



KNAUF

RioTinto

STRUCTURAL TESTING FOR LIGHTWEIGHT CONSTRUCTION

A GUIDE

RONDO®

Build on us.

Introduction

Lightweight construction refers to structural systems and assemblies made from components significantly lighter than those used in traditional construction methods for similar applications. These components can be made from a variety of materials, both combustible and non-combustible, such as wood and steel.

While lightweight construction systems offer speed, versatility and efficiency, thoughtful design is essential—particularly in meeting fire safety requirements. Their reduced mass means they behave differently under fire conditions, which is why the National Construction Code (NCC) outlines specific provisions to ensure structural robustness and fire resistance. With an evolving market and a growing range of innovative lightweight wall systems, navigating compliance can be complex—but with the right guidance, it is entirely achievable.

In this whitepaper, we provide a useful walkthrough of the structural requirements, NCC Specification 6 tests and relevant Australian standards that impact the design and specification of lightweight wall and ceiling systems.





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Design of lightweight steel-framed systems

General

Lightweight construction is the efficient use of component materials to provide an effective composite performance; the result is a vast range of system configurations so that the desired performance can be customised. A typical lightweight wall construction consists of Rondo steel framing, Knauf insulation, Knauf plasterboard, or other lining board.

As required by the NCC and relevant Australian standards, lightweight systems must meet a range of performance requirements, including acoustic and fire performance, as well as structural adequacy under dead, live, wind and other applicable loads. For more information, see “Lightweight plasterboard systems in multi-residential projects: National Construction Code structural, fire and acoustic requirements”, which is available [here](#).

Metal components

Typically, metal members known as “studs” are arranged vertically to form a framed or stud wall. Horizontal panels on top and bottom are used to connect the studs, which are spaced at regular intervals. These studs offer vertical support for the main wall.

Insulation

Glasswool insulation, also known as fiberglass insulation, is a material made from fine fibres of glass that are woven together. Glasswool insulation offers high thermal performance and superior sound absorption, making it ideal for various applications.

Glasswool insulation enhances safety by reducing fire risks, while its sound absorption properties make it suitable for environments where noise reduction is important. Additionally, glasswool insulation is low in embodied carbon, contributing to sustainability and reducing environmental impact.

Plasterboard

There is a diverse range of plasterboard products on the market, including products designed for specific applications (such as fire-rated, mould-resistant and impact-resistant variants). Just like with any material, the type of plasterboard you choose will have a significant impact on the appearance, usability, and performance of the wall or ceiling assembly.

Figure 1. Types of Plasterboard (Knauf)

Plasterboard

Knauf offers a wide range of plasterboard products to suit various applications:

| TABLE A7: KNAUF PLASTERBOARD | | | |
|--|--------------|--------------------------|--|
| PRODUCT NAME | THICKNESS mm | WEIGHT kg/m ² | APPLICATIONS |
| SHEETROCK® ONE | 10 | 5.9 | Lightweight wall and ceiling linings |
| SHEETROCK® HD | 13 | 8.5 | Wall and ceiling linings |
| WETSTOP® | 10 | 7.2 | Tiling substrate in wet areas |
| | 13 | 9.2 | |
| SOUNDSTOP® | 10 | 9.0 | Sound insulation between rooms |
| | 13 | 11.8 | |
| ECHOSTOP® | 12.5 | 10.0 | Sound absorption within a room |
| STRATOPANEL® | 12.5 | 7.4-8.6 | Sound absorption within a room |
| FIRESTOP® | 13 | 10.9 | Fire resistant linings |
| | 16 | 13.4 | |
| FIRE WETSTOP™ | 13 16 | 10.9 13.4 | Fire resistant linings in tiled wet areas |
| MULTISTOP™ 4/4HI MULTISTOP™ 5/5HI | 13 | 12 | Fire, sound, moisture and impact resistant linings (optional mould resistant properties) |
| | 16 | 14.6 | |
| FLEXIBOARD® | 6.5 | 4.1 | Curved wall and ceiling linings |
| SHAFTLINER™ MOULDSTOP | 25 | 20.5 | Shaft enclosures & separating walls |
| FIBEROCK® Aqua-Tough™ (paperless gypsum board) | 13 | 11.7 | Impact, moisture, fire, sound & mould resistant linings |
| | 16 | 15.1 | |
| X-Block® | 13 | 17.2 | X-ray radiation protection |

Source: <https://www.knauf.com>



Design examples

| Application | Framing | Plasterboard / Insulation | FRL /Acoustics |
|--|-----------------------------|--|--|
| Corridor or intertenancy wall. In high-rise buildings, corridor and intertenancy walls are intended to act as a separating wall between units. These non-load bearing systems need to perform exceptionally well in terms of fire and acoustics. | 92mm Rondo Quiet Stud | 16mm Firestop both sides KI 75G11 | -/90/90, Rw 50  |
| | 64mm Rondo twin stud frame | 16mm Firestop both sides 2 x KI 75G11 | -/90/90, Rw+ctr 50  |
| Service shaft walls are designed to encase elevator systems and other shafts and ducts in multi-level buildings, and must have the requisite fire resistance. | Rondo 64mm or 102mm CH-Stud | 13mm/16mm Firestop (number of layers dependent on FRL) 25mm Shaftliner Mouldstop KI 50G11 | Upto -/120/120, Rw 52  |

Structural requirements generally

Section B "Structure" of the NCC 2022 contains the structural requirements for Class 2 to 9 buildings. Performance Requirement B1P1 provides that a building must perform adequately under all reasonably expected design actions, withstand extreme or frequently repeated design actions, be designed to sustain local damage, and avoid causing damage to other properties. The types of actions the building must resist include permanent and imposed actions, wind actions, earthquake actions, ground movement and more.

Deemed-to-Satisfy (DtS) Provision B1D2 provides criteria that buildings can meet to satisfy the requirements of B1P1. Under DtS Provision B1D2, the resistance of a building or structure must be greater than the most critical action effect resulting from different combinations of actions.

DtS Provision B1D3 provides standards by which the magnitude of individual actions is to be determined in accordance with "Importance Levels of Buildings and Structures", whereby Level 1 is low degree of hazard to life and Level 4 is essential to post-disaster recovery. In general, actions are determined with reference to the AS/NZS 1170 "Structural design actions" series, which covers the determination of wind (AS/NZS 1170.2), seismic (AS/NZS 1170.4), snow and ice actions (AS/NZS 1170.3), and more.



In relation to wind actions under AS/NZS 1170.2, designers should note that interior wall systems are subject to internal design pressures. When strong winds interact with a structure, the pressures and forces on the surface of the structure can generate internal pressures if there are dominant openings linking the exterior of the building to the interior. These internal pressures need to be factored into the design of internal wall systems.

In relation to lightweight steel-framed systems, designers, architects and specifiers should reference structural steel design standards, including AS/NZS 4600 Cold-formed steel structures, which provides the requirements for the design of structural members.

Structural tests for lightweight construction

General

Lightweight construction systems can offer effective fire protection when appropriately designed and detailed, with additional measures in place to maintain their integrity under fire conditions. Tests on lightweight construction are outlined in Specification 6 in Section C “Fire Resistance” of the NCC 2022 and can be used to prove that the system is acceptable for use as a fire protection system under the Deemed-to-Satisfy Provisions.

Under this provision, “lightweight construction” includes:

- sheet or board material, plaster, render, sprayed application, or other material similarly susceptible to damage by impact, pressure or abrasion; or
- concrete and concrete products containing pumice, perlite, vermiculite, or other soft material similarly susceptible to damage by impact, pressure or abrasion; or
- masonry having a width of less than 70 mm.

Walls generally

Under Clause S6C6, an external and internal wall of lightweight construction that is required to be fire-resisting, other than one covered by S6C3, S6C4 or S6C5 (see below), must be subjected to the following tests:

- the materials tests specified for the constituent materials of the construction of the standards adopted by reference in the NCC;
- a static test by the imposition of a uniformly distributed load of 0.25 kPa (or its equivalent) in accordance with the provisions for testing walls under transverse load in ASTM E72-15;
- a dynamic test by fall of the impact bag through a height of 100 mm in accordance with the provisions for testing wall systems in ASTM E695-03; and
- the surface indentation test carried out at three points on the surface of an undamaged sample sheet.

Walls of certain Class 9b buildings

Clause S6C3 applies to a wall of a lift shaft and stair shaft and an external and internal wall bounding a public corridor, public lobby or the like, including a fire-isolated and non-fire-isolated passageway or ramp, in a spectator stand, sports stadium, cinema or theatre, railway or bus station or airport terminal.

For this type of construction, the static test involves the imposition of a uniformly distributed load of 1.0 kPa (or its equivalent) (rather than 0.25 kPa for walls generally). Additionally, the dynamic test by the fall of the impact bag is at a height of 350 mm.

Walls of shafts and fire-isolated exits

Clause S6C4 applies to walls of lightweight construction that are required to be fire-resisting and which bound a lift shaft, stair shaft, or service shaft, fire-isolated passageway or fire-isolated ramp.

This type of construction must be subjected to the tests outlined above, except that the static test involves the imposition of a uniformly distributed load of 0.35 kPa and the dynamic test involves the fall of the impact bag at a height of 150 mm.

Additional requirements for lift shafts

In addition to Clauses S6C3 and S6C4, Clause S6C5 requires that a wall system for use in a lift shaft that is required to be fire-resisting be subjected to dynamic testing by the imposition of:

- where the lift car speed is 7 m/s or less – 106 cycles of a uniformly distributed load between 0 and 0.2 kPa (or its equivalent); or
- where the lift car speed is greater than 7 m/s – 106 cycles of a uniformly distributed load between 0 and 0.35 kPa (or its equivalent) in accordance with S6C10(e) and must fulfil the damage criteria of S6C11(b).

Clause S6C10(e) sets out requirements when testing the resistance of lift shaft construction to repetitive loads.

Note that the static test should be conducted after the successful conclusion of this dynamic test.

Test methods

Testing needs to be done on a laboratory specimen of the construction in situ. If in-situ testing is required, it must be done on the part of the construction that is least likely to withstand the loads due to a specific combination of the wall height, the support conditions, and other construction-related factors.

When testing a wall specimen in a lab, it is necessary to align the specimen to match the height of the actual wall. The specimen must be supported at both ends in the same way as the actual construction, and the dimensions must correspond to the actual dimensions of the construction.

A smaller specimen may be tested if the actual support distance is greater than three metres, as long as the support distance is not less than three metres. It is also necessary to model the forces and conditions that affect the construction.



Soft body impact to NCC requirements

Criteria for compliance

Clause S6C11 sets out the criteria for compliance as follows:

- **Materials:** Materials must comply with the applicable standard adopted by reference in the NCC.
- **Damage:** There must be no crack, penetration or permanent surface-deformation to a depth of more than 0.5 mm or any other non-elastic deformation or fastener failure.
- **Deflection (static pressure):** Under static pressure, the deflection must not be more than $1/240$ th of the height between supports; or for construction other than a lift shaft – 30 mm; or for a lift shaft – 20 mm.
- **Deflection (impact):** Under impact, the instantaneous deflection must not be more than $1/120$ th of the height of the wall between supports; or for construction other than a lift shaft – 30 mm; or for a lift shaft – 20 mm.
- **Surface indentation:** No impression must be more than 5 mm in diameter.

Choosing the right wall configurations

With the current spotlight on compliance, architects, builders and contractors are under increasing pressure to ensure that all products they specify and install have been designed, verified and/or tested to comply with the requirements of the NCC and relevant Australian standards.

As the leading manufacturer of lightweight systems, including plasterboard and insulation products, Knauf has a range of building solutions to help achieve compliance with the NCC. Their products and systems are independently tested and/or assessed to meet NCC requirements for structural, fire and acoustic performance for lightweight systems.

Knauf products and systems are tested in their NATA-accredited laboratory and satisfy the requirements of NCC Specification 6.

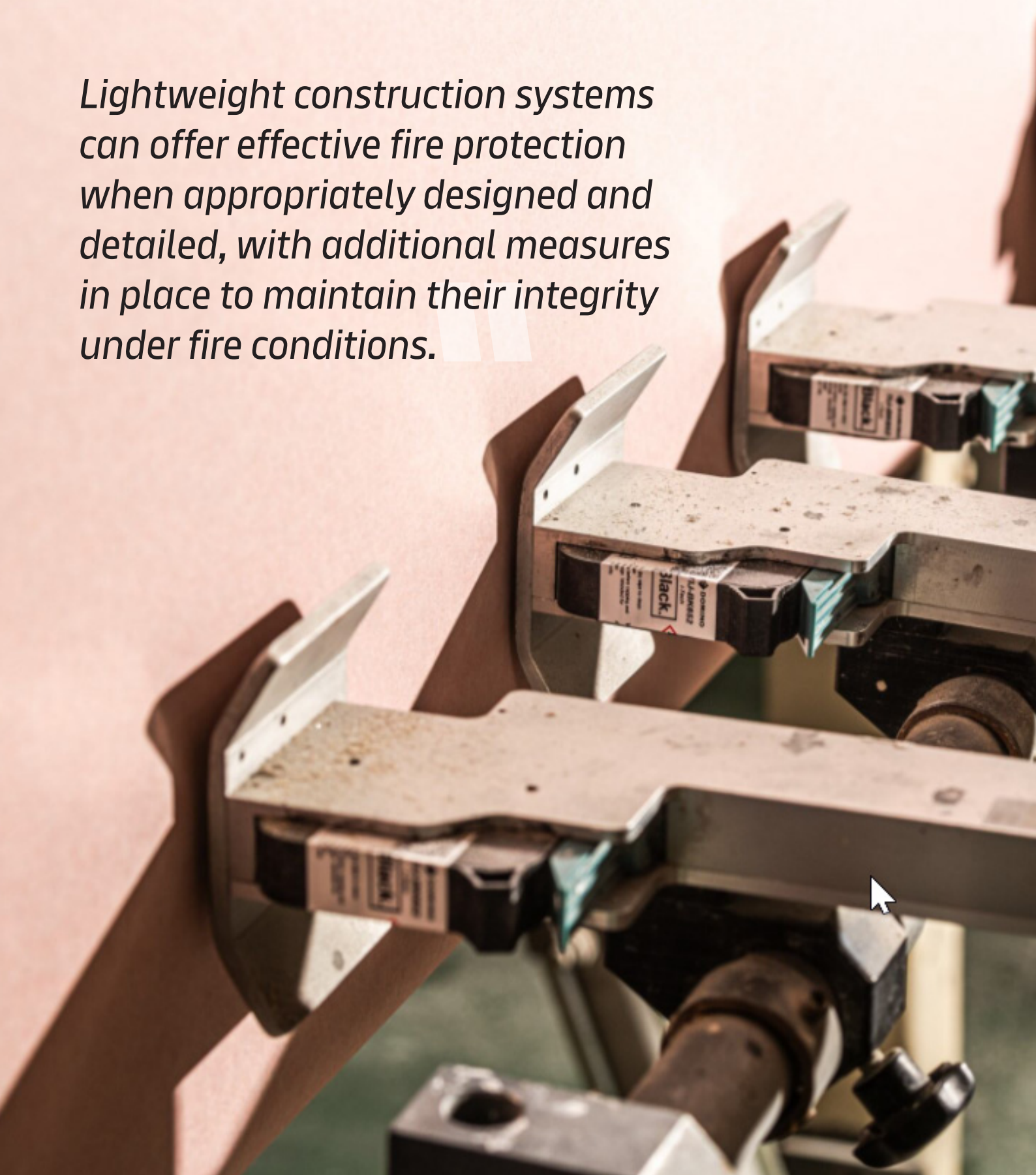
Rondo manufactures and supplies a range of light-gauge rolled-formed steel products and systems, primarily for the construction industry. The company ensures that the performance of its various internal stud wall systems is tested in accordance with the NCC.

Rondo's steel framing systems, including Rondo C-Stud and Quiet Stud framing, enable designs to be carried out in accordance with the NCC and the relevant Australian standards. They will also provide design tables that comply with AS/NZS 4600 and formulate wall heights and ceiling spans in accordance with NCC Specification 6, as required.

Together, Knauf and Rondo can assist you in designing code-compliant lightweight wall systems for various types of applications. This includes both internal and external walls and specialty systems, such as service shaft and lift shaft systems.

These designs are outlined in Systems+, a design guide that makes it easy for architects, engineers, builders, certifiers and plastering contractors to select the right system for any project. The 2024 edition of System+ is available at <https://www.knauf.com>.

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All information provided correct as of April 2025

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