

Project process

This fact sheet outlines the key steps and activities that should take place in a building services project where the seismic design is carried out during the construction design phase. This is not the only approach, but it is commonly used in New Zealand.

ANY SEISMIC DESIGN undertaken during the detailed design phase (and included in tender documents) is likely to be typical and needing additional construction phase design to achieve compliance with NZS 4219:2009 *Seismic performance of engineering systems in buildings*.

For more information, see the *Seismic Guide for Mechanical Services Subcontractors* published by the Climate Control Companies Association (CCCA) in 2014.

Objective of the design process

The purpose of the detailed design is to assess and coordinate the interaction of services, structure and architectural elements. The aim is to allow adequate space in ceiling voids, risers and plantrooms for the coordinated seismic restraint of all building services and other relevant non-structural components in accordance with NZS 4219:2009.

Information required at tender

Tender documents should identify:

- building importance level
- building location (or zone factor)
- the design floor accelerations (g loadings) imposed on major proprietary plant and equipment
- identification of all systems that are required for life safety
- for an importance level 4 building, identification of all systems that are to remain operational during and after an SLS2 design strength earthquake
- structure-specific seismic deformation criteria (otherwise, NZS 4219:2009 defaults should be used)
- identification of any concrete or steel structure plastic hinge zones within



which non-structural component fixings should not be made

- premanufacture seismic submission requirements
- the level of construction monitoring to be provided by the building services seismic specialist in order to provide reasonable grounds for the specialist's construction review producer statement (PS4)
- any requirement for the main contractor to engage a single building services seismic specialist to undertake seismic engineering, inspection and certification for all building services trades.

The main contractor should provide architectural and structural drawings.

Tender preparation

Ensure proprietary plant and equipment suppliers receive and price for the design loads (g loadings) that should be included in the tender documents as above.

Post-tender acceptance

Building services seismic specialist

The successful building services contractor should select their seismic specialist(s) as early as practicable.

Seismic design includes the following:

- Design of seismic bracing and fixings for linear components (ducts, pipes, rigid cable support), suspended equipment (for example, fan coil units) and tall floor-mounted equipment (for example, floor-mounted switchboards).
- Design of floor/roof-mounted equipment fixing for seismic loads, including overturning effects.
- When plinths are required, detailing of plinth size/location/thickness including equipment weights plus horizontal and vertical seismic loads at each anchor point.
- Design of wall-mounted equipment support and fixing for seismic loads.

Note that the wall must be sufficiently strong to transfer these loads.

- Selection of vibration isolators and their fixings for seismic loads or design of separate seismic limit stops/snubbers.
- Design of vertical pipe restraints to accommodate structural deformation during a seismic event.
- Design/coordination of pipe expansion/contraction systems and seismic restraint/movement provisions.
- Selection of seismically qualified post-installed concrete anchors.

Construction design phase

Coordination

Coordination meetings/discussions between all relevant trades (for example, services, ceilings and partitions) and their respective seismic specialists should be undertaken as early as practicable. It is important to identify and agree methodologies for key coordination issues:

- Coordination of ceiling and above-ceiling services restraints and seismic clearances. (Some services that may not otherwise need to be restrained may need such restraint to reduce seismic clearance requirements to other services.)
- Coordination of ceiling-mounted services that weigh more than 10 kg where it is aesthetically unacceptable to maintain 25 mm clearance between ceiling and services components. The ceiling must be designed for the gravity and seismic loads associated with the services components.

Building services contractor

The building services contractor should provide the seismic specialist with the following:

- Construction issue versions of tender documents.
- Coordinated shop drawings of architecture, structure, piping, ducting, equipment and associated electrical switchboards, control panels and rigid cable support systems.
- Details of items of proprietary equipment requiring seismic restraint and/or seismic design of fixings.
- For pipe risers and/or other long straight pipe runs with specific thermal expansion provisions, pipe anchor and guide layouts

and corresponding gravity and thermal expansion loads. (Anchors and guides should be designed for combined gravity, thermal expansion and seismic loads.)

- For all pipes and ducts crossing structural seismic joints – proposed methodology and details, for example, bends, offsets, loops and so on or proprietary flexible connections.

Seismic specialist

The seismic specialist should provide the following:

- Seismic restraint layout drawings and design details as required by the contractor to enable construction to begin.
- Calculations and other inputs to enable the building services contractor to submit drawings and details.
- A design producer statement (PS1) confirming that the design meets the performance requirements of NZS 4219:2009. Where the building services contractor prepares designs and details for review and certification by the seismic specialist, they should provide a design review producer statement (PS2).

Seismic submissions

Building services contractor

The building services contractor should provide the following:

- Any seismic calculations and details as specified in the tender/contract documents. In the absence of such specification, refer to the *Seismic Guide for Mechanical Services Subcontractors* Appendix B for a checklist.
- A design producer statement (PS1) and design review producer statement (PS2) where applicable.

Main contractor

The main contractor is responsible for the following:

- Managing the coordination of seismic solutions and details by relevant trade contractors (including but not necessarily limited to services, ceiling and partition subcontractors).
- Communicating any changes that may affect the seismic design of any of the restraint systems.
- Coordinating and reviewing all non-

structural component point loads on the structure prior to submission to the (structural) engineer for review.

Construction phase

Installation

- The building services contractor should install seismic restraints as per the design drawings and provide appropriate quality assurance/inspection of work by site personnel.
- Where on-site or client-driven changes are required, these should be communicated to the seismic specialist, who should provide an amendment to the design.
- The building services contractor should manage and coordinate inspections by the building services seismic specialist commensurate with the required level of seismic specialist construction monitoring as described below.

Construction monitoring

The building services seismic specialist should provide the level of construction monitoring specified in the tender/contract documents. In the absence of such specification, refer to the *Seismic Guide for Mechanical Services Subcontractors* Appendix C for guidelines.

A defined level of construction monitoring provides the reasonable grounds for the seismic specialist's construction review producer statement (PS4).

Seismic certification

The building services contractor should provide a construction producer statement (PS3) certifying that the works have been completed in accordance with the building services seismic specialist's design.

The building services seismic specialist should provide a construction review producer statement (PS4). This certifies that, based on the level of construction monitoring provided by them and information provided by the subcontractor, they believe on reasonable grounds that the works have been completed in accordance with the relevant requirements of the building consent.

Disclaimer: The information contained within this publication is of a general nature only. BRANZ does not accept any responsibility or liability for any direct, indirect, incidental, consequential, special, exemplary or punitive damage, or for any loss of profit, income or any intangible losses, or any claims, costs, expenses, or damage, whether in contract, tort (including negligence), equality or otherwise, arising directly or indirectly from or connected with your use of this publication, or your reliance on information contained in this publication.

ISSN 2463-672X

Copyright © BRANZ 2015. No part of this publication may be photocopied or otherwise reproduced without the prior permission in writing from BRANZ.