

BUILDING CODE REQUIREMENTS

The Litecrete Construction System, which is subject to specific engineering design, meets the following performance requirements of the Building Code:

- **Clause B1 STRUCTURE:** Performance B1.3.1, B1.3.2 and B1.3.4 for the relevant conditions as in B1.3.3. a, b, f, g, h, i, j
- **Clause B2 DURABILITY:** Performance B2.3.1, 50 years
- **Clause C3 SPREAD OF FIRE:** Performance C3.3.5
- **Clause E2/AS1 EXTERNAL MOISTURE:** Performance E2/AS1:3.2, E2/AS1:3.3, E2/AS1:3.6
- **Clause E3 INTERNAL MOISTURE:** Performance E3.3.1
- **Clause F2 HAZARDOUS BUILDING MATERIALS:** Performance F2.3.1
- **Clause G6 AIR & IMPACT SOUND:** Performance G6.3.1
- **Clause H1 ENERGY EFFICIENCY:** Performance H1.3.1, H1.3.2

Clause B1 STRUCTURE

Performance requirement B1.3.1

Litecrete Lightweight Precast Concrete Systems are required to withstand the combination of loads they are likely to experience during construction or alteration and throughout their serviceable life. The systems have a low probability of rupturing, becoming unstable, losing equilibrium, or collapsing and have a low probability of causing loss of amenity through undue deformation, vibratory response, degradation or other physical characteristics throughout their serviceable life. Litecrete Lightweight Precast Concrete Systems meet the requirements for loads arising from self-weight, imposed gravity loads, earthquake, wind, fire and human impact.

Demonstration of Compliance

Litecrete applications are subject to specific engineering design. Typical design and construction details of panel-to-panel, panels and the connection details of the panels to the adjoining structure are shown in *Section 13 Construction Details*. All reinforcing shall comply with the provisions of AS/NZS 4671; either grade 300 or grade 500.

Wall Panel Bracing Units

Litecrete 3000 x 1200 x 220 mm thick panels achieve 640 bu's (University of Auckland In-Plane Test report).

Clause B2 DURABILITY

Performance requirement B2.3.1 (a) not less than 50 years (b) 15 years and (c) 5 years

The NZBC sets durability requirements for building elements depending on the use and the ease of replacement and maintenance. Within the building elements the different components can have different durability requirements. Litecrete exterior wall panels are **structural elements** and therefore require a durability of **not less than 50 years**. This applies to the bracing panels and system connection components. Litecrete associated joint sealants, seals, flashings and sealing systems are required to have 15 years' durability.

Demonstration of Compliance

1. History of Pumice Concrete

Although lightweight precast pumice concrete is new to the New Zealand construction market, pumice concrete has been used for various structures here for over 100 years. The first documented application was for structural wall elements in Tudor Towers, the former Government Bathhouse in Rotorua, which was built in 1906. Since then proprietary systems have come and gone. Konka Board, a factory-made panel (900 mm x 450 mm) was produced by Bassett & Co of Wanganui from 1914 until the 1950s. It was held in place by patented clips and was used for both internal and external walls. Another pumice-concrete panel for walls and floors, Fabricona, began production in the 1940s but closed down in 1951. Atlas Concrete Ltd in Wellington also manufactured pumice concrete panels successfully for a number of years but widespread acceptance was generally suppressed due to (1) the relative costs of the pumice concrete compared to the standard timber-framed cavity walls and (2) the reluctance of builders to use concrete as they believed it had the propensity to take away a major part of their trade skill. However, of recent times problems such as leaky homes, ongoing timber price rises and the increasing awareness of concrete as an energy efficient building material have gone a long way towards increasing the acceptance of concrete in general, and pumice concrete in particular, as a viable alternative.

2. Lightweight concrete durability

The durability of concrete is defined as its ability to resist weathering action, chemical attack, abrasion, or any process of deterioration. The mechanism that can cause premature deterioration resulting in a serviceable life <50 years, is weathering action caused by water.

It is well known that the superior water absorption/desorption characteristics of pumice means that the moisture held in the aggregate is not immediately available for chemical interaction with cement, so is extremely beneficial in maintaining longer periods of curing, resulting in better strength in the final concrete.

Auckland Uniservices have tested samples of Litecrete vs 30 MPa normal precast concrete, for water absorption. The test report concluded that Litecrete does not saturate with water to the same extent when compared to 30 MPa concrete. However, to enhance durability where Litecrete is to be used with a raw concrete external finish the panels should be treated with a clear matt finish vapour permeable (breathable) sealer to. As is the case with normal precast, the below-ground area of the Litecrete panels should have a waterproofing membrane applied.

The minimum reinforcement cover requirements as per NZS 3101, Section 3, for 25 MPa concrete, is 40mm. Litecrete recommends a minimum 50 mm cover for any steel reinforcement design.

3. Exterior Coatings

Exterior coatings (paints/plaster/stain/clear sealant) where specified must be of a vapour-permeable type and comply with the relevant clauses of the NZBC. In all cases the manufacturers' application and maintenance instructions must be followed, with particular attention given to the following areas:

1. Weathering, flashing and sealing systems at door and window openings, junctions with other materials and any other penetrations of the exterior envelope. The need for specific flashings will depend on the configuration and design of the detail but are strongly recommended in all circumstances.
2. The ground/ foundation/floor/wall interface. Particular care needs to be given to ensure that minimum distances between ground and floor level, as stated in NZS 3604:2011, are complied with.
3. External plaster systems where specified are installed and cured within the temperature limitations, climatic and curing conditions set by the manufacturer. The finished external plaster system is sealed and protected from the weather with a vapour-permeable coating system such as Resene X200 or Mapei Elastocolor. Exterior paint systems will require a minimum 5-year durability as part of the system.

Clause C3 SPREAD OF FIRE

Performance C3.3.5

The Litecrete Lightweight Precast Concrete System is naturally fire resistant being made from non-combustible materials.

Demonstration of Compliance

BRANZ test report FR3524 - Fire resistance of a lightweight concrete panel load bearing wall; the 150 mm thick wall achieved a 240-minute fire resistance rating.

Clause E2/AS1 EXTERNAL MOISTURE

Performance E2/AS1:3.2, E2/AS1:3.5, E2/AS1:3.6

Exterior walls shall prevent the penetration of water that could cause undue dampness, or damage to building elements. Concealed spaces and cavities in buildings shall be constructed in a way, which prevents external moisture being transferred and causing condensation and the degradation of building elements. Excess moisture present at the completion of construction shall be capable of being dissipated without permanent damage to building elements.

Demonstration of Compliance

This Litecrete Lightweight Precast Concrete System catalogue contains a well proven set of typical construction joint, penetration, openings and attachment details that can be used for both residential and commercial construction (see *Section 13, Construction Details*). The window design details are based on recommendations from the Window Association of New Zealand (WANZ). Because engineers use a varied range of precast attachment details to cope with a diverse range of commercial building designs we cannot cover all of these in this document. However, such design solutions have been used successfully for many years. Auckland Uniservices have tested samples of Litecrete for water absorption and the report shows that when compared to normal concrete,

Litecrete does not saturate to the same extent with water (see Auckland Uniservices Report 10646.04). However, to enhance durability, we recommend that a clear matt finish sealant is applied to the external surfaces of natural (raw) Litecrete panels.

Exterior Plaster/Paint/Clear Sealant Systems

If exterior plaster/paint (coating) and clear sealant systems are used they must comply with the relevant clauses of the NZBC. The combination of pumice concrete and air entrainment used in the manufacture of Litecrete wall panels provides an in-built insulation

value. This means that the walls can “breathe”, allowing water vapour (condensation) to move through the wall to the exterior of the building. Therefore, where paint, plaster or clear sealant systems are used, they should be vapour-permeable. We recommend systems that have a BRANZ Appraisal and/or meet the NZBC requirements.

Maintenance

External coating systems must be maintained in accordance with the respective manufacturer’s instructions and all damage repaired promptly to ensure the ongoing weathertight properties of the coating systems. In addition to these system-specific requirements, the following general maintenance procedures must also be implemented: Any dirt accumulation or organic growth that may occur should be regularly removed from the external surface by cleaning with warm water and detergent and a soft bristled broom. Solvent-based cleaners must not be used. The external cladding system should be checked yearly for damage to the system itself, deterioration of seals and possible water entry at junctions and joints. Any damage to the coatings, which does occur, must be repaired in accordance with the manufacturer’s instructions.

Clause E3 INTERNAL MOISTURE

Performance E3.3.1

The Litecrete Lightweight Precast Concrete System must take into consideration installation details for maintaining correct moisture levels in buildings where normal occupancy levels exist and adequate ventilation is provided (e.g. complying with NZBC E3/AS1 Paragraph 1.2) ensuring the performance requirements of NZBC E3.3.1 will be met. Correct thermal design and installation must be strictly followed to meet the minimum R-values in NZBC Acceptable Solution E3/AS1 Paragraph 1.1.1 (b) solid construction.

Demonstration of Compliance

The Litecrete Lightweight Precast Concrete System has test a report from Curtin University stating an achieved R Value of R0.6 for a 150 mm thick panel. The introduction of revised H1 in 2009 revised the R-value requirements for Litecrete:

Climate Zone 1, R-value of R0.8

This is achieved with 220 mm thick panels (“Solid Construction – excluding timber”)

Climate Zone 2, R-value of R1.0

This is achieved with 280 mm thick panels (“Solid Construction – excluding timber”).

Climate Zone 3, R-value of R1.2

This is achieved with 330 mm thick panels (“Solid Construction – excluding timber”).

Auckland Uniservices have tested samples of Litecrete for water absorption and the report shows that when compared to normal 30 MPa concrete, Litecrete does not saturate to the same extent with water.

Clause F2 HAZARDOUS BUILDING MATERIALS

Performance F2.3.1.

The materials and components used in the manufacture and site construction of Litecrete comply with NZS 3604:2011, which is an NZBC referenced Compliance Document. The Litecrete Lightweight Precast Concrete System meets this requirement and will not present a health hazard to people.

Demonstration of Compliance

A Material Safety Data Sheet is attached in Appendix.

Clause G6 AIRBORNE AND IMPACT SOUND

Performance G6.3.1

The sound transmission class of walls, floor and ceilings shall not be less than STC 55.

Demonstration of Compliance

The Litecrete Lightweight Precast Concrete System has acoustic testing on 150 mm thick wall panels strapped on one face, insulated and an additional layer of 13 mm plasterboard applied. It achieved an STC 60 rating. (See Auckland Uni Acoustic Report T0607-3).

Clause H1 ENERGY EFFICIENCY & INTERNAL MOISTURE

Performance H1.3.1 & H1.3.2

Buildings constructed using the Litecrete lightweight precast concrete system, are able to meet the performance requirements for energy efficiency as required by NZBC Clause H1.3.1 and H1.3.2. It should be noted that compliance with NZBC H1 will also include many factors resulting from the design of the building, all of which have an influence on the energy efficiency of a building. The excellent thermal insulation properties of the Litecrete wall panel system ensures that when used with both an adequate level of ventilation and an appropriate level of ceiling / roof insulation, Litecrete will satisfy the internal moisture provisions of NZBC Clause E3.3.1. Appropriate or adequate levels of ventilation and insulation are provided in the NZBC Acceptable Solution E3/AS1. NZBC Acceptable Solution E3/AS1 Paragraph 1.1.1(b) requires a current minimum wall R-value. Higher levels are required to meet the new energy efficiency requirements of NZBC Clause H1.

Demonstration of Compliance

A Test Report from Curtin University shows that Litecrete achieved an R-value of R0.6 for a 150 mm thick panel.

NZBC Clause H1 – Energy Efficiency to NZS 4218:2009

The Building Code Clause H1 Energy Efficiency is defined in New Zealand Standard 4218:2009. Residential construction categories are changed to:

1. Non-solid Construction; eg (timber framing with various types of exterior cladding), or
2. Solid Timber Walls (such as "Lockwood" type system), or
3. Solid Construction – excluding timber (concrete or masonry)

Litecrete falls under the definition of Solid Construction – excluding timber. Because of the benefits of the thermal mass of the concrete (its ability to absorb and slowly dissipate energy) this category has been allocated a dispensation in R-value requirements compared to Categories 1 and 2. Following are Category 3 requirements for the various climate zones:

Climate Zone	Min R-values	Litecrete Building Code compliance solution
Zone 1: Northland, Auckland and Coromandel, Option 1 (a)	R0.8	Solid Construction – excluding timber 220 mm thick panels (R0.8)
Zone 2: Rest of North Island except Volcanic Plateau, Option 2 (a)	R1.0	Solid Construction – excluding timber 280 mm thick panels (R1.0)
Zone 3: South Island and Volcanic Plateau, Option 3 (a)	R1.2	Solid Construction – excluding timber 330 mm thick panels (R1.2)

The Standard provides for three methods of compliance:

1. The Schedule Method shall only be used where:
 - (a) The glazing area is 30% or less of the total wall area;
 - (b) The combined area of glazing on the east, south and west-facing walls is 30% or less of the combined total area of these walls;
 - (c) The skylight area is no more than 1.2 m² or 1.2% of the total roof area (whichever is the greater);
 - (d) The total area of decorative glazing and louvers is 3 m² or less
2. The Calculation Method shall only be used where:
The glazing area is 40% or less of the total wall area
3. The Modelling Method shall only be used where:
The glazing area is more than 40% of the total wall area

* Note that installing insulation on the internal face of normal precast concrete or masonry negates the benefits of thermal mass.