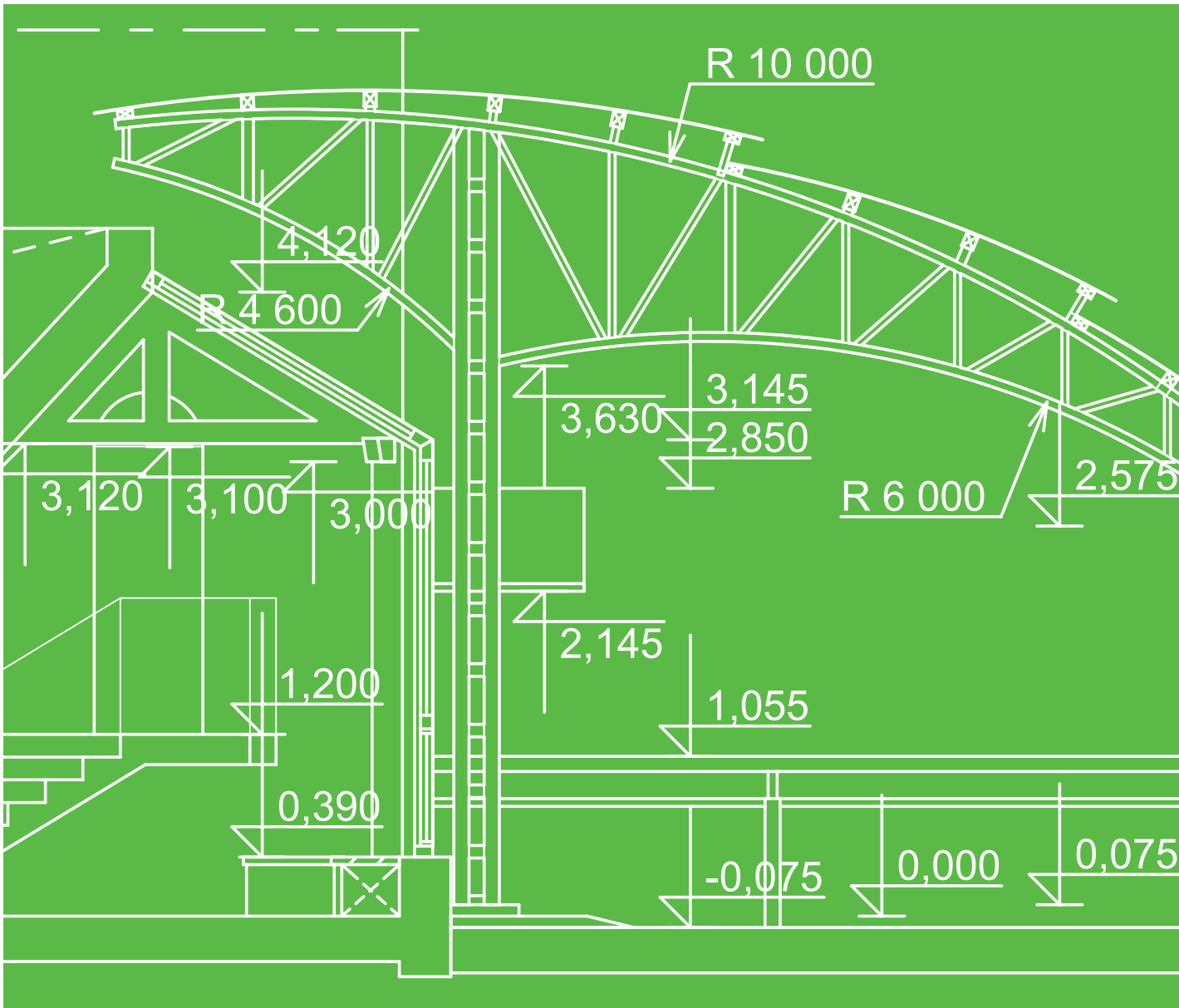
4.0 Structural



Structural Design Guidelines

The design guidelines have been developed to provide a greater level of certainty for all stakeholders when CIAL embark on developing a new commercial asset – the focus is to deliver on the three core pillars of our mission: enhancing people's lives, fuelling economic prosperity and being great Kaitiaki of our planet.

This document outlines CIAL's Structural design requirements for commercial projects with the aim of providing safe, compliant, sustainable, simple and cost effective outcomes for the structure of a building asset.

PURPOSE

CHAMPIONING TE WAIPOUNAMU THE SOUTH ISLAND AND AOTEAROA NEW ZEALAND FOR TODAY AND TOMORROW

MISSION

CHRISTCHURCH AIRPORT IS RECOGNISED FOR

ENHANCING PEOPLE'S LIVES
Our team, customers, partners, communities

+

FUELLING ECONOMIC PROSPERITY
of the South Island and New Zealand

+

GREAT KAITIAKI OF OUR PLANET
Safety, security and sustainability

CHRISTCHURCH AIRPORT

CONTENTS

4.1 INTRODUCTION

Structural designs to be provided to CIAL developments shall meet the NZBC requirements as a minimum but shall also consider the client brief where this specifies a higher standard to be met. Designs shall balance future flexibility and building performance with capital costs.

The guidelines are intended to ensure that the structural design and documentation for the developments are to a consistent high standard.

Selected structural systems must be rationalised against alternative options described in these guidelines to ensure that all options have been considered and the final solution is the most fit for purpose. All projects are to complete the attached compliance checklist for each major design phase.

The guidelines are not intended to restrict designers from making recommendations in the interest of the project but rather to encourage the incorporation of features and systems that will provide flexibility for change of use, new technologies or expansion in the future.

4.2 ENVIRONMENTALLY SUSTAINABLE DESIGN PRACTICES

Environmentally sustainable design (ESD) practices and features should be considered for the structural systems employed in CIAL developments in accordance with section 1.1.7 of the General Design Guidelines.

Some specific ESD practices to be demonstrated for structural systems are listed below:

- Structural systems considered at the preliminary stage shall consider different structural material types and how these can benefit the project from an ESD perspective. This shall be undertaken in conjunction with the architect and client, and some of these considerations may be as below:
  - If using concrete, consider sustainable mix options.
  - If using timber, consider FSC or PEFC-approved timbers.
  - If using steel structure, consider whether:
    - cold rolled steel is suitable for the primary structure, dependent on structural type and form
    - recycled steel can be incorporated into the structure.
- Consideration of ESD at the site preparation and demolition stage if appropriate (e.g. whether the existing concrete and steel foundations can be recycled as recycled aggregate and scrap metal).
- Structural designs shall consider and discuss the possibilities and implications of allowing flexibility for future installation of roof or wall mounted solar.

4.3
CODES AND STANDARDS

The building structure shall meet the requirements of the NZBC, specifically clauses B1 *Structure* and B2 *Durability*.

Below are the key standards that, if met, currently ensure compliance via the verification method for NZBC clause B1.

- AS/NZS 1170.0 *Structural design actions Part 0: General principles*
- AS/NZS 1170.1 *Structural design actions – Part 1: Permanent, imposed and other actions*
- AS/NZS 1170.2 *Structural design actions – Part 2: Wind actions*
- AS/NZS 1170.3 *Structural design actions – Part 3: Snow and ice actions*
- NZS 1170.5 *Structural design actions – Part 5: Earthquake actions – New Zealand*
- NZS 3101.1&2 *Concrete structures standard*
- NZS 4230 *Design of reinforced concrete masonry structures*
- NZS 3404 Parts 1 and 2 *Steel structures standard*
- AS/NZS 4600 *Cold-formed steel structures*
- NZS 3603 *Timber structures standard*
- AS/NZS 1664.1 *Aluminium structures – Limit state design*
- NZS 4297*Engineering design of earth buildings*
- NZS 4211 *Specification for performance of windows*
- NZS 4219 *Seismic performance of engineering systems in buildings*

Below are the key standards that, if met, currently ensure compliance via NZBC acceptable solution B1/AS1.

- NZS 4229 Concrete masonry buildings not requiring specific engineering design
- NZS 3604 *Timber-framed buildings*

The designer shall allow to follow the current standards referenced under NZBC clause B1, which may include revisions, modifications and amendments to these standards or new standards that may supersede all or part of the standards noted above.

In accordance with NZBC clause B2, structural elements are required to meet a durability requirement of not less than 50 years. Below are the key standards with regard to structure that, if met, currently ensure compliance via NZBC acceptable solution B2/AS1.

- NZS 3101.1 *Concrete structures standard* (section 3)
- SNZ TS 3404 *Durability requirements for steel structures and components*
- NZS 3602 *Timber and wood-based products for use in building* as modified in NZBC clause B2 and NZS 3640 *Chemical preservation of round and sawn timber* as modified in NZBC clause B2

The designer shall allow to follow the current standards referenced under NZBC clause B2, which may include revisions, modifications and amendments to these standards or new standards that may supersede all or part of the standards noted above.

4.4 HEALTH AND SAFETY BY DESIGN

Health and safety by design shall be considered as part of the structural design. Refer to the Health and Safety Design Guidelines for specific details with regard to expected documentation and templates. The design shall allow for safe installation of structural components such as but not limited to the following:

- Limitation of precast concrete sizes to those that enable safe transportation and on-site lifting considering any site-specific access constraints.
- Potential for roof erection on the ground.
- Consideration of bolted portal splices where applicable and reducing the extent of on-site welding for structural steelwork.
- The design of the roof structure shall allow for the support of required accessways as required by the other disciplines such as mechanical and fire.
- Consideration shall be given to any requirements for access in order to maintain structural components (e.g. access requirements for future coating upgrades etc.).

As part of the coordination process, the structural consultant shall consider and advise other design consultants if it is obvious that maintenance of structure or services is not possible due to proximity and lack of clearance to structural elements (e.g. an AC unit is proposed next to a structural beam preventing access to filters for maintenance).

4.5 SEISMIC DESIGN

The seismic design of the structure shall meet the minimum requirements of NZS 1170:5. The structural engineer shall consider and discuss with CIAL whether low-damage design is appropriate for the project.

The consultant structural engineer shall provide a PS1 and PS4 on completion of the design and construction phases of the project, or in the instance of a design build project, a PS1, PS3 and PS4 shall be provided. Additionally, the structural engineer shall provide a letter at the completion of the project that states that the building meets a minimum of 100% NBS at the time of design for the use by the client for tenancy of the building.

Consider and discuss with the client whether it is best for the project for the structural consultant to undertake the seismic restraint design for the services and ceilings within the structure.

Where it is decided that the structural engineer is not to undertake the services and ceiling restraint themselves, they shall provide the fundamental period and expected structural displacements of the structure, which are required for the design of the seismic restraint of services to NZS 4219.

Ceilings (designed by the structural consultant if deemed appropriate or as part of a design-build project) shall be designed to AS/NZS 2785 *Suspended ceilings – Design and installation* with seismic restraint of the ceilings undertaken to the actions from NZS 1170.5.

4.6 APPROVED CONTRACTORS

Consider and discuss with CIAL prior to tendering of structural works in CIAL developments whether there is a preference for any nominated contractors or subcontractors.

4.7 DESIGN CONDITIONS AND REQUIREMENTS

4.7.1 DOCUMENTATION LEVEL

The level of detailing (LOD) appropriate for the structure shall be considered and discussed with CIAL. However, the minimum level of detailing expected for structure is LOD 300.

4.7.2 COORDINATION WITH DESIGN TEAM

The structural design and structural model shall be coordinated with the architectural and other design consultants including but not limited to the following:

- Civil
- Hydraulic
- Mechanical
- Electrical
- Fire (including fire protection services).

Where these consultants are not engaged on a project, the civil consultant shall identify any areas of concern or issues with compliance in these areas to the CIAL project manager for discussion.

4.7.3 AWARENESS OF SPACE AND FUTURE FLEXIBILITY

The structural designer shall consider and discuss with CIAL the usable space and ability for the structure to be adapted for future use. As part of this, the structural designer at the preliminary stage shall consider and discuss with CIAL the implications of the following:

- Making the structure as free spanning as possible whilst still meeting the other performance criteria required for the specific project.
- An allowance for future expansion. This future expansion pathway shall be considered in conjunction with the architect and client. This may dictate a specific building structure orientation in order to best allow for future expansion (e.g. it is easier to expand a building through the addition of additional portals than to try and extend the building on the end of existing portals).
- Slab design shall consider how future installation of in-slab services can be achieved.
- Flexibility for future installation of roof or wall-mounted solar. Consider and discuss with the consultant team including mechanical and electrical engineers whether it is possible to place mechanical plant on the south side of the building to leave the north side free for future solar installation.

4.7.4 PENETRATIONS

The structural system shall allow for flexibility of penetrations. Where limitations on penetration locations exist, these shall be communicated with the design team and documented in the consent documentation for future reference. Thought should also be given to provision for spare penetrations within the structure as part of the design, documentation and construction of the building.

4.7.5
FINISHES/COATINGS

The finish of structural systems shall be considered and discussed with CIAL and coordinated with the architect to ensure they meet aesthetic requirements along with other clauses of the NZBC (e.g. concrete finishes for slabs on ground will need to meet the non-slip requirements). Additionally, CIAL may have desire for the project to paint panels on the street frontage.

The structural components shall meet minimum 50-year durability as required by NZBC clause B2. Examples of the ways in which structural materials will be deemed to meet NZBC clause B2 are as follows:

- Concrete surface finishes including placement tolerances shall meet the requirements of NZS 3109 Concrete construction and NZS 3114 *Specification for concrete surface finishes* or any other standard that supersedes these in the future.
- Structural steel protective coatings by paint or hot-dip galvanising shall meet the requirements of AS/NZS 2312 *Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings*.

4.7.6
FOUNDATIONS

The structural engineer shall review the available geotechnical information for the site and provide advice to CIAL. If further testing is required, the structural engineer shall notify CIAL. Foundation design shall be in accordance with geotechnical recommendations.

4.7.7
STRUCTURAL PERFORMANCE CRITERIA

The structural design shall meet the minimum requirements of the NZBC. However, the structural engineer shall consider and discuss with CIAL prior to design whether low-damage design is appropriate for the project.

4.7.8
SUPPORT OF PLANT AND EQUIPMENT

As per section 4.7.2, the structural design shall be coordinated with the consultant team. This shall extend to providing plant decks as required and the provision or structure to support the intended plant at the time of design.

4.7.9
FUTURE EQUIPMENT ALLOWANCE

In addition to support of designed services, the structural designer should consider the addition of future equipment to the roof (i.e. solar panels) and discuss any additional requirements with CIAL.

4.7.10
PEER REVIEW OF STRUCTURAL DESIGN

A peer review of structural design shall be considered and discussed with CIAL. As a general rule, peer review will only be required where the council requests this.

4.7.11
SPECIFIC INDUSTRIAL REQUIREMENTS

4.7.11.1
Warehouse/Breezeway Min Slab Performance

- Min Racking requirements
- 75kN max static column load
- 165kN max seismic column load
- 2T capacity reach trucks with solid rubber wheels
- Min 40Mpa concrete
- Dust sealer with armoured joints at roller doors and construction joints. Preference to have slabs without sawcuts
- Seal slab perimeter and column block outs with galv steel flashings
- All slab design criteria to be agreed with CIAL prior to finalising

4.7.11.2
Warehouse Canopy Supports

All canopy supports shall be designed above the canopy roof line.

4.8 DOCUMENTATION

- The structural designer shall supply a PS1, PS4, structural specification, design features report, calculations and drawings in .dwg and .pdf format.
- If a peer review is undertaken, the peer reviewer shall issue a PS2 and log of communication.
- The contractor shall supply the following:
  - PS3
  - Shop drawing for the following trades:
    - Precast concrete
    - Structural steel
  - Mill certificates for imported materials and confirm compliance with the specification.
- The services seismic restraint designer shall supply a PS1 and PS4 for their package of work.
- The ceiling seismic restraint designer shall supply a PS1 and PS4 for their package of work.

4.9
STRUCTURAL COMPLIANCE CHECKLIST

PROJECT NAME: **DATE:**

SUBMITTED BY: **STAGE:**

SECTION 4.0 STRUCTURAL

		Compliant	Non-Compliant	Not Applicable	Comments
1.0	**GENERAL DESIGN GUIDELINE**				
	All Clauses	☐	☐	☐	
4.0	**MECHANICAL DESIGN GUIDELINES**				
4.1	Introduction	☐	☐	☐	
4.2	Environmentally sustainable design practices	☐	☐	☐	
4.3	Codes and standards	☐	☐	☐	
4.4	Health and safety by design	☐	☐	☐	
4.5	Seismic design	☐	☐	☐	
4.6	Approved contractors	☐	☐	☐	
4.7	Design conditions and requirements	☐	☐	☐	
4.7.1	Documentation level	☐	☐	☐	
4.7.2	Coordination with design team	☐	☐	☐	
4.7.3	Awareness of space and future flexibility	☐	☐	☐	
4.7.4	Penetrations	☐	☐	☐	
4.7.5	Finishes/coatings	☐	☐	☐	
4.7.6	Foundations	☐	☐	☐	
4.7.7	Structural performance criteria	☐	☐	☐	
4.7.8	Support of plant and equipment	☐	☐	☐	
4.7.9	Future equipment allowance	☐	☐	☐	
4.7.10	Peer review of structural design	☐	☐	☐	
4.7.11	Specific industrial requirements	☐	☐	☐	
4.8	Documentation	☐	☐	☐	