nzsee
NEW ZEALAND SOCIETY FOR EARTHQUAKE ENGINEERING

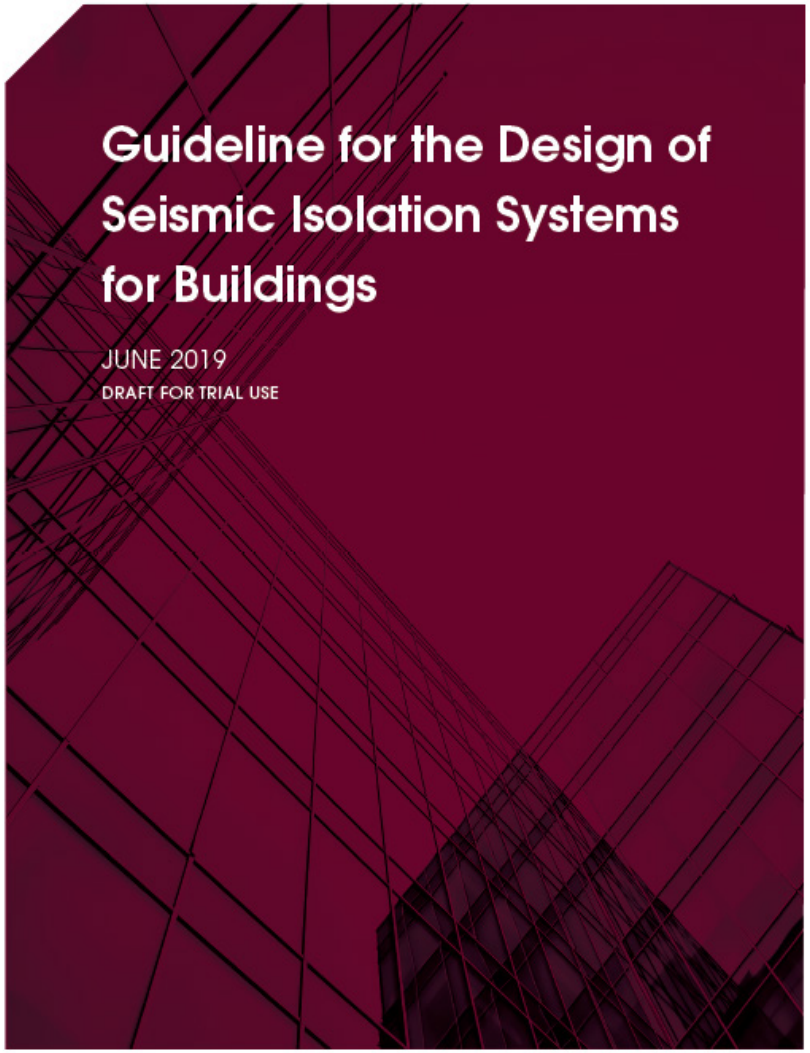
MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HIKINA WHAKATUTUKI

SESOC

NZCS New Zealand Concrete Society

EQC

QuakeCentre






nzsee NEW ZEALAND SOCIETY FOR EARTHQUAKE ENGINEERING

Beca

# Guideline for Buildings with Seismic Isolation

https://www.nzsee.org.nz/wp-content/uploads/2019/06/2825-Seismic-Isolation-Guidelines-Digital.pdf

- Supplements NZS 1170.5 (Earthquake actions)
- Displacement-based with period elongation and damping
- 4 system types – Simple, General, Complex, Brittle
- Analysis methods: simple SDOF ADRS, Modal Response Spectrum and NLRHA (time history)
- Design actions and step by step procedures for substructure, isolation & superstructure
- Includes inspection & maintenance, purchase specification for isolation system and devices
- Draft for Trial Use – now 5 years old!

# TABLE OF CONTENTS

nzsee NEW ZEALAND SOCIETY FOR EARTHQUAKE ENGINEERING

Beca

# "Parts" of isolated structures



## 8.2 DESIGN RESPONSE COEFFICIENT FOR PARTS

When the part is supported directly on the ground floor it shall be designed as a separate structure with design actions derived in accordance with Section 5 using the structural characteristics determined in Section 4.

In cases when the part is supported at level $i$ of a structure, the design response coefficient for parts, $C_p(T_p)$ is the horizontal acceleration coefficient derived for the level of structure that provides support for the part. It shall be determined from Equation 8.2(1):

$$C_p(T_p) = C(0)\, C_{Hi}\, C_i(T_p) \quad \ldots 8.2(1)$$

where

$C(0)$ = the site hazard coefficient for $T = 0$ determined from Clause 3.1, using the values for the modal response spectrum method and numerical integration time history methods

$C_{Hi}$ = the floor height coefficient for level $i$, determined from Clause 8.3

$T_p$ = the period of the part

$C_i(T_p)$ = the part spectral shape factor at level $i$, determined from Clause 8.4

## 5.8 Analysis of part of a building, and floor response spectra.

Parts of an isolated structure, permanent non-structural components and the attachments to them, and the attachments for permanent equipment supported by a structure should be analysed and designed to resist seismic forces and displacements based on the 'parts and components' loading of NZS 1170.5 Section 8 with the site hazard coefficient C(0) modified to equate the peak design acceleration of the base slab just above the isolators for the required limit state (typically SLS and ULS will be required as a minimum).

# Comments

- 5 years old … time to remove “Draft”
- Isolation not the only protective technology
- Isolation + viscous damping - double reduction
- “0.3” Rules of thumb
  - 0.3% drift for onset of drift sensitive elements
  - 0.3g floor acceleration for force sensitive elements

# Challenges for EQ Protective Technologies

- Increased seismic risk awareness and expectations
- Updated NSHM has increased seismic hazard estimates
- Limited experience of structural engineers
- Building Code compliance
- Specification, supply and testing of devices
- Earthquake insurance availability
- Sustainability and resilient infrastructure demands

END