



Code of Practice for the Design, Installation and Seismic Restraint of Suspended Ceilings

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- Despite requirements of various NZ Standards, the seismic compliance of ceilings has received scant attention in recent years
- Canterbury and the more recent Wellington and Seddon earthquakes have highlighted a systematic problem



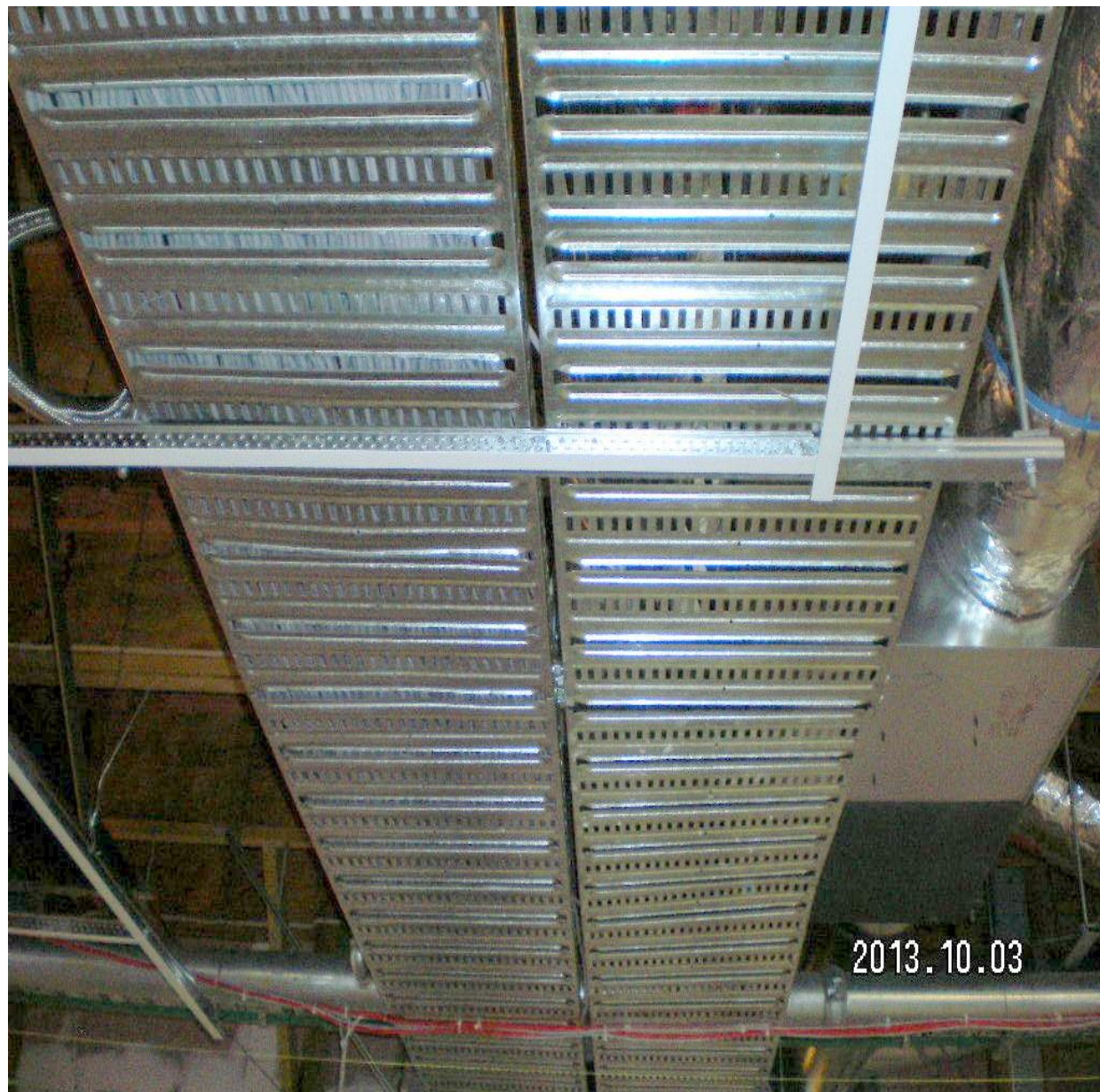
Canterbury University Report

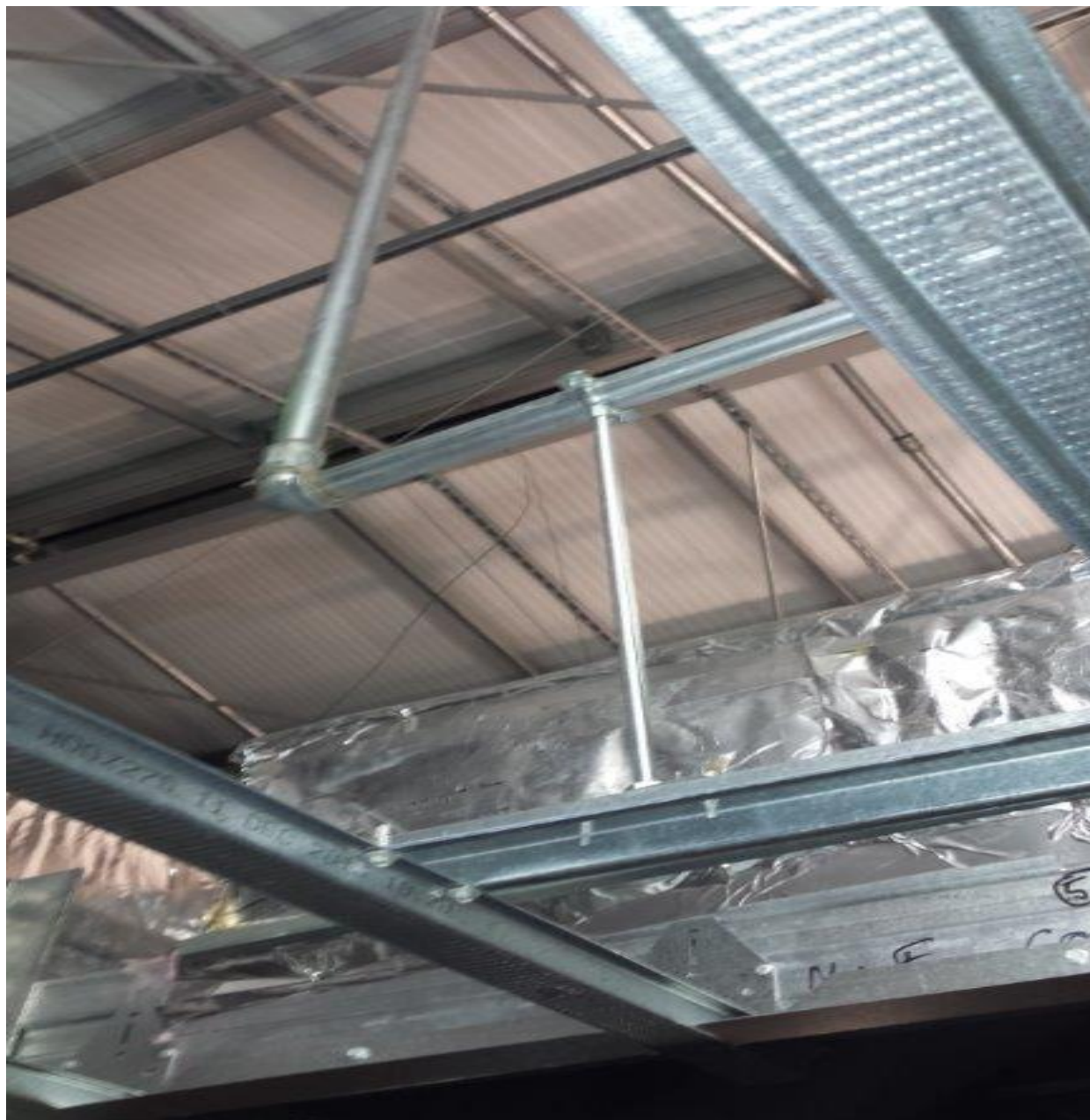
- Review of Design & Installation Practices for Non-Structural Components
- Ceilings, facades & partitions
- Three workshops held at Canterbury University in 2011
- A range of technical & regulatory recommendations
- Restraints of ceilings & other NSE mandatory under Building Code



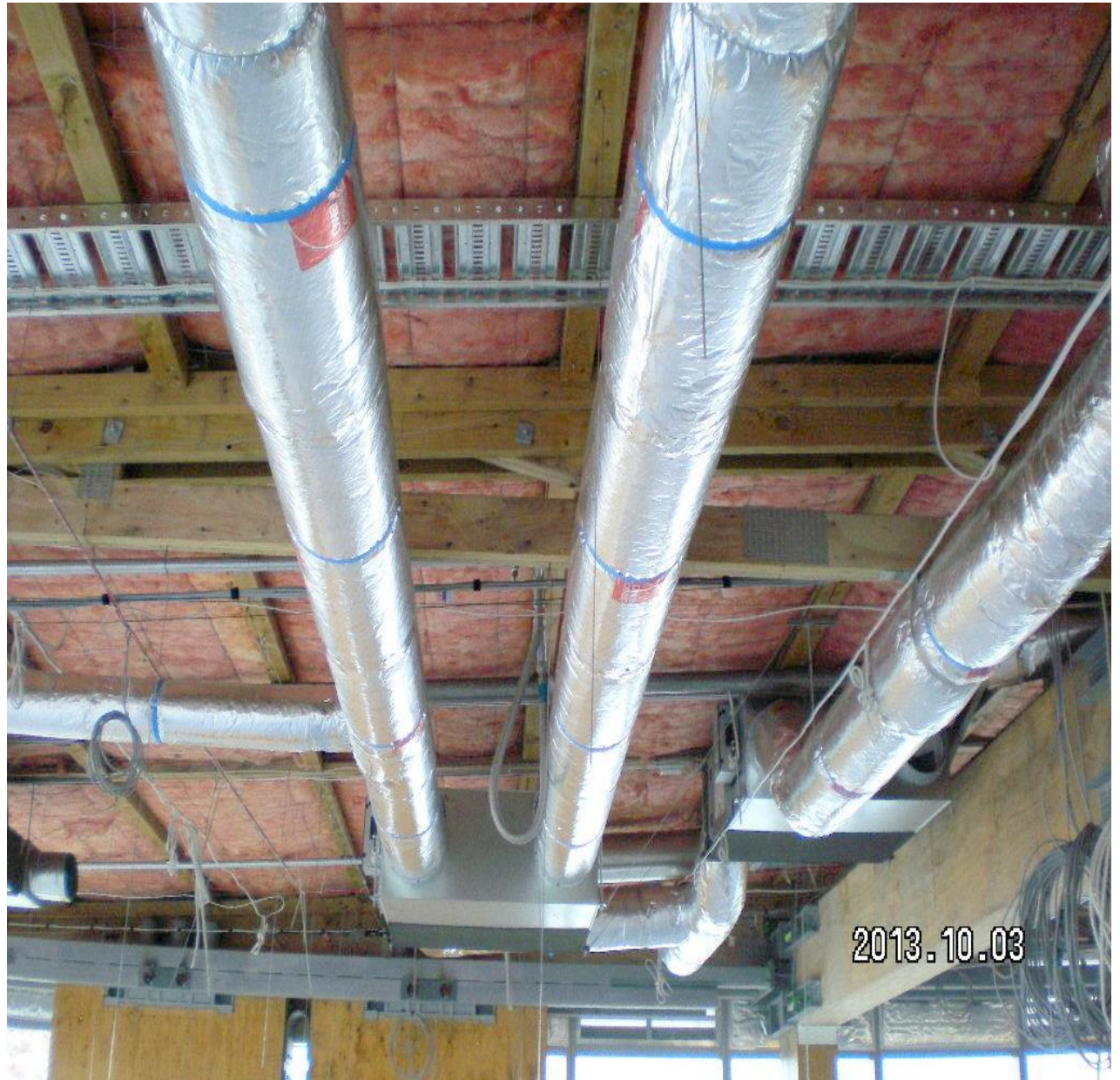
- Well over half the cost incurred in the Christchurch earthquakes were associated with non – structural elements such as ceilings, partitions and services.
- The cost of non – structural element failures had resulted in otherwise repairable buildings being demolished.
- Buildings completed post earthquake often are non-compliant















AWCI Industry Forums

- Held in 2012
- Lack of restraint detail on tender documents
- No integrated design provided of in-ceiling services
- Tenderers are not provided with necessary information or have the resources to design restraint systems
- Ceiling contractors are not Seismic Engineers
- AS / NZS 2785:2000 Suspended Ceilings – Design & Installation long overdue in need of review



AWCI / BRANZ Partnership

to develop an industry Code of Practice

Objectives

- To create greater awareness in the construction sector from design to sign-off, of requirements and conditions for suspended ceilings that are appropriately designed and installed to meet appropriate seismic performance limits in compliance with the NZBC
- Reduced earthquake damage (and associated cost repair) caused by suspended ceiling failure
- To become a cited document in the Building Code as an acceptable solution



Who is it for?

- Designers, engineers, project managers, suppliers, installers and building officials for seismic design, installation & certification of suspended ceilings



The adoption of this Code of Practice will lead to

- Reduced damage
- Reduced repair cost
- Reduced length of time to re-occupy post event



Code of Practice Contents

Introduction

Design

Suspended Ceiling Types

Acoustics

Tendering

Monitoring Design & Construction

Maintenance

Background

Design Documentation

Fire & Suspended Ceilings

Possible Reasons &
Consequences of Failure

Installation

Roles & Responsibilities

Appendices

Design

Integrated design at the earliest possible stage leads to

- More accurate costings
- Better & faster installation
- Fewer variations
- Fewer time delays
- Fewer site conflicts
- Compliance

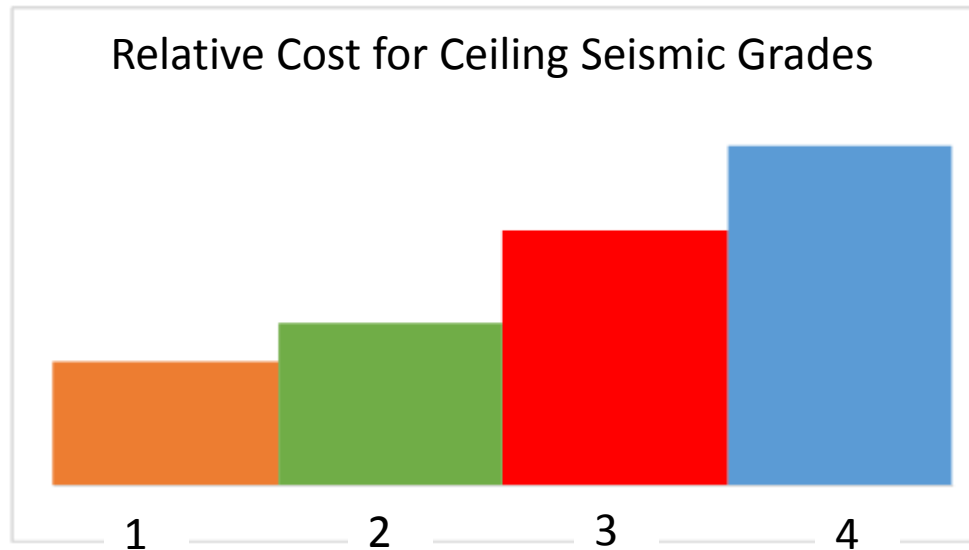
Seismic Grade

Extent of seismic
restraints,
engineering,
design,
monitoring &
certification

High



Low





Identifying the Seismic Grade of each ceiling

- Structural Engineer to make conservative assumptions on
 - Site subsoil category
 - Building & ceiling risk category
 - Building & ceiling ductility
 - Period of vibration

Design Documentation

What Engineers need!!!

What Contractors need !!!

- All the necessary information to calculate a compliant design
- All the necessary information to calculate and/or cost a compliant design

Information needed with consent and required in specification

- Building Classification
- Importance level
- Category
- ULS or SLS
- Return periods
- PS1 – PS4 ??

Why?

- So it can be done right
- Or else assumptions will rule
- PS 3's only lead to abuse

Possible reasons for failure of suspended ceilings

- Unsuitable ceiling design
- The use of an unsuitable product / system
- Installation not meeting manufacturer, supplier or NZ Building Code requirements
- Ceiling wires not installed correctly
- Services in the ceiling space or connected to the ceiling grid not installed to the current Standards / Building Code requirements



- Perimeter walls or bulkheads insufficient to receive line loads of the ceiling
- Insufficient seismic gaps to allow for movement of the building structure
- Partitions being connected to the ceiling system but not independently braced
- A lighter gauge of ceiling grid or non-tested system being installed outside of its non – structural capacity



- Interference from non – structural building components in the plenum

Tender

- Usually no restraint detail on tender documents
- Four common tendering scenarios
 - Seismic restraints are tagged out
 - Provisional Sums nominated
 - Seismic Engineer employed to design restraints
 - Restraints are ignored

Guess which tender wins????

AWCI Tendering Protocol for Grid Suspended Ceiling Installations

AWCI Tendering Protocol for Grid Suspended Ceiling Installations

1. All installed suspended ceilings must comply with AS/NZS 2769:2005 and the seismic restraint requirements of AS/NZS 1170:2004.
2. AS/NZS 2769:2005 is encouraged to submit tenders for grid suspended ceilings based on the AWCI Tendering Protocol to assure compliance.
3. Options for the design of seismic restraints for Grid Suspended Ceilings include:
 - Option 1:** Full design of ceiling seismic restraint system by structural engineer tender documents. Full seismic restraint design incorporated in building consent documentation and tender documents. This option is preferred to encourage fully conforming and unsplit tenders, and to assure fully compliant ceiling installations.
 - Option 2:** Generic Design Guidelines. New Zealand manufacturer/supplier Generic Design Guidelines provide seismic bracing installation details for basic ceilings within production limitations and structural performance assumptions for sub-contractor design and pricing. This option encourages fully conforming tenders generally limited to Category 1-2 (AS/NZS 1170:2004 Table 4-1) ceilings to Seismicity Limit State (SLS) with limited SLS options also available. Option 3 tenders should identify the proposed bracing concept, the applicable Generic Design Guide, and any underlying design assumptions. Any ceilings outside the scope of Generic Design Guides (generally being greater than 3000 mm above ground level, or where individual components weigh more than 10 kg and are able to fall more than 3 m onto a publicly accessible area) should be nominated in the tender and identified for specific engineering design, and a Provisional Sum allowed for engineering design.
 - * Unless otherwise stated, in the ceiling contractor's tender underlying assumptions include building importance level of 1 or less (AS/NZS 1170:2004 Table 1-1), seismic geographic location (AS/NZS 1170:2004 Table 1-2), annual probability of exceedance 10% (AS/NZS 1170:2004 Table 1-3), and adequate space and fixing provisions for installation of compliant seismic restraints. The main contractor or the client's structural engineer should verify tendered fixed assumptions (wherever other full engineering data is available, and any required additional bracing should be a variation).
 - Option 3:** Specific engineering design. Specific engineering design required where Option 1 does not apply, and Option 2 does not apply to some or all ceilings. Unless full engineering data has been provided within the tender documents, such design must be carried out (wherever other full structural and building performance data is available). Where the scope of seismic bracing cannot be accurately ascertained at tender a Provisional Sum should be nominated for the added cost of bracing.
 - * A Provisional Sum (not being an estimate for seismic bracing) should identify the ceiling areas requiring specific engineering design, to cover the cost of specialist engineering design, design (product statements (PSs) apply) and installation of seismic bracing, and engineer product statements (PSs) for the actual seismic restraints. Unless otherwise stated such Provisional Sum should be included in the tender price.

General


- Minimum structural engineering information requirements for Options 2 and 3 include mean period, building importance level, building classification, SLS/LSLs, provisions for load transfer to structure, requirements for product statement, any confirmation that seismic loads will be maintained (in accordance with AS/NZS 4216).
- Product statements, where specified, shall be provided for the entire design and/or the completed ceiling installation. Any additional or interim product statements for separate areas or completion stages shall be a variation.
- Shop drawings shall comply as a minimum reflected ceiling plans marked up to show the position and type of seismic bracing and seismic control provisions.
- Shop drawings submitted for approval shall unless approved in writing be deemed approved within 10 working days of submission.

Coordination of services and windows with ceiling fixings and bracing

The main contractor shall initiate steps to the ceiling contractor:

- Provide suitable fixing points and all secondary steelwork, girth bracing, etc. for fixing of ceiling hangers and bracing.
- Provide continuous rigid ceiling and fixings wherever ceilings abut partitions and bulkheads.
- Ensure that all hoisting services are installed early in accordance with AS/NZS 4216 including all components and services over 10g are restrained from falling and compatible (back up) paper claspings from ceiling and supports in accordance with AS/NZS 4216.
- Coordinate the applied bracing with structure and hoisting services.

Any requirement for additional steelwork, in mostly proposed bracing or support requirements due to a lack of structural fixings and support or for coordination with hoisting services, should be a variation.


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- Protocol options are designed to assist tenderers
 - Submit offers based on consistent information
 - Reduce the number of tags
 - Reduce the number of on-site variations
 - Reduce on-site conflicts with other trades
 - Give a more accurate costing
 - Reduce the number of variables in the tender



Where Tender Documents do not nominate seismic allowances, a sample tender note is suggested:

A Provisional Sum of \$ xxx,xxx excl GST has been included for the installation of seismic restraints for the ceiling system including the engineering by an independent specialist seismic design engineer) supply, installation and certification to AS/NZS 2785:2000 and NZS 1170.5:2004.



Producer Statements

- PS 1 Design
- PS 2 Design review
- PS 3 Construction
- PS 4 Construction Review



Roles & Responsibilities

NZS 4219

Services covered under this standard must be designed and constructed for compatibility.

Who is responsible?



- The Designer
 - Identify the Seismic Grade of the ceiling
 - Design the ceiling
 - Design appropriate seismic restraints
 - Issue a PS1 to certify the design (when required)
 - Commission a PS2 if required
 - Issue a PS4 if requested to do so



- The Tenderer
 - Ensure all ceiling details work
 - Identify the Seismic Grade of the ceiling
 - Identify a provisional sum allowance for seismic restraints (as applicable)
 - Review coordination with other trades



- The Installer
 - Prepare shop drawings (if required)
 - Submit shop drawings
 - Obtain approvals
 - Install the ceiling in accordance with the approved shop drawings or seismic specialist design
 - Inspect seismic restraints for conformance with approved design
 - Issue a PS3 on completion



- The Building Consent Authority
 - Review consent documents for Building Code compliance, especially the requirement for and design of seismic restraints
 - Review installation for conformance with consented drawings



Here is the Draft Code of Practice for Design, Installation and Seismic Restraint of Suspended Ceiling

Please download from www.awcinz.org.nz

We want your comments

Where to from here?

Public discussion forums Oct / Nov in

- Wellington
- Auckland
- Hamilton
- Christchurch
- Submissions close 27th November
- Launch by Minister Feb 2015
- Develop Tool Box version 2015
- Education seminars 2015



Questions Please?