See Paragraph 14.1.

Clause H1 ENERGY EFFICIENCY: Performance H1.3.1 and H1.3.2E. The Green Precast 'Livin Modular' System contributes to meeting these requirements. See Paragraphs 15.1 – 15.5.

Technical Specification

4.1 The Green Precast 'Livin Modular' System is a modular, precast concrete building system for use in the construction of residential and light commercial buildings. The system comprises of made to order 5-sided modular precast units available in the following range of sizes:

Module Code:	External Dimensions (LxWxH):	Internal Floor Area - 90 mm wall thickness (m ²):	Nominal Module Weight (tonnes)
A	5 X 3.5 X 2.81 m	15.84	15.6
B	7 X 3.5 X 2.81 m	22.44	20.1
C	6 x 3.5 x 3.11 m	19.14	19.24
D	8 x 3.5 x 3.11 m	25.74	24
E	9 x 3.5 x 3.11 m	29.04	26.4

4.2 The walls of the modular precast units can be varied in thickness to suit the structural requirements of the building design. The minimum wall thickness is 90 mm to ensure appropriate cover to reinforcement.

4.3 All modular precast units can be manufactured to include window and door openings and conduits for plumbing and electrical services cast integrally into the modules as required. The modules can be configured to achieve various layouts and building designs.

4.4 All modular precast units are subject to Specific Engineering Design by a Chartered Professional Engineer in accordance with NZS 3101, with consideration given to structural loads and building importance levels.

4.5 Supporting foundation structures, ground floor slabs and structural connections between modular precast units are subject to Specific Engineering Design. Design of these elements have not been assessed by BRANZ and are outside the scope of the Appraisal.

Handling and Storage

5.1 The modular precast units should ideally be installed into position directly from transport delivery. Where it is necessary to store modular precast units on site, they shall be stored on stable, flat ground and protected from impact damage from vehicles. Movements of the modular precast units on the site should be kept to a minimum to further minimize the risks of damage.

Technical Literature

6.1 Refer to the Appraisals listing on the BRANZ website for details of the current Technical Literature for The Green Precast 'Livin Modular' System. The Technical Literature must be read in conjunction with this Appraisal. All aspects of design, installation, use and maintenance contained within the Technical Literature and within the scope of this Appraisal must be followed.



Design Information

General

- 7.1 The Green Precast 'Livin Modular' System, when specifically designed and constructed in accordance with the Technical Literature, will meet the requirements of NZBC Clause B1 Structure. The Green Precast 'Livin Modular' System is intended for buildings up to a height of three storeys and shall in all cases be subject to specific engineering design by a Chartered Professional Engineer.
- 7.2 Window and door openings and conduits for plumbing and electrical services can be cast integrally into the modules as required. Green Precast Australia and the design Engineer should be consulted with to confirm the locations of any proposed openings or conduits to ensure they will not compromise the structural design of the finished construction.
- 7.3 Structural connection joints between all modular precast units and other interfacing building elements (foundations, roof framing and other constructions) shall be specifically designed by the Engineer. Suggested details for structural connections between units are given in the Green Precast 'Livin Modular' System Technical Literature.
- 7.4 Any constraints or restrictions that may limit site access for heavy vehicles and mobile cranes must be considered by the designer during the project feasibility stage. Access constraints can include the size, grade or location of the building site / platform as well as roads and access routes to the site and how close the modular precast units can be physically transported to their intended location before being craned into position.
- 7.5 Precast concrete provides a robust and stable substrate for the application of a wide number of cladding systems. Suggested exterior cladding details are given in the Green Precast 'Livin Modular' System Technical Literature. Final selection of cladding systems over the precast modules is the responsibility of the designer. Cladding systems for use over The Green Precast 'Livin Modular' System have not been assessed by BRANZ and are outside the scope of the Appraisal.
- 7.6 The Green Precast 'Livin Modular' System modular precast units are cast and finished to a high visual standard to all interior surfaces with any surface blemishes filled and smoothed. The interior surfaces are factory coated with a primer / undercoat paint layer, ready to accept an interior grade paint top coat once installed. The typical final interior finish of the modular precast units is a paint finish, however other surface finish materials and linings that are suitable to be adhered to a concrete substrate can also be used.

Durability

Serviceable Life

- 8.1 The Green Precast 'Livin Modular' System is expected to have a serviceable life equal to that of similar precast concrete components. The serviceable life of the Green Precast 'Livin Modular' System is expected to be in excess of 50 years, where subjected to normal maintenance.
- 8.2 The minimum compressive strength of the concrete used in the construction of The Green Precast 'Livin Modular' System is typically 40 mPa, or otherwise nominated by the design engineer, with regard given to expected in-service environmental conditions.
- 8.3 Cover to steel must meet minimum values set out in NZS 3101 or otherwise nominated by the design engineer.

Maintenance

- 9.1 Conventional maintenance procedures typical of precast concrete may be used for buildings constructed using the Green Precast 'Livin Modular' System.
- 9.2 Any exposed concrete surfaces shall be inspected and cleaned at least annually, and any damage to the concrete repaired immediately. Any applied coatings or claddings must be maintained throughout the life of the building in accordance with the proprietor's instructions to ensure the ongoing protection of the structure.



Control of Internal Fire and smoke spread

- 10.1 Where walls or floors of buildings constructed using the Green Precast 'Livin Modular' System form separations between tenancies, the separations are required to have fire resistance ratings (FRR) in accordance with NZBC Acceptable Solutions C/AS1-C/AS7. Precast concrete typically provides good fire resistance rating, however the performance of sealed joints between the modular precast units, penetrations through walls and floors for pipes and cables must be considered in determining the FRR of the separation. Specific fire resistance ratings of the Green Precast 'Livin Modular' System have not been assessed by BRANZ and are outside the scope of the Appraisal.

Control of External Fire Spread

- 11.1 Where walls of buildings constructed using the Green Precast 'Livin Modular' System are required to meet specific requirements for external spread of fire, protective coatings and claddings applied to the exterior surfaces of the precast modules shall be selected to meet these requirements based on information from the coating or cladding supplier. Cladding systems and coatings for use over The Green Precast 'Livin Modular' System have not been assessed by BRANZ and are outside the scope of the Appraisal.

External Moisture

- 12.1 Cladding systems and coatings where applied over The Green Precast 'Livin Modular' System, shall be designed to meet the requirements of NZBC Clause E2 External Moisture. NZBC E2/AS3 provides suitable guidance for the weathertight design of precast concrete structures.
- 12.2 Conventional cladding systems intended to be installed over a framed wall such as weatherboards, sheet claddings and the like can be affixed to the Green Precast 'Livin Modular' System. Suggested exterior cladding details are given in the Green Precast 'Livin Modular' System Technical Literature. Final Selection of cladding systems and detailing of fixing methods to the precast modules is the responsibility of the designer. Cladding systems for use over The Green Precast 'Livin Modular' System have not been assessed by BRANZ and are outside the scope of the Appraisal.
- 12.3 Ground clearances in accordance with NZBC E2/AS3 must be maintained throughout the life of the building. Where the proprietor of any selected cladding system specifies ground clearances exceeding those given in E2/AS3, these shall take precedence.
- 12.4 Window and door openings cast integrally into the modules are profiled to meet the joinery opening detailing given in E2/AS3 details. Other detailing can be accommodated to integrate with selected cladding / joinery detailing upon request.

Internal Moisture

- 13.1 Impervious interior linings and coatings as required in areas subjected to watersplash can be selected in accordance with NZBC E3/AS1.
- 13.2 Precast concrete provides a robust and stable substrate for the application of a wide number of coating and lining systems. Suggested interior lining details are given in the Green Precast 'Livin Modular' System Technical Literature. Final selection of lining systems over the precast modules is the responsibility of the designer. Coating and lining systems for use over The Green Precast 'Livin Modular' System have not been assessed by BRANZ and are outside the scope of the Appraisal.
- 13.3 Adequate thermal resistance to walls and ceilings must be provided to discourage fungal growth in service areas. NZBC Acceptable Solution E3/AS1 gives acceptable R values for finished construction.
- 13.4 Where the Green Precast 'Livin Modular' System is to be used to construct multiple residential tenancies in one building, consideration must be given in the design to meeting the requirements of NZBC Clause E3 Internal Moisture for containment and discharge of freewater from accidental overflow resulting from sanitary fixtures or sanitary appliances.

Airbourne and Impact Sound

14.1 Precast concrete elements typically provide a high level of sound reduction between occupancies or adjoining spaces. The Green Precast 'Livin Modular' System, when designed and constructed in accordance with the Technical Literature, can contribute to meeting the requirements of NZBC Clause G6 Airbourne and Impact Sound. Consideration should be given in the building design to ensuring requirements for Sound Transmission Class (STC) and Impact Insulation Class (IIC) are met by the finished construction.

Energy Efficiency

- 15.1 The Green Precast 'Livin Modular' System, when designed and constructed in accordance with the Technical Literature, can contribute to meeting the requirements of NZBC Clause H1 Energy Efficiency. It is the responsibility of the designer to ensure that compliance with the requirements of NZBC Clause H1 are achieved by the completed building, which will typically involve calculation of construction R-values, or thermal modelling.
- 15.2 Precast concrete is considered by H1/AS1 to be high thermal mass construction, recognising the benefits in the thermal performance when thermal mass is used appropriately. To be beneficial, thermal mass must be integrated into the building with sound passive solar design.
- 15.3 On request, the modular precast units can be manufactured with a 60 mm thick EPS foam insulation layer cast into the walls of the units. In this configuration, the nominal wall thickness of the units is 200 mm.
- 15.4 Thermal insulation can typically be incorporated into the finished design by fitting insulating materials to the exterior or interior surfaces of the modular precast units and installing within roof spaces.
- 15.5 If the Green Precast 'Livin Modular' System is to contain an embedded heating system, then it must achieve the minimum construction R-values as given in H1/AS1 for elements containing embedded heating systems.

Installation Information

- 16.1 Installation must be carried out in accordance with the Technical Literature and this Appraisal by, or under the supervision of, a Licensed Building Practitioner (LBP) with the relevant Licence Class.
- 16.2 Installation of Green Precast 'Livin Modular' System must be in accordance with the Technical Literature. The main items for consideration are summarized here.
- Site preparation – a flat, level platform must be prepared. Where fill material is used to prepare the site, it should be tested to ensure that it meets the ground bearing capacity specified by the engineer. Cut platforms should not be left exposed to dry out for any significant time, particularly where the underlying soils are identified as expansive.
 - Concrete floor slab – the ground floor slab shall be prepared and poured in accordance with the engineer's design. The floor slab will typically feature 100 x 30mm deep set downs in which the precast modules are placed. The prepared slab must be thoroughly checked for line, level and squareness prior to concrete pour – this will ultimately influence its ability to readily accept the placement of the precast modules.
 - The completed slab is checked with a laser level. Where necessary, plastic packers are placed within slab rebates to ensure correct alignment and level of the modular precast units when placed.
 - Placement of modular precast units – non-shrink grout is placed in all rebates immediately prior to placement of the modular precast units. Following placement, excess grout is troweled off from the joints and made good.
 - Structural connections – structural connections including welded, bolted or alternative connection methods shall be made in accordance with the engineer's design.



- Placement of other building elements – installation of claddings, insulation, interior linings, services, joinery, roofing and roof structures can be completed in accordance with the instructions of the designer. Whilst the modular precast units are relatively unaffected by rain or moisture, construction should be programmed in a sequence that gives adequate protection to other moisture sensitive building elements and materials.
- 16.3 All concrete used in the construction of buildings on site using the Green Precast 'Livin Modular' System must be placed, finished and cured in accordance with the requirements of NZS 3109.

Health and Safety

- 17.1 It is the site managers responsibility to ensure that adequate space is provided on the construction site for the delivery, unloading, storage and placement of modular precast units and to ensure the safety of construction workers and the public. It is the site managers responsibility to ensure that the site complies with the relevant provisions of NZBC Clause F5 Construction and Demolition Hazards.

Basis of Appraisal

The following is a summary of the technical investigations carried out.

BRANZ Investigations

- 18.1 A structural review of The Green Precast 'Livin Modular' System was undertaken by BRANZ structural engineers and found to be satisfactory.
- 18.2 A Durability assessment has been provided by BRANZ technical experts.
- 18.3 The Technical Literature has been reviewed by BRANZ and found to be satisfactory.
- 18.4 Inspections of Green Precast 'Livin Modular' System installations being placed and completed installations have been made by BRANZ to assess the practicability of installation, and to examine completed installations.

Quality

- 19.1 Green Precast Australia is responsible for the quality of the components supplied for the Green Precast 'Livin Modular' System.
- 19.2 Quality of on-site construction is the responsibility of the building contractor.
- 19.3 Designers are responsible for incorporating The Green Precast 'Livin Modular' System into the design of buildings.
- 19.4 Building owners are responsible for the maintenance of The Green Precast 'Livin Modular' System in accordance with the instructions of Green Precast Australia.

Sources of Information

- AS/NZS 4671: 2001 Steel reinforcing materials.
- NZS 3101: 2006 Concrete structures standard.
- NZS 3104:2003 Specification for concrete production.
- NZS 3109:1997 Concrete construction.
- NZS 3604:2011 Timber-framed buildings.
- NZS 4218:2009 Thermal insulation – Housing and small buildings.
- Acceptable Solutions and Verification Methods for the New Zealand Building Code Structure Clause B1, Ministry of Business, Innovation and Employment, First Edition July 1992 [Amendment 17, 30 November 2018].
- Acceptable Solutions and Verification Methods for the New Zealand Building Code Durability Clause B2, Ministry of Business, Innovation and Employment, Second Edition February 1998 [Amendment 10, 30 November 2018].



- Acceptable Solutions and Verification Methods for the New Zealand Building Code Protection From Fire Clause C, Ministry of Business, Innovation and Employment, New Document April 2012 [Amendment 4, 1 January 2017].
- Acceptable Solutions and Verification Methods for the New Zealand Building Code External Moisture Clause E2, Ministry of Business, Innovation and Employment, Third Edition July 2004 [Amendment 8, 30 November 2018].
- Acceptable Solutions and Verification Methods for the New Zealand Building Code Internal Moisture Clause E3, Ministry of Business, Innovation and Employment, Second Edition February 1998 [Amendment 6, 1 January 2017].
- Acceptable Solutions and Verification Methods for the New Zealand Building Code Hazardous Building Materials Clause F2, Ministry of Business, Innovation and Employment, First Edition July 1992 [Amendment 3, 1 January 2017].
- Acceptable Solutions and Verification Methods for the New Zealand Building Code Construction and Demolition Hazards Clause F5, Ministry of Business, Innovation and Employment, First Edition July 1992.
- Acceptable Solutions and Verification Methods for the New Zealand Building Code Airborne and Impact Sound Clause G6, Ministry of Business, Innovation and Employment, First Edition July 1992 [Amendment 2, 1 December 1995].
- Acceptable Solutions and Verification Methods for the New Zealand Building Code Energy Efficiency Clause H1, Ministry of Business, Innovation and Employment, Fourth Edition January 2017 [Amendment 3, 1 January 2017].
- Ministry of Business, Innovation and Employment Record of Amendments for Compliance Documents and Handbooks.
- The Building Regulations 1992.



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23 May 2019

GREEN PRECAST 'LIVIN
MODULAR' SYSTEM



In the opinion of BRANZ, **Green Precast Livin Modular System** is fit for purpose and will comply with the Building Code to the extent specified in this Appraisal provided it is used, designed, installed and maintained as set out in this Appraisal.

The Appraisal is issued only to **Green Precast Australia Pty Ltd**, and is valid until further notice, subject to the Conditions of Appraisal.

Conditions of Appraisal

1. This Appraisal:
 - a) relates only to the product as described herein;
 - b) must be read, considered and used in full together with the Technical Literature;
 - c) does not address any Legislation, Regulations, Codes or Standards, not specifically named herein;
 - d) is copyright of BRANZ.
2. **Green Precast Australia Pty Ltd**:
 - a) continues to have the product reviewed by BRANZ;
 - b) shall notify BRANZ of any changes in product specification or quality assurance measures prior to the product being marketed;
 - c) abides by the BRANZ Appraisals Services Terms and Conditions;
 - d) warrants that the product and the manufacturing process for the product are maintained at or above the standards, levels and quality assessed and found satisfactory by BRANZ pursuant to BRANZ's Appraisal of the product.
3. BRANZ makes no representation or warranty as to:
 - a) the nature of individual examples of, batches of, or individual installations of the product, including methods and workmanship;
 - b) the presence or absence of any patent or similar rights subsisting in the product or any other product;
 - c) any guarantee or warranty offered by **Green Precast Australia Pty Ltd**.
4. Any reference in this Appraisal to any other publication shall be read as a reference to the version of the publication specified in this Appraisal.
5. BRANZ provides no certification, guarantee, indemnity or warranty, to **Green Precast Australia Pty Ltd** or any third party.

For BRANZ

Chelydra Percy

Chief Executive

Date of Issue:

23 May 2019