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New Zealand Standard

Committee: P1170.5

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Standards New Zealand

PO Box 1473, Wellington 6140

Committee representation

This standard was prepared by the P1170.5 Committee. The membership of the committee was approved by the New Zealand Standards Executive and appointed by the New Zealand Standards Executive under the Standards and Accreditation Act 2015.

The committee consisted of representatives of the following nominating organisations:

BRANZ

Building Officials Institute of NZS (BOINZ)

Building Systems Performance, MBIE

Concrete Learned Society

GNS Science

HERA

Ministry of Education

NZ Geotechnical Society

NZ Society for Earthquake Engineering (NZSEE)

Structural Engineering Society New Zealand (SESOC)

Te Whatu Ora – Health New Zealand

Timber Design Society

Universities New Zealand – Te Pōkai Tara

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DZ TS 1170.5:2024

New Zealand technical specification

Structural design actions

Part 5: Earthquake actions – New Zealand

Table of Contents

Referenced documents

Reference is made in this document to the following:

New Zealand standards

NZS 3101:- - - - Concrete structures standard

Part 1:2006 The design of concrete structures

Part 2: 2006 Commentary on the design of concrete structures

NZS 3101:- - - - Concrete structures standard

Part 1:1995 The design of concrete structures

Part 2:1995 Commentary on the design of concrete structures

Joint Australian/New Zealand standards

AS/NZS 1170:- - - - Structural-design actions

Part 0: 2002 General principles

Part 1: 2002 Permanent, imposed, and other actions

Part 3: 1995 Snow and ice actions

Other publications

Fenwick, R C, Dely, R, Davidson, B J. 'Ductility demand for uni-directional and reversing plastic hinges in ductile moment resisting frames.' *Bulletin of the New Zealand National Society for Earthquake Engineering*, 32(1) (1999): 1–12.

Websites

www.legislation.govt.nz

Table 3.4 & 3.5 - https://www.standards.govt.nz/Resources/TS-1170.5-Tables-3.4-and-3.5.zip

Latest revisions

The users of this technical specification should ensure that their copies of the above-mentioned New Zealand standards are the latest revisions. Amendments to referenced New Zealand and joint Australian/New Zealand standards can be found at www.standards.govt.nz

Review of standards

Suggestions for improvement of this standard are welcomed. They should be sent to the National Manager, Standards New Zealand, PO Box 1473, Wellington 6140.

Foreword

This technical specification (TS) was prepared by the TS 1170.5 Committee to introduce the National Seismic Hazard Model (NSHM) 2022 update into design practice. The TS also introduces the geotechnical requirements for seismic design and addresses other pertinent issues.

The provisions of this TS were developed through modifications to NZS 1170.5:2004, with consideration of aspects from Amendment 1 considered valid to include at this time. At time of publication, this TS is not referenced in the Verification Method B1/VM1 of the New Zealand Building Code; NZS 1170.5:2004 remains the referenced standard at this time.

This TS addresses::

(a) Limitations on the extent of reduction in seismic demand parameters available from special studies;
(b) Inclusion of new site demand parameters as a result of the NSHM 2022 update;
(c) Revision of formulation for the site spectra;
(d) Revision to site soil-class derivation;
(e) Consideration of additional faults when evaluating the near-fault factor;
(f) Specific inclusion of geotechnical considerations in performance requirements and setting appropriate geotechnical loading parameters;
(g) Changes to the derivation of the horizontal design action coefficient for short-period structures;
(h) Addition of a simplified design for shallow foundations;
(i) Removal of specific requirements for ratcheting;
(j) Acceptance of sliding under ultimate limit state (ULS) actions; and
(k) Changes to the derivation of design actions for parts and components.

The commentary to this TS is TS 1170.5 Supplement 1:2024. It provides background to the various provisions of the TS, suggests approaches that may satisfy the intent of this TS and, if appropriate, describes differences between this TS and the previous standard. Clause numbers in the commentary are prefixed with the letter ‘C’ to differentiate them from the TS. References related to each section, provided for further reading, are listed in the ‘Referenced documents’ section of the commentary.

The terms ‘normative’ and ‘informative’ are used in this TS to define the application of the appendix to which they apply. A normative appendix is an integral part of this TS; an informative appendix is for information and guidance only. Appendix A is an informative appendix to guide developers of material-specific structural-design standards that are intended to be used with this TS. Appendix A does not apply to the design of a specific structure when a conforming material-specific structural-design standard is being used.

1 General

1.1 Scope

This technical specification (TS) sets out procedures and criteria for establishing the earthquake actions to be used in the limit-state design of structures and parts of structures in New Zealand that are within the scope of Part 0 of AS/NZS 1170.

The design of the following structures for earthquake actions is outside the scope of this TS:

(a) Bridges;
(b) Tanks containing liquids;
(c) Civil structures, including dams and bunds;
(d) Offshore structures that are partly or fully immersed; and
(e) Soil-retaining structures.

This TS does not address the effects of slope instability, liquefaction, fault displacement, or seiche or tsunami caused by earthquake shaking.

This TS is to be used in conjunction with material-specific structural design standards that comply with the requirements of Appendix A. Any such standard is referred to here as an 'appropriate-material standard'.

1.2 Determination of earthquake actions

Earthquake actions for use in design, E_u for ultimate limit state (ULS) and E_s for serviceability limit state (SLS), shall be appropriate for the type of structure or element, its intended use, design working life and exposure to earthquake shaking. Earthquake actions determined in accordance with this TS shall be deemed to comply with the requirements of this clause.

1.3 Limit states

The requirements for the ULS and SLS defined in AS/NZS 1170.0 are deemed to be satisfied by compliance with this TS, except as specified in 3.1.3.2 for site-specific dynamic analysis for Site Class VII sites when no reduction is permissible.

1.4 Special studies

A special study shall be carried out to justify any departure from, or extension of, the provisions of this TS. Such studies are outside the scope of this TS. A special study shall ensure that the underpinning principles and performance objectives of this TS are maintained. Further guidance is given in Appendix A of AS/NZS 1170.0.

Site demand parameters derived via a special study shall be at least 0.8 times the respective parameters determined based on the minimum provisions of this TS, except as specified in 3.1.3.2 for site-specific dynamic analysis for Site Class VII sites when no reduction is permissible.

1.5 Units

Except when specifically noted, this TS uses SI units of kilograms (kg), metres (m), seconds (s), pascals (Pa) and newtons (N).

1.6 Definitions

For the purpose of this TS, the definitions below apply:

Appropriate material standard	A limit state format material standard for the particular material under consideration that has been developed for use with this TS and, where required (i.e., where μ is taken greater than 1.00), incorporates detailing provisions to achieve the required inelastic strain demands under earthquake actions, and also procedures for carrying out capacity design. Such standards shall comply with Appendix A
Base	The level at which earthquake motions are considered to be imparted to the structure, or the level at which the structure as a dynamic vibrator is supported, or the level at which primary ground coupling takes place

Brittle structure	See the definitions under ‘structural systems’ in this clause
Building part	A member or element that is attached to and supported by the structure, and can be loaded by an earthquake, but is not considered to be part of the primary structure for the purposes of design.
Capacity design	The design method in which elements of the primary horizontal earthquake-action-resisting system are chosen and suitably designed and detailed for energy dissipation under severe deformations. All other structural elements are then provided with sufficient strength so that the chosen means of energy dissipation can be maintained
Capacity design principles	Appropriate-material-standard design and detailing provisions that enable zones where post-elastic response is acceptable to be identified and detailed in a manner that ensures these zones are capable of accepting the inelastic demands placed upon them. All other zones are designed to ensure that undesirable inelastic response mechanisms are suppressed and detailed in a manner that the ULS horizontal deformations that they are expected to be subjected to can be sustained without significant (e.g. > 20%) loss of load-carrying capacity after four complete cycles of loading
Connection	A mechanical means that provides a load path for actions between structural members, between non-structural elements, and between structural members and non-structural elements
Design capacity	The capacity of an element or a structure, or both, taking into account its design strength and ductile capability as determined from the appropriate-material standard
Design spectrum	A spectrum used for the analysis and design of a structure
Design strength	Nominal strength multiplied by the strength-reduction factor, as given in the appropriate-material standard
Designer	A suitably qualified person who is responsible for the adequacy of all aspects of a design that affect structural performance
Diaphragm	A horizontal or near-horizontal system that acts to transmit horizontal actions to the vertical elements of lateral action-resisting elements NOTE – See also the definitions of ‘flexible diaphragm’ and ‘rigid diaphragm’
Ductile structure	A structure designed and detailed in accordance with this TS and the appropriate-material standard, so that it is appropriate to use a structural-ductility factor greater than 1.25 and less than or equal to 6.0 to assess the ULS seismic actions
Ductility	See the definitions of ‘member ductility’ ‘structural ductility’, ‘ductility provisions’ and ‘ductile structure’
Ductility provisions	An appropriate material standard, as described in clause 2.2.1 of B1/VM1 of the New Zealand Building Code, which provides details of provisions for the development of potential inelastic zones within members, either when post-elastic behaviour is expected, or the development of inelastic behaviour is suppressed

	NOTE – See also the definition of 'ductile structure'
Earthquake actions	Inertia-induced actions arising from the structural response to earthquake
Element	A physically distinguishable assembly of members that act together in resisting lateral actions (e.g. moment-resisting frames, structural or 'shear' walls, and diaphragms)
Flexible diaphragm	A diaphragm in which the maximum lateral deformation of the diaphragm is more than twice the average inter-storey deflection of the vertical lateral force-resisting elements of the associated storey at the limit state under consideration
Inter-storey height	The overall height between two successive levels of a structure
Limit state	See the definitions of 'serviceability limit state (SLS)' and 'ultimate limit state (ULS)'
Limited ductility provisions	Appropriate material standard detailing provisions that will result for potential inelastic zones within members when post-elastic behaviour is expected, and other zones or members where the development of inelastic behaviour is suppressed. Potential inelastic zones shall be capable of sustaining the level of inelastic demand placed on them when they are subjected to ULS shaking. Zones where inelastic behaviour is suppressed are to be designed, to ensure suppression of that behaviour. These zones are to be detailed in such a manner that the ULS horizontal deformations can be sustained without significant (e.g. > 20%) loss of vertical load-carrying capacity
Load-deflection characteristics of a member	The load versus deformation relationship for a member under a deformation-imposed inelastic loading regime, in accordance with a recognised seismic-element testing standard
Member	A physically distinguishable part of a structure, such as a wall, beam, column, slab, or connection
Member ductility	The ability of a member to maintain the capacity to carry certain loads while exhibiting plastic deformations and dissipating energy when it is subjected to cyclic inelastic displacements during an earthquake
Nominal strength	Nominal strength multiplied by the strength-reduction factor, as given in the appropriate material standard
Nominally ductile structure	A structure designed and detailed in accordance with this TS and the appropriate material standard, so that a structural-ductility factor that is greater than 1.0 and less than or equal to 1.25 can be used to assess the ULS seismic actions
Overstrength	The maximum probable strength of a member section, calculated by taking into account the main factors that may contribute to an increase in strength, as defined in the appropriate-material standard
P-delta effect	The structural actions induced as a consequence of gravity loads being displaced horizontally due to horizontal actions

Part	An element that is not intended to participate in a structure's overall resistance to horizontal displacement under earthquake conditions, for the direction being considered
Partition	A permanent or relocatable internal dividing wall between floor spaces
Primary structure	The structural system provided to carry the inertial-action effects generated in the structure by earthquake actions to the ground
Principal axis	One of two orthogonal directions of consideration, at least one of which is aligned parallel to a system's principal horizontal action-resisting system
Probable strength	The theoretical strength of a member section, calculated using the expected mean material strengths, as defined in the appropriate-material standard
Rigid diaphragm	A diaphragm in which the maximum lateral deformation of the diaphragm is equal to or less than twice the average inter-storey deflection of the vertical lateral force-resisting elements of the associated storey at the limit state under consideration
Rocking foundations	Any seismic lateral-load-resisting foundation system in which the fixed-base overturning demand exceeds the foundation overturning capacity
Secondary elements	Elements of a secondary structure that are not part of the main energy-dissipating structure
Secondary members	Members that are not considered to be part of an earthquake-resisting system and whose strength and stiffness against seismic actions is neglected. Secondary members are not required to comply with this TS, but shall be designed and detailed to maintain support of gravity loads when subjected to the displacements caused by the seismic design condition
Secondary structure	The structural system provided to carry actions other than earthquake actions generated in the structure
Seismic demand parameters	See definitions of 'peak ground accelerations' and 'spectral accelerations' 'in section 3 and 'design actions on parts and components' in section 8
Serviceability limit state (SLS)	The condition reached when a structure experiences damage that limits its intended use, through deformation, vibratory response, degradation, or other physical aspects under an earthquake of low intensity
Special study	A procedure to justify departure from some or all of the requirements of this-TS NOTE – Special studies are outside the scope of this TS
Storey	The part of a structural system between logical consecutive horizontal divisions
Strength	See the definitions of 'design strength', 'nominal strength', 'overstrength', and 'probable strength' in this clause
Structural ductility	The ability of a structure to sustain its load-carrying capacity and dissipate energy when it is subjected to cyclic inelastic displacements during an earthquake, taking into account plastic mechanisms developing and the

	ability of structural members to accommodate the consequential demands for plasticity
Structural-ductility factor	A numerical assessment of a structure's ability to sustain cyclic inelastic displacements. The value of the structural-ductility factor depends on the structural form, the ductility of the structure's materials, and structural damping characteristics
Structural-performance factor	A numerical assessment of a structure's ability to survive cyclic inelastic displacements. The value of the structural-performance factor depends on the material, form, and period of the seismic-resisting system, damping of the structure, and interaction of the structure with the ground
Structural systems	See the definitions of 'brittle structure', 'ductile structure', and 'nominally ductile structure' in this clause
Top (of a structure)	The level of the uppermost principal seismic weight
Ultimate limit state (ULS)	In earthquake-resistant design, the state when the capacity of an element or structure, or both, is reached, based on the strength, strain, ductility, and deformation design limits that are specified in this TS and appropriate material standards. If the structure as a whole has sustained significant structural damage, it shall have reserve capacity to avoid structural collapse
Weak storey	A storey whose shear strength is less than 90% that of the storey above

1.7 Notation

Unless stated otherwise, this TS uses the following notations:

a_j	Horizontal offset at column *j*
b	Width of a structure measured normal to the direction of the applied seismic design forces (mm) (see 5.4.2)
b_j	Vertical distance between the base of the upper column and the top of the lower column (see 4.5.3)
$C(T)$	Elastic site spectrum for horizontal loading (g) (see 3.1.1)
$C(T_1)$	Ordinate of the elastic site spectrum for the highest translational period of vibration (g) (see 5.2.1.1)
$C_d(T)$	Horizontal design response spectrum (g) (see 5.2.2.1)
$C_d(T_1)$	Horizontal design action coefficient (g) (see 5.2.1.1)
C_{Hi}	Floor-height coefficient at level *i* (see 8.3)
$C_I(T_v)$	Spectral acceleration for horizontal loading, determined for Site Class I from 3.1.1, for the annual probability of exceedance appropriate for the limit state under consideration, as prescribed in Table 3.3 of AS/NZS 1170.0 (g) (see 3.2)
$C_i(T_p)$	Spectral-shape coefficient, for a part or component (see 8.5)
CPT	Cone Penetration Test
$C_p(T_p)$	Horizontal design coefficient, for a part or component (see 8.2)
$C_p(T_{p,long})$	Design response coefficient for a long-period parts or component (see 8.2)

C_{ph}	Horizontal-response factor, for a part or component (see 8.6)
C_{pv}	Vertical-response factor, for a part or component (see 8.6)
C_{str}	Structural-nonlinearity-reduction factor (see 8.4)
$C_{str,max}$	Maximum structural-nonlinearity-reduction factor (see 8.4)
$C_v(T_v)$	Elastic site-hazard spectrum for vertical loading, for the annual probability of exceedance appropriate for the limit state under consideration (g) (see 3.2)
C_{vd}	Vertical design action coefficient for the period of a system supporting a part or component (g) (see 5.5)
D	Shortest distance from a site to the nearest fault (km) (see 3.1.4)
D_1	Root mean square difference between the logs of a scaled primary component and the target spectra over the period of interest (see 5.6.2)
d_i	Horizontal displacement of the centre of mass at level i (m)
d_{av}	Average of the displacements at the extreme points of a structure at level i, produced by the actions above this level (m) (see 4.5.3.3)
d_{max}	Maximum storey displacement at the extreme points of a structure at level i, in the direction of the earthquake induced by the equivalent static forces acting at distances ± 0.10 times the plan dimension of a structure from the centres of mass at each floor (m) (see 4.5.3.3)
E_d	Design action effect (AS/NZS 1170.0)
E_s	Earthquake actions for SLS (N, kNm)
E_u	Earthquake actions for ULS (N, kNm)
e_{str}	Floor-height distribution exponent for structural nonlinearity reduction (see 8.4)
F_i	Displacing force at level i (N)
F_{ph}	Horizontal design earthquake actions on a part or component (see 8.7.1)
F_{pv}	Vertical design earthquake actions on a part or component (see 8.7.2)
F_t	Component of equivalent static horizontal force at top level (N) (see 6.2.1.3)
$f_{A,i}$, $f_{B,i}$	Distance between points of inflection (m) (see Appendix B)
G	Permanent (self-weight or 'dead') action (N, N/m or kPa)
G_i	Permanent (self-weight or 'dead') action at level i (N, N/m or kPa)
g	Acceleration due to gravity, usually taken as 9.81 m/s^2
h_i	Height of level i above the base of a structure (mm)
$(h_i - h_{i-1})$	Inter-storey height for storey i
h_n	Height from the base of a structure to the uppermost seismic weight or mass (mm)
h'	Height between the centre of a plastic hinge at the base of a wall and the top of the wall
i	Level of a structure under consideration
K	Factor used in determining P-delta effects that allows for the period and site class (see 6.5.4.2)

k	Seismic design actions and displacements
k_1	Record scale factor (see 5.6.1)
k_2	Family scale factor (see 5.6.1)
k_3	Inter-storey deflection-scale factor
k_d	Deflection scale factor (see 6.2.3)
k_p	Factor used in determining P-delta effects (see 6.5.4.1)
k_s	Storey shear-strength factor for column sway mode (see Appendix B)
k_μ	Inelastic-spectrum-scaling factor (see 5.2)
L	Span of beams between column centrelines (mm) (see Appendix B)
L'	Distance between the centres of plastic-hinge zones (mm) (see Appendix B)
M	Earthquake magnitude (see 3.3.2)
M_a, M_b	Bending moments sustained at critical sections of a beam (kNm) (see Appendix B)
$M_{A,i}$, $M_{B,i}$	Overstrength moments applied to columns through plastic-hinge zones in beams (kNm) (see Appendix B)
m_i	Seismic mass at each level (N) (see 4.2)
$_{max}(PGA)$	Maximum peak ground acceleration for defining alternate default site class (see 3.3.1)
$_{max}(SA_{principal})$	Maximum principal component of each record in a family at each period considered (see 5.6.2)
$_{max}(S_{a,s})$	Maximum short-period spectral acceleration for defining alternate default site class (see 3.1.3.3)
$N(T,D)$	Near-fault factor (see 3.1.4)
N_c	Total number of columns at the level under consideration (see 4.5.3)
$N_{max}(T)$	Maximum near-fault factor that is linearly interpolated for period T from Table 3.3
$N_{max}(T,D)$	Maximum near-fault factor (see 3.1.4)
n	Number of levels in a structure or distinct layers of ground, used to evaluate $V_{s(30)}$
PGA	Peak ground acceleration (g) (see 3.1.2)
PGA_{500}	Peak ground acceleration for an annual exceedance probability of 1 in 500 years (g) (see 5.2.1.1)
Q	Imposed or 'live' action (due to occupancy and use)
Q_i	Imposed action for each occupancy class on level i (N, N/m or kPa)
q_c	CPT penetration resistance
R_d	Design capacity (equal to ϕR) (AS/NZS 1170.0)
R_p	Risk factor of a part or component (see Table 8.1)
$SA_{component}$	Spectral acceleration of each component of the 5% damped spectrum of a ground-motion record (g) (see 5.6.2)
$SA_{principal}$	Principal component of the spectral acceleration of a ground-motion record (g) (see 5.6.2)

SA_{target}	Spectral acceleration of the target 5% damped design spectrum (g) (see 5.6.2)
$S_a(T)$	Spectral acceleration determined for T from 3.1.2 (see 3.1.2)
$S_{a,s}$	Short-period spectral acceleration
$S_a(T_p)$	Spectral acceleration of the part determined at period T_p (see 8.2)
SPT	Standard Penetration Test
S_p	Structural-performance factor (see 4.4)
T	Period for defining the elastic site spectrum $C(T)$ of Eq 3.1 and its components $S_a(T)$ and $N(T,D)$
T_1	Largest translational period of a structure in the direction being considered (s)
T_c	Spectral-acceleration-plateau corner period (s) (see 3.1.2)
T_d	Spectral-velocity-plateau corner period (s) (see 3.1.2)
T_i	Period of the i th mode (s)
T_n	Period of the highest mode in the direction being considered (s)
T_{max}	Maximum period of interest (s) (see 5.6.2)
T_{min}	Minimum period of interest (s) (see 5.6.2)
T_p	Period of a part or component, in the direction being considered (s) (see 8.2)
T_{range}	Period range of interest (s) (see 5.6.2)
T_v	Vertical period of a structure (s) (see 3.2)
t_i	Thickness of the i th layer, between 0 and 30 m (see Equation 3.6)
u_i	Horizontal deflection of the centre of mass at level i (m)
V	Horizontal seismic base shear found from the modal response spectrum method (N) (see 6.3)
V_c	Column shear (N) (see Appendix B)
$V_{c,i}$	Column shear sustained when plastic hinges form in a column and sustain their overstrength moments (N) (see Appendix B)
V_e	Horizontal seismic base shear found from the equivalent static method (N) (see 6.2)
V_g	Vertical loading shear (N) (see Appendix B)
V_i	Shear strength of storey i (N)
V_s	Shear-wave velocity (m/s) (see 3.1.3.1)
V_{SLS}	Seismic base shear of a structure for SLS design actions derived in accordance with 5.2.1.2 (see 5.9.1.2)
$V_s(z)$	Shear-wave-velocity profile as a function of z (m/s) (see 3.1.3.5)
$V_{s(30)}$	Time-averaged shear-wave velocity over 30 m depth from the ground surface (m/s) (see 3.1.3.1)
V_{si}	Shear-wave velocity for layer i (m/s) (see 3.1.3.1)
V_{sz}	Time-averaged shear-wave velocity from the ground surface to a depth z (m/s)

V_{ULS}	Seismic base shear for ULS design actions derived in accordance with 5.2.1.1 using the assigned structural-ductility factor from 5.9.1.2(a) (see 5.9.1.2)
W_i	Seismic weight at level *i* (N) (see 4.2)
W_p	Weight of a part or component (N) (see 8.7)
W_t	Seismic weight of a structure (N) (see 4.2)
z	Depth of soil profile (m)
α	Plastic-hinge rotation (radians) (see Appendix B)
β	Factor used in determining P-delta effects that allows for the ductility demand (see 6.5.4.2)
δ	Inter-storey drift (m)
δ_e	Elastic deformation (m) (see Appendix B)
δ_p	Plastic deformation (m) (see Appendix B)
δ_t	Lateral displacement at the top of a wall (m) (see Appendix B)
δ_{ui}	Inter-storey displacement for storey *i* for the ULS specified in 7.3.1 (m) (see 7.3.1)
$\theta_{f,a}$	Pre-rocking foundation-rotation allowance (see 5.9.1.2)
γ	Maximum of all values of γ_i in both orthogonal directions (see 4.5.3.3)
γ_i	Torsional sensitivity (see 4.5.3.3)
μ	Structural-ductility factor (see 4.3)
μ_p	Ductility of a part or component (see 8.2)
θ	Stability coefficient (see 6.5.2)
ψ_c	Combination factor for imposed action (AS/NZS 1170.0)
Ψ_E	Earthquake-imposed-action combination factor for storage and other applications (see 4.2)
Ω_p	Reserve-capacity factor of a part or component (see 8.7.1)

2 Verification

2.1 General requirements

2.1.1 General

All structures shall comply with the requirements for the ULS and SLS set out in 2.3 and 2.4, and the appropriate material standard.

2.1.2 Structural systems

All structures shall be configured with a clearly defined load path(s) to transfer earthquake actions (both horizontal and vertical) generated in an earthquake together with gravity loads, to the supporting foundation soil. All elements shall be capable of performing their required function while sustaining the deformation of the structure resulting from the application of the earthquake actions determined for each limit state.

2.1.3 Localised actions

Structural elements and members shall be tied together to enable the structure to act as a whole in resisting seismic actions. Consideration shall be given to actions induced in individual elements due to the displaced shape and the gravity loads.

2.1.4 Earthquake limit-state design performance requirements

The design performance requirements are as follows:

(a) ULS for earthquake loading shall provide for:
   - (i) Maintenance of overall structural integrity and gravity load support, while accounting for horizontal and vertical deflections, soil-structure interaction, and sliding of the structure or its parts
   - (ii) Maintenance of stability against overturning
   - (iii) Avoidance of collapse or loss of support to parts in Categories P.1, P.2, P.3, and P.4 (see section 8)
   - (iv) Avoidance of damage to non-structural systems necessary for building evacuation following earthquake that would render them inoperative for parts in Category P.4 (see section 8); and

(b) SLS for earthquake loading are to avoid damage to:
   - (i) The structure and the non-structural components that would prevent the structure from being used as originally intended without repair after the SLS1 earthquake defined in 2.4
   - (ii) In a structure with a critical post-earthquake designation (i.e. importance level 4) all elements required to maintain those operations for which the structure is designated as critical, are to be maintained in an operational state or are to be returned to a fully operational state within an acceptable timeframe (usually minutes to hours rather than days) after the SLS2 earthquake defined in 2.4.

2.2 Structural types

2.2.1 Ductile structures

A ductile structure is one where the structural ductility factor is greater than 1.25 but does not exceed 6.0.

2.2.2 Structures of limited ductility

Structures of limited ductility are a subset of ductile structures. A structure of limited ductility is one where the structural ductility factor is greater than 1.25 but less than 3.0.

2.2.3 Nominally ductile structures

A nominally ductile structure is one where the structural ductility factor is greater than 1.0 and equal to or less than 1.25.

2.2.4 Brittle structures

A brittle structure is defined as a structure with structural components that are not capable of inelastic deformation without undergoing sudden and significant loss of strength. The structural ductility factor, μ, for brittle structures shall be taken as 1.0.

2.3 Verification of ultimate limit state

2.3.1 General

Structures shall be designed to ensure the performance requirements of 2.1.4(a) are satisfied.

The ultimate limit state performance requirements are met when a structure, analysed in accordance with section 6 for ULS design actions, satisfies all of the following:
(a) The ULS deflection limits in section 7;
(b) The design capacity, which is specified by the appropriate material standard, is equal to or greater than the design action specified in AS/NZS 1170.0 and this TS;
(c) The material strains in potential inelastic zones do not exceed the limiting values given in the appropriate material standards;
(d) The gravity load carrying capacity is maintained; and
(e) The deformations of the foundation soils do not compromise the assumed behaviour of the structure.

The ULS design actions shall be derived in accordance with section 5, using the structural characteristics determined from section 4 and the site spectra determined from section 3.

2.3.2 Ductility requirements

The assignment of the structural-ductility factor, μ, shall be consistent with the capability of the associated detailing from the appropriate material standard, with consideration of:
(a) Plastic mechanisms that develop within the structure because of inelastic zones forming in structural members that are required to sustain action effects;
(b) Material strain demands within inelastic zones of individual structural members;
(c) Material strain limits for potential inelastic zones, given in the appropriate material standard;
(d) The displacement profiles calculated in accordance with 7.2.1;
(e) Additional structural displacement resulting from foundation deformation; and,
(f) When an appropriate-material standard is not available, the structural-ductility factor, μ, shall be determined by a special study.

2.3.3 Capacity design

2.3.3.1 Ductile structures and structures of limited ductility

The provisions of 5.4.1.1 and the requirements for capacity design in 5.7 shall be applied to all ductile structures, including structures of limited ductility.

2.3.3.2 Nominally ductile structures and brittle structures

The provisions of 5.4.1.2 shall be applied to nominally ductile structures and brittle structures, together with the requirements for capacity design, when required by the appropriate-material standard.

2.3.4 Deformation control

Structure deformations shall be determined in accordance with section 7.

Deformations, including those resulting from the supporting foundation soils, shall be limited at the ULS as provided for in 7.4 and 7.5 so that:
(a) The structural system continues to maintain gravity-load support; and
(b) The structural system is able to resist the seismic loads as intended, and
(c) Contact with neighbouring structures is avoided; and
(d) Parts when considered as category P.1, P.2, P.3, or P.4 shall continue to be supported.

2.4 Verification of serviceability limit state

Structures shall be designed to ensure the performance requirements of 2.1.4(b) are satisfied.

The SLS performance requirements are met when a structure, including consideration of its foundation soils, analysed in accordance with section 6 for SLS design actions, satisfies the following:

(a) The SLS deflection limits in section 7; and
(b) The design capacity, as specified by the appropriate material standard, equals or exceeds the serviceability design actions specified in AS/NZS 1170.0 and in 7.5.2.

For structural systems that experience inelastic response under SLS actions, the calculated deflections and deformations shall include the deflections resulting from the total accumulated inelastic deformation in each potential inelastic zone and the supporting foundation soils.

The SLS design actions for SLS1 and SLS2 as appropriate shall be derived in accordance with section 5 using the structural characteristics determined in section 4 and the site spectra determined from section 3.

2.5 Parts and components

All parts of structures and non-structural components shall meet the requirements of section 8.

3 Site demand parameters

3.1 Elastic site spectra for horizontal loading

3.1.1 Elastic site spectra

The elastic site spectrum for horizontal loading, $C(T)$ in units of g, for the annual probability of exceedance that is appropriate for the limit state under consideration, prescribed in Table 3.3 of AS/NZS 1170.0, shall be calculated using Equation 3.1:

$C(T) = S_a(T)N(T,D)$ ....(Eq. 3.1)

where

$S_a(T)$ = the spectral acceleration in units of g determined from 3.1.2 or 3.1.3.3

$N(T,D)$ = the near-fault factor determined from 3.1.4

3.1.2 Spectral acceleration

The spectral acceleration, $S_a(T)$, at a period of vibration T, shall be calculated using Equations 3.2 to 3.5. $S_a(T)$ is illustrated in Figure 3.1 as a function of the site class, defined in 3.1.3, and the annual probability of exceedance appropriate for the limit state under consideration that is prescribed in Table 3.3 of AS/NZS 1170.0.

$S_a(T) = PGA$ for $T = 0$ s ....(Eq. 3.2)

$S_a(T) = S_{a,s}$ for $0.1\text{s} < T < T_c$ ....(Eq. 3.3)

$S_a(T) = S_{a,s}\frac{T_c}{T}$ for $T_c < T < T_d$ ....(Eq. 3.4)

$S_a(T) = S_{a,s}\frac{T_c}{T}\left(\frac{T_d}{T}\right)^{0.5}$ for $T_d < T$ ....(Eq. 3.5)

where

PGA = peak ground acceleration, determined from 3.3.1

$S_{a,s}$ = short-period spectral acceleration, determined from Table 3.4 or Table 3.5, for the building location and annual probability of exceedance appropriate for the limit state under consideration

T_c = spectral-acceleration-plateau corner period, determined from Table 3.4 or Table 3.5, for the building location and annual probability of exceedance appropriate for the limit state under consideration

T_d = the spectral-velocity-plateau corner period, taken as 3 s

The values in Table 3.4 are provided by name. They apply for all locations that fall within urban and rural settlement boundaries. The values in Table 3.5 apply for all other locations, by taking the nearest 0.1 x 0.1 degree latitude/longitude grid point.

For periods between 0 and 0.10 s, $S_a(T)$ shall be taken as $S_a(T) = S_{a,s}$ for the equivalent-static-analysis method; however, linear interpolation between *PGA* and $S_{a,s}$ can be used to define $S_a(T)$ for other analysis methods.

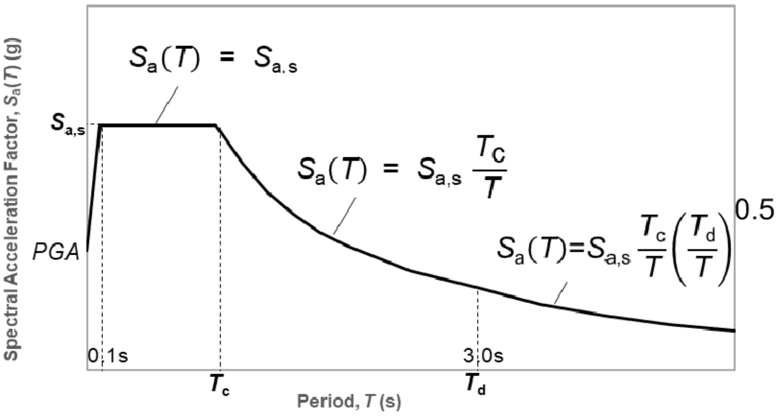


Figure 3.1 – Spectral acceleration, $S_a(T)$

3.1.3 Site class

The site class shall be determined from 3.1.3.1 to 3.1.3.6.

3.1.3.1 Site classification for elastic site spectra

The site class shall be determined as one of Classes I to VII according to the criteria in Table 3.1. Application of 3.1.3.4 may require the effect of multiple site classes to be considered.

Site classification for elastic site spectra uses the time-averaged shear-wave velocity over a 30 m depth from the ground surface, $V_{s(30)}$, which shall be calculated using Equation 3.6.

$$V_{s(30)} = \frac{\sum_{i=1}^{n} t_i}{\sum_{i=1}^{n} \frac{t_i}{V_{si}}} \quad \text{(Eq. 3.6)}$$

where

t_i = thickness of layer I, between 0 and 30 m

V_{si} = shear-wave velocity for layer i , m

$\sum_{i=1}^{n} t_i$ = 30 m

Methods for evaluating the V_s profile for the top 30 m of the site shall be in accordance with 3.1.3.5.

3.1.3.2 Sites that require special considerations

Site-specific dynamic site response analyses shall be performed for Site Class VII. Spectral values obtained from site-specific dynamic site response analysis for Site Class VII sites shall not be less than the elastic spectra for Site Class VI, as defined in 3.1.2 including the site demand parameters provided in Table C1 and Table C2.

3.1.3.3 Default site class

When available soil properties are insufficient to determine the site class according to Table 3.1, a default site class can be adopted, provided that geotechnical (geologic) data confirm that soils defined by Table 3.1 as Site Classes VI and VII are not present at the site from the ground surface to a depth of 20 m below the ground surface. The spectral acceleration for the default site class shall be determined using the envelope of the design spectra for Site Classes II, III, IV, and V.

For Importance Level 1 and 2 structures, it is permitted to use Equation 3.7 without the need to confirm that Site Class VI or VII soils are not present at the site.

$S_a(T) = {}_{max}(S_{a,s})$ -- (Eq. 3.7)

where

${}_{max}(S_{a,s})$ = the maximum of the short-period spectral accelerations ($S_{a,s}$) for Site Classes II, III, IV, V, and VI for the building location and the annual probability of exceedance appropriate for the limit state under consideration

Using Equation 3.7 does not preclude the need to address, through appropriate geotechnical assessment, the impact that deformations of the foundation soils have on the assumed behaviour of the structure, as required by section 2.

3.1.3.4 Multiple site classes

When uncertainty in V_s estimates specified in 3.1.3.6 results in a range of $V_{s(30)}$ values that encompass two or more site classes, then multiple site classes shall be adopted for the site. The design spectrum for such cases shall be determined as the envelope of the design spectra of the multiple site classes that are relevant, based on the estimated range of $V_{s(30)}$ values.

Table 3.1 – Site classification for elastic site spectra

Site Class	Site class criteria
I	Rock site with time-averaged shear-wave velocity in the top 30 m, $V_{s(30)}$ > 750 m/s and the following additional characteristics: a. The profile shall not contain material with a shear-wave velocity less than 600 m/s; and b. There shall be no more than 3 m of soil or highly weathered rock between the bedrock and the ground surface, unless excavated for a basement structure founded on rock.
II	Very stiff soil, very dense soil or soft rock with one of the following characteristics: a. Time-averaged shear-wave velocity in the top 30 m, 450 < $V_{s(30)}$ ≤ 750 m/s, and not underlain by materials with a shear-wave velocity less than 300 m/s; or b. Time-averaged shear-wave velocity in the top 30 m, $V_{s(30)}$ > 750 m/s, with more than 3 m of soil or highly weathered rock between the bedrock and the ground surface, or underlain by materials with a shear-wave velocity less than 600 m/s.
III	Stiff or dense soil with one of the following characteristics: a. Time-averaged shear-wave velocity in the top 30 m, 300 < $V_{s(30)}$ ≤ 450 m/s; or b. Time-averaged shear-wave velocity in the top 30 m, 450 < $V_{s(30)}$ ≤ 750 m/s, underlain by materials with a shear-wave velocity less than 300 m/s.
IV	Moderately stiff or medium dense soil with time-averaged shear-wave velocity in the top 30 m, 250 < $V_{s(30)}$ ≤ 300 m/s.
V	Soft or loose soil with time-averaged shear-wave velocity in the top 30 m, 200 < $V_{s(30)}$ ≤ 250 m/s, and the following soil characteristics from the ground surface to a depth of 20 m: a. No more than 10 m of very soft soils with undrained shear strength less than 40 kPa; and b. No more than 10 m of sandy soils or non-plastic silty soils with SPT *N* values less than 6; and c. No more than 10 m of sandy soils or non-plastic silty soils with q_c values less than 2.5 MPa; and d. No more than 10 m of clayey soils or plastic silty soils with q_c values less than 1.0 MPa; and e. No more than 10 m of soils with shear wave velocities of 150 m/s or less; and f. No more than 10 m combined depth of soils with properties described in (a), (b), (c), or (d),above. In the case of constructed fills, (a) to (f) shall be assessed over 20 m or the depth of the fill, whichever is larger.
VI	Very soft or very loose soil with one of the following soil characteristics: a. Time-averaged shear-wave velocity in the top 30 m, 150 m/s < $V_{s(30)}$ ≤ 200 m/s; or b. Time-averaged shear-wave velocity in the top 30 m, $V_{s(30)}$ > 200 m/s, with any of the following soil characteristics from the ground surface to a depth of 20 m: i. More than 10 m of very soft soils with undrained shear strength less than 40 kPa;or ii. More than 10 m of sandy soils or non-plastic silty soils with SPT *N* values less than 6;or iii. More than 10 m of sandy soils or non-plastic silty soils with q_c values less than 2.5 MPa;or iv. More than 10 m of clayey soils or plastic silty soils with q_c values less than 1.0 MPa;or v. More than 10 m of soils with shear wave velocities of 150 m/s or less; or vi. More than 10 m combined depth of soils with properties described in (i), (ii), (iii), (iv), or (v) above. In the case of constructed fills, conditions (i) to (vi) shall be assessed over 20 m or the depth of the fill, whichever is larger.
VII	Sites with time-averaged shear-wave velocity in the top 30 m, $V_{s(30)}$ ≤ 150 m/s. See 3.1.3.2.

3.1.3.5 Methods for evaluation of shear-wave velocity

Shear wave velocity profile, $V_{s}(z)$, for z = 0 to 30 m depth on the site shall be determined using one of the following three methods, including allowing for uncertainty in accordance with 3.1.3.6:

(a) Method 1 (measured V_s). Shear wave velocity profile is established from the ground surface to 30 m depth using direct field measurements of shear-wave velocity, V_s, at the site.

When the V_s measurement extends to a depth of less than 30 m, but more than 25 m, the shear wave velocity of the last layer shall be extended to 30 m depth for the calculation of $V_{s(30)}$ in Equation 3.6;

(b) Method 2 (partially measured V_s). Shear wave velocity profile is defined using direct field measurements of shear wave velocity, V_s, at the site, to a depth of at least 15 m. Over the remaining depth of the profile to 30 m, the shear wave velocity profile shall be estimated based on one of the following:
   (i) Geotechnical parameters (e.g., CPT or SPT resistance)
   (ii) Authoritative geologic model for well-defined soil units in the area of interest
   (iii) V_{sz}-$V_{s(30)}$ correlation;

(c) Method 3 (inferred V_s). The necessary depth requirements of Method 1 or Method 2 are not satisfied, and the shear wave velocity profile is inferred from CPT, SPT, or V_s measurements, including a combination of these measurements. CPT, SPT, or V_s data shall be available to a depth of at least 20 m when establishing the V_s profile.

For this method, the 20 m limitation can be relaxed to 15 m if the site geology is such that soft layers are unlikely to be encountered between 15 m and 30 m deep. In such cases, the shear-wave velocity of the last layer shall be extended to 30 m depth for the calculation of $V_{s(30)}$ in Equation 3.6.

In cases where the data does not extend to a depth of 15 m, a default site class shall be used, as presented in 3.1.3.3.

3.1.3.6 Uncertainties in $V_{s(30)}$

Bounds on $V_{s(30)}$ shall be considered when determining the site class based on 3.1.3.1 and 3.1.3.4. The bounds shall be established using the following uncertainties:

(a) For Method 1, ± 5% (measured V_s);

(b) For Method 2 (partially measured V_s), the uncertainty shall be linearly interpolated between:
   (i) ± 15% for measured V_s to a depth of 15 m, and
   (ii) ± 5% for measured V_s to a depth of 25 m;

(c) For Method 3, ± 30% (inferred V_s).

3.1.4 Near-fault factor

The near-fault factor, $N(T,D)$, shall be determined from Equations 3.8 and 3.9 for locations at shortest distance, D, of less than 20 km from the nearest major fault listed in Table 3.2. The locations of these faults are shown in Figure 3.2.

3.1.4.1 Annual probability of exceedance ≥ $^1/_{250}$

$N(T,D) = 1.0$ --(Eq.3.8)

3.1.4.2 Annual probability of exceedance < $^1/_{250}$

$$N(T,D) = N_{max}(T) \qquad D \leq 2 \text{ km}$$

$$= 1 + (N_{max}(T) - 1)\left(\frac{20 - D}{18}\right) \qquad 2 \text{ km} < D \leq 20 \text{ km}$$

$$= 1.0 \qquad D > 20 \text{ km} \qquad \text{(Eq. 3.9)}$$

where

D = the shortest distance, km, from the site to the nearest fault listed in Table 3.2, which shall be obtained from Table 3.4 for listed locations and from Table 3.5 for grid points

$N_{max}(T)$ = the maximum near-fault factor, which is linearly interpolated for period T from Table 3.3

The near-fault factor shall be taken as 1.0 for locations that are 20 km or more from a major fault listed in Table 3.2.

Table 3.2 – Major faults requiring consideration of near-fault factors > 1.0

Alpine: Caswell	BooBoo	Puysegur Ridge
Alpine: Caswell to South George	Dreyers Rock	Snares
Alpine: George landward	Gable End North	Wairarapa: 1
Alpine: George seaward	Hope: Conway	Wairarapa: 2
Alpine: George to Jacksons	Hope: Hanmer NW	Wairarapa: 3
Alpine: Jacksons to Kaniere	Hope: Hanmer SE	Wairarapa: Needles
Alpine: Kaniere to Springs Junction	Hope: Hope River	Wellington Hutt Valley: 1
Alpine: Nancy	Hope: Hurunui	Wellington Hutt Valley: 2
Alpine: Resolution – Charles	Hope: Kakapo-2-Hamner	Wellington Hutt Valley: 3
Alpine: Resolution – Dagg	Jordan	Wellington Hutt Valley: 4
Alpine: Resolution – Five Fingers	Kakapo	Wellington Hutt Valley: 5
Alpine: Springs Junction to Tophouse	Kekerengu 1	Wellington: Pahiatua
Ariel Bank	Kelly	Wellington: Tararua 1
Ariel Bank 2	Needles	Wellington: Tararua 2
Awatere: Northeast 1	Palliser – Kaiwhata	Wellington: Tararua 3
Awatere: Southwest	Puysegur	

Table 3.3 – Maximum near-fault factors $N_{max}(T)$

Period T (s)	$N_{max}(T)$
≤ 1.5	1.00
2	1.12
3	1.36
4	1.60
≥ 5	1.72

Figure 3.2 – Major faults (faults listed in Table 3.2) requiring consideration of near-fault factors > 1.0

Table 3.4 – Site demand parameters by location name

Table 3.4 is located at the end of this TS (after Appendix B).

Table 3.5 – Site demand parameters by grid point

Table 3.5 can be found at the link provided in Referenced Documents (Websites).

3.2 Site spectra for vertical loading

The elastic site spectrum for vertical loading, $C_v(T_v)$ in units of g, for a given period T_v shall be calculated using Equations 3.10 and 3.11:

$C_v(T_v) = 0.7C(T_v)$ for $D > 10$km ---------- (Eq. 3.10)

$= C_I(T_v)$ for $D \leq 10$km ---------- (Eq. 3.11)

where

$C(T_v)$ = elastic site spectrum for horizontal loading determined for the relevant site class from 3.1.1 for the annual probability of exceedance appropriate for the limit state under consideration, as prescribed in Table 3.3 of AS/NZS 1170.0

$C_I(T_v)$ = spectral acceleration for horizontal loading determined for site class I from 3.1.1 for the annual probability of exceedance appropriate for the limit state under consideration, as prescribed in Table 3.3 of AS/NZS 1170.0

The period T_v is that which is relevant for the vertical mode under consideration. For some applications, this is specified as 0 in this TS (see C5.2 in DZ SNZ TS 1170.5 Supp. 1).

3.3 Hazard parameters for geotechical assessment and design

3.3.1 Peak ground acceleration

The peak ground acceleration, *PGA*, shall be determined from Table 3.4 for listed locations and Table 3.5 for grid points for the site class defined in 3.1.3 and the annual probability of exceedance appropriate for the limit state under consideration.

PGA for the default site class (see 3.1.3.3) shall be determined using the maximum *PGA* for Site Classes II, III, IV. and V.

For Importance Level 1 and 2 structures, it is permitted to assume Equation 3.12, without the need to confirm that there are no Site Class VI or VII soils at the site. Here, max(PGA) is the maximum PGA for Site Classes II, III, IV, V, and VI for the building location and the annual probability of exceedance appropriate for the limit state under consideration. Using Equation 3.12 does not preclude the need to address, through appropriate geotechnical assessment, the impact that deformation of the foundation soils has on the assumed behaviour of the structure as required by section 2.

$PGA = \max(PGA)$ ---------- (Eq. 3.12)

PGA for the Multiple Site Class (see 3.1.3.4) shall be determined using the maximum *PGA* of the relevant multiple site classes adopted for the site.

3.3.2 Earthquake magnitude

The earthquake magnitude, *M*, shall be determined from Table 3.4 for listed locations and Table 3.5 for grid points, for the annual probability of exceedance appropriate for the limit state under consideration.

4 Structural characteristics

4.1 Period of vibration

4.1.1 General

The periods of vibration, T_i, shall be established from properly substantiated data or computation, or both, using material and section properties appropriate to the limit state under consideration.

4.1.2 Period determination for the equivalent static method

When the equivalent static method of analysis is used, the largest translational period in the direction under consideration, T_1, can by calculated using Rayleigh Method (Equation 4.1), or using an equivalent method.

4.1.2.1 Rayleigh method

$$T_1 = 2\pi\sqrt{\frac{\sum_{i=1}^{n}\left(W_i d_i^2\right)}{g\sum_{i=1}^{n}(F_i d_i)}} \quad \text{(Eq. 4.1)}$$

where

d_i = the horizontal displacement of the centre of mass at level i, ignoring the effects of torsion, m

F_i = the displacing force acting at level i, kN

g = acceleration due to gravity, m/s^2

i = the level of structure under consideration

n = the number of levels in the structure

W_i = the seismic weight at level i, kN

4.2 Seismic weight and seismic mass

The seismic weight at each level shall be given by Equation 4.2.

$$W_i = G_i + \Sigma \Psi_l Q_i \quad \text{(Eq. 4.2)}$$

where

G_i and $\Psi_E Q_i$ are summed between the mid-heights of adjacent storeys:

G_i = the permanent action (self-weight or 'dead' action) at level i

Ψ_E = the earthquake-imposed action (imposed-load) combination factor

0.6 = for storage applications

0 = for roofs within the scope of AS/NZS 1170.1, 3.5.1, except when required by AS/NZS 1170.3

0.3 = for all other cases, except roofs without public access where Ψ_E equals 0

Q_i = the imposed action for each occupancy class on level i

Q_i is determined from the reference value of imposed floor actions, multiplied by the area reduction factor for the level being considered (see AS/NZS 1170.1, 3.4)

When ice on roofs needs to be considered by AS/NZS 1170.3, $\Psi_E Q_i$ shall be taken as 0.6 kPa.

The seismic mass at each level, m_i, shall be taken as W_i/g.

4.3 Structural-ductility factor

4.3.1 Ultimate limit state

4.3.1.1 Assignment of the structural-ductility factor

The assignment of the structural-ductility factor, μ, shall be consistent with the capability of the associated detailing from the appropriate-material standard, in accordance with 2.3.2.

4.3.1.2 Mixed systems

For mixed systems comprising of different structural forms of seismic-resisting systems for a given direction of loading, the design seismic action on each system shall be determined by a rational analysis. This analysis shall take into account the relative stiffness, plastic-mechanism development, and material-strain capacities in the potential inelastic zones associated with each system.

4.3.2 Serviceability limit state

The structural-ductility factor, μ, for SLS1 shall be $1.0 \le \mu \le 1.25$ and for SLS2 shall be $1.0 \le \mu \le 2.0$.

4.4 Structural-performance factor

4.4.1 For stability

When considering the lateral stability of a whole structure against sliding or toppling, the structural-performance factor, S_p, shall be taken as 1.0.

4.4.2 For ultimate limit state

Unless otherwise defined by the appropriate-material standard, the structural-performance factor, S_p, for the ULS shall be taken as 0.7, except when $1.0 \le \mu < 2.0$ when S_p shall be determined by Equation 4.3.

$$S_p = 1.3 - 0.3\mu \qquad \text{(Eq. 4.3)}$$

4.4.3 Systems with ductile capabilities greater than μ

Structural systems that have strain capability greater than that corresponding to μ can, for the ULS, use the structural-performance factor, S_p, appropriate for the provided level of ductility capacity.

4.4.4 For serviceability limit state

The structural-performance factor, S_p, for the SLS shall be taken as 0.7, unless otherwise defined by the appropriate-material standard.

4.5 Structural irregularity

4.5.1 General

A structure shall be considered as irregular if it has any of the features listed in 4.5.2 and 4.5.3. One-storey penthouses or roofs with a weight less than 10% of the level below shall not be considered when applying these criteria.

4.5.2 Vertical irregularity

4.5.2.1 Weight (mass) irregularity

Weight irregularity shall be considered to exist when the weight, W_i, of any storey is more than 150% of the weight of an adjacent storey. A roof that is lighter than the floor below need not be considered when determining irregularity.

4.5.2.2 Vertical stiffness irregularity

Vertical stiffness irregularity shall be considered to exist when the lateral stiffness of the primary structure in a storey is less than 70% of the stiffness of an adjacent storey, or less than 80% of the average stiffness of the three storeys above or below.

4.5.2.3 Discontinuity in capacity – weak storey

A weak storey is one in which the storey shear strength is less than 90% of the shear strength of the storey above. The storey shear strength is the total strength of all vertical seismic-resisting elements of the primary structure that share the storey shear for the direction under consideration.

4.5.2.4 Vertical geometric irregularity

Vertical geometric irregularity shall be considered to exist when the sum of the horizontal dimensions of the vertical elements of the primary structure, in the direction under consideration in any storey, is more than 130% of that in an adjacent storey.

4.5.3 Plan irregularity

4.5.3.1 Horizontal offsets of columns in moment-resisting frames

Horizontal plan irregularity shall be considered to exist when, in the direction under consideration, in-plane or out-of-plane offsets of columns at any floor level are present where either (a) or (b) are satisfied:

(a) The average of the absolute values of the tangent of the offset angle,

$$\frac{\sum^{N_c}\left|\frac{a_j}{b_j}\right|}{N_c} > 0.1 \qquad \text{(Eq. 4.4)}$$

where

a_j = the horizontal offset at column j

b_j = the vertical distance between the base of the upper column and the top of the lower column j

N_c = the total number of columns at the level under consideration

(b) For any single column j, the tangent of the offset angle,

$$\frac{a_j}{b_j} > 0.4 \qquad \text{(Eq. 4.5)}$$

4.5.3.2 Out-of-plane offsets of lateral force-resisting walls

Horizontal plan irregularity shall be considered to exist in lateral force-resisting walls when out-of-plane offsets occur that conform to Equations 4.4 and 4.5.

4.5.3.3 Torsional sensitivity

Horizontal plan irregularity resulting from torsional sensitivity shall be considered to exist when the ratio γ_i, for each level i, determined independently for each orthogonal direction according to Equation 4.6, exceeds 1.4.

$$\gamma_i = \frac{d_{max}}{d_{av}} \qquad \text{(Eq. 4.6)}$$

where

d_{av} = the average of the displacements at the extreme points of the structure at level i produced by the actions at and above this level

d_{max} = the maximum displacement at the extreme points of the structure at level *i* in the direction of the earthquake induced by the equivalent static actions acting at distances ± 0.10 times the plan dimension of the structure at right angles to the earthquake direction, *b*, from the centres of mass at each floor

γ = the maximum of all values of γ_i in both orthogonal directions

5 Design earthquake actions

5.1 General

The earthquake actions for the ULS and SLS shall be evaluated in accordance with 5.2 or 5.5 for structural considerations, and 5.3 for geotechnical considerations.

The elastic site spectrum, $C(T)$, for the appropriate limit state and the near-fault factor, $N(T,D)$, shall be determined from section 3.

The structural-performance factor, S_p, the largest translational period in the direction being considered, T_1, and the structural-ductility factor, μ, shall be determined from section 4.

5.2 Horizontal design action coefficients and design spectra

5.2.1 Equivalent static method – horizontal design action coefficient

5.2.1.1 Ultimate limit state

For the ULS, the horizontal design action coefficient, $C_d(T_1)$, shall be calculated using Equations 5.1 and 5.2:

$$C_d(T_1) = \frac{C(T_1)S_p}{k_\mu} \quad \text{(Eq. 5.1)}$$

$$C_d(T_1) \geq \left(\frac{PGA}{20} + 0.02\right) \text{but not less than } \frac{0.03PGA}{PGA_{500}} \quad \text{(Eq. 5.2)}$$

where

$C(T_1)$	=	the ordinate of the elastic site spectrum determined from 3.1.1
S_p	=	the structural-performance factor determined from 4.4
PGA	=	peak ground acceleration for horizontal loading for the relevant site class, determined from 3.3.1
PGA_{500}	=	peak ground acceleration for horizontal loading for the relevant site class, determined from 3.3.1 for an annual exceedance probability of 1 in 500 years

For all site classes $k_\mu = \mu$

5.2.1.2 Serviceability limit state

For the SLS, the horizontal design action coefficient, $C_d(T_1)$, shall be calculated using Equation 5.1where:

$C(T_1)$	=	the ordinate of the elastic site spectrum for the largest translational period of vibration determined from 3.1.1 for the appropriate annual probability of exceedance
T_1	=	the largest translational period of vibration in the direction being considered
S_p	=	the structural-performance factor determined from 4.4
μ	=	the structural-ductility factor determined from 4.3.2

5.2.2 Modal response spectrum method

5.2.2.1 Ultimate limit state design response spectrum

For the ULS, the horizontal design response spectrum, $C_d(T)$, shall be calculated using Equation 5.3:

$$C_d(T) = \frac{C(T)S_p}{k_\mu} \quad \text{(Eq. 5.3)}$$

where $C(T)$, k_{μ} and S_p are defined in 5.2.1.1.

5.2.2.2 Ultimate limit state design – scaling of actions and displacements

Seismic design actions and displacements shall be scaled by the appropriate factor, k, given in (a) or (b):

(a) Structures that are not classified as irregular under 4.5
   (i) Where V is equal to or greater than 80% of V_e, k = 1.0
   (ii) Where V is less than 80% of V_e, $k = 0.8\ V_e/V$;

(b) Structures that are classified as irregular under 4.5
   (i) Where V is equal to or greater than 100% of V_e, k = 1.0
   (ii) Where V is less than V_e, $k = V_e/V$

where

V_e = the horizontal seismic base shear found from the equivalent static method

V = the horizontal seismic base shear found from the modal response spectrum method

5.2.2.3 Serviceability limit state

For the SLS, the horizontal design response spectrum, $C_d(T)$, shall be calculated using Equation 5.4:

$$C_d(T) = \frac{C(T)S_p}{k_{\mu}} \quad \text{(Eq. 5.4)}$$

where $C(T)$ is defined in 3.1.1 for the appropriate annual probability of exceedance, and using $N(T,D)$ defined in 3.1.6; S_p is defined in 4.4.4; and k_{μ} is defined in 5.2.1.1, using μ defined in 4.3.2.

5.3 Design actions for geotechnical considerations

5.3.1 General

For geotechnical assessment, and to inform structural design, the peak ground acceleration, *PGA* and associated earthquake magnitude, *M*, shall be determined from section 3.

5.4 Application of design actions

5.4.1 Direction of actions

For all structures, different directions of application of the specified actions shall be considered in order to determine the most unfavourable effect in any structural member.

5.4.1.1 All structures at the serviceability limit state and ductile structures at the ultimate limit state

For all structures at the SLS, and for ductile structures, including structures of limited ductility at the ULS apply actions defined in (a) or (b):

(a) With seismic-resisting systems located along two perpendicular directions, the specified actions can be assumed to act separately along each of these two horizontal directions; or
(b) With seismic-resisting systems not located along two perpendicular directions, the specified actions shall be applied separately in sufficient directions to produce the most unfavourable effect in any structural member.

5.4.1.2 Nominally ductile and brittle structures at the ultimate limit state

For nominally ductile and brittle structures, an action set comprising 100% of the specified earthquake actions in one direction plus 30% of the specified earthquake actions in an orthogonal direction to this shall be applied as follows:

(a) For seismic-resisting systems located along two perpendicular directions, the action set shall be applied separately in each perpendicular direction (100% on the first axis with 30% on the second axis, and then 30% on the first axis and 100% on the second axis); or
(b) For seismic-resisting systems not located along two perpendicular directions, the action set shall be applied in sufficient directions so as to produce the most unfavourable effect in any structural member.

5.4.2 Accidental eccentricity

For each required direction of earthquake loading, allowance shall be made for accidental eccentricity of the earthquake actions. The eccentricity shall be applied in the same direction at all levels.

The accidental eccentricity shall be measured from the nominal centre of mass and determined as follows:

(a) For actions applied in a direction parallel to the principal orthogonal axes of the structure, the eccentricity shall be taken as not less than ± 0.1 times the plan dimension, b, of the structure at right angles to the direction of loading; or

(b) For actions applied in other directions, the accidental eccentricity can be assumed to lie on the outline of an ellipse with semi-axes equal to the eccentricities specified for the orthogonal directions.

5.5 Vertical design actions

When the response parameter under consideration is significantly influenced by vertical excitation, or as required by 8.5.2, the vertical design action coefficient, C_{vd}, shall be calculated using Equation 5.5:

$C_{vd} = C_v(T_v)$ -- (Eq. 5.5)

where

$C_v(T_v)$ = the elastic site spectrum for vertical loading, determined from 3.2

T_v = the vertical period of the element under consideration (see C3.2)

The resulting vertical design actions shall be combined with 100% of horizontal actions, as specified in 5.3.1.

5.6 Ground-motion records for time-history analyses

5.6.1 Selection of acceleration ground-motion records

Earthquake ground-motion records used for time-history analysis shall consist of at least two horizontal components. The vertical component of the record can also be necessary when considering the response of structures or parts that are sensitive to vertical accelerations, such as for horizontal cantilevers or some items of equipment.

The ground-motion records shall be selected from actual records that have a seismological signature (i.e., magnitude, source characteristic [including fault mechanism], and source-to-site distance) the same as (or reasonably consistent with) the signature of the events that significantly contributed to the target design spectra of the site over the period range of interest. The ground motion is to have been recorded by an instrument located at a site, the soil conditions of which are the same as (or reasonably consistent with) the soil conditions at the site.

When the site is near a major fault (i.e., when $N(T,D)$ > 1.0 in 3.1.5), then one record in three in each family selected shall have a forward-directivity component, while the remainder of the family shall be of near-neutral or backwards directivity. A record has strong forward directivity when half or more of the rupture propagation is towards the site (i.e., the epicentre is at a distance of half the rupture length or greater from the site).

The ground-motion records used for time-history analysis shall consist of a family of at least three records. When three appropriate ground-motion records are not available, simulated ground-motion records can be used to make up the family.

Each record shall be scaled by a record scale factor, k_1, so as to match the target spectrum over the period range of interest. The target spectrum is the design spectrum appropriate for the site and limit state of the structure under consideration. Each record within the family of records is then to be scaled by the family scale factor, k_2, which is applied to ensure that the energy content of at least one record in the family exceeds that of the design spectrum over the target period range.

As most structures do not have the same fundamental period in different directions, the period range of interest will differ in different directions. It should be expected that both the record scale factor, k_1, and the family scale factor, k_2, will be different for different directions. It is therefore also likely that the principal component (defined in 5.6.2(c)) of any record) can also switch, according to the period of the structure.

5.6.2 Scaling ground-motion records

The record scale factor, k_1, shall be calculated using steps (a) to (g):

(a) Compute the target spectrum for the site, SA_{target}, using Equation 5.6

$$SA_{\text{target}} = \left(\frac{1+S_{\text{p}}}{2}\right) C(T) \quad \text{(Eq. 5.6)}$$

where

$C(T)$ = elastic site-hazard spectrum

S_{p} = structural-performance factor given by 4.4.2;

(b) Calculate the 5% damped spectrum, $SA_{\text{component}}$, of each component of each ground-motion record within the family of records being considered;

(c) Determine the principal component, $SA_{\text{principal}}$, and associated record scale factor for each direction in which the records are to be applied as follows:

(i) Determine the structure orientation relative to the direction selected

(ii) Determine the largest translational period, T_1, of the response mode in the direction of interest

(iii) Calculate the period range of interest, T_{range}, as being between T_{min} and T_{max}

where

$T_{\text{min}} = 0.4\ T_1$

$T_{\text{max}} = 1.3T_1$

T_1 is the largest translational period in the direction being considered but not less than 0.4 seconds

(iv) Select records that have a seismological signature (i.e., magnitude; source characteristic, [including fault mechanism]; and source-to-site distance) the same as (or reasonably consistent with) the signature of the site

(v) Determine the record scale factor, k_1, for each of the horizontal ground-motion components

where

k_1 = the scale value that minimises, in a least-mean-square sense, the function $\log(k_1 SA_{\text{component}}/SA_{\text{target}})$ over the period range of interest

In each case, the periods used to determine k_1 are to be selected so that each period is within 10% of the preceding one, except that an increment not greater than 1 second can be used for periods greater than 5 seconds

(vi) Verify that the amplitude of the selected record is sufficiently similar, by confirming that $0.33 < k_1 < 3.0$. Reject records that do not satisfy this criterion

(vii) Verify that the selected record is of reasonable fit to the target spectra. This can be demonstrated by it satisfying the requirement that D_1, being the root mean square difference between the logs of the scaled primary component and the target spectra over the period range of interest, is less than log(1.5). Reject records that are not of reasonable fit

(viii) Nominate the principal component as being the record component with the smaller k_1 value and assign this value of k_1 as the record scale factor for this target period T. The other component of the record is the secondary component;

(d) Determine the record family scale factor, k_2, which is required to ensure that for every period in the period range of interest, the principal component of at least one record spectrum scaled by its record scale factor k_1, exceeds the target spectrum

The record family scale factor, k_2, is the maximum value of the ratio $SA_{\text{target}}/max(SA_{\text{principal}})$ but at least 1.0 over the period range of interest for the direction under consideration and $max(SA_{\text{principal}})$ is the maximum principal component of each record within the family at each period considered;

(e) If k_2 is in the range 1.0 to 1.3, then the principal and secondary components selected can be confirmed. If $k_2 > 1.3$ then:

(i) Continue using the principal components as selected; or

(ii) Select a different record as one of the family so as to better cover the target spectrum and reassess k_2, or

(iii) Continue using the principal components as selected, or

(iv) If the record scale factors of the components are within 20% of each other at period T, swap the principal and secondary component and reassess k_2;

(f) Confirm the principal and secondary components of each record as being those selected from (e) above or amend this selection by consideration of the scaled secondary components so as to minimise the product of k_1 k_2;
(g) Repeat the steps in (c) to (f) for other directions of interest, noting that in each case the orthogonal direction to each initial selection will need to be considered.

5.7 Capacity design

5.7.1 General

Capacity design shall be applied to structures of limited ductility, ductile structures, and other structures where required by the appropriate material standard as set out in 5.7.2, 5.7.3 and Appendix A, together with additional requirements on capacity design as set out in the appropriate material standard.

5.7.2 Structures of limited ductility

The nominal capacity design requirements for the design of structures of limited ductility in the appropriate material standard can be used in lieu of the requirements set out in 5.7.3 for structures of limited ductility that satisfy all these criteria:
(a) They are not classified as irregular under 4.5;
(b) A height which is less than 15 m;
(c) Any additional requirements in the appropriate material standard.

Structures that do not satisfy these requirements shall be designed to satisfy the requirements of 5.7.3.

5.7.3 Capacity design requirements for ductile structures

5.7.3.1 Potential inelastic zones

Ductile failure modes for the proposed structure shall be identified for each potential direction of seismic actions. The location of all potential inelastic zones shall be identified and proportioned so that the design strength exceeds the design actions at these locations. The form of the potential inelastic zone, whether unidirectional or reversing, shall be identified.

5.7.3.2 Deformation of potential inelastic zones

The level of detailing required to sustain the material strain levels in the critical potential inelastic zones, when the displacements defined in section 7 are applied to the structure, shall be determined. Detail the potential inelastic zones to be capable of sustaining these deformations, as specified in the appropriate material standard.

In unidirectional inelastic zones, allowance shall be made for the amplification of material strain levels beyond that found for reversing inelastic zones (see Appendix B3.5).

5.7.3.3 Overstrength actions in potential inelastic zones

The maximum likely strength of each potential inelastic zone, as designed and detailed, as specified in the appropriate material standard, shall be determined. When an appropriate material standard does not exist, use the upper characteristic strengths and allow for strain hardening levels appropriate to the level of material strain required in the potential inelastic zones.

5.7.3.4 Design outside inelastic zones

When members sustain actions due to overstrength moments and shears from two axes, the bi-axial effects from both axes shall be considered. The full dynamic magnification coefficient shall be assumed to act on one axis, while on the other axis, the dynamic magnification factor shall be not less than 1.0.

In certain cases, appropriate material standards can specify a nominal distribution of actions in a member in place of dynamic magnification factors.

Design actions shall, where required, be either:
(a) Amplified by dynamic magnification factors; or
(b) Distributed into the element, as specified in the appropriate material standard, to prevent premature failure modes developing due to higher-mode effects.

5.8 Diaphragms

5.8.1 General

Diaphragms shall be considered part of the primary structure, with identifiable internal load paths to transfer the required actions between the diaphragms and associated connected elements to the elements of the lateral force-resisting structural systems.

Elements within diaphragms, and connections between diaphragms and elements of the lateral force-resisting structural systems shall be capable of accommodating both the imposed displacement and force demands.

5.8.2 Design actions

Design actions for diaphragms shall include actions arising from all of the following:

(a) Associated permanent (dead-load) and imposed (imposed-load) actions on the floor;
(b) Floor design accelerations;
(c) Force transfer between the lateral force-resisting elements interconnected by the diaphragm;
(d) Interaction with elements vertically supporting the diaphragm;
(e) Deformations between the diaphragm elements.

Diaphragm design actions shall include higher-mode effects and overstrength effects from the structure as a whole, in accordance with 5.7.

5.9 Shallow foundations

5.9.1 Rocking foundations

Where foundations and foundation elements can develop a rocking mechanism under the lesser of the overstrength actions or actions derived using μ = 1.25, the structure shall be subject to a special study, unless the structure and foundations meet the limitations of 5.9.1.1 for simplified rocking design.

Additional displacement from foundation rotation shall be allowed for when checking inter-storey deflection limits, and when designing and detailing the structure and secondary elements, except as noted in 5.9.1.2 for simplified design.

5.9.1.1 Limitations for simplified design

Simplified design of rocking foundation as outlined in 5.9.1.2 may be used, if all of the following limitations are satisfied:

(a) The height of the structure is less than 15 m, from the underside of the foundation to the uppermost floor or heavy roof. A roof is permitted above this height, provided that the seismic mass of that storey does not exceed 150 kg/m^2; and
(b) The aspect ratio of each lateral force-resisting assembly (including the foundation) is less than or equal to 3 vertical : 1 horizontal; and
(c) All foundations are unrestrained against rocking; and
(d) All foundations are symmetric about the axis in the direction of rocking, unless resulting out-of-plane actions are restrained; and
(e) The difference in height between the underside of separate foundation elements that are part of the lateral force-resisting system is less than one storey.

5.9.1.2 Simplified design of rocking foundations

The following simplifications can be applied only to structures for which all structure and foundation assemblies that are part of the lateral force-resisting system meet the limitations of 5.9.1.1:

(a) The assigned structural-ductility factor for checking rocking stability for ULS need not be taken less than 2.0; and
(b) Foundation mass can be neglected for calculating horizontal seismic actions; and
(c) Lateral loads can be redistributed between structure and foundation assemblies, provided that the overall system resistance to torsion is not reduced; and
(d) Vertical actions from earthquakes need not be considered; and
(e) Additional displacements from foundation rotation need not be specifically calculated when checking inter-storey deflection limits in accordance with 7.5. Where required for the design of secondary structure and non-structural elements, the additional displacement due to rocking shall be calculated using the pre-rocking foundation rotation allowance, $\theta_{f,a}$, from Table 5.1, and be added to the displacement of the structure calculated from 7.2.

Table 5.1 – Pre-rocking foundation-rotation allowance, $\theta_{f,a}$

Limit state	$\theta_{f,a}$ (radians)
SLS	$0.004 \times V_{SLS}/V_{ULS}$
ULS	0.004

NOTE –

(1) V_{SLS} = the seismic base shear of the structure for the SLS design actions derived in accordance with 5.2.1.2, kN

(2) V_{ULS} = the seismic base shear of the structure for the ULS design actions derived in accordance with 5.2.1.1, using the assigned structural-ductility factor from 5.9.1.2(a), kN

5.9.1.3 Foundation sliding

Foundation elements can exceed their sliding capacity prior to developing a rocking mechanism. Differential sliding of individual foundation elements shall be suppressed by connecting foundation elements together. The whole foundation system can slide as a single unit, provided that stability under gravity load is not reduced and the limitations for simplified design in 5.9.1.1 are met. In no case shall sliding occur under SLS loads.

6 Structural analysis

6.1 General

6.1.1 Method of analysis

A structural analysis to determine the action effects shall be carried out in accordance with one of the following, providing the limitations of 6.1.3 are complied with:

(a) A method based on equivalent static forces as outlined in 6.2; or
(b) The modal response spectrum method as outlined in 6.3;
(c) The numerical time history method as outlined in 6.4.

6.1.2 P-delta analysis

P-delta effects shall be considered in accordance with 6.5, in analyses of design actions and deflections for the ULS.

6.1.3 Limitations on the use of methods of analysis

6.1.3.1 Equivalent static method

The equivalent static method of analysis can only be used when at least one of the following criteria is satisfied:

(a) The height between the base and the top of the structure is less than 10 m; or
(b) The largest translational period, calculated as specified in 4.1.2, is less than 0.4 seconds; or
(c) The structure is not classified as irregular, as outlined in 4.5, and the largest translational period is less than 2.0 seconds.

6.1.3.2 Model response spectrum method

The modal response spectrum method can be used on all structures that fall within the scope of this TS, provided that three-dimensional analyses are used when the structure is classified as torsionally sensitive under 4.5.3.3.

6.1.3.3 Numerical integration time-history analyses

Numerical integration time-history (NITH) analyses can be used on all structures that fall within the scope of this TS to verify that specific response parameters are within the limits of acceptability assumed during design. Three-dimensional time-history analyses shall be used where the structure is classified as torsionally sensitive under 4.5.3.3.

6.1.4 Modelling of diaphragms

6.1.4.1 Requirements for modelling

It is acceptable to model a diaphragm as infinitely rigid in-plane when one of the following criteria is satisfied:

(a) It is a rigid diaphragm, as defined in 1.7, and the structure is not classified as irregular, as outlined in 4.5; or
(b) The structure is irregular, as outlined in 4.5, and it can be shown that the deformations of diaphragms will produce a response comparable to the response of a rigid diaphragm.

6.1.4.2 Actions for design of diaphragms

When the conditions in 6.1.4.1 are not met, the modelling shall include representation of the flexibility of the diaphragm.

6.2 Equivalent static methods

6.2.1 Equivalent static forces

6.2.1.1 General

The set of equivalent static forces in the direction being considered, that are specified in 6.2.1, shall be assumed to act simultaneously at each level of the structure.

6.2.1.2 Horizontal seismic shear

The horizontal seismic shear, V_e, acting at the base of the structure in the direction being considered, shall be calculated using Equation 6.1:

$$V_e = C_d(T_1)W_t \quad \text{(Eq. 6.1)}$$

where

$C_d(T_1)$ = the horizontal design action coefficient for the ULS (see 5.2.1.1) or SLS (see 5.2.1.2)

W_t = The seismic weight of the structure, defined in 4.2

6.2.1.3 Equivalent static horizontal force at each level

The equivalent static horizontal force, F_i, at each level, *i*, shall be obtained from Equation 6.2

$$F_i = F_t + 0.92V \frac{W_i h_i}{\sum_{i=1}^{n} (W_i h_i)} \quad \text{(Eq. 6.2)}$$

where

F_t = $0.08V$ at the top level and 0.00 elsewhere

6.2.2 Points of application of equivalent static forces

The equivalent static forces shall be applied through points that are eccentric to the nominal centre of mass at each level, as specified in 5.4.2.

6.2.3 Scaling of deflections

The magnitudes of the deflections, including the inter-storey deflections, can be reduced by multiplying by the deflection scale factor, k_d, given below.

(a) For determining the period of the structure by the method set out in 4.1.2.1, the deflection scale factor used for the lateral displacements, d_i, shall be taken as 1.0;

(b) For structures that have a weak storey or a flexible storey, as defined in 4.5, the deflection scale factor shall be taken as 1.0.

(c) For other structures, the deflection-scale factor shall be taken from Table 6.1.

Table 6.1 – Deflection scale factors

No. of storeys	Deflection scale factor, k_d
1	1.00
2	0.97
3	0.94
4	0.91
5	0.88
6 or more	0.85

6.3 Modal response spectrum method

6.3.1 General

A dynamic analysis of a structure by the modal response spectrum method shall use the peak response of the modes specified in 6.3.3. Peak modal responses shall be calculated using the ordinates of the appropriate response spectrum given in 6.3.2. The design action effects shall be the maximum modal action effects combined in accordance with 6.3.4.

6.3.2 Design response spectrum

The design response spectrum used for the modal response spectrum method shall be calculated for the ULS in accordance with 5.2.2.1, and for the SLS in accordance with 5.2.2.3.

6.3.3 Number of modes

6.3.3.1 Two-dimensional analyses

Sufficient modes shall be included in the analysis to ensure that at least 90% of the total mass of the structure is participating in the direction under consideration.

6.3.3.2 Three-dimensional analyses

Sufficient modes shall be included in the analysis to ensure that at least 90% of the total mass of the structure is participating in each of the two orthogonal directions.

In structures that are modelled so that modes are considered that are not those of the horizontal load-resisting systems, then all modes not part of the horizontal load-resisting systems shall be ignored.

6.3.4 Combination of modal action effects

6.3.4.1 Two-dimensional analyses

For two-dimensional analyses, the combination of modal action effects (e.g., storey shear, moment, drift, displacements, and inter-storey displacements) shall be carried out either by taking the square root of the sum of the squares of the contribution from each mode, or by using the complete quadratic combination technique or any other generally accepted combination method.

6.3.4.2 Three-dimensional analyses

For three-dimensional analyses, the combination of modal action effects shall be carried out using the complete quadratic combination technique or any other generally accepted combination method.

6.3.4.3 Closely spaced modes

If the square-root-sum of squares (SRSS) combination method is used, the modal action effects from any modes with frequencies within 15% shall first be combined by direct summation ignoring any signs.

6.3.5 Torsion

6.3.5.1 General

When a structure is not classified as plan irregular, as defined in 4.5.3, and a two-dimensional modal response spectrum analysis is used for translational effects, an analysis for torsional effects can be conducted by the static method defined in 6.3.5.2.

In all other cases, torsional effects shall be included in a three-dimensional analysis method, as defined in 6.3.5.3.

6.3.5.2 Static analyses for torsional effects

For a static analysis for torsional effects, the applied torsion at each level shall use either the actions calculated by the equivalent static method, or the combined storey earthquake actions found in a two-dimensional modal response spectrum analysis for translation. The eccentricity used shall be that required in 5.4.2. Torsional effects shall be combined with the translational effects using direct summation, with signs chosen to produce the most adverse combined effects in the resisting members.

6.3.5.3 Three-dimensional analyses

(a) Except as provided for in (b), for each direction of loading the position and distribution of the mass shall be adjusted to account for the eccentricity specified in 5.4.2. The sign of the eccentricity shall be that which produces the largest design actions in the resisting members; or

(b) If a rigid-floor diaphragm is provided, the effects of eccentricity for any of the required directions of loading shall be allowed for by procedure (i) or (ii):

  (i) The general procedure of (a) shall be used, with the centre of mass adjusted. The rotational inertia of the floor about the nominal centre of mass need not be modified to account for the altered distribution of mass, or

  (ii) The mass position and distribution need not be adjusted, but the line of action of the earthquake actions shall be taken as eccentric to the nominal centre of mass.

6.4 Numerical integration time-history method

6.4.1 General

When the numerical integration time-history (NITH) method is used, the structure shall be subjected to a family of not less than three ground motion records, each of which has been scaled to match the design level earthquake for the limit state and location of the structure.

When only horizontal excitation effects are to be assessed, then the two horizontal components of an appropriately scaled ground-motion record shall be applied to the structure simultaneously in orthogonal directions. When the response parameter under consideration is significantly influenced by vertical excitation, then the vertical component shall also be applied in addition to, but simultaneously with, the two horizontal components.

6.4.2 Structural modelling

The sectional properties assigned to members for time-history analyses shall be those that result in the most adverse response of the parameter under consideration, with the constraint that they remain within an appropriate range for the limit state under consideration. Unless otherwise justified, section parameters (i.e., the strength, post-elastic degradation models, and member stiffness that are to be applied, and the viscous damping that is to be assigned) are to be determined by reference to the appropriate material standards. Variations that result in a difference in response of less than 10% are to be considered insignificant and need not be the subject of further investigation.

6.4.3 Application of time-history analyses

The response parameter of interest shall be assessed by subjecting the structure to ground motion represented by each member of the family of ground-motion records scaled in accordance with 5.6.2.

Application of each ground motion record shall be as follows:

(a) Each component of the ground-motion record shall be scaled by the record scale factor, k_1, and the family scale factor, k_2, and applied in the time domain (i.e., the record ordinate shall be multiplied by the product k_1k_2, with the values of k_1 and k_2 determined according with 5.6.2), where

  k_1 = the record scale factor for the principal component of the record at period T_1

  k_2 = the family scale factor

  T_1 = the largest translational period of the structure in the direction that the principal component of the ground-motion record is applied; and

(b) The principal and secondary components, scaled as indicated above, will generally be applied together and at orthogonal directions one to the other.

The direction of application of the principal component of the ground-motion record shall be the one that produces the most adverse response of the parameter under consideration.

6.4.4 Direction of application

At least two analyses of the structure shall be carried out for each earthquake. In the first of these, the principal component of the earthquake (scaled by k_1k_2) shall be directed along the direction of translation of the first translational mode together with the secondary component of the same record also scaled by k_1k_2. In the second analysis, the direction of the principal component of the earthquake shall be applied in a direction orthogonal to the first analysis. Both the principal component and the scaling factors will usually be different for each analysis, because T_1 is different for both situations.

Other analyses that have different directions of application of the appropriately scaled earthquake components shall also be considered in order to determine the most unfavourable effect in any structural member.

6.4.5 Analysis time step

The analysis time step shall meet the following criteria:

(a) It shall not be greater than the step at which the records are digitised;

(b) It shall be less than or equal to:

   (i) $T_1/100$

   (ii) T_n

   (iii) 0.01 s

   where

   T_1 = the largest translational period of the first mode, judged by largest mass contribution, in the direction of the principal component of the earthquake

   T_n = is the period of the highest mode, in the same direction required to achieve the 90% mass described in the modal response spectrum method; and

(c) It should be sufficiently small to ensure convergence to an accurate solution.

6.4.6 Viscous damping

Viscous damping of 5% shall be used for all modes whose period is less than the analysis time step included in the analysis, unless a different value is recommended by the appropriate material standard. If Rayleigh damping is used, there shall be no more than 5% of critical damping in the two first translational modes, and no more than 40% damping in the mode with period T_n.

6.4.7 Assessment of response parameter

The most critical value of any response parameter (e.g., stress, strain, rotation, or displacement) across the family of records shall be used to determine acceptability.

6.4.8 Determination of design horizontal deflections

Calculation of design horizontal deflections for the SLS shall take into account any departures from linear elastic behaviour.

The design horizontal deflections shall be taken as the maxima of the appropriate deflections obtained for each of the required ground motions.

6.4.9 Determination of inter-storey deflection

The design inter-storey deflection between adjacent levels shall be taken as the maximum of the inter-storey deflections obtained for each of the required ground motions, except that the maximum inter-storey deflections from records that include forward directivity should be multiplied by a factor of 0.67.

6.4.10 Design values

The strength requirements of potentially inelastic members can be taken as the maximum values obtained from elastic time-history analyses, using earthquake records scaled in accordance with 5.6.2 to match the elastic-response spectra divided by k_μ, but shall not be taken as less than necessary to satisfy the requirements of the SLS and ULS deformation and displacement limits. The value to use for k_μ is that specified in 5.2.1.1.

Inelastic demands placed on the members and capacity actions shall be obtained from inelastic time-history analyses, in which the inelastic properties of the members are modelled, using earthquake records scaled in accordance with 5.6.2 and the P-delta actions shall be included in the analysis. The inter-storey displacements shall not exceed the limits given in 7.5.1, and inelastic deformation demands shall not exceed the limits given in the appropriate material standard.

6.5 P-delta effects

6.5.1 General

When required by 6.5.2, P-delta effects shall be included in the analysis of action effects and deflections, in accordance with 6.5.4.

P-delta actions shall be assessed as specified in 6.5.2 to 6.5.4.2 when either the equivalent static method or the modal response spectrum analysis method are used. When the NITH method of analysis is used, P-delta effects shall be incorporated into the analysis for the ULS.

6.5.2 Ultimate limit state

An analysis for P-delta effects for the ULS is not required when any one of the following factors applies:

(a) The largest translational period is less than 0.40 seconds; or

(b) The height of the structure measured from the base is less than 15 m, and the largest translational period is less than 0.6 seconds; or

The maximum value of the stability coefficient, θ, found for every storey in a structure is less than 0.1, as calculated using Equation 6.3:

$$\theta = \frac{W_{\mathrm{i}}\delta_{\mathrm{ui}}}{V_i(h_i - h_{i-1})} \qquad \text{(Eq. 6.3)}$$

where

h_{i} = the height of level *i* above the base of the structure

$(h_{\mathrm{i}} - h_{\mathrm{i-1}})$ = the inter-storey height for storey *i*

δ_{ui} = the inter-storey displacement for storey *i* for the ULS, as specified in 7.3.1

V_{i} = the storey shear strength, which can be conservatively taken as the design storey seismic shear force

W_{i} = the seismic weight resisted by the storey, *i* ,being considered

For structures of two or more storeys, when capacity design is used to specifically exclude column-sway mechanisms, and vertical stiffness irregularities and weak storeys, as defined in 4.5, do not exist, Equation 6.3 shall be applied to all storeys between the base and mid-height. For all other structures, Equation 6.3 shall be applied to all storeys.

When the stability coefficient calculated from Equation 6.3 exceeds 0.3, the configuration of the structure is not acceptable.

6.5.3 Serviceability limit state

Assessment of P-delta effects is not required for the SLS.

6.5.4 Analysis for P-delta effects

When the equivalent static method or modal response spectrum analysis method is used, and an analysis for P-delta actions is required, it shall be made using Method A outlined in 6.5.4.1 or Method B outlined in 6.5.4.2.

6.5.4.1 Approximate method for P-delta effects – Method A

The structural action effects from 6.2 or 6.3 shall be multiplied by the ratio, as provided in Equation 6.4.

$$\frac{k_{\mathrm{p}} W_t + V}{V} \qquad \text{(Eq. 6.4)}$$

where

k_{p} = $(0.015 + 0.0075(\mu - 1))$

with the limits of $0.015 < k_p < 0.03$

V = the seismic base shear

W_t = the seismic weight of the structure

6.5.4.2 P-delta analysis – Method B

Step 1

Analyse the structure using either the equivalent static method, defined in 5.2.1 and 6.2, or the modal response spectrum method, defined in 5.2.2 and 6.3, neglecting P-delta effects. From the results of the analysis, find the maximum of the horizontal displacements of the centre of seismic weight at each floor level in the direction being considered.

Where the diaphragms are stiff, a single ratio of the seismic weight can be assumed for each level. Where the diaphragms are flexible, the seismic weight shall be distributed to two or more centres for each level, in such a way that the resultant centre of seismic weight is maintained.

Step 2

Scale the horizontal displacements of the centres of seismic weight found in Step 1, as required in 7.2.1.1, to give the predicted horizontal displacements allowing for inelastic deformation.

Step 3

By assuming that the seismic weight at each level is concentrated at its centre, calculate the actions induced by these weights being displaced through the displacements found in Step 2. Find the 'additional displacements' due to these actions (see C6.5.4.2 for a simple method of carrying out this analysis).

Step 4

Use Equations 6.6 and 6.7 to calculate the value of β. β makes an allowance for the ductility and incorporates the factor K, which makes an allowance for the period and the site class on P-delta actions. Use Equations 6.8 to 6.13 to calculate the value of K.

$$\beta = \frac{2\mu K}{3.5} \text{ for } \mu \leq 3.5 \quad \text{(Eq. 6.6)}$$

$$\beta = 2.0K \text{ for } \mu > 3.5 \quad \text{(Eq. 6.7)}$$

For Site Classes I, II, and III:

$$K = 1.0 \text{ for } T_1 < 2 \quad \text{(Eq. 6.8)}$$

$$K = \frac{(6.0 - T_1)}{4} \text{ for } 2.0 \leq T_1 < 4.0 \quad \text{(Eq. 6.9)}$$

$$K = 0.5 \text{ for } T > 4 \quad \text{(Eq. 6.10)}$$

For Site Classes IV, V, VI, and VII:

$$K = 1.0 \text{ for } T_1 < 2.5 \quad \text{(Eq. 6.11)}$$

$$K = \frac{(6.5 - T_1)}{4} \text{ for } 2.5 \leq T_1 < 4.5 \quad \text{(Eq. 6.12)}$$

$$K = 0.5 \text{ for } T > 4.5 \quad \text{(Eq. 6.13)}$$

In no case shall the value of β be taken as less than 1.0.

Step 5

Multiply the additional structural action effects found in Step 3 by β and add these to the corresponding actions found in the equivalent static method or modal response spectrum analysis method carried out for Step 1. The resultant actions are the design actions.

Step 6

Multiply the further lateral displacements found in Step 3 by β and add these to the corresponding values found by the equivalent static method or modal response spectrum method of analysis. The resultant displacements are scaled, as required in 7.2.1.1, to give the resultant deflection profile for the structure including P-delta actions.

6.6 Rocking structures and structural elements

Rocking mechanisms can be adopted as an alternative structural mechanism to conventional yielding systems. Rocking can occur either at the foundation level or within the structure above the foundation.

The actions on the structures, and the parts being supported by the structures, shall be determined by special study, except when rocking foundations meet the limitations of 5.9.1.1. Such special studies are outside the scope of this TS (see 1.4).

7 Earthquake-induced deflections

7.1 General

7.1.1 Calculations of deflections

Design horizontal deflections at each level of the structure shall be calculated in accordance with 7.2, using one of the methods of analysis given in section 6 and shall not exceed the limits specified in 7.4.

7.1.2 Actions considered for calculating deflections

Calculation of design horizontal deflections shall include the effects of both translation and torsion, as well as the and the effects of foundation deformations. P-delta effects shall be considered, where required by 6.5.2.

7.1.3 Determination of inter-storey deflection

Design inter-storey deflection shall be calculated in accordance with 7.3 and shall not exceed the appropriate limits specified in 7.5.

7.1.4 Properties to be used when determining deflections

For each limit state, deflections shall be calculated from the actions determined from section 5, based on the stiffness properties of components or members, as designed and detailed.

7.2 Determination of design horizontal deflections

7.2.1 Ultimate limit state

7.2.1.1 Using equivalent static or modal response spectrum methods

For all structures analysed by the equivalent static method or modal response spectrum method of analysis, the horizontal deflection envelope for the ULS shall be taken as the larger of the values determined from (a) or (b):

(a) The elastic deflection envelope found from either the equivalent static method (6.2) or the modal response spectrum method (6.3) is multiplied by a scale factor equal to the structural-ductility factor, μ. The deflection for inelastic deformation is equal to (μ -1) times the elastic deflection; or

(b) Deflections found by adding the elastic deflection profile, determined in accordance with (i), to each possible sidesway mechanism deflection profile, determined in accordance with (ii):

  (i) The elastic deflection profile shall be determined using the equivalent static method or the modal response spectrum; and

  (ii) The sidesway mechanism deflection profiles shall be constructed by considering all potential sidesway mechanisms, except those that are specifically suppressed through the application of capacity-design procedures. The deflection profile for each sidesway mechanism shall be consistent with obtaining a deflection at the level of the uppermost principal seismic weight equal to the corresponding value found in (a) for this level. The inelastic component of deflection at each level is equal to the difference between the final deflection profile found in (b) minus the initial elastic deflection at that level.

7.2.1.2 Increase of displacements due to P-delta actions

When the equivalent static method or modal response spectrum method is used, the following shall apply.

(a) When Method A, given in 6.5.4.1, is used to allow for P-delta effects, the deflections found from 7.2.1.1 shall be multiplied by the factor given by Equation 6.4;

(b) When Method B, given in 6.5.4.2, is used to allow for P-delta effects, the resultant deflections, which include the P-delta effects, are given by 6.5.4.2.

7.2.1.3 Using numerical integration time-history analysis

The ULS horizontal deflections shall be taken as the maxima of the appropriate deflections obtained for each required ground motions.

7.2.2 Serviceability limit state

Calculation of design horizontal deflections for the SLS shall be based on the linear elastic response of each member, unless some additional, but limited, inelastic displacement is considered acceptable and is nominated as such within the appropriate material standard. If so, account shall be taken of the inelastic displacement in the calculation.

7.3 Determination of inter-storey deflection

7.3.1 Ultimate limit state

7.3.1.1 Design inter-storey deflections based on the equivalent static and modal response spectrum methods

The design inter-storey deflection shall be taken as the difference in inter-storey deflections, given in 7.2.1.1, multiplied by the drift modification factor, k_{dm}, which is given in Table 7.1.

Table 7.1 – Drift modification factor

Structure height, h	Drift modification factor, k_{dm}
h < 15 m	1.2
15 ≤ h ≤ 30 m	1.2 + 0.02(h – 15)
h > 30 m	1.5

7.3.1.2 Numerical integration time-history method

When the horizontal deflections have been computed in accordance with 7.2.1.4, incorporating inelastic member response, the design inter-storey deflection between the levels shall be taken as the maximum inter-storey deflection obtained for each required ground-motion record that does not include forward-directivity motions, and 0.67 of that maximum for records that do include forward-directivity motions.

7.3.2 Serviceability limit state

Design inter-storey deflection for the SLS shall be taken as the difference in the design horizontal deflections between adjacent levels, calculated in accordance with 7.2.2, or those determined from the combined modal inter-storey deflections.

7.4 Horizontal deflection limits

7.4.1 Ultimate limit state

7.4.1.1 Adjacent to boundaries

The design horizontal deflection of any point on the perimeter of a structure shall not exceed the distance from that point on the structure to the boundaries of adjacent sites, except for street frontages.

7.4.1.2 Adjacent to structures on the same site, or existing structures on adjacent sites

At any point above the ground, the design horizontal deflection of the structure shall be such that, when combined with the design horizontal deflection of any adjacent structure at the same height, contact does not occur.

7.5 Inter-storey deflection limits

7.5.1 Ultimate limit state

The ULS inter-storey deflection, determined in accordance with 7.3.1, shall not exceed 2.5% of the corresponding storey height or such lesser limit as could be prescribed in the appropriate-material standard.

7.5.2 Serviceability limit state

The SLS inter-storey deflection shall be limited so as not to adversely affect the required performance of other structure components, in accordance with 2.1.4(b). The design horizontal deflections shall not be greater than any separation provided to avoid contact between adjacent parts of the structure, or between the structure and its parts and shall be limited so as not to impair their function nor that of other structure components

8 Requirements for parts and components

8.1 General

8.1.1 Scope

All parts of structures and non-structural components, their connections (both to the part and to the structure), and the part supports are collectively referred to as 'parts' or 'components' or both, unless specifically noted otherwise. When required by section 2, parts and components shall be designed for the earthquake actions, deflection-induced actions and differential displacements specified in section 8. All parts shall be designed for both SLS and ULS requirements, except as exempted in Table 8.1.

When there is a requirement to consider the actions for more than one limit state, or for multiple values of R_p for the same limit state, the part or component shall be designed to meet each requirement.

Where the mass of the part is more than 20% of the combined mass of the part, and the primary structure and the lowest translational period of the part is longer than 0.2 seconds, a special study shall be carried out to determine the dynamic characteristics of the part.

8.1.2 Classification of parts and components

Parts and components shall be classified into the categories shown in Table 8.1. A part or component shall be classified into more than one category, if more than one of the criteria is appropriate.

Table 8.1 – Classification of parts and components

Category	Criteria	Part risk factor R_p	Limit state[a]
P.1	Parts or components that represent a hazard to human life outside the structure[b, c]	1.0	ULS
P.2 and P.3	Parts or components that represent a hazard to human life within the structure[b, c]	1.0	ULS
P.4	Parts or components required for the continuing function of the evacuation systems (after earthquake) and human life support systems within the structure	1.0	ULS
P.5	Importance Level 4 buildings: parts or components required to maintain operational continuity[d]	1.0	SLS2
P.6	All buildings: A part or component the failure of which causes damage which is disproportionately greater than the loss of the part or component itself	2.0	SLS1
P.7	All parts or components	1.0	SLS1

NOTE –

a. Refer to section 2 for the annual probabilities of exceedance appropriate for each limit state.
b. These parts are not considered to represent a hazard to life:
   (i) A part that weighs less than 1.5 kg and which, if it experiences a loss of gravity support or becomes decoupled from the structure, would fall less than 4 m, provided that the loss of support does not lead to release of hazardous material;
   (ii) A part that weighs less than 7.5 kg and which, if it experiences a loss of gravity support or becomes decoupled from the structure, would fall less than 3 m, provided that the loss of support does not lead to release of hazardous material;
   (iii) A part that weighs less than 25 kg and is wall-mounted, provided that the loss of support does not lead to the release of hazardous material; and
   (iv) A part supported at floor level that weighs less than 50 kg, provided that the loss of lateral restraint does not lead to release of hazardous material.

c. A part tethered to the structure to prevent it becoming a hazard to life need not be considered in this category, provided the tether has sufficient strength to arrest the falling part, but not less than 2 G where G is the gravity load of the part plus the tether.
d. For IL4 structures, these will be elements that need to return to a fully operational state within an acceptably short time (minutes or hours, rather than days) in order for the structure to maintain the operations for which it is designated as critical.

8.2 Design response coefficient for parts and components

The design response coefficient for parts and components, $C_p(T_p)$, is the horizontal acceleration coefficient derived for the level of structure that provides support for the part. It shall be calculated using Equation 8.1.

$$C_p(T_p) = PGA\left[\frac{C_{\mathrm{Hi}}}{C_{\mathrm{str}}}\right]\left[\frac{C_i(T_\mathrm{p})}{C_{\mathrm{ph}}}\right] \quad \text{(Eq. 8.1)}$$

where

PGA = the peak ground acceleration, determined from 3.3.1.

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

C_{str} = the structural-nonlinearity-reduction factor, determined from 8.4

T_p = the period of the part

$C_\mathrm{i}(T_\mathrm{p})$ = the part or component spectral-shape coefficient, determined from 8.5

C_{ph} = the part or component horizontal-response factor, determined from 8.6

For long-period parts and components possessing a period, T_p, greater than $T_{\mathrm{p.long}}$, determined using Equation 8.2, the design response coefficient, $C_{\mathrm{p,long}}(T_\mathrm{p})$ can be used in place of $C_\mathrm{p}(T_\mathrm{p})$ and calculated using Equation 8.3.

$$T_{p,long} = T_1(1+\sqrt{\mu}) \quad \text{(Eq. 8.2)}$$

where

T_1 = the largest translational period of vibration of the primary structure, in the direction being considered

μ = the structural-ductility factor, determined from 4.3

$$C_{p,long}(T_p) = \frac{S_\mathrm{a}(T_\mathrm{p})}{C_{\mathrm{ph}}}\left[1+\frac{1}{\left(\frac{T_\mathrm{p}}{T_1}-1\right)^2}\right] \quad \text{(Eq. 8.3)}$$

where

$S_\mathrm{a}(T_\mathrm{p})$ = the spectral-acceleration of the part, , determined from $S_\mathrm{a}(T)$ (see 3.1.2) at period T_p

8.3 Floor-height coefficient

The floor-height coefficient at level i, C_{Hi}, shall be calculated using Equation 8.4.

$$C_{Hi} = 1+\frac{1}{T_1}\left(\frac{h_\mathrm{i}}{h_\mathrm{n}}\right)+\left[1-\left(\frac{0.4}{T_1}\right)^2\right]\left(\frac{h_\mathrm{i}}{h_n}\right)^{10} \quad \text{(Eq. 8.4)}$$

Alternatively, it is permitted to determine C_{Hi} from Equation 8.5.

$$C_{Hi} = 1 + 2.5\left(\frac{h_i}{h_n}\right) \quad \text{(Eq. 8.5)}$$

where

T_1 = the largest translational period of vibration of the primary structure in the direction being considered, but not less than 0.4 seconds

h_i = the height of the attachment of the part or component from the base of the structure

h_n = the height from the base of the structure to the uppermost seismic weight or mass in the structure

For single-storey structures, when n equals 1, the floor-height coefficient at the roof level, C_{Hi}, shall be taken as the ratio of the short-period spectral acceleration, $S_{a,s}$, to *PGA*, determined from 3.3.1.

8.4 Structural-nonlinearity-reduction factor

The structural-nonlinearity-reduction factor, C_{str}, shall be taken as 1.0 for components at ground level and shall be calculated using Equation 8.6 for parts and components at other levels.

$$C_{str} = (C_{str,max})^{\wedge e_{str}} \quad \text{(Eq. 8.6)}$$

where

$C_{str,max}$ = the maximum structural-nonlinearity-reduction factor, determined using Equation 8.7

e_{str} = the floor-height distribution exponent for structural nonlinearity reduction, determined using Equation 8.8

$$C_{str,max} = \sqrt{\mu} \geq 1.3 \quad \text{(Eq. 8.7)}$$

where

μ = the structural-ductility factor, determined from 4.3

$$e_{str} = \left(\frac{h_i}{h_n}\right)^{1.5} \quad \text{(Eq. 8.8)}$$

where

h_i = the height of the attachment of the part or component from the base of the structure

h_n = the height from the base of the structure to the uppermost seismic weight or mass in the structure

8.5 Part or component spectral-shape coefficient

The part or component spectral-shape coefficient, $C_i(T_p)$, shall be determined from Table 8.2. .

Table 8.2 – Part or component spectral-shape coefficient, $C_i(T_p)$

Rigid components	**Flexible components**	
All levels	At ground level or below ground level	Above ground level
1.0	$\frac{S_{as}}{PGA}$	4.0

where

$S_{a,s}$ = the short-period spectral acceleration, determined from 3.1.2

PGA = the peak ground acceleration, determined from 3.3.1

NOTE –

(1) Refer to C8.5 for guidance on classifying parts or components as rigid or flexible.

(2) The part or component spectral-shape coefficient for flexible and long-period components assumes that parts are characterised with 5% damping. Alternative spectral-shape coefficients can be adopted if they are supported by the results of a special study.

8.6 Part-response factor or component-response factor

The part-horizontal-response factor or component-horizontal-response factor, C_{ph}, shall be taken from Table C8.3 with the ductility of the part μ_p = 1.0 for SLS1 design and μ_p =1.25 for SLS2 design. The recommendations of Table C8.3 can be used, directly or by interpolation, without further verification. Alternatively, part ductility values for ULS design may be determined based on analysis or testing.

The part-vertical-response factor or component-vertical-response factor, C_{pv}, shall be taken from Table 8.3 with μ_p = 1.0.

Table 8.3 – Part-response or component-response factor, C_{ph} and C_{pv}

Ductility of the part μ_p	Rigid components	Flexible components		Long-period components[a]
	All levels	At ground level or below	Above ground level	All levels
1.0	1.0	1.0	1.0	1.0
1.25	1.0	1.25	1.4	1.25
1.5	1.0	1.5	1.85	1.5
2.0	1.0	2.0	2.8	2.0
≥2.5	1.0	2.5	4.0	2.5

NOTE –

a. A long-period component is taken as a component that has a fundamental period, T_p, greater than $T_{p,long}$, where $T_{p,long}$ is defined in 8.2.

8.7 Design actions on parts and components

8.7.1 Horizontal design actions

The horizontal design earthquake actions on a part, F_{ph}, shall be determined from Equation 8.9.

$$F_{ph} = \frac{C_p(T_p)}{\Omega_p} R_p W_p \leq \frac{7.5\, PGA\, W_p}{\Omega_p} \quad \text{(Eq. 8.9)}$$

where

$C_p(T_p)$ = the horizontal design coefficient of the part or component, determined from 8.2

Ω_p = the part or component reserve-capacity factor, taken as 1.5 for ULS and 1.0 for SLS1 and SLS2, unless demonstrated to be greater

R_p = the part or component risk factor, given by Table 8.1

PGA = the peak ground acceleration, determined from 3.3.1.

W_p = the weight of the part or component

8.7.2 Vertical design actions

Parts or components that are sensitive to vertical acceleration amplification shall be designed for vertical earthquake actions. The vertical earthquake actions on a part or component, F_{pv}, shall be calculated using Equation 8.10.

$$F_{pv} = \frac{C_{vd}}{C_{pv}} R_p W_p \leq 2.5 W_p \quad \text{(Eq. 8.10)}$$

where

C_{pv} = the part or component vertical-response factor, determined from 8.6

C_{vd} = the vertical design action coefficient, determined from 5.5 for the period of the system supporting the part

R_p = the part risk factor, given by Table 8.1

W_p = the weight of the part

8.7.3 Deflection-induced actions

When the part is connected to the primary structure on more than one level, the part shall be designed to sustain the actions resulting from the relative deflections that occur for the limit state being considered.

Parts and components that are supported at more than one level, or between different structures, and where at least one support is on a sliding ledge, shall also comply with 8.9.

8.8 Connections

8.8.1 Non-ductile connections

Non-ductile connections for parts shall be designed for seismic actions that correspond to a ductility factor of the part of μ_p= 1.0, or derived using capacity design considering the maximum resistance of the part. Non-ductile connections include, but are not limited to, expansion anchors, shallow chemical anchors, or shallow (non-ductile) cast-in-place anchors in tension and not engaged with the main reinforcement.

8.8.2 Other connections

Other connections can be designed for a greater value of μ_p, where the specific detailing can be verified to sustain not less than 90% of its design action effects at a displacement greater than twice its yield displacement under reversed cyclic loading.

8.9 Parts supported on ledges

8.9.1 General

Ledge supports for parts that are supported at more than one level in a structure, or between structures that can displace differentially, shall comply with 8.9.2 and 8.9.3.

8.9.2 Lateral design actions for a sliding ledge

In addition to any other actions, a sliding ledge shall be designed to resist the maximum frictional forces.

8.9.3 Minimum dimensions for a sliding ledge

A sliding ledge support shall be proportioned so that it can maintain gravity-load support of the part after allowing for the following:

(a) Structure inter-storey drifts, calculated in accordance with 7.3.1 multiplied by $2/S_p$;
(b) Construction tolerances in both the part and the structure;
(c) Movements due to temperature change, creep and/or shrinkage in both the part and the structure;
(d) Foundation and soil deformations;
(e) Displacements arising from elongation, rocking or rotation of structural members supporting the ledge;
(f) Permanent inelastic deformations in the part between points of support; and
(g) Reduction in the ledge width, due to spalling.

The intended position of the part on the sliding ledge support after construction shall be clearly shown on the construction drawings.

APPENDIX A – REQUIREMENTS FOR MATERIAL DESIGN STANDARDS

(Informative)

A1 General

This appendix identifies the linkages that are required between the material design standards and this TS for earthquake design.

A2 Design objectives

This TS has been written to satisfy objectives that are listed in C2.1. In developing a material standard, or in a special study, all of the objectives shall be considered.

A3 Structural-ductility factors

Application of the provisions of this TS requires assigning a structural-ductility factor to the building under consideration. In some cases, different structural-ductility factors may apply for different directions, depending on the structural configuration and construction materials used. It is expected that the structural-ductility factor will be specified in the appropriate-material design standard.

Material standards are to provide structural-ductility factors that are consistent with the expected inelastic performance of the materials and structural configurations being defined (see 2.3.2). There is an expectation that the levels of inelastic material strain implied by a particular choice of structural-ductility factor will be reliably achievable at the ULS load levels defined by this TS.

Material standards shall consider the potential adverse effects of localised high-ductility demands, where inelastic deformation is concentrated in relatively few locations. Even without this concentration, additional ductility demand may be required to meet the collapse-risk expectations set out in C2.1. In these circumstances, it is expected that the material standards may either reduce the structural-ductility factor that can be used or alternatively apply other restrictions, such as those discussed in C2.1.

A4 Material-strain limits

It is an expectation of this TS that material design standards will define material-strain limits for the specified detailing that will be appropriate for the ULS. It is also expected that the material standards will provide the material-strain capacity of the specified detailing, to enable verification of the collapse risk where this might be attempted.

Material-strain limits may be defined in several different ways, including limitations on curvatures and plastic-hinge lengths may be defined, or limiting plastic-hinge rotations. The difference between limiting values for both unidirectional and reversing plastic hinges shall be defined. Limiting shear strain and axial-strain values shall be defined.

A5 Inter-storey displacement limits

Further restrictions on inter-storey displacements for the ULS are expected to be specified in the material design standards, when the inter-storey displacement limits specified in this TS are inappropriate for the structural configuration, material detailing or part under consideration. The inter-storey displacement limits for the ULS shall reflect the need for the material and structural configuration to meet the collapse-risk expectations set out in C2.1.

A6 Information to be provided by material design standards

The use of this TS depends on design information being sourced from the relevant material standard. This is to be consistent with objectives of this TS and provide the following design information:

A6.1 ULS

(a) Calculations of nominal strengths;
(b) Strength-reduction factors;
(c) Maximum permissible structural-ductility factors;
(d) Minimum permissible structural-performance factors;
(e) Maximum permissible material strains, including with axial strains, shear strains, section curvatures or plastic rotations, and plastic-hinge lengths, for both unidirectional and reversing inelastic zones, as appropriate for respective materials;
(f) Maximum inter-storey deflection limits;

(g) Detailing requirements related to material strain levels;
(h) Section properties to be used in seismic analyses;
(i) Calculations of overstrength actions;
(j) Definitions of regular and irregular buildings; and
(k) Dynamic magnification factors, when required for columns, walls, and combined wall-frame structures.

A6.2 SLS

(a) Calculations of strength for seismic-serviceability requirements;
(b) Structural-performance factors;
(c) Section properties to be used for serviceability seismic analyses;
(d) Maximum permissible strain and deformation limits; and
(e) Detailing requirements for serviceability.

APPENDIX B – DESIGNING FOR ULTIMATE LIMIT STATE

(Informative)

B1 General

This appendix gives guidance on four areas related to design for the ULS:
(a) Design for higher-mode effects in frames and structural walls;
(b) Different forms of plastic hinge that may form;
(c) Assessment of material strains in plastic-hinge zones; and
(d) Stiffness values for use in seismic analysis.

B2 Design for higher-mode effects

B2.1 Background

This section gives guidance on the 'design strengths' required with capacity design for structural members and regions of structural members that are outside potential inelastic zones (plastic hinges).

When inelastic zones form in structures, their dynamic characteristics change in ways that cannot be predicted from elastic-based analyses, such as the equivalent static method, modal response spectrum method, or elastic time-history methods. Structural actions that arise from this change in structural behaviour are referred to as 'higher-mode effects'. The resultant bending moments and shears may be distributed in patterns that are very different from those found in the elastic-based methods of analysis. Due to the dependence of higher-mode actions on the dynamic behaviour, these values cannot be predicted from push-over analyses, even though inelastic behaviour is modelled. The extent to which higher-mode effects or actions arise increases with the ductility and the number of potential modes or storeys. Hence, recommendations to cover these effects may be expected to vary with the structural-ductility factor, and the number of levels or fundamental period of the buildings.

Numerous time-history analyses have been made to assess how actions obtained from elastic based methods of analysis, should be modified to allow for higher-mode effects. The recommendations that are necessary to cover structural actions associated with higher-mode effects have been based on two different approaches for finding the strengths. The first approach has traditionally been used for the design of reinforced concrete columns. In this approach, analytical moments are scaled to correspond to overstrength values in the beams. These values are then multiplied by a dynamic magnification factor. The second approach has been used for structural concrete walls. In this approach, a design action, such as a bending moment at the base of a wall, is scaled to correspond to its overstrength value. This value is then applied to a standard distribution, to define the design bending moments, or other structural actions, over the height of the wall. For structural walls or structures that are not pure moment-resisting frames, or structural walls a mix of these two approaches may be appropriate.

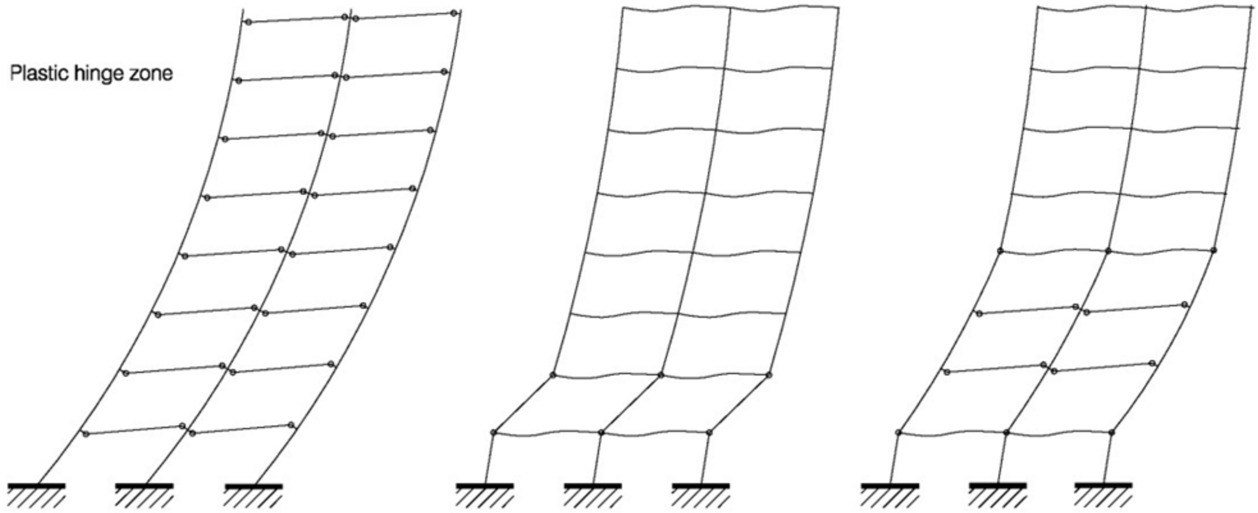
Material characteristics can have a significant influence on the value of the dynamic magnification factor that is used. For example, plastic hinging in reinforced concrete columns in ductile moment-resisting frames is undesirable for two reasons:
(a) Plastic hinging has an adverse influence on the performance of laps in reinforcing bars; therefore, it is important to keep laps away from these regions. Where potential plastic-hinge zones may form in columns, laps or splices are confined to the mid-height regions of storeys. This involves additional complications in construction; and
(b) where potential plastic hinging may form in columns extensive confinement reinforcement is required to prevent premature failure. In addition, spalling cover concrete from high columns can also impose a hazard to life.

For these reasons, structural concrete columns are often designed to have a high level of protection against yielding above the base level. However, structural steel columns used in a similar structural form can sustain some yielding and still perform adequately, provided that is the columns have sufficient strength to prevent the premature formation of a column-sway mechanism.

B2.2 Moment-resting frames

B2.2.1 *Background*

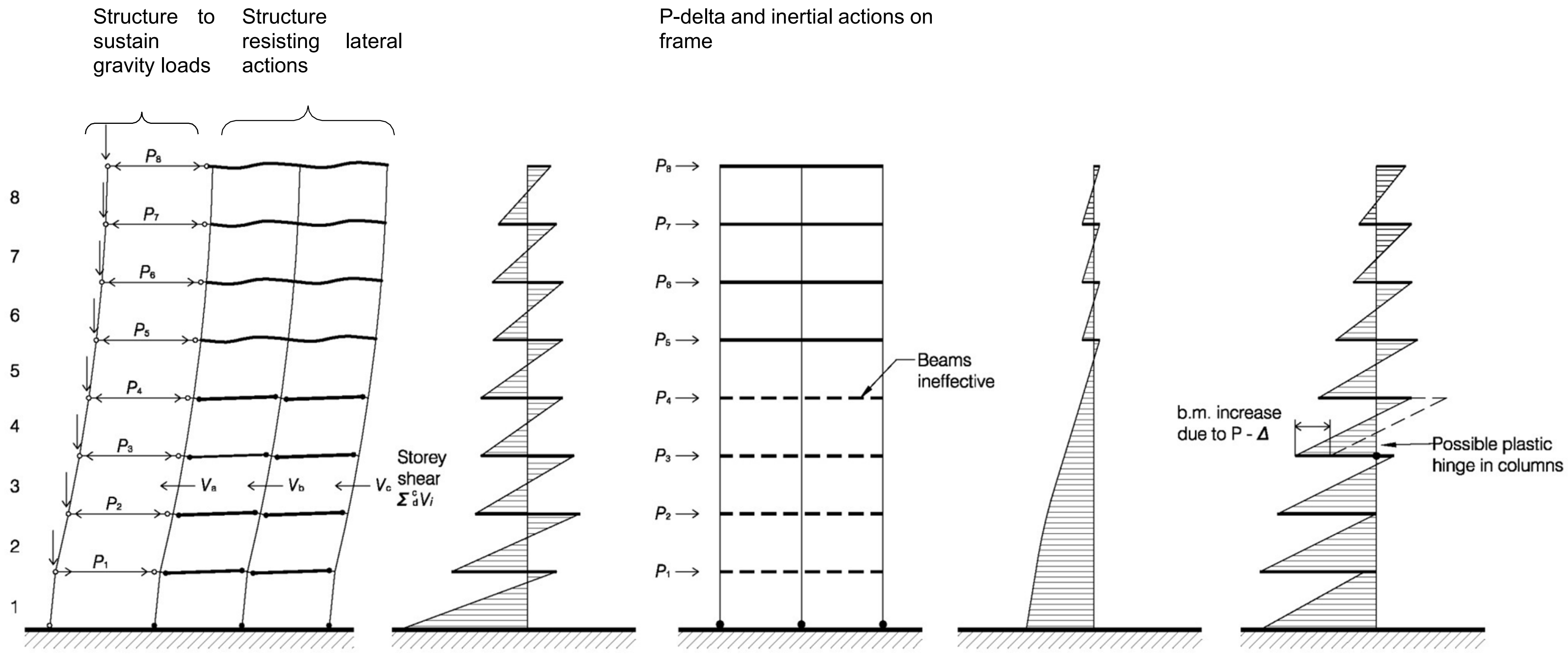
The different sway modes that may develop in moment-resisting frame structures are illustrated in Figure B1. In general, the column-sway mode has limited ductility; and structures deforming in this way are very susceptible to collapse, due to P-delta actions. To avoid this potential non-ductile-failure mechanism, or the premature formation of a mixed beam–column-sway mode, the columns require strength in excess of that indicated by elastic analysis. This may be achieved by ensuring that the storey shear strength corresponding to a column-sway mode is greater than the corresponding strength in a beam-sway mode. It should be noted that this is a minimum requirement, to ensure that the structure will behave in a ductile manner in a major earthquake. In addition to this, with some construction materials there will be additional requirements, such as those indicated for reinforced concrete in B2.1.



(a) Beam-sway mode (b) Column-sway mode (c) Mixed beam–column-sway mode

Figure B1 – Sway modes for moment-resisting frames

The actions arising in a multi-storey ductile moment-resisting frame are illustrated in Figure B2. During a major earthquake, plastic hinges tend to form in the beams in several levels simultaneously. Over the time interval that these have formed, the only resistance to additional lateral displacement, due to P-delta actions and inertia actions on the structure, arises from the elastic response of the columns, so long as they remain elastic. The columns act as springs that tend to reduce the residual displacement of the frame after each phase when the beam plastic hinges have formed. Without this spring action the displacement could progressively increase, and P-delta actions could accumulate during the earthquake. This would endanger collapse of the structure, if the earthquake motion is of long duration.



(a) Basic structure	(b) Bending moments in a column due to moments sustained by beams	(c) Effective structure to resist P-delta and inertia actions when beam plastic hinges form in levels 1–4	(d) Bending moments induced in a column by P-delta and internal actions when beam plastic hinges form in levels 1 to 4	(e) Resultant column bending moments

Figure B2 – Amplification of column bending moments in ductile frames due to P-delta hinges

Figure B2(a) shows a portion of a multi-storey frame at a stage when plastic hinges have formed in the beams over several levels, in this case on levels 1 to 4. The actions arising from P-delta actions can be visualised, by assuming the gravity loads act on a line of columns that are pinned at each level. This is a valid way of assessing P-delta actions due to seismic response in any structure (see commentary B6.5.4). With the lateral displacement of the gravity-load-resisting columns, lateral actions are transmitted to the frame due to the P-delta actions.

Figure B2(b) shows the moments induced in a column by the beams. However, as the frame is displaced laterally, P-delta actions act on the frame and induce shear in the columns. Added to this are further small inertia actions associated with the motion of the floors. These lateral actions induce shear in the columns over several storeys and hence additional bending moments are induced. This is illustrated in Figures B2(c) and B2(d). The resultant bending moments in the columns are shown in Figure B2(e). These bending moments can increase until a mixed beam–column-sway mode develops. This involves the formation of plastic hinges in columns separated by several storeys, which is illustrated in Figure B1(c). This action can lead to premature failure, unless the column strengths are appreciably greater than those indicated in an elastic-based analysis.

B2.2.2 *Recommendations for columns in multi-storey ductile moment-resisting frames*

In B2.2.1 it was noted that structures should be proportioned to avoid the formation of a column-sway mode in a major earthquake. It is suggested that this objective can be achieved by designing columns in ductile moment-resisting frames to satisfy two criteria. The first criterion is to ensure that the design storey shear strength, based on the column-sway mechanism, equals or exceeds 1.2 times the design storey shear. The second criterion involves designing the structure so that the storey shear strength in a column-sway mode is greater than the corresponding shear strength in a beam-sway mode.

Provided that the margin between these storey shear strengths is sufficient, premature formation of a mixed beam–column-sway mode should be prevented. On this basis, the recommendation is that ductile moment-resisting frame structures should be proportioned so that the nominal storey shear strength, based on a column-sway mode, equals or exceeds k_s times the corresponding overstrength storey shear strength, based on the beam-sway mode. A difficulty arises when assessing the storey shear strength based on the beam-sway mode. This may be based on a push-over analysis or on an analysis that assumes the positions of inflection points. Allowance also needs to be made for the influence of bi-axial actions in any column that is part of two frames in different planes. Suggested values for k_s are given in Table B1. In this table, the first axis refers to the axis containing the moment-resisting frame, while the second axis refers to the case where the column also forms part of a second frame. In this case bi-axial actions are induced, with the overstrength moments being amplified by the appropriate k_s values from each axis.

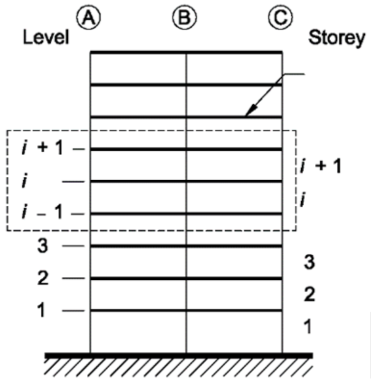
Table B1 – Values of k_s

Type of column	**k_s**	
	First axis	**Second axis**
Top storey	1.1	1.0
All other storeys	1.3	1.0

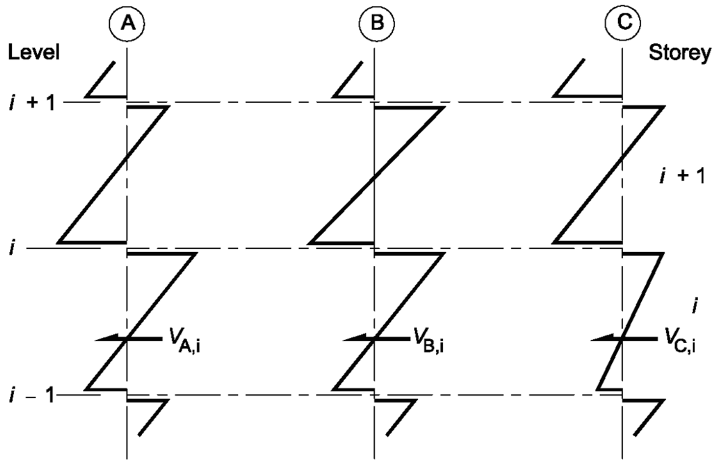
Figure B3 illustrates how this approach can be applied to ductile moment-resisting frames in which the potential plastic-hinge zones, except those at the base of the columns, are designed to form in the beams. As illustrated in Figure B3(b), the nominal column-sway storey shear strength is found by the shear that can be resisted in each of column in the storey. The individual column shears are found from the nominal flexural strengths of the column being considered. The nominal bending-moment strengths are used to identify the position of the points of inflection in the columns. To assess the beam-sway shear strength, the beams are assumed to sustain their overstrengths. With these strengths, either of the following methods may be used:

(a) A push-over analysis is made, with the loading pattern based on either equivalent static actions or actions that correspond to the first translational mode in the direction being considered. In this case, the storey beam-sway shear strength is obtained directly from the push over analysis; or
(b) Points of inflection are assumed to develop in each column at the same level that was assumed for the column-sway shear strength, which is illustrated in Figure B3(b). The storey shear strength is taken to equal the sum of the beam overstrength moments, which act at the column centrelines divided by the distance between the points of inflection in the columns in the storeys adjacent to the level being

considered. This is illustrated in Figure B3(b) (dimension f2). It should be noted that this is an approximate value; therefore, a higher coefficient is used with this approach than with the push-over analysis method.



(a) Elevation of frame



Column shears found assuming nominal strength
Column-sway storey shear = $V_{A,i} + V_{B,i} + V_{C,i}$

(b) Column-sway storey shear strength

Figure B3 – Assessment of column storey shear strengths

This approach can be adapted to deal with the case where the design solution assumes that potential plastic hinges can occur in some of the columns instead of beams. This situation is illustrated in Figure B4, which assumes that column C can form plastic hinges in the upper and lower levels of the storey. The nominal storey shear strength based in the column-sway mode is found as before. To assess the beam-sway storey shear strength, the overstrength shear that can be sustained from column C is found. This is added to the shear corresponding to the sum of the beam bending moments applied to the columns, and divided by the distance between the points of inflection in adjacent storeys. This distance is found from the nominal column bending moments, which is illustrated in Figure B3(b). With reference to the illustration The beam-sway mode storey shear strength is calculated using Equation B1:

$$\frac{M_{A,i}}{f_{A.i}} + \frac{M_{B,i}}{f_{B,i}} + V_{c,i} \quad \text{-------- Eq. B1}$$

where

$f_{A,i}$ and $f_{B,i}$ = the distance between points of inflection

$M_{A,i}$ and $M_{B,i}$ = the overstrength moments applied to the columns through the plastic-hinge zones in the beams

$V_{c,i}$ = the column shear sustained when plastic hinges form in the column and sustain their overstrength moments

B2.3 Cantilever structural walls

The ductile-failure mechanism for cantilever walls is generally based on the formation of a plastic hinge at its base. Above this level, the wall is intended to remain essentially elastic; however, in practice a limited amount of flexural yielding is acceptable. The formation of the plastic hinge at the base reduces the structural actions, bending moments, and shears that are associated with first-mode-type behaviour. However, as the wall above this level remains essentially elastic, higher-mode responses that do not induce appreciable moments at the base of the wall are not suppressed (NZS 3101:1995). As a result, both bending-moment and shear-force envelopes over the height of the walls are very different from those deduced from elastic-based analyses, where ductile behaviour at the base of the wall is assumed to reduce all modes equally.

Several different distributions have been made for design envelopes for bending moments and shears in uniform walls. The recommended design envelope for bending-moments in NZS 3101 is shown in Figure B5. This distribution limits yielding above the plastic-hinge zone at the base to acceptable limits for sections without special confinement reinforcement. The corresponding distributions for shear forces are also given in the commentary to NZS 3101:1995.

Figure B3 illustrates how the column-sway storey shear strength can be assessed. It is assumed that the columns can sustain their nominal flexural strengths at the top and bottom levels of the storey being considered. There is one limitation on this method, which occurs when the equivalent static analysis or first-mode response analysis indicates that a point of contra-flexure does not develop in the storey being considered. In this situation, it may be necessary to limit the moment that is assumed to act at one of the critical sections in the column, to ensure the plastic-hinge deformation associated with the moment redistribution does not cause the material strains to exceed permissible values.

The beam-sway storey shear strength may be assessed by considering the actions induced in the columns, when overstrength bending moments act in the plastic-hinge zones, and by scaling from an equivalent static analysis or first-mode analysis. This process is illustrated in Figure B4. Overstrength bending moments are assumed to develop simultaneously in the plastic-hinge zones associated with the beam-sway mode at the level immediately above the storey being considered. This is illustrated in Figure B4(b) for the case when all the plastic hinges are located in the beams, and in Figure B4(c) for the case when some of the plastic hinges are located in the columns. A scale factor, R, equals the sum of the overstrength moments acting on the columns at the intersection of beams and columns divided by the corresponding moments form the equivalent static analysis or first-mode analysis (see Equation B2).

$$R = \frac{\sum M_{o,1}}{\sum M_{E,I}} \quad \text{Eq. B2}$$

The beam-sway storey shear strength is assessed by summing the shear resisted in each column in the storey. Points of inflection may be assumed to occur at the mid-height of each storey, that is a distance of f_{i+1} above level i and f_i below level i. The storey shear strength is calculated using Equation B3.

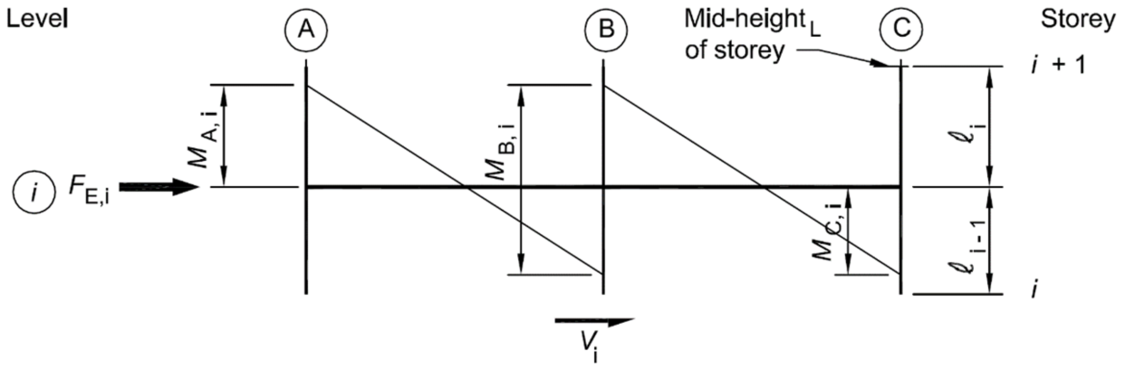
$$V_{bi} = \sum \frac{M_{o,i}}{f_{i+1} + f_i} + RF_{Ei}\frac{f_{i+1}}{f_{i+1} + f_i} \quad \text{Eq. B3}$$

where

F_{Ei} = the lateral force at level i found from equivalent static analysis or first-mode analysis, illustrated in Figure B4(a)

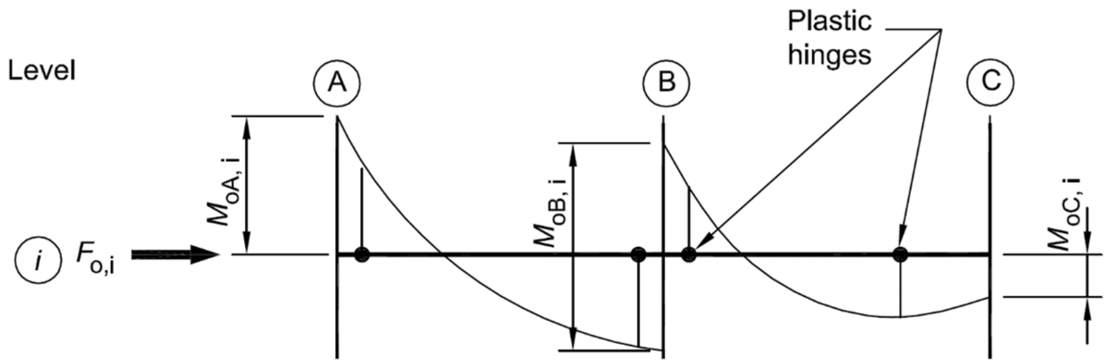
For the top storey, f_i =0.0

The required column-sway storey shear strength is found by multiplying the beam-sway storey shear strength, V_{bi}, by k_s, and distributing this shear into the columns in the storey. It is important to ensure that the resultant bending moments in the columns are such that the locations of the potential beam-sway plastic-hinge zones are maintained.



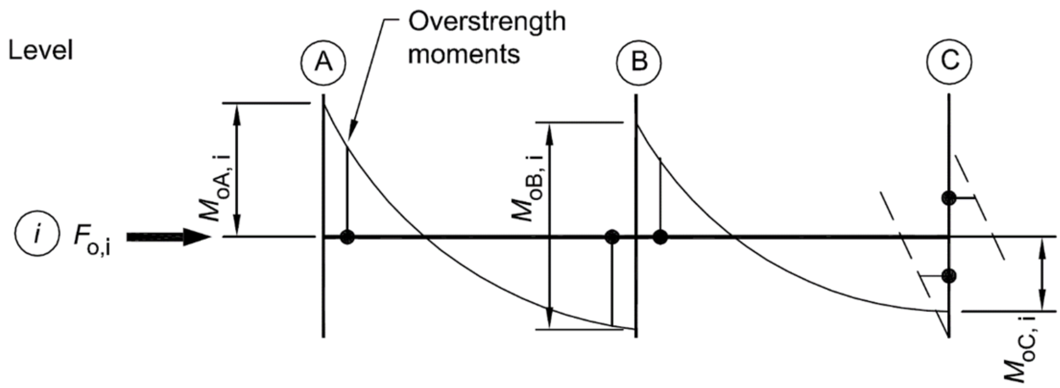
$M_{EI} = M_{AI} + M_{Bi} + M_{Ci}$

(a) Equivalent static analysis or first-mode analysis



$M_{oi} = M_{OA} + M_{OB} + M_{osi}$

(b) Plastic hinges in beams



(c) Some plastic hinges located in columns

Figure B4 – Beam-sway storey shear strength

B2.3.1 Other structures

The behaviour of other structural forms, such as structural walls or wall frames, is strongly dependent upon the material that is used. Guidance on appropriate dynamic magnification factors or distribution of design actions is given in the appropriate-material standards.

B3 Assessing material-strain demands in plastic-hinge zones

B3.1 General

The distribution of strain within a plastic-hinge zone is complex and cannot be easily determined. It depends on the material, magnitude of shear and axial load that act, the way in which the potential plastic hinge is attached to an adjacent column, foundation pad, or foundation beam; and whether the plastic hinge is unidirectional or reversing. In practice, a designer is required to assess the likely order of material strain sustained by an inelastic zone in the event of a design-level earthquake. This material strain is then used as an index to establish the appropriate level of detailing. For example, this index is curvature for a plastic hinge.

B3.2 General ductile moment-resisting frames

The inter-storey displacement in a level is composed of two components: an inter-storey displacement due to the elastic response of the structure, and a displacement due to plastic deformation in the plastic-hinge zones. By knowing the inter-storey drift in the ULS and the drift that corresponds to a ductility of one, the plastic-hinge rotations can be assessed. However, to determine the critical rotation for design purposes, two different forms of plastic hinge need to be recognized, unidirectional and reversing plastic hinges (Fenwick & Davidson,1999). The appropriate-material standards indicate that each of these forms of plastic hinge can sustain different peak rotation.

B3.3 Criteria for determining plastic-hinge type

Reversing plastic hinges are illustrated in Figure B5(a). These are sustained if either of the following criteria are satisfied:

(a) The member strengths are varied along the member in a way that prevents positive-moment plastic hinges forming away from the column faces (see Figure B6); or

(b) The shear induced by the bending moments acting at the two ends of the member exceeds the shear induced by the vertical loading. This case is illustrated in Figure B5(a), where the vertical loading shear, V_g, is less than the value determined by Equation B4.

$$V_g < \frac{M_a + M_b}{L^*} \quad \text{------- Eq. B4}$$

where

M_a = the bending moments sustained at the critical sections of the beam

M_b = the bending moments sustained at the critical sections of the beam

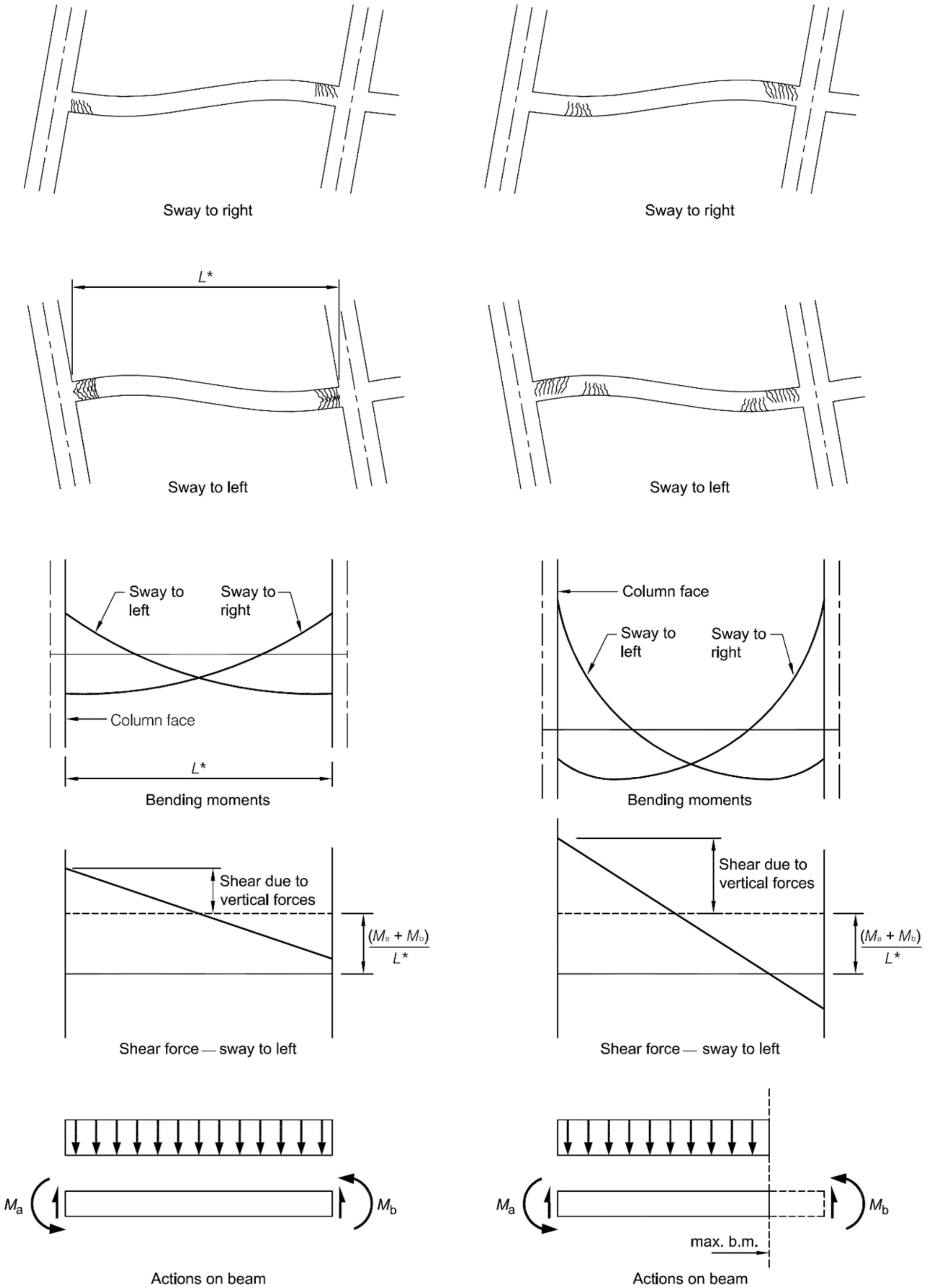
L^* = the distance between these critical sections (generally the column faces)

If neither of these two criteria are satisfied, a unidirectional plastic hinge can form in a severe earthquake, which is illustrated in Figure B5(b).

The theoretical criterion that establishes which type of plastic hinge may form is given by Equation B4, for cases where additional strength has not been added to confine the location of positive-moment plastic hinges (see Figure B6). The curvature limits for the two forms of plastic hinge should be given in the appropriate-material standard. For the cases when the gravity-load shear, V_g, is close to the limiting value given by Equation B4 some interpolation between the limits given by the appropriate-material standard may be used to define the permissible curvature. In such cases, inelastic zones may form as a mix of reversing and unidirectional plastic hinges. The form of plastic hinge that may develop in a particular situation cannot be rigorously identified for loading cases close to the criterion given by Equation B4. This uncertainty occurs due to differing rates in which different plastic hinges strain-harden, the uncertainty in imposed loading, and shears arising from vertical ground motion.

B3.4 Reversing plastic-hinge zones

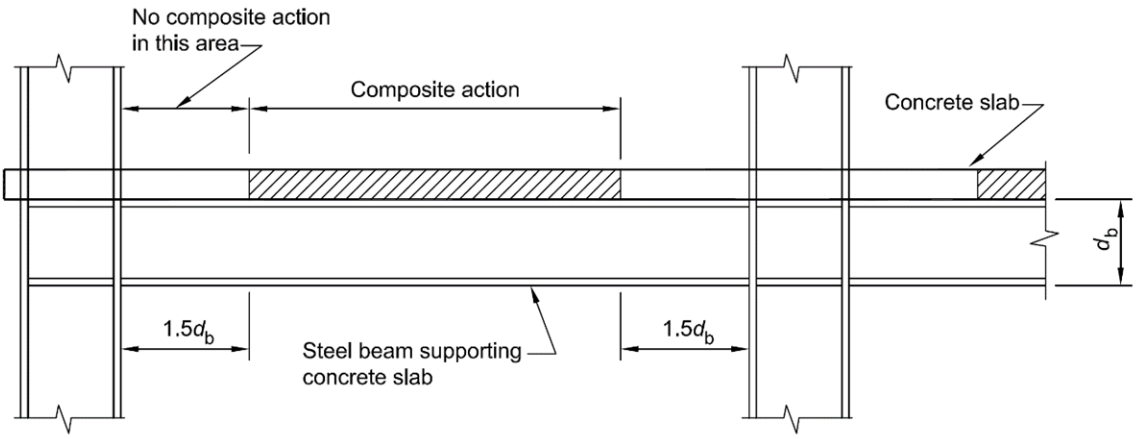
As illustrated in Figure B5(a), with this form of plastic hinge, plastic-hinge sway to the right generates a positive-moment rotation close to the left-hand column, and a negative-moment rotation close to the right-hand column. A reversal in the direction of rotation results in rotations in the opposite direction. Consequently, the maximum rotation sustained coincides with the maximum inter-storey displacement.



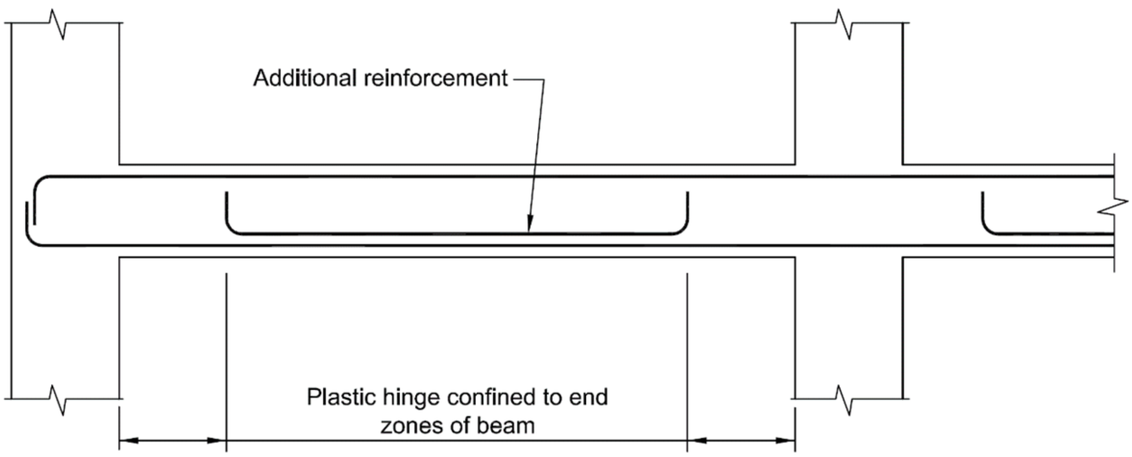
(a) Reversing plastic hinges

(b) Unidirectional plastic hinges

Figure B5 – Formation of reversing and unidirectional plastic hinges



(a) Structural beams supporting concrete slab



(b) Reinforced concrete

Figure B6 – Structural details to prevent formation of unidirectional plastic hinges

In general, for ductile moment-resisting frames the inter-storey drift due to elastic deformation of the columns is small. In Figure B7 the peak lateral displacement sustained in part of a ductile moment-resisting frame is broken down into two components: that which can be sustained by elastic deformation, δ_e, and the value δ_p, which is associated with the plastic-hinge rotations of θ_p in the beams. The plastic-hinge rotation is related to the inter-storey drift calculated by Equation B5.

$$\theta_p = \frac{\delta L}{h_i L'} \qquad \text{Eq. B5}$$

where

h_i	=	the inter-storey height
L	=	the span of the beams between the column centrelines
L'	=	the distance between the centres of the plastic-hinge zones

In practice, the plastic-hinge rotation can be conservatively estimated, neglecting the elastic deformation of the structure. With this assumption, plastic-hinge rotation can be calculated using Equation B6:

$$\theta_p = \frac{\delta L}{h_i L'}$$ ---------- Eq. B6

where

δ = the inter-storey drift of the storey

Only in a few cases will it be necessary to use the more accurate expression and only critical inelastic zones need to be considered.

From the plastic-hinge rotation, the required curvature, which is one form of material strain, can be assessed as θ_p divided by the plastic-hinge length. The effective length of the plastic hinge is given in the appropriate-material standard, and is generally of the order of half the beam or member depth.

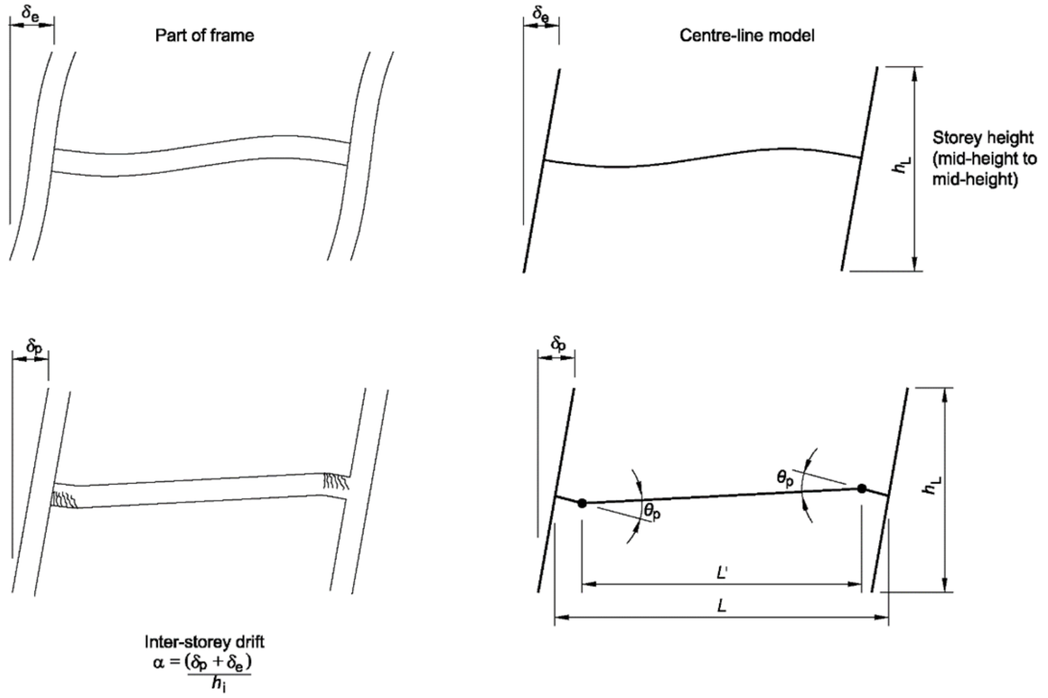


Figure B7 – Elastic and inelastic deformation in part of a ductile moment-resisting frame with a reversing plastic hinge

B3.5 Unidirectional plastic hinges

With unidirectional plastic hinges the gravity-load shear exceeds the flexural induced shear, due to the bending moments that can be sustained at the two ends of the member. This situation is illustrated in Figure B5(b). When sway occurs to the left-hand side, a negative plastic-hinge rotation occurs close to the left-hand column face and a positive-moment plastic hinge forms in the right-hand side of the span. When the direction of displacement is reversed, a negative-moment rotation occurs in a plastic hinge close to the face of the column on the right-hand side and a new positive-moment plastic hinge forms in the left-hand side of the span. However, the inelastic rotations sustained in the initial displacement to the left-hand side remain. With each inelastic displacement of the structure during the earthquake, the plastic-hinge rotations increase (Fenwick & Davidson,1999). This is illustrated in Figure B8(b). Therefore, the maximum rotation sustained is considerably greater than the equivalent rotation sustained by the reversing plastic hinge, and it cannot be calculated by the approach outlined for reversing plastic-hinge zones.

Analyses have indicated that the rotation imposed on a unidirectional plastic hinge is appreciably greater than that required for a reversing plastic hinge. However, analyses have also found that a unidirectional plastic hinge can sustain appreciably more rotation than a reversing plastic hinge (Fenwick & Davidson,1999).

A series of time-history analyses of structures forming unidirectional and reversing plastic hinges has been reported (Fenwick & Davidson,1999). These analyses show that, with a displacement ductility of 6, the rotation imposed on a unidirectional plastic hinge varied from between 2.5 to 4.4 times the corresponding rotation imposed on a reversing plastic hinge located on the column centreline. This ratio was found to decrease with a reduction in the displacement ductility.

On the basis of these analyses, it is proposed that the equivalent rotation demand on a unidirectional plastic hinge can be assessed for design purposes, as set out in steps (a) and (b) and illustrated in Figure B8.

(a) Determine the plastic-hinge rotations that are required, assuming that reversing plastic hinges in the beam are located on the column centrelines –, that is angle α in Figure B8(b); and

(b) Multiply this value by the appropriate factor given in Equation B7 or B8, depending on the magnitude of the structural-ductility factor, μ.

$1.0 + 0.63\ (\mu - 1)$ for $\mu < 2.0$ -- Eq.B7

$1.63\sqrt{(\mu - 1)}$ for $2.0 < \mu < 6.0$ -- Eq. B8

Calculating the critical curvature for unidirectional plastic hinges follows the same approach as for reversing plastic hinges. As the positive-moment plastic hinges develop in a zone of low shear away from the column faces, the inelastic curvature spreads over a longer length than for negative-moment plastic hinges.

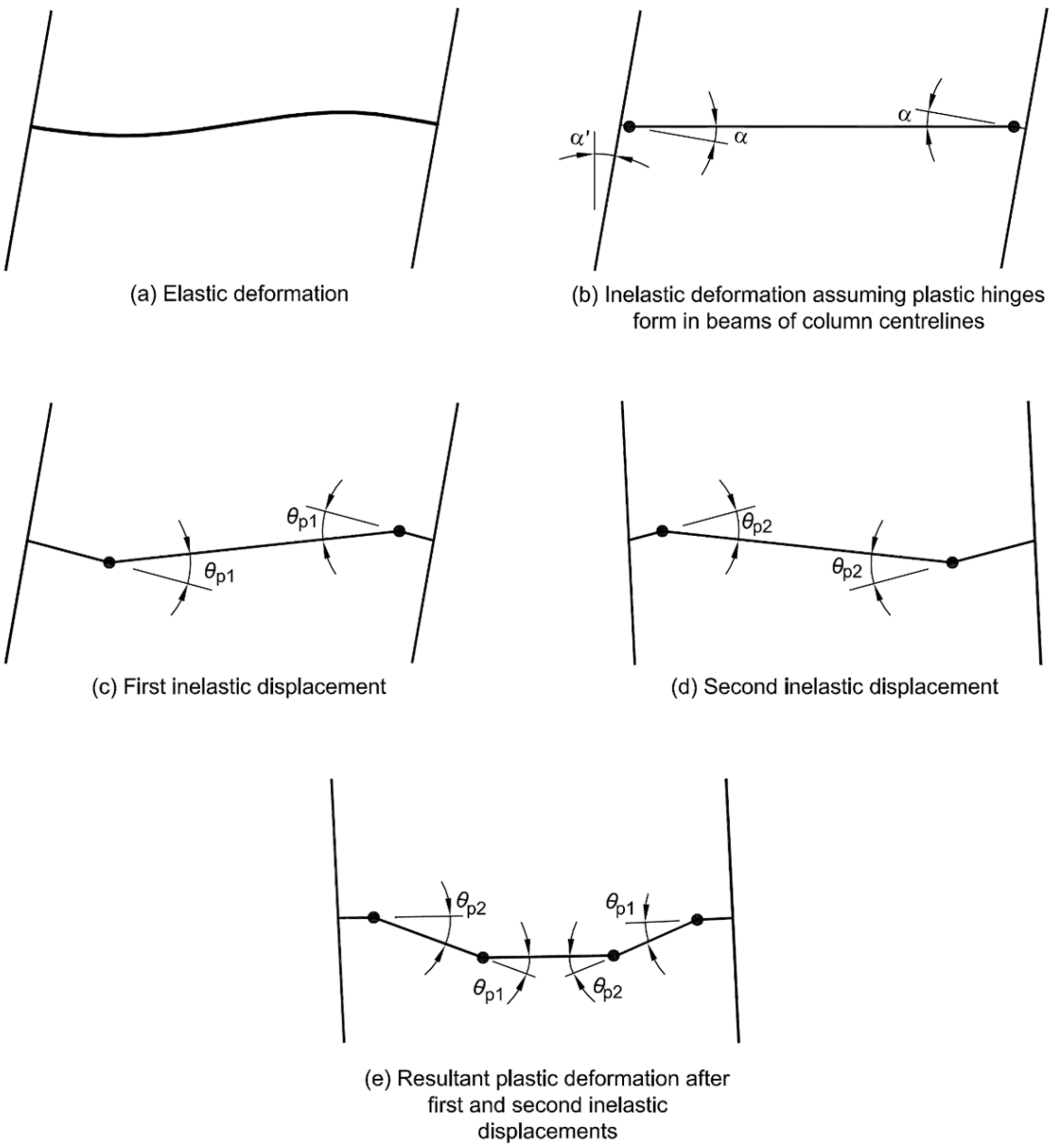


Figure B8 – Plastic-hinge rotations in a beam with unidirectional plastic hinges

B3.6 Structural walls

The rotation that a potential plastic hinge is required to be capable of sustaining may be assessed from the ULS deflection at the top of the wall. This is calculated using Equation B9.

$$\theta_{\mathrm{p}} = \frac{(\mu - 1)}{\mu} \frac{\delta_{\mathrm{t}}}{h'} \quad \text{Eq. B9}$$

where

δ_t = the lateral displacement at the top of the wall

h' = the height between the centre of the plastic hinge at the base of the wall and the top of the wall

The curvature to be sustained by the plastic hinge at the base of the wall can be assessed by dividing the plastic rotation by the effective plastic-hinge length.

B4 Stiffness values for seismic analyses

The stiffness to be used in analyses for seismic actions in the ULS, in which a structural-ductility factor of greater than 1.0 is used, should be based on the member stiffness determined from the load and deflection that is sustained by the member when either of the following criteria apply:

(a) The material sustains first yield; or
(b) The material sustains significant inelastic deformation.

In either case, when assessing stiffness, assume that the member has been cycled to plus and minus the displacement corresponding to the critical deflection given in a or b above.

For SLS analyses, the stiffness is to be based on several cycles of loading to plus and minus the level of anticipated deformation for that load level in the SLS (NZS 3101:1995) (Fenwick & Davidson,1999).

TABLE 3.4 – SITE DEMAND PARAMETER TABLES

TABLE 3.4(a) part 1: Site demand parameters for an annual probability of exceedance of 1/25

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Kaitaia	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Kerikeri	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Haruru	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Paihia	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Opua	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Kawakawa	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Moerewa	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Kaikohe	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Hikurangi	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Ngunguru	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Whangarei	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
One Tree Point	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Ruakaka	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Dargaville	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Waipu	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Mangawhai Heads	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Wellsford	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Warkworth	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Snells Beach	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Hibiscus Coast	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Parakai	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Helensville	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Coromandel	6.4	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Riverhead	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Kumeu-Huapai	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Waimauku	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Waiheke West	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Whitianga	6.5	n/a	0.02	0.03	0.4	0.02	0.04	0.5	0.02	0.05	0.5	0.03	0.06	0.6	0.03	0.07	0.6	0.03	0.09	0.6
Muriwai	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Auckland	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6

TABLE 3.4(a) part 2: Site demand parameters for an annual probability of exceedance of 1/25

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Maraetai	6.3	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Beachlands-Pine Harbour	6.3	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Manukau City	6.2	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Tairua	6.5	n/a	0.02	0.03	0.5	0.02	0.04	0.5	0.02	0.05	0.6	0.03	0.07	0.6	0.03	0.08	0.7	0.03	0.09	0.7
Pauanui	6.5	n/a	0.02	0.03	0.5	0.02	0.04	0.5	0.02	0.05	0.6	0.03	0.07	0.6	0.03	0.08	0.7	0.03	0.09	0.7
Clarks Beach	6.3	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Thames	6.5	n/a	0.02	0.03	0.5	0.02	0.04	0.5	0.02	0.05	0.6	0.03	0.06	0.6	0.03	0.07	0.7	0.03	0.09	0.7
Patumahoe	6.3	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Pukekohe	6.4	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Whangamata	6.6	n/a	0.02	0.04	0.5	0.02	0.05	0.5	0.03	0.06	0.6	0.03	0.07	0.6	0.03	0.09	0.7	0.04	0.1	0.7
Pokeno	6.4	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Waiuku	6.3	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Tuakau	6.4	n/a	0.02	0.03	0.4	0.02	0.04	0.4	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.5	0.03	0.09	0.6
Ngatea	6.5	n/a	0.02	0.03	0.5	0.02	0.04	0.5	0.02	0.05	0.6	0.03	0.06	0.6	0.03	0.07	0.7	0.03	0.09	0.7
Paeroa	6.6	n/a	0.02	0.04	0.5	0.02	0.05	0.5	0.02	0.06	0.6	0.03	0.07	0.6	0.03	0.08	0.7	0.04	0.1	0.7
Waihi	6.6	n/a	0.02	0.04	0.5	0.02	0.05	0.5	0.03	0.06	0.6	0.03	0.08	0.6	0.03	0.09	0.7	0.04	0.11	0.7
Te Kauwhata	6.5	n/a	0.02	0.03	0.4	0.02	0.04	0.5	0.02	0.05	0.5	0.03	0.06	0.6	0.03	0.07	0.6	0.03	0.09	0.6
Waihi Beach-Bowentown	6.6	n/a	0.02	0.04	0.5	0.03	0.06	0.5	0.03	0.07	0.6	0.04	0.09	0.6	0.04	0.1	0.6	0.04	0.12	0.7
Te Aroha	6.6	n/a	0.02	0.04	0.5	0.02	0.05	0.5	0.03	0.06	0.6	0.03	0.08	0.6	0.03	0.09	0.7	0.04	0.11	0.7
Huntly	6.5	n/a	0.02	0.03	0.5	0.02	0.04	0.5	0.02	0.05	0.6	0.03	0.06	0.6	0.03	0.07	0.7	0.03	0.09	0.7
Katikati	6.6	n/a	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.6	0.04	0.09	0.6	0.04	0.1	0.6	0.04	0.12	0.7
Omokoroa	6.6	n/a	0.03	0.05	0.4	0.03	0.07	0.5	0.04	0.08	0.5	0.04	0.1	0.6	0.05	0.12	0.6	0.05	0.14	0.7
Mount Maunganui	6.6	n/a	0.03	0.06	0.4	0.04	0.08	0.5	0.04	0.1	0.5	0.05	0.12	0.6	0.05	0.13	0.6	0.06	0.16	0.6
Morrinsville	6.6	n/a	0.02	0.04	0.5	0.02	0.05	0.5	0.03	0.06	0.6	0.03	0.08	0.6	0.03	0.09	0.7	0.04	0.1	0.7
Ngaruawahia	6.6	n/a	0.02	0.03	0.5	0.02	0.04	0.6	0.02	0.05	0.6	0.03	0.06	0.6	0.03	0.07	0.7	0.03	0.09	0.7
Tauranga	6.6	n/a	0.03	0.06	0.4	0.04	0.08	0.5	0.04	0.1	0.5	0.05	0.12	0.6	0.05	0.13	0.6	0.06	0.16	0.6
Te Puke	6.5	n/a	0.04	0.08	0.4	0.04	0.09	0.4	0.05	0.11	0.5	0.06	0.14	0.5	0.06	0.16	0.6	0.07	0.19	0.6
Hamilton	6.6	n/a	0.02	0.03	0.5	0.02	0.04	0.6	0.02	0.06	0.6	0.03	0.07	0.6	0.03	0.08	0.7	0.03	0.1	0.7
Raglan	6.6	n/a	0.02	0.03	0.5	0.02	0.04	0.5	0.02	0.05	0.6	0.03	0.06	0.6	0.03	0.07	0.6	0.03	0.09	0.7
Matamata	6.7	n/a	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.6	0.04	0.09	0.6	0.04	0.1	0.7	0.05	0.12	0.7

TABLE 3.4(a) part 3: Site demand parameters for an annual probability of exceedance of 1/25

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	***Sas***	***Tc***	***PGA***	***Sas***	***Tc***	***PGA***	***Sas***	***Tc***	***PGA***	***Sas***	***Tc***	***PGA***	***Sas***	***Tc***	***PGA***	***Sas***	***Tc***
Cambridge	6.7	n/a	0.02	0.04	0.5	0.02	0.05	0.5	0.03	0.06	0.6	0.03	0.08	0.6	0.03	0.09	0.7	0.04	0.11	0.7
Ruatoria	6.6	n/a	0.08	0.17	0.3	0.09	0.2	0.3	0.11	0.23	0.4	0.12	0.26	0.4	0.13	0.29	0.4	0.13	0.32	0.5
Whakatane	6.4	n/a	0.09	0.19	0.3	0.1	0.22	0.3	0.12	0.26	0.4	0.13	0.29	0.4	0.14	0.32	0.5	0.14	0.35	0.5
Edgecumbe	6.3	n/a	0.07	0.15	0.3	0.08	0.18	0.3	0.1	0.21	0.4	0.11	0.24	0.4	0.11	0.27	0.5	0.12	0.3	0.5
Ohope	6.5	n/a	0.09	0.19	0.3	0.1	0.22	0.3	0.12	0.26	0.4	0.13	0.29	0.4	0.14	0.32	0.4	0.15	0.35	0.5
Pirongia	6.7	n/a	0.02	0.04	0.5	0.02	0.05	0.5	0.03	0.06	0.6	0.03	0.07	0.6	0.03	0.09	0.7	0.04	0.1	0.7
Te Awamutu	6.7	n/a	0.02	0.04	0.5	0.02	0.05	0.5	0.03	0.06	0.6	0.03	0.08	0.6	0.03	0.09	0.7	0.04	0.11	0.7
Opotiki	6.5	n/a	0.09	0.19	0.3	0.1	0.22	0.3	0.12	0.26	0.4	0.13	0.29	0.4	0.14	0.32	0.4	0.15	0.35	0.5
Kihikihi	6.7	n/a	0.02	0.04	0.5	0.02	0.05	0.5	0.03	0.06	0.6	0.03	0.08	0.6	0.03	0.09	0.7	0.04	0.11	0.7
Putaruru	6.7	n/a	0.03	0.05	0.4	0.03	0.07	0.5	0.04	0.08	0.6	0.04	0.1	0.6	0.05	0.12	0.7	0.05	0.14	0.7
Ngongotaha	6.6	n/a	0.04	0.08	0.4	0.04	0.09	0.4	0.05	0.12	0.5	0.06	0.14	0.6	0.06	0.16	0.6	0.07	0.19	0.6
Kawerau	6.4	n/a	0.06	0.13	0.3	0.07	0.15	0.4	0.08	0.18	0.4	0.09	0.21	0.5	0.1	0.23	0.5	0.11	0.27	0.5
Rotorua	6.6	n/a	0.04	0.08	0.4	0.05	0.1	0.4	0.06	0.12	0.5	0.06	0.15	0.5	0.07	0.17	0.6	0.08	0.2	0.6
Otorohanga	6.7	n/a	0.02	0.04	0.5	0.02	0.05	0.5	0.03	0.06	0.6	0.03	0.08	0.6	0.04	0.09	0.7	0.04	0.11	0.7
Tokoroa	6.7	n/a	0.03	0.06	0.4	0.04	0.08	0.5	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.13	0.6	0.06	0.16	0.7
Te Kuiti	6.7	n/a	0.02	0.04	0.5	0.02	0.05	0.5	0.03	0.07	0.6	0.03	0.08	0.6	0.04	0.1	0.7	0.04	0.11	0.7
Mangakino	6.7	n/a	0.03	0.06	0.4	0.04	0.08	0.5	0.04	0.1	0.5	0.05	0.12	0.6	0.05	0.13	0.6	0.06	0.16	0.7
Murupara	6.7	n/a	0.07	0.15	0.3	0.08	0.18	0.3	0.1	0.21	0.4	0.11	0.24	0.4	0.11	0.26	0.5	0.12	0.29	0.5
Gisborne	6.6	n/a	0.09	0.19	0.3	0.1	0.22	0.3	0.12	0.26	0.4	0.13	0.29	0.4	0.14	0.31	0.4	0.15	0.34	0.5
Taupo	6.6	n/a	0.05	0.1	0.4	0.06	0.12	0.4	0.06	0.14	0.5	0.07	0.17	0.5	0.08	0.19	0.6	0.09	0.22	0.6
Taumarunui	6.7	n/a	0.03	0.07	0.4	0.04	0.08	0.5	0.04	0.1	0.5	0.05	0.12	0.6	0.06	0.14	0.6	0.06	0.16	0.7
Turangi	6.7	n/a	0.06	0.14	0.3	0.08	0.16	0.4	0.09	0.19	0.4	0.1	0.22	0.4	0.11	0.25	0.5	0.11	0.28	0.5
Waitara	6.7	n/a	0.02	0.04	0.5	0.02	0.05	0.5	0.03	0.06	0.6	0.03	0.08	0.6	0.04	0.09	0.7	0.04	0.11	0.7
Wairoa	6.7	n/a	0.08	0.18	0.3	0.1	0.21	0.3	0.11	0.24	0.4	0.12	0.27	0.4	0.13	0.3	0.4	0.14	0.33	0.5
New Plymouth	6.6	n/a	0.02	0.04	0.5	0.02	0.05	0.5	0.03	0.06	0.6	0.03	0.08	0.6	0.03	0.09	0.7	0.04	0.11	0.7
Oakura (New Plymouth District)	6.6	n/a	0.02	0.04	0.5	0.02	0.05	0.5	0.03	0.06	0.6	0.03	0.08	0.6	0.03	0.09	0.7	0.04	0.1	0.7
Inglewood	6.7	n/a	0.02	0.04	0.5	0.03	0.06	0.5	0.03	0.07	0.6	0.04	0.09	0.6	0.04	0.1	0.7	0.04	0.12	0.7
Stratford	6.8	n/a	0.03	0.05	0.5	0.03	0.06	0.5	0.04	0.08	0.6	0.04	0.1	0.6	0.04	0.11	0.7	0.05	0.13	0.7
Ohakune	6.8	n/a	0.06	0.13	0.3	0.07	0.16	0.4	0.09	0.19	0.4	0.1	0.22	0.5	0.1	0.24	0.5	0.11	0.27	0.5
Raetihi	6.8	n/a	0.06	0.13	0.3	0.07	0.15	0.4	0.08	0.18	0.4	0.09	0.21	0.5	0.1	0.23	0.5	0.11	0.27	0.5

TABLE 3.4(a) part 4: Site demand parameters for an annual probability of exceedance of 1/25

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Eltham	6.8	n/a	0.03	0.05	0.4	0.03	0.07	0.5	0.04	0.09	0.6	0.04	0.1	0.6	0.05	0.12	0.7	0.05	0.14	0.7
Opunake	6.7	n/a	0.02	0.05	0.5	0.03	0.06	0.5	0.03	0.07	0.6	0.04	0.09	0.6	0.04	0.1	0.7	0.04	0.12	0.7
Waiouru	6.8	n/a	0.07	0.15	0.3	0.08	0.18	0.3	0.1	0.21	0.4	0.11	0.24	0.4	0.11	0.26	0.5	0.12	0.29	0.5
Napier	6.7	n/a	0.09	0.19	0.3	0.1	0.22	0.3	0.12	0.25	0.4	0.13	0.29	0.4	0.14	0.31	0.5	0.15	0.34	0.5
Clive	6.7	n/a	0.09	0.2	0.3	0.11	0.23	0.3	0.12	0.26	0.4	0.13	0.29	0.4	0.14	0.32	0.5	0.15	0.35	0.5
Hawera	6.8	n/a	0.03	0.06	0.4	0.04	0.07	0.5	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.13	0.6	0.06	0.15	0.7
Hastings	6.7	n/a	0.09	0.2	0.3	0.11	0.23	0.3	0.12	0.27	0.4	0.14	0.3	0.4	0.14	0.32	0.5	0.15	0.36	0.5
Taihape	6.8	n/a	0.08	0.16	0.3	0.09	0.19	0.3	0.1	0.22	0.4	0.12	0.26	0.4	0.12	0.28	0.5	0.13	0.31	0.5
Havelock North	6.7	n/a	0.09	0.2	0.3	0.11	0.23	0.3	0.12	0.27	0.4	0.14	0.3	0.4	0.14	0.33	0.5	0.15	0.36	0.5
Patea	6.8	n/a	0.04	0.08	0.4	0.04	0.09	0.5	0.05	0.11	0.5	0.06	0.13	0.6	0.06	0.15	0.6	0.07	0.18	0.6
Whanganui	6.8	n/a	0.07	0.15	0.3	0.08	0.18	0.3	0.1	0.21	0.4	0.11	0.24	0.4	0.11	0.27	0.5	0.12	0.3	0.5
Waipawa	6.8	n/a	0.1	0.22	0.3	0.12	0.25	0.3	0.13	0.29	0.4	0.15	0.33	0.4	0.15	0.35	0.5	0.16	0.38	0.5
Waipukurau	6.8	n/a	0.1	0.22	0.3	0.12	0.26	0.3	0.14	0.29	0.4	0.15	0.33	0.4	0.16	0.35	0.5	0.17	0.39	0.5
Marton	6.8	n/a	0.08	0.18	0.3	0.1	0.21	0.3	0.11	0.24	0.4	0.12	0.27	0.4	0.13	0.3	0.5	0.14	0.33	0.5
Bulls	6.8	n/a	0.09	0.19	0.3	0.1	0.22	0.3	0.12	0.25	0.4	0.13	0.29	0.4	0.13	0.31	0.5	0.14	0.34	0.5
Dannevirke	6.8	n/a	0.1	0.23	0.3	0.12	0.26	0.3	0.14	0.3	0.4	0.15	0.33	0.4	0.16	0.36	0.5	0.17	0.39	0.5
Feilding	6.8	n/a	0.09	0.19	0.3	0.11	0.23	0.3	0.12	0.26	0.4	0.13	0.3	0.4	0.14	0.32	0.5	0.15	0.35	0.5
Ashhurst	6.8	7	0.1	0.21	0.3	0.11	0.24	0.3	0.13	0.28	0.4	0.14	0.32	0.4	0.15	0.34	0.5	0.16	0.37	0.5
Woodville	6.8	6	0.1	0.23	0.3	0.12	0.26	0.3	0.14	0.3	0.4	0.15	0.33	0.4	0.16	0.36	0.5	0.17	0.39	0.5
Palmerston North	6.8	6	0.1	0.21	0.3	0.11	0.24	0.3	0.13	0.28	0.4	0.14	0.31	0.4	0.15	0.34	0.5	0.16	0.37	0.5
Pahiatua	6.8	7	0.11	0.24	0.3	0.13	0.27	0.3	0.14	0.31	0.4	0.16	0.34	0.4	0.16	0.37	0.5	0.17	0.4	0.5
Foxton Beach	6.8	n/a	0.1	0.21	0.3	0.11	0.24	0.3	0.13	0.27	0.4	0.14	0.31	0.4	0.15	0.33	0.5	0.16	0.37	0.5
Foxton	6.8	n/a	0.1	0.21	0.3	0.11	0.24	0.3	0.13	0.28	0.4	0.14	0.31	0.4	0.15	0.34	0.5	0.16	0.37	0.5
Shannon	6.9	15	0.1	0.22	0.3	0.12	0.25	0.3	0.13	0.29	0.4	0.15	0.32	0.4	0.15	0.35	0.5	0.16	0.38	0.5
Levin	6.9	18	0.1	0.22	0.3	0.12	0.25	0.3	0.13	0.29	0.4	0.15	0.32	0.4	0.15	0.35	0.5	0.16	0.38	0.5
Otaki Beach	6.9	n/a	0.1	0.22	0.3	0.12	0.25	0.3	0.13	0.29	0.4	0.15	0.32	0.4	0.15	0.35	0.5	0.16	0.38	0.5
Otaki	6.9	n/a	0.1	0.22	0.3	0.12	0.25	0.3	0.13	0.29	0.4	0.15	0.33	0.4	0.16	0.35	0.5	0.16	0.38	0.5
Waikanae	6.9	n/a	0.1	0.22	0.3	0.12	0.26	0.3	0.14	0.3	0.4	0.15	0.33	0.4	0.16	0.36	0.5	0.17	0.39	0.5
Takaka	6.9	n/a	0.05	0.1	0.3	0.05	0.11	0.4	0.06	0.14	0.4	0.07	0.16	0.5	0.08	0.18	0.5	0.09	0.21	0.6
Paraparaumu	6.9	18	0.1	0.22	0.3	0.12	0.26	0.3	0.14	0.3	0.4	0.15	0.33	0.4	0.16	0.36	0.5	0.17	0.39	0.5

TABLE 3.4(a) part 5: Site demand parameters for an annual probability of exceedance of 1/25

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Masterton	6.9	6	0.12	0.25	0.3	0.13	0.29	0.3	0.15	0.33	0.4	0.17	0.36	0.4	0.17	0.39	0.5	0.18	0.41	0.5
Paekakariki	6.9	16	0.11	0.23	0.3	0.12	0.26	0.3	0.14	0.3	0.4	0.15	0.33	0.4	0.16	0.36	0.5	0.17	0.39	0.5
Carterton	6.9	4	0.12	0.25	0.3	0.13	0.29	0.3	0.15	0.33	0.4	0.17	0.36	0.4	0.17	0.38	0.5	0.18	0.41	0.5
Greytown	6.9	4	0.11	0.25	0.3	0.13	0.29	0.3	0.15	0.32	0.4	0.16	0.36	0.4	0.17	0.38	0.5	0.18	0.41	0.5
Porirua	6.9	6	0.11	0.23	0.3	0.12	0.27	0.3	0.14	0.31	0.4	0.16	0.34	0.4	0.16	0.37	0.5	0.17	0.4	0.5
Featherston	6.9	0	0.11	0.25	0.3	0.13	0.28	0.3	0.15	0.32	0.4	0.16	0.36	0.4	0.17	0.38	0.5	0.18	0.41	0.5
Motueka	6.9	n/a	0.06	0.12	0.3	0.07	0.14	0.4	0.08	0.17	0.4	0.09	0.2	0.5	0.09	0.22	0.5	0.1	0.25	0.5
Upper Hutt	6.9	0	0.11	0.24	0.3	0.13	0.28	0.3	0.15	0.32	0.4	0.16	0.35	0.4	0.17	0.38	0.5	0.18	0.41	0.5
Lower Hutt	6.9	0	0.11	0.24	0.3	0.13	0.28	0.3	0.15	0.31	0.4	0.16	0.35	0.4	0.17	0.37	0.5	0.18	0.4	0.5
Martinborough	6.9	16	0.11	0.24	0.3	0.13	0.28	0.3	0.15	0.32	0.4	0.16	0.35	0.4	0.17	0.37	0.5	0.18	0.4	0.5
Mapua	6.9	n/a	0.06	0.13	0.3	0.07	0.16	0.4	0.09	0.19	0.4	0.1	0.22	0.5	0.1	0.24	0.5	0.11	0.27	0.5
Wainuiomata	6.9	0	0.11	0.24	0.3	0.13	0.28	0.3	0.15	0.31	0.4	0.16	0.35	0.4	0.17	0.37	0.5	0.18	0.4	0.5
Nelson	6.9	n/a	0.07	0.14	0.3	0.08	0.17	0.4	0.09	0.2	0.4	0.1	0.23	0.5	0.11	0.25	0.5	0.12	0.29	0.5
Picton	6.8	n/a	0.09	0.2	0.3	0.11	0.23	0.3	0.12	0.27	0.4	0.14	0.31	0.4	0.14	0.33	0.5	0.15	0.37	0.5
Wellington CBD	6.9	0	0.11	0.24	0.3	0.13	0.28	0.3	0.15	0.32	0.4	0.16	0.35	0.4	0.17	0.38	0.5	0.18	0.41	0.5
Wellington	6.9	0	0.11	0.24	0.3	0.13	0.28	0.3	0.15	0.32	0.4	0.16	0.35	0.4	0.17	0.38	0.5	0.18	0.41	0.5
Eastbourne	6.9	0	0.11	0.24	0.3	0.13	0.28	0.3	0.15	0.31	0.4	0.16	0.35	0.4	0.17	0.37	0.5	0.18	0.4	0.5
Richmond	6.8	n/a	0.07	0.14	0.3	0.08	0.17	0.4	0.09	0.2	0.4	0.1	0.23	0.5	0.11	0.26	0.5	0.12	0.29	0.5
Hope	6.8	n/a	0.07	0.14	0.3	0.08	0.17	0.4	0.09	0.2	0.4	0.1	0.23	0.5	0.11	0.26	0.5	0.12	0.29	0.5
Brightwater	6.8	n/a	0.07	0.14	0.3	0.08	0.17	0.4	0.09	0.2	0.4	0.1	0.23	0.5	0.11	0.25	0.5	0.12	0.29	0.5
Wakefield	6.8	n/a	0.07	0.14	0.3	0.08	0.17	0.4	0.09	0.2	0.4	0.1	0.23	0.5	0.11	0.25	0.5	0.12	0.29	0.5
Renwick	6.8	n/a	0.1	0.21	0.3	0.11	0.24	0.3	0.13	0.28	0.4	0.14	0.31	0.4	0.15	0.34	0.5	0.16	0.37	0.5
Blenheim	6.8	11	0.1	0.22	0.3	0.12	0.26	0.3	0.14	0.29	0.4	0.15	0.33	0.4	0.16	0.36	0.5	0.17	0.39	0.5
Seddon	6.7	5	0.12	0.25	0.3	0.14	0.29	0.3	0.15	0.33	0.4	0.17	0.37	0.4	0.18	0.39	0.5	0.18	0.43	0.5
Westport	6.6	n/a	0.05	0.11	0.3	0.06	0.13	0.4	0.07	0.15	0.4	0.08	0.18	0.5	0.09	0.2	0.5	0.09	0.23	0.5
St Arnaud	6.7	0	0.08	0.18	0.3	0.1	0.21	0.3	0.11	0.24	0.4	0.12	0.28	0.4	0.13	0.3	0.5	0.14	0.34	0.5
Murchison	6.6	n/a	0.07	0.16	0.3	0.09	0.19	0.3	0.1	0.22	0.4	0.11	0.25	0.4	0.12	0.28	0.5	0.13	0.31	0.5
Ward	6.6	5	0.12	0.26	0.3	0.14	0.3	0.3	0.16	0.34	0.4	0.17	0.37	0.4	0.18	0.4	0.4	0.19	0.43	0.5
Reefton	6.6	n/a	0.07	0.14	0.3	0.08	0.17	0.3	0.09	0.2	0.4	0.1	0.23	0.4	0.11	0.26	0.5	0.12	0.29	0.5
Springs Junction	6.6	2	0.08	0.18	0.3	0.1	0.21	0.3	0.11	0.25	0.4	0.12	0.28	0.4	0.13	0.31	0.5	0.14	0.34	0.5

TABLE 3.4(a) part 6: Site demand parameters for an annual probability of exceedance of 1/25

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Runanga	6.7	n/a	0.05	0.1	0.3	0.06	0.12	0.4	0.07	0.14	0.4	0.08	0.17	0.5	0.08	0.19	0.5	0.09	0.22	0.6
Kaikoura	6.6	6	0.09	0.2	0.3	0.11	0.23	0.3	0.12	0.27	0.4	0.14	0.3	0.4	0.14	0.33	0.5	0.15	0.36	0.5
Greymouth	6.6	n/a	0.05	0.1	0.3	0.06	0.12	0.4	0.07	0.15	0.4	0.08	0.18	0.5	0.08	0.2	0.5	0.09	0.23	0.5
Hanmer Springs	6.4	4	0.12	0.26	0.3	0.14	0.3	0.3	0.16	0.34	0.4	0.17	0.38	0.4	0.18	0.4	0.5	0.19	0.44	0.5
Hokitika	6.5	n/a	0.05	0.11	0.3	0.06	0.13	0.4	0.07	0.15	0.4	0.08	0.18	0.5	0.09	0.2	0.5	0.09	0.23	0.5
Cheviot	6.5	n/a	0.08	0.16	0.3	0.09	0.19	0.3	0.11	0.23	0.4	0.12	0.26	0.4	0.12	0.29	0.5	0.13	0.32	0.5
Otira	6.4	1	0.08	0.16	0.3	0.09	0.19	0.3	0.11	0.23	0.4	0.12	0.26	0.4	0.12	0.29	0.5	0.13	0.32	0.5
Arthurs Pass	6.4	13	0.08	0.17	0.3	0.1	0.2	0.3	0.11	0.24	0.4	0.12	0.27	0.4	0.13	0.29	0.5	0.13	0.33	0.5
Harihari	6.4	0	0.05	0.1	0.3	0.06	0.12	0.4	0.07	0.15	0.4	0.08	0.18	0.5	0.08	0.2	0.5	0.09	0.23	0.5
Amberley	6.6	n/a	0.06	0.12	0.3	0.07	0.14	0.4	0.08	0.17	0.4	0.09	0.2	0.5	0.1	0.23	0.5	0.1	0.26	0.5
Oxford	6.5	n/a	0.06	0.12	0.3	0.07	0.14	0.4	0.08	0.17	0.4	0.09	0.2	0.5	0.09	0.22	0.5	0.1	0.26	0.5
Rangiora	6.5	n/a	0.06	0.11	0.3	0.07	0.13	0.4	0.08	0.16	0.4	0.09	0.19	0.5	0.09	0.21	0.5	0.1	0.25	0.5
Pegasus	6.5	n/a	0.05	0.11	0.3	0.06	0.13	0.4	0.08	0.16	0.4	0.08	0.19	0.5	0.09	0.21	0.5	0.1	0.25	0.5
Woodend	6.5	n/a	0.05	0.11	0.3	0.06	0.13	0.4	0.08	0.16	0.4	0.08	0.19	0.5	0.09	0.21	0.5	0.1	0.25	0.5
Franz Josef	6.5	0	0.04	0.09	0.3	0.05	0.1	0.4	0.06	0.12	0.4	0.07	0.15	0.5	0.07	0.17	0.5	0.08	0.2	0.6
Kaiapoi	6.4	n/a	0.06	0.11	0.3	0.07	0.13	0.4	0.08	0.16	0.4	0.09	0.19	0.5	0.09	0.21	0.5	0.1	0.25	0.5
Fox Glacier	6.5	0	0.04	0.08	0.3	0.05	0.1	0.4	0.06	0.12	0.4	0.06	0.15	0.5	0.07	0.17	0.5	0.08	0.2	0.6
Darfield	6.4	n/a	0.05	0.11	0.3	0.06	0.13	0.4	0.07	0.16	0.4	0.08	0.19	0.5	0.09	0.21	0.5	0.1	0.24	0.5
West Melton	6.3	n/a	0.05	0.11	0.3	0.06	0.13	0.4	0.07	0.16	0.4	0.08	0.19	0.5	0.09	0.21	0.5	0.1	0.24	0.5
Christchurch	6.2	n/a	0.06	0.11	0.3	0.07	0.14	0.4	0.08	0.17	0.4	0.09	0.2	0.5	0.09	0.22	0.5	0.1	0.25	0.5
Prebbleton	6.3	n/a	0.05	0.11	0.3	0.06	0.13	0.4	0.08	0.16	0.4	0.08	0.19	0.5	0.09	0.21	0.5	0.1	0.24	0.5
Lyttelton	6.2	n/a	0.05	0.11	0.3	0.06	0.13	0.4	0.07	0.16	0.4	0.08	0.19	0.5	0.09	0.21	0.5	0.1	0.24	0.5
Rolleston	6.3	n/a	0.05	0.11	0.3	0.06	0.13	0.4	0.07	0.15	0.4	0.08	0.19	0.5	0.09	0.2	0.5	0.1	0.24	0.5
Methven	6.5	n/a	0.05	0.09	0.3	0.05	0.11	0.4	0.06	0.13	0.4	0.07	0.16	0.5	0.08	0.18	0.5	0.08	0.21	0.6
Diamond Harbour	6.2	n/a	0.05	0.1	0.3	0.06	0.12	0.4	0.07	0.15	0.4	0.08	0.18	0.5	0.09	0.2	0.5	0.09	0.23	0.5
Lincoln	6.3	n/a	0.05	0.11	0.3	0.06	0.13	0.4	0.07	0.15	0.4	0.08	0.18	0.5	0.09	0.2	0.5	0.09	0.23	0.5
Mt Cook Village	6.5	n/a	0.04	0.08	0.3	0.05	0.1	0.4	0.06	0.12	0.4	0.06	0.15	0.5	0.07	0.16	0.5	0.08	0.19	0.6
Rakaia	6.4	n/a	0.04	0.09	0.3	0.05	0.1	0.4	0.06	0.13	0.4	0.07	0.15	0.5	0.07	0.17	0.5	0.08	0.2	0.6
Leeston	6.4	n/a	0.04	0.09	0.3	0.05	0.11	0.4	0.06	0.13	0.4	0.07	0.16	0.5	0.07	0.18	0.5	0.08	0.21	0.5
Akaroa	6.3	n/a	0.04	0.08	0.3	0.04	0.09	0.4	0.05	0.11	0.4	0.06	0.13	0.5	0.06	0.15	0.5	0.07	0.18	0.6

TABLE 3.4(a) part 7: Site demand parameters for an annual probability of exceedance of 1/25

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Ashburton	6.5	n/a	0.04	0.08	0.3	0.04	0.09	0.4	0.05	0.11	0.5	0.06	0.14	0.5	0.06	0.15	0.5	0.07	0.18	0.6
Geraldine	6.5	n/a	0.03	0.07	0.3	0.04	0.09	0.4	0.05	0.1	0.5	0.06	0.13	0.5	0.06	0.14	0.6	0.07	0.17	0.6
Fairlie	6.5	n/a	0.04	0.07	0.3	0.04	0.09	0.4	0.05	0.11	0.5	0.06	0.13	0.5	0.06	0.15	0.6	0.07	0.18	0.6
Temuka	6.4	n/a	0.03	0.07	0.3	0.04	0.08	0.4	0.05	0.1	0.5	0.05	0.12	0.5	0.06	0.14	0.6	0.06	0.16	0.6
Pleasant Point	6.4	n/a	0.03	0.07	0.3	0.04	0.08	0.4	0.05	0.1	0.5	0.05	0.12	0.5	0.06	0.14	0.6	0.06	0.17	0.6
Twizel	6.6	n/a	0.04	0.08	0.3	0.05	0.09	0.4	0.05	0.11	0.5	0.06	0.14	0.5	0.07	0.16	0.5	0.07	0.19	0.6
Timaru	6.4	n/a	0.03	0.06	0.3	0.04	0.08	0.4	0.04	0.1	0.5	0.05	0.12	0.5	0.06	0.13	0.6	0.06	0.16	0.6
Lake Hawea	6.8	n/a	0.05	0.1	0.3	0.06	0.12	0.4	0.07	0.14	0.4	0.08	0.17	0.5	0.08	0.19	0.5	0.09	0.22	0.6
Milford Sound	6.8	16	0.11	0.24	0.3	0.13	0.28	0.3	0.15	0.32	0.4	0.16	0.35	0.4	0.17	0.38	0.5	0.18	0.41	0.5
Wanaka	6.8	n/a	0.05	0.1	0.3	0.06	0.12	0.4	0.07	0.15	0.4	0.08	0.18	0.5	0.08	0.2	0.5	0.09	0.23	0.6
Waimate	6.3	n/a	0.03	0.06	0.3	0.04	0.08	0.4	0.04	0.09	0.5	0.05	0.11	0.5	0.05	0.13	0.5	0.06	0.15	0.6
Arrowtown	6.8	n/a	0.05	0.11	0.3	0.06	0.13	0.4	0.07	0.15	0.4	0.08	0.18	0.5	0.09	0.2	0.5	0.09	0.24	0.6
Arthurs Point	6.8	n/a	0.05	0.11	0.3	0.06	0.13	0.4	0.08	0.16	0.4	0.08	0.19	0.5	0.09	0.21	0.5	0.1	0.25	0.6
Lake Hayes	6.8	n/a	0.05	0.11	0.3	0.06	0.13	0.4	0.07	0.15	0.4	0.08	0.18	0.5	0.09	0.2	0.5	0.09	0.23	0.6
Queenstown	6.8	n/a	0.05	0.11	0.3	0.06	0.13	0.4	0.07	0.16	0.4	0.08	0.19	0.5	0.09	0.21	0.5	0.1	0.24	0.6
Cromwell	6.7	n/a	0.04	0.09	0.3	0.05	0.11	0.4	0.06	0.13	0.5	0.07	0.16	0.5	0.07	0.18	0.5	0.08	0.21	0.6
Oamaru	6.3	n/a	0.03	0.06	0.3	0.04	0.07	0.4	0.04	0.09	0.4	0.05	0.11	0.5	0.05	0.12	0.5	0.06	0.14	0.6
Clyde	6.7	n/a	0.04	0.08	0.4	0.05	0.1	0.4	0.06	0.12	0.5	0.06	0.15	0.5	0.07	0.17	0.6	0.08	0.2	0.6
Alexandra	6.7	n/a	0.04	0.08	0.4	0.05	0.1	0.4	0.06	0.12	0.5	0.06	0.14	0.5	0.07	0.16	0.6	0.08	0.19	0.6
Te Anau	7.0	n/a	0.07	0.15	0.3	0.08	0.17	0.4	0.1	0.2	0.4	0.11	0.24	0.5	0.11	0.26	0.5	0.12	0.29	0.6
Palmerston	6.3	n/a	0.03	0.06	0.3	0.03	0.07	0.4	0.04	0.09	0.4	0.05	0.11	0.5	0.05	0.12	0.5	0.06	0.14	0.6
Waikouaiti	6.2	n/a	0.03	0.06	0.3	0.03	0.07	0.4	0.04	0.09	0.4	0.05	0.11	0.5	0.05	0.12	0.5	0.06	0.14	0.6
Mosgiel	6.3	n/a	0.03	0.06	0.3	0.03	0.07	0.4	0.04	0.09	0.4	0.05	0.11	0.5	0.05	0.12	0.5	0.06	0.14	0.6
Dunedin	6.2	n/a	0.03	0.06	0.3	0.03	0.07	0.4	0.04	0.09	0.4	0.05	0.1	0.5	0.05	0.12	0.5	0.06	0.14	0.6
Brighton	6.2	n/a	0.03	0.06	0.3	0.03	0.07	0.4	0.04	0.09	0.4	0.05	0.11	0.5	0.05	0.12	0.5	0.06	0.14	0.6
Gore	6.6	n/a	0.04	0.08	0.4	0.04	0.09	0.4	0.05	0.11	0.5	0.06	0.13	0.5	0.06	0.15	0.6	0.07	0.18	0.6
Milton	6.3	n/a	0.03	0.06	0.3	0.04	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.5	0.05	0.12	0.5	0.06	0.15	0.6
Winton	6.8	n/a	0.04	0.09	0.4	0.05	0.11	0.4	0.06	0.13	0.5	0.07	0.15	0.5	0.07	0.18	0.6	0.08	0.2	0.6
Mataura	6.6	n/a	0.04	0.08	0.4	0.04	0.09	0.4	0.05	0.11	0.5	0.06	0.13	0.5	0.06	0.15	0.6	0.07	0.18	0.6
Balclutha	6.3	n/a	0.03	0.06	0.3	0.04	0.08	0.4	0.04	0.09	0.5	0.05	0.11	0.5	0.05	0.13	0.5	0.06	0.15	0.6

TABLE 3.4(a) part 8: Site demand parameters for an annual probability of exceedance of 1/25

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Riverton	6.8	n/a	0.05	0.09	0.3	0.05	0.11	0.4	0.06	0.13	0.5	0.07	0.16	0.5	0.08	0.18	0.5	0.09	0.21	0.6
Invercargill	6.7	n/a	0.04	0.08	0.4	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.15	0.5	0.07	0.17	0.6	0.08	0.19	0.6
Bluff	6.7	n/a	0.04	0.08	0.4	0.05	0.1	0.4	0.06	0.12	0.5	0.06	0.14	0.5	0.07	0.16	0.6	0.08	0.19	0.6
Oban	6.7	n/a	0.04	0.08	0.3	0.05	0.1	0.4	0.06	0.12	0.5	0.06	0.14	0.5	0.07	0.16	0.6	0.08	0.19	0.6

TABLE 3.4(b) part 1: Site demand parameters for an annual probability of exceedance of 1/50

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Kaitaia	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Kerikeri	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Haruru	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Paihia	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Opua	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Kawakawa	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Moerewa	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Kaikohe	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Hikurangi	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Ngunguru	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Whangarei	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
One Tree Point	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Ruakaka	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Dargaville	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Waipu	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Mangawhai Heads	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Wellsford	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Warkworth	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Snells Beach	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Hibiscus Coast	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Parakai	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Helensville	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Coromandel	6.4	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Riverhead	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Kumeu-Huapai	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Waimauku	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Waiheke West	6.3	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Whitianga	6.5	n/a	0.03	0.06	0.4	0.03	0.07	0.5	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Muriwai	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Auckland	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6

TABLE 3.4(b) part 2: Site demand parameters for an annual probability of exceedance of 1/50

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Maraetai	6.3	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0f.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Beachlands-Pine Harbour	6.3	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Manukau City	6.2	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Tairua	6.6	n/a	0.03	0.06	0.5	0.03	0.07	0.5	0.04	0.09	0.6	0.05	0.11	0.7	0.05	0.12	0.7	0.06	0.15	0.7
Pauanui	6.7	n/a	0.03	0.06	0.5	0.03	0.07	0.5	0.04	0.09	0.6	0.05	0.11	0.7	0.05	0.12	0.7	0.06	0.15	0.7
Clarks Beach	6.3	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Thames	6.6	n/a	0.03	0.06	0.5	0.03	0.07	0.5	0.04	0.09	0.6	0.05	0.11	0.6	0.05	0.12	0.7	0.06	0.15	0.7
Patumahoe	6.4	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Pukekohe	6.4	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Whangamata	6.7	n/a	0.03	0.06	0.5	0.04	0.08	0.5	0.04	0.1	0.6	0.05	0.12	0.7	0.05	0.13	0.7	0.06	0.16	0.7
Pokeno	6.4	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Waiuku	6.4	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Tuakau	6.4	n/a	0.03	0.06	0.4	0.03	0.07	0.4	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.6
Ngatea	6.6	n/a	0.03	0.06	0.5	0.03	0.07	0.5	0.04	0.09	0.6	0.05	0.11	0.6	0.05	0.12	0.7	0.06	0.15	0.7
Paeroa	6.7	n/a	0.03	0.06	0.5	0.03	0.07	0.6	0.04	0.09	0.6	0.05	0.12	0.7	0.05	0.13	0.7	0.06	0.16	0.8
Waihi	6.7	n/a	0.03	0.06	0.5	0.04	0.08	0.5	0.04	0.1	0.6	0.05	0.13	0.7	0.06	0.14	0.7	0.06	0.17	0.7
Te Kauwhata	6.6	n/a	0.03	0.06	0.4	0.03	0.07	0.5	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.12	0.6	0.06	0.15	0.7
Waihi Beach-Bowentown	6.8	n/a	0.04	0.07	0.5	0.04	0.09	0.5	0.05	0.11	0.6	0.06	0.14	0.6	0.06	0.16	0.7	0.07	0.19	0.7
Te Aroha	6.8	n/a	0.03	0.06	0.5	0.04	0.08	0.5	0.04	0.1	0.6	0.05	0.12	0.7	0.06	0.14	0.7	0.06	0.17	0.7
Huntly	6.6	n/a	0.03	0.06	0.5	0.03	0.07	0.5	0.04	0.09	0.6	0.05	0.11	0.6	0.05	0.12	0.7	0.06	0.15	0.7
Katikati	6.8	n/a	0.04	0.07	0.5	0.04	0.09	0.5	0.05	0.11	0.6	0.06	0.14	0.6	0.06	0.16	0.7	0.07	0.19	0.7
Omokoroa	6.8	n/a	0.04	0.08	0.4	0.05	0.1	0.5	0.06	0.13	0.6	0.07	0.16	0.6	0.07	0.18	0.6	0.08	0.21	0.7
Mount Maunganui	6.7	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.15	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.24	0.7
Morrinsville	6.8	n/a	0.03	0.06	0.5	0.04	0.08	0.6	0.04	0.1	0.6	0.05	0.12	0.7	0.05	0.14	0.7	0.06	0.16	0.8
Ngaruawahia	6.6	n/a	0.03	0.06	0.5	0.03	0.07	0.5	0.04	0.09	0.6	0.05	0.11	0.7	0.05	0.12	0.7	0.06	0.15	0.7
Tauranga	6.7	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.15	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.24	0.7
Te Puke	6.6	n/a	0.06	0.12	0.4	0.07	0.15	0.4	0.08	0.18	0.5	0.09	0.22	0.6	0.1	0.24	0.6	0.11	0.28	0.6
Hamilton	6.7	n/a	0.03	0.06	0.5	0.03	0.07	0.6	0.04	0.09	0.6	0.05	0.11	0.7	0.05	0.13	0.7	0.06	0.15	0.8
Raglan	6.6	n/a	0.03	0.06	0.5	0.03	0.07	0.5	0.04	0.09	0.6	0.05	0.11	0.6	0.05	0.12	0.7	0.06	0.15	0.7
Matamata	6.8	n/a	0.04	0.08	0.5	0.04	0.09	0.5	0.05	0.12	0.6	0.06	0.14	0.7	0.06	0.16	0.7	0.07	0.19	0.7

TABLE 3.4(b) part 3: Site demand parameters for an annual probability of exceedance of 1/50

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Cambridge	6.8	n/a	0.03	0.07	0.5	0.04	0.08	0.6	0.05	0.1	0.6	0.05	0.13	0.7	0.06	0.14	0.7	0.06	0.17	0.8
Ruatoria	6.8	n/a	0.13	0.28	0.3	0.15	0.32	0.3	0.17	0.37	0.4	0.18	0.4	0.4	0.19	0.43	0.5	0.2	0.46	0.5
Whakatane	6.6	n/a	0.14	0.3	0.3	0.16	0.35	0.3	0.18	0.39	0.4	0.2	0.44	0.4	0.2	0.46	0.5	0.21	0.5	0.5
Edgecumbe	6.4	n/a	0.11	0.25	0.3	0.13	0.29	0.3	0.15	0.33	0.4	0.17	0.38	0.5	0.17	0.4	0.5	0.18	0.45	0.6
Ohope	6.6	n/a	0.14	0.3	0.3	0.16	0.35	0.3	0.18	0.4	0.4	0.2	0.44	0.4	0.21	0.47	0.5	0.21	0.5	0.5
Pirongia	6.8	n/a	0.03	0.06	0.5	0.04	0.08	0.6	0.04	0.1	0.6	0.05	0.12	0.7	0.05	0.13	0.7	0.06	0.16	0.8
Te Awamutu	6.8	n/a	0.03	0.06	0.5	0.04	0.08	0.6	0.04	0.1	0.6	0.05	0.12	0.7	0.06	0.14	0.7	0.06	0.17	0.8
Opotiki	6.6	n/a	0.14	0.3	0.3	0.16	0.35	0.3	0.18	0.4	0.4	0.2	0.44	0.4	0.21	0.46	0.5	0.21	0.5	0.5
Kihikihi	6.8	n/a	0.03	0.07	0.5	0.04	0.08	0.6	0.05	0.1	0.6	0.05	0.13	0.7	0.06	0.14	0.7	0.06	0.17	0.8
Putaruru	6.9	n/a	0.04	0.08	0.5	0.05	0.1	0.5	0.06	0.13	0.6	0.07	0.16	0.6	0.07	0.18	0.7	0.08	0.21	0.7
Ngongotaha	6.8	n/a	0.06	0.13	0.4	0.07	0.15	0.5	0.08	0.19	0.5	0.09	0.22	0.6	0.1	0.25	0.6	0.11	0.28	0.7
Kawerau	6.5	n/a	0.1	0.21	0.3	0.12	0.25	0.4	0.13	0.29	0.4	0.14	0.33	0.5	0.15	0.36	0.5	0.16	0.4	0.6
Rotorua	6.7	n/a	0.07	0.13	0.4	0.08	0.16	0.4	0.09	0.2	0.5	0.1	0.23	0.6	0.11	0.26	0.6	0.11	0.3	0.6
Otorohanga	6.8	n/a	0.03	0.07	0.5	0.04	0.08	0.6	0.05	0.1	0.6	0.05	0.13	0.7	0.06	0.15	0.7	0.06	0.17	0.8
Tokoroa	6.9	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.15	0.6	0.08	0.18	0.6	0.08	0.21	0.6	0.09	0.24	0.7
Te Kuiti	6.9	n/a	0.03	0.07	0.5	0.04	0.09	0.6	0.05	0.11	0.6	0.06	0.13	0.7	0.06	0.15	0.7	0.07	0.18	0.8
Mangakino	6.9	n/a	0.05	0.1	0.4	0.06	0.13	0.5	0.07	0.15	0.6	0.08	0.19	0.6	0.08	0.21	0.6	0.09	0.24	0.7
Murupara	6.8	n/a	0.11	0.24	0.3	0.13	0.28	0.3	0.15	0.32	0.4	0.16	0.36	0.5	0.17	0.39	0.5	0.18	0.43	0.6
Gisborne	6.8	n/a	0.14	0.32	0.3	0.17	0.36	0.3	0.19	0.41	0.4	0.21	0.44	0.4	0.21	0.47	0.5	0.22	0.5	0.5
Taupo	6.8	n/a	0.08	0.16	0.4	0.09	0.19	0.4	0.11	0.23	0.5	0.12	0.27	0.5	0.12	0.29	0.6	0.13	0.33	0.6
Taumarunui	6.9	n/a	0.05	0.11	0.4	0.06	0.13	0.5	0.07	0.16	0.5	0.08	0.19	0.6	0.09	0.22	0.6	0.1	0.25	0.7
Turangi	6.8	n/a	0.1	0.23	0.3	0.12	0.26	0.4	0.14	0.3	0.4	0.15	0.35	0.5	0.16	0.37	0.5	0.17	0.41	0.6
Waitara	6.8	n/a	0.03	0.07	0.5	0.04	0.09	0.5	0.05	0.11	0.6	0.05	0.13	0.7	0.06	0.15	0.7	0.07	0.18	0.7
Wairoa	6.9	n/a	0.13	0.29	0.3	0.15	0.33	0.3	0.17	0.38	0.4	0.19	0.41	0.4	0.2	0.44	0.5	0.21	0.47	0.5
New Plymouth	6.7	n/a	0.03	0.07	0.5	0.04	0.08	0.5	0.05	0.1	0.6	0.05	0.13	0.7	0.06	0.15	0.7	0.06	0.17	0.7
Oakura (New Plymouth District)	6.7	n/a	0.03	0.07	0.5	0.04	0.08	0.5	0.05	0.1	0.6	0.05	0.13	0.7	0.06	0.14	0.7	0.06	0.17	0.7
Inglewood	6.8	n/a	0.04	0.07	0.5	0.04	0.09	0.5	0.05	0.11	0.6	0.06	0.14	0.7	0.06	0.16	0.7	0.07	0.19	0.7
Stratford	6.9	n/a	0.04	0.09	0.5	0.05	0.11	0.5	0.06	0.13	0.6	0.07	0.16	0.6	0.07	0.18	0.7	0.08	0.21	0.7
Ohakune	7.0	n/a	0.1	0.22	0.3	0.12	0.25	0.4	0.13	0.29	0.4	0.15	0.33	0.5	0.16	0.36	0.5	0.17	0.4	0.6
Raetihi	6.9	n/a	0.1	0.21	0.3	0.11	0.24	0.4	0.13	0.28	0.4	0.14	0.32	0.5	0.15	0.35	0.5	0.16	0.39	0.6

TABLE 3.4(b) part 4: Site demand parameters for an annual probability of exceedance of 1/50

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Eltham	6.9	n/a	0.05	0.09	0.5	0.05	0.11	0.5	0.06	0.14	0.6	0.07	0.17	0.6	0.08	0.19	0.7	0.08	0.22	0.7
Opunake	6.8	n/a	0.04	0.08	0.5	0.05	0.1	0.5	0.05	0.12	0.6	0.06	0.15	0.7	0.07	0.17	0.7	0.07	0.2	0.7
Waiouru	7.0	n/a	0.11	0.24	0.3	0.13	0.28	0.4	0.15	0.32	0.4	0.16	0.36	0.5	0.17	0.39	0.5	0.18	0.43	0.6
Napier	7.0	n/a	0.14	0.31	0.3	0.16	0.35	0.3	0.19	0.4	0.4	0.2	0.44	0.5	0.21	0.46	0.5	0.22	0.5	0.6
Clive	7.0	n/a	0.15	0.32	0.3	0.17	0.36	0.3	0.19	0.41	0.4	0.21	0.45	0.5	0.22	0.48	0.5	0.22	0.51	0.6
Hawera	6.9	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.15	0.6	0.08	0.18	0.6	0.08	0.2	0.7	0.09	0.23	0.7
Hastings	7.0	n/a	0.15	0.33	0.3	0.17	0.37	0.3	0.2	0.42	0.4	0.21	0.46	0.5	0.22	0.48	0.5	0.23	0.52	0.6
Taihape	7.0	n/a	0.12	0.27	0.3	0.14	0.31	0.4	0.16	0.35	0.4	0.18	0.39	0.5	0.19	0.42	0.5	0.2	0.46	0.6
Havelock North	6.9	n/a	0.15	0.33	0.3	0.18	0.38	0.3	0.2	0.43	0.4	0.21	0.46	0.5	0.22	0.49	0.5	0.23	0.52	0.6
Patea	6.9	n/a	0.06	0.12	0.4	0.07	0.15	0.5	0.08	0.18	0.5	0.09	0.22	0.6	0.1	0.24	0.6	0.11	0.28	0.7
Whanganui	6.9	n/a	0.11	0.25	0.3	0.13	0.29	0.4	0.15	0.33	0.4	0.17	0.37	0.5	0.17	0.4	0.5	0.18	0.43	0.6
Waipawa	7.0	n/a	0.17	0.37	0.3	0.19	0.41	0.3	0.22	0.46	0.4	0.23	0.5	0.5	0.24	0.52	0.5	0.25	0.55	0.6
Waipukurau	7.0	n/a	0.17	0.37	0.3	0.2	0.42	0.3	0.22	0.47	0.4	0.23	0.51	0.5	0.24	0.53	0.5	0.25	0.56	0.6
Marton	7.0	n/a	0.13	0.29	0.3	0.16	0.33	0.3	0.18	0.38	0.4	0.19	0.42	0.5	0.2	0.44	0.5	0.21	0.48	0.6
Bulls	7.0	n/a	0.14	0.31	0.3	0.16	0.35	0.3	0.18	0.4	0.4	0.2	0.44	0.5	0.21	0.46	0.5	0.22	0.5	0.6
Dannevirke	7.1	n/a	0.18	0.38	0.3	0.2	0.43	0.3	0.23	0.48	0.4	0.24	0.52	0.5	0.25	0.54	0.5	0.25	0.57	0.6
Feilding	7.1	n/a	0.15	0.32	0.3	0.17	0.37	0.3	0.19	0.41	0.4	0.21	0.45	0.5	0.22	0.48	0.5	0.22	0.51	0.6
Ashhurst	7.1	7	0.16	0.36	0.3	0.19	0.4	0.3	0.21	0.45	0.4	0.23	0.49	0.5	0.23	0.51	0.5	0.24	0.54	0.6
Woodville	7.1	6	0.17	0.38	0.3	0.2	0.43	0.3	0.22	0.48	0.4	0.24	0.51	0.5	0.25	0.54	0.5	0.25	0.57	0.6
Palmerston North	7.1	6	0.16	0.35	0.3	0.19	0.4	0.3	0.21	0.45	0.4	0.22	0.48	0.5	0.23	0.51	0.5	0.24	0.54	0.6
Pahiatua	7.1	7	0.18	0.4	0.3	0.21	0.45	0.3	0.23	0.5	0.4	0.25	0.53	0.5	0.26	0.55	0.5	0.26	0.58	0.6
Foxton Beach	7.1	n/a	0.16	0.34	0.3	0.18	0.38	0.3	0.2	0.43	0.4	0.22	0.47	0.5	0.22	0.5	0.5	0.23	0.53	0.6
Foxton	7.1	n/a	0.16	0.34	0.3	0.18	0.39	0.3	0.21	0.44	0.4	0.22	0.48	0.5	0.23	0.5	0.5	0.24	0.54	0.6
Shannon	7.1	15	0.17	0.37	0.3	0.19	0.41	0.3	0.22	0.46	0.4	0.23	0.5	0.5	0.24	0.52	0.5	0.25	0.55	0.6
Levin	7.2	18	0.17	0.37	0.3	0.2	0.42	0.3	0.22	0.46	0.4	0.23	0.5	0.5	0.24	0.53	0.5	0.25	0.56	0.6
Otaki Beach	7.2	n/a	0.17	0.37	0.3	0.2	0.42	0.3	0.22	0.47	0.4	0.23	0.5	0.5	0.24	0.53	0.5	0.25	0.56	0.6
Otaki	7.2	n/a	0.17	0.37	0.3	0.2	0.42	0.3	0.22	0.47	0.4	0.24	0.51	0.5	0.24	0.53	0.5	0.25	0.56	0.6
Waikanae	7.2	n/a	0.17	0.38	0.3	0.2	0.43	0.3	0.22	0.48	0.4	0.24	0.51	0.5	0.25	0.54	0.5	0.25	0.57	0.6
Takaka	7.0	n/a	0.08	0.16	0.3	0.09	0.19	0.4	0.1	0.22	0.5	0.11	0.26	0.5	0.12	0.28	0.6	0.13	0.32	0.6
Paraparaumu	7.2	18	0.18	0.38	0.3	0.2	0.43	0.3	0.23	0.48	0.4	0.24	0.52	0.5	0.25	0.54	0.5	0.25	0.57	0.6

TABLE 3.4(b) part 5: Site demand parameters for an annual probability of exceedance of 1/50

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	***Sas***	***Tc***	***PGA***	***Sas***	***Tc***	***PGA***	***Sas***	***Tc***	***PGA***	***Sas***	***Tc***	***PGA***	***Sas***	***Tc***	***PGA***	***Sas***	***Tc***
Masterton	7.2	6	0.2	0.44	0.3	0.23	0.49	0.3	0.26	0.54	0.4	0.27	0.57	0.5	0.28	0.59	0.5	0.28	0.61	0.6
Paekakariki	7.2	16	0.18	0.39	0.3	0.21	0.44	0.3	0.23	0.49	0.4	0.24	0.52	0.5	0.25	0.54	0.5	0.26	0.57	0.6
Carterton	7.2	4	0.2	0.44	0.3	0.23	0.49	0.3	0.26	0.54	0.4	0.27	0.57	0.5	0.28	0.59	0.5	0.28	0.61	0.6
Greytown	7.2	4	0.2	0.44	0.3	0.23	0.49	0.3	0.26	0.54	0.4	0.27	0.57	0.5	0.28	0.58	0.5	0.28	0.61	0.6
Porirua	7.2	6	0.18	0.4	0.3	0.21	0.45	0.3	0.23	0.5	0.4	0.25	0.53	0.5	0.26	0.55	0.5	0.26	0.58	0.6
Featherston	7.2	0	0.2	0.43	0.3	0.23	0.48	0.3	0.25	0.53	0.4	0.27	0.57	0.5	0.27	0.58	0.5	0.28	0.6	0.6
Motueka	7.1	n/a	0.09	0.19	0.3	0.11	0.23	0.4	0.12	0.26	0.4	0.13	0.3	0.5	0.14	0.33	0.6	0.15	0.37	0.6
Upper Hutt	7.2	0	0.19	0.42	0.3	0.22	0.47	0.3	0.25	0.52	0.4	0.26	0.55	0.5	0.27	0.57	0.5	0.27	0.59	0.6
Lower Hutt	7.2	0	0.19	0.41	0.3	0.22	0.46	0.3	0.24	0.51	0.4	0.26	0.55	0.5	0.26	0.57	0.5	0.27	0.59	0.6
Martinborough	7.3	16	0.2	0.42	0.3	0.23	0.47	0.3	0.25	0.52	0.4	0.26	0.56	0.5	0.27	0.57	0.5	0.27	0.6	0.6
Mapua	7.0	n/a	0.1	0.21	0.3	0.12	0.25	0.4	0.13	0.29	0.4	0.15	0.33	0.5	0.16	0.36	0.5	0.17	0.4	0.6
Wainuiomata	7.2	0	0.19	0.41	0.3	0.22	0.46	0.3	0.24	0.51	0.4	0.26	0.55	0.5	0.26	0.57	0.5	0.27	0.59	0.6
Nelson	7.1	n/a	0.11	0.23	0.3	0.13	0.27	0.4	0.14	0.31	0.4	0.16	0.35	0.5	0.17	0.38	0.5	0.18	0.42	0.6
Picton	7.0	n/a	0.15	0.33	0.3	0.18	0.38	0.3	0.2	0.43	0.4	0.22	0.47	0.5	0.22	0.49	0.5	0.23	0.53	0.6
Wellington CBD	7.2	0	0.19	0.41	0.3	0.22	0.46	0.3	0.24	0.51	0.4	0.26	0.55	0.5	0.26	0.57	0.5	0.27	0.59	0.6
Wellington	7.2	0	0.19	0.41	0.3	0.22	0.46	0.3	0.24	0.51	0.4	0.26	0.55	0.5	0.26	0.57	0.5	0.27	0.59	0.6
Eastbourne	7.2	0	0.19	0.41	0.3	0.22	0.46	0.3	0.24	0.51	0.4	0.26	0.55	0.5	0.26	0.57	0.5	0.27	0.59	0.6
Richmond	7.0	n/a	0.11	0.23	0.3	0.13	0.27	0.4	0.14	0.31	0.4	0.16	0.36	0.5	0.17	0.38	0.5	0.18	0.42	0.6
Hope	7.0	n/a	0.11	0.23	0.3	0.13	0.27	0.4	0.14	0.31	0.4	0.16	0.36	0.5	0.17	0.38	0.5	0.18	0.43	0.6
Brightwater	7.0	n/a	0.11	0.23	0.3	0.13	0.27	0.4	0.14	0.31	0.4	0.16	0.35	0.5	0.17	0.38	0.5	0.18	0.42	0.6
Wakefield	7.0	n/a	0.11	0.23	0.3	0.13	0.27	0.4	0.14	0.31	0.4	0.16	0.35	0.5	0.17	0.38	0.5	0.18	0.42	0.6
Renwick	7.0	n/a	0.16	0.34	0.3	0.18	0.39	0.3	0.21	0.44	0.4	0.22	0.48	0.5	0.23	0.5	0.5	0.23	0.54	0.6
Blenheim	7.0	11	0.17	0.36	0.3	0.19	0.41	0.3	0.22	0.46	0.4	0.23	0.5	0.5	0.24	0.52	0.5	0.24	0.56	0.6
Seddon	6.9	5	0.19	0.41	0.3	0.22	0.47	0.3	0.24	0.52	0.4	0.26	0.56	0.5	0.26	0.58	0.5	0.27	0.61	0.6
Westport	6.7	n/a	0.08	0.18	0.3	0.1	0.21	0.4	0.11	0.24	0.4	0.12	0.28	0.5	0.13	0.31	0.5	0.14	0.35	0.6
St Arnaud	6.9	0	0.13	0.29	0.3	0.15	0.33	0.3	0.17	0.38	0.4	0.19	0.42	0.5	0.2	0.45	0.5	0.21	0.49	0.6
Murchison	6.8	n/a	0.12	0.25	0.3	0.14	0.29	0.3	0.16	0.34	0.4	0.17	0.38	0.5	0.18	0.41	0.5	0.19	0.45	0.6
Ward	6.9	5	0.2	0.43	0.3	0.23	0.48	0.3	0.25	0.53	0.4	0.26	0.57	0.5	0.27	0.59	0.5	0.27	0.62	0.6
Reefton	6.8	n/a	0.11	0.23	0.3	0.13	0.27	0.4	0.14	0.32	0.4	0.16	0.36	0.5	0.17	0.39	0.5	0.18	0.43	0.6
Springs Junction	6.8	2	0.14	0.29	0.3	0.16	0.34	0.3	0.18	0.39	0.4	0.2	0.43	0.5	0.2	0.46	0.5	0.21	0.5	0.6

TABLE 3.4(b) part 6: Site demand parameters for an annual probability of exceedance of 1/50

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Runanga	6.9	n/a	0.08	0.17	0.3	0.1	0.2	0.4	0.11	0.23	0.4	0.12	0.28	0.5	0.13	0.3	0.6	0.13	0.34	0.6
Kaikoura	6.9	6	0.15	0.33	0.3	0.18	0.38	0.3	0.2	0.42	0.4	0.21	0.46	0.5	0.22	0.49	0.5	0.23	0.53	0.6
Greymouth	6.9	n/a	0.08	0.17	0.3	0.1	0.2	0.4	0.11	0.24	0.4	0.12	0.28	0.5	0.13	0.31	0.5	0.14	0.35	0.6
Hanmer Springs	6.6	4	0.19	0.42	0.3	0.22	0.47	0.3	0.25	0.53	0.4	0.26	0.57	0.5	0.26	0.59	0.5	0.27	0.62	0.6
Hokitika	6.8	n/a	0.09	0.19	0.3	0.1	0.22	0.4	0.12	0.26	0.4	0.13	0.3	0.5	0.14	0.32	0.5	0.15	0.37	0.6
Cheviot	6.7	n/a	0.12	0.27	0.3	0.14	0.31	0.3	0.16	0.36	0.4	0.18	0.4	0.5	0.19	0.43	0.5	0.2	0.47	0.6
Otira	6.7	1	0.13	0.29	0.3	0.16	0.33	0.3	0.18	0.38	0.4	0.19	0.42	0.5	0.2	0.45	0.5	0.21	0.49	0.6
Arthurs Pass	6.6	13	0.14	0.3	0.3	0.16	0.34	0.3	0.18	0.39	0.4	0.2	0.43	0.5	0.2	0.45	0.5	0.21	0.49	0.6
Harihari	6.7	0	0.09	0.19	0.3	0.1	0.22	0.4	0.12	0.26	0.4	0.13	0.3	0.5	0.14	0.32	0.5	0.15	0.36	0.6
Amberley	6.7	n/a	0.09	0.19	0.3	0.11	0.23	0.4	0.12	0.27	0.4	0.13	0.31	0.5	0.14	0.34	0.5	0.15	0.38	0.6
Oxford	6.6	n/a	0.09	0.19	0.3	0.11	0.22	0.4	0.12	0.27	0.4	0.13	0.31	0.5	0.14	0.33	0.5	0.15	0.38	0.6
Rangiora	6.6	n/a	0.09	0.18	0.3	0.1	0.22	0.4	0.12	0.26	0.4	0.13	0.3	0.5	0.14	0.32	0.5	0.14	0.37	0.6
Pegasus	6.6	n/a	0.09	0.18	0.3	0.1	0.22	0.4	0.12	0.25	0.4	0.13	0.3	0.5	0.13	0.32	0.5	0.14	0.37	0.6
Woodend	6.6	n/a	0.09	0.18	0.3	0.1	0.22	0.4	0.12	0.25	0.4	0.13	0.3	0.5	0.13	0.32	0.5	0.14	0.37	0.6
Franz Josef	6.7	0	0.07	0.15	0.3	0.09	0.18	0.4	0.1	0.22	0.4	0.11	0.25	0.5	0.12	0.28	0.5	0.13	0.32	0.6
Kaiapoi	6.5	n/a	0.09	0.19	0.3	0.11	0.22	0.4	0.12	0.26	0.4	0.13	0.3	0.5	0.14	0.33	0.5	0.15	0.37	0.6
Fox Glacier	6.7	0	0.07	0.15	0.3	0.09	0.18	0.4	0.1	0.21	0.4	0.11	0.25	0.5	0.12	0.28	0.5	0.13	0.31	0.6
Darfield	6.5	n/a	0.09	0.18	0.3	0.1	0.21	0.4	0.12	0.25	0.4	0.13	0.29	0.5	0.13	0.32	0.5	0.14	0.36	0.6
West Melton	6.4	n/a	0.09	0.19	0.3	0.11	0.22	0.4	0.12	0.26	0.4	0.13	0.3	0.5	0.14	0.33	0.5	0.15	0.37	0.6
Christchurch	6.3	n/a	0.1	0.2	0.3	0.11	0.23	0.3	0.13	0.28	0.4	0.14	0.31	0.5	0.14	0.34	0.5	0.15	0.38	0.6
Prebbleton	6.3	n/a	0.09	0.19	0.3	0.11	0.22	0.4	0.12	0.27	0.4	0.13	0.3	0.5	0.14	0.33	0.5	0.15	0.37	0.6
Lyttelton	6.2	n/a	0.09	0.19	0.3	0.11	0.22	0.3	0.12	0.26	0.4	0.13	0.3	0.5	0.14	0.33	0.5	0.15	0.37	0.6
Rolleston	6.3	n/a	0.09	0.18	0.3	0.1	0.21	0.4	0.12	0.25	0.4	0.13	0.29	0.5	0.13	0.32	0.5	0.14	0.36	0.6
Methven	6.6	n/a	0.07	0.15	0.3	0.09	0.18	0.4	0.1	0.22	0.5	0.11	0.25	0.5	0.12	0.28	0.5	0.12	0.32	0.6
Diamond Harbour	6.2	n/a	0.09	0.18	0.3	0.1	0.21	0.4	0.12	0.25	0.4	0.13	0.29	0.5	0.13	0.31	0.5	0.14	0.36	0.6
Lincoln	6.3	n/a	0.09	0.18	0.3	0.1	0.21	0.4	0.12	0.25	0.4	0.13	0.29	0.5	0.13	0.31	0.5	0.14	0.36	0.6
Mt Cook Village	6.8	n/a	0.07	0.15	0.3	0.08	0.17	0.4	0.1	0.21	0.5	0.11	0.24	0.5	0.11	0.27	0.6	0.12	0.31	0.6
Rakaia	6.5	n/a	0.07	0.14	0.3	0.08	0.17	0.4	0.09	0.2	0.5	0.1	0.24	0.5	0.11	0.27	0.5	0.12	0.31	0.6
Leeston	6.4	n/a	0.07	0.15	0.3	0.08	0.18	0.4	0.1	0.21	0.4	0.11	0.25	0.5	0.11	0.27	0.5	0.12	0.31	0.6
Akaroa	6.4	n/a	0.06	0.13	0.3	0.07	0.15	0.4	0.08	0.18	0.4	0.1	0.22	0.5	0.1	0.24	0.5	0.11	0.28	0.6

TABLE 3.4(b) part 7: Site demand parameters for an annual probability of exceedance of 1/50

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Ashburton	6.6	n/a	0.06	0.12	0.3	0.07	0.15	0.4	0.08	0.18	0.5	0.09	0.22	0.5	0.1	0.24	0.6	0.11	0.28	0.6
Geraldine	6.6	n/a	0.06	0.12	0.4	0.07	0.14	0.4	0.08	0.17	0.5	0.09	0.2	0.5	0.1	0.23	0.6	0.1	0.27	0.6
Fairlie	6.6	n/a	0.06	0.12	0.3	0.07	0.15	0.4	0.08	0.18	0.5	0.09	0.21	0.5	0.1	0.23	0.6	0.11	0.27	0.6
Temuka	6.5	n/a	0.06	0.11	0.4	0.07	0.13	0.4	0.08	0.16	0.5	0.09	0.2	0.5	0.09	0.22	0.6	0.1	0.26	0.6
Pleasant Point	6.5	n/a	0.06	0.11	0.4	0.07	0.14	0.4	0.08	0.17	0.5	0.09	0.2	0.5	0.09	0.22	0.6	0.1	0.26	0.6
Twizel	6.8	n/a	0.07	0.13	0.3	0.08	0.16	0.4	0.09	0.19	0.5	0.1	0.23	0.5	0.11	0.25	0.6	0.11	0.29	0.6
Timaru	6.5	n/a	0.05	0.11	0.3	0.06	0.13	0.4	0.07	0.16	0.5	0.08	0.19	0.5	0.09	0.21	0.6	0.1	0.25	0.6
Lake Hawea	7.0	n/a	0.08	0.17	0.3	0.1	0.2	0.4	0.11	0.24	0.5	0.12	0.28	0.5	0.13	0.3	0.6	0.14	0.34	0.6
Milford Sound	7.1	16	0.2	0.43	0.3	0.23	0.48	0.3	0.25	0.53	0.4	0.27	0.57	0.5	0.27	0.58	0.5	0.27	0.6	0.6
Wanaka	7.0	n/a	0.09	0.18	0.3	0.1	0.21	0.4	0.11	0.25	0.5	0.13	0.29	0.5	0.13	0.31	0.6	0.14	0.35	0.6
Waimate	6.4	n/a	0.05	0.11	0.3	0.06	0.13	0.4	0.07	0.15	0.5	0.08	0.19	0.5	0.09	0.21	0.6	0.1	0.24	0.6
Arrowtown	7.0	n/a	0.09	0.18	0.3	0.1	0.22	0.4	0.12	0.25	0.5	0.13	0.29	0.5	0.14	0.32	0.6	0.14	0.36	0.6
Arthurs Point	7.1	n/a	0.09	0.19	0.3	0.11	0.23	0.4	0.12	0.27	0.5	0.13	0.3	0.5	0.14	0.33	0.6	0.15	0.37	0.6
Lake Hayes	7.0	n/a	0.09	0.18	0.3	0.1	0.21	0.4	0.12	0.25	0.5	0.13	0.29	0.5	0.13	0.32	0.6	0.14	0.36	0.6
Queenstown	7.0	n/a	0.09	0.19	0.3	0.1	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.5	0.14	0.32	0.6	0.15	0.36	0.6
Cromwell	6.9	n/a	0.07	0.15	0.3	0.09	0.18	0.4	0.1	0.21	0.5	0.11	0.25	0.5	0.12	0.28	0.6	0.13	0.32	0.6
Oamaru	6.3	n/a	0.05	0.1	0.3	0.06	0.12	0.4	0.07	0.15	0.5	0.08	0.18	0.5	0.08	0.2	0.5	0.09	0.23	0.6
Clyde	6.8	n/a	0.07	0.14	0.4	0.08	0.17	0.4	0.09	0.2	0.5	0.1	0.23	0.5	0.11	0.26	0.6	0.12	0.3	0.6
Alexandra	6.8	n/a	0.07	0.13	0.4	0.08	0.16	0.4	0.09	0.19	0.5	0.1	0.23	0.5	0.11	0.26	0.6	0.12	0.29	0.6
Te Anau	7.2	n/a	0.12	0.25	0.3	0.14	0.29	0.4	0.16	0.34	0.4	0.17	0.38	0.5	0.18	0.41	0.6	0.19	0.45	0.6
Palmerston	6.3	n/a	0.05	0.1	0.3	0.06	0.12	0.4	0.07	0.15	0.5	0.08	0.18	0.5	0.08	0.2	0.5	0.09	0.23	0.6
Waikouaiti	6.3	n/a	0.05	0.1	0.3	0.06	0.12	0.4	0.07	0.14	0.5	0.08	0.18	0.5	0.08	0.2	0.5	0.09	0.23	0.6
Mosgiel	6.3	n/a	0.05	0.1	0.3	0.06	0.12	0.4	0.07	0.15	0.5	0.08	0.18	0.5	0.08	0.2	0.5	0.09	0.23	0.6
Dunedin	6.2	n/a	0.05	0.1	0.3	0.06	0.12	0.4	0.07	0.14	0.5	0.08	0.17	0.5	0.08	0.19	0.5	0.09	0.23	0.6
Brighton	6.3	n/a	0.05	0.1	0.3	0.06	0.12	0.4	0.07	0.14	0.5	0.08	0.18	0.5	0.08	0.2	0.5	0.09	0.23	0.6
Gore	6.6	n/a	0.06	0.12	0.4	0.07	0.15	0.4	0.08	0.18	0.5	0.09	0.21	0.5	0.1	0.24	0.6	0.11	0.28	0.6
Milton	6.3	n/a	0.05	0.1	0.3	0.06	0.12	0.4	0.07	0.15	0.5	0.08	0.18	0.5	0.08	0.2	0.6	0.09	0.23	0.6
Winton	6.9	n/a	0.07	0.15	0.4	0.09	0.18	0.4	0.1	0.21	0.5	0.11	0.25	0.5	0.11	0.27	0.6	0.12	0.31	0.6
Mataura	6.6	n/a	0.06	0.12	0.4	0.07	0.15	0.4	0.08	0.18	0.5	0.09	0.21	0.5	0.1	0.24	0.6	0.11	0.28	0.6
Balclutha	6.3	n/a	0.05	0.1	0.3	0.06	0.13	0.4	0.07	0.15	0.5	0.08	0.18	0.5	0.09	0.2	0.6	0.09	0.24	0.6

TABLE 3.4(b) part 8: Site demand parameters for an annual probability of exceedance of 1/50

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Riverton	7.0	n/a	0.08	0.16	0.4	0.09	0.19	0.4	0.1	0.22	0.5	0.12	0.26	0.5	0.12	0.29	0.6	0.13	0.32	0.6
Invercargill	6.8	n/a	0.07	0.14	0.4	0.08	0.17	0.4	0.09	0.2	0.5	0.1	0.23	0.5	0.11	0.26	0.6	0.12	0.3	0.6
Bluff	6.8	n/a	0.07	0.14	0.4	0.08	0.16	0.4	0.09	0.2	0.5	0.1	0.23	0.5	0.11	0.25	0.6	0.12	0.29	0.6
Oban	6.8	n/a	0.07	0.14	0.4	0.08	0.17	0.4	0.09	0.2	0.5	0.1	0.23	0.5	0.11	0.26	0.6	0.12	0.29	0.6

TABLE 3.4(c) part 1: Site demand parameters for an annual probability of exceedance of 1/100

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Kaitaia	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Kerikeri	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Haruru	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Paihia	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Opua	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Kawakawa	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Moerewa	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Kaikohe	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Hikurangi	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Ngunguru	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Whangarei	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
One Tree Point	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Ruakaka	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Dargaville	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Waipu	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Mangawhai Heads	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Wellsford	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Warkworth	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Snells Beach	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Hibiscus Coast	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Parakai	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Helensville	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Coromandel	6.5	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Riverhead	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Kumeu-Huapai	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Waimauku	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Waiheke West	6.3	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Whitianga	6.6	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Muriwai	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Auckland	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7

TABLE 3.4(c) part 2: Site demand parameters for an annual probability of exceedance of 1/100

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Maraetai	6.3	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Beachlands-Pine Harbour	6.3	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Manukau City	6.2	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Tairua	6.7	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.6	0.08	0.18	0.6	0.08	0.2	0.7	0.09	0.23	0.7
Pauanui	6.7	n/a	0.05	0.1	0.5	0.06	0.12	0.5	0.07	0.14	0.6	0.08	0.18	0.7	0.08	0.2	0.7	0.09	0.23	0.7
Clarks Beach	6.3	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Thames	6.6	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.6	0.08	0.18	0.6	0.08	0.2	0.7	0.09	0.23	0.7
Patumahoe	6.4	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Pukekohe	6.4	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Whangamata	6.8	n/a	0.05	0.1	0.5	0.06	0.12	0.6	0.07	0.15	0.6	0.08	0.18	0.7	0.08	0.2	0.7	0.09	0.24	0.8
Pokeno	6.5	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Waiuku	6.4	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Tuakau	6.4	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Ngatea	6.7	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.6	0.08	0.18	0.6	0.08	0.2	0.7	0.09	0.23	0.7
Paeroa	6.8	n/a	0.05	0.1	0.5	0.06	0.12	0.6	0.07	0.14	0.6	0.08	0.18	0.7	0.08	0.2	0.7	0.09	0.24	0.8
Waihi	6.8	n/a	0.05	0.1	0.5	0.06	0.13	0.6	0.07	0.16	0.6	0.08	0.19	0.7	0.08	0.22	0.7	0.09	0.25	0.8
Te Kauwhata	6.6	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.08	0.2	0.6	0.09	0.23	0.7
Waihi Beach-Bowentown	6.9	n/a	0.05	0.11	0.5	0.06	0.14	0.5	0.08	0.17	0.6	0.09	0.21	0.7	0.09	0.23	0.7	0.1	0.27	0.8
Te Aroha	6.8	n/a	0.05	0.1	0.5	0.06	0.12	0.6	0.07	0.16	0.6	0.08	0.19	0.7	0.08	0.21	0.7	0.09	0.25	0.8
Huntly	6.6	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.6	0.08	0.18	0.6	0.08	0.2	0.7	0.09	0.23	0.7
Katikati	6.9	n/a	0.06	0.11	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.09	0.21	0.7	0.09	0.24	0.7	0.1	0.28	0.8
Omokoroa	6.9	n/a	0.06	0.13	0.5	0.08	0.16	0.5	0.09	0.2	0.6	0.1	0.24	0.6	0.11	0.27	0.7	0.11	0.31	0.7
Mount Maunganui	6.9	n/a	0.07	0.15	0.4	0.09	0.19	0.5	0.1	0.23	0.5	0.11	0.27	0.6	0.12	0.3	0.7	0.13	0.34	0.7
Morrinsville	6.8	n/a	0.05	0.1	0.5	0.06	0.12	0.6	0.07	0.15	0.6	0.08	0.18	0.7	0.08	0.21	0.7	0.09	0.24	0.8
Ngaruawahia	6.7	n/a	0.05	0.1	0.5	0.06	0.12	0.5	0.07	0.14	0.6	0.08	0.18	0.7	0.08	0.2	0.7	0.09	0.23	0.7
Tauranga	6.9	n/a	0.07	0.15	0.4	0.09	0.19	0.5	0.1	0.23	0.5	0.11	0.27	0.6	0.12	0.3	0.7	0.13	0.34	0.7
Te Puke	6.8	n/a	0.09	0.19	0.4	0.11	0.23	0.4	0.12	0.28	0.5	0.14	0.32	0.6	0.14	0.35	0.6	0.15	0.4	0.7
Hamilton	6.8	n/a	0.05	0.1	0.5	0.06	0.12	0.6	0.07	0.14	0.6	0.08	0.18	0.7	0.08	0.2	0.7	0.09	0.23	0.8
Raglan	6.6	n/a	0.05	0.1	0.4	0.06	0.12	0.5	0.07	0.14	0.6	0.08	0.18	0.6	0.08	0.2	0.7	0.09	0.23	0.7
Matamata	6.9	n/a	0.06	0.12	0.5	0.07	0.14	0.5	0.08	0.18	0.6	0.09	0.22	0.7	0.1	0.24	0.7	0.11	0.28	0.8

TABLE 3.4(c) part 3: Site demand parameters for an annual probability of exceedance of 1/100

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Cambridge	6.9	n/a	0.05	0.1	0.5	0.06	0.13	0.6	0.07	0.16	0.6	0.08	0.19	0.7	0.09	0.22	0.7	0.09	0.26	0.8
Ruatoria	7.1	n/a	0.2	0.45	0.3	0.23	0.5	0.3	0.26	0.55	0.4	0.28	0.59	0.5	0.28	0.61	0.5	0.29	0.64	0.6
Whakatane	6.8	n/a	0.21	0.46	0.3	0.24	0.52	0.3	0.27	0.58	0.4	0.28	0.62	0.5	0.29	0.65	0.5	0.29	0.68	0.6
Edgecumbe	6.6	n/a	0.18	0.39	0.3	0.21	0.45	0.4	0.23	0.5	0.4	0.25	0.55	0.5	0.25	0.58	0.6	0.26	0.62	0.6
Ohope	6.8	n/a	0.21	0.46	0.3	0.24	0.52	0.3	0.27	0.58	0.4	0.28	0.62	0.5	0.29	0.64	0.5	0.29	0.68	0.6
Pirongia	6.8	n/a	0.05	0.1	0.5	0.06	0.12	0.6	0.07	0.15	0.6	0.08	0.18	0.7	0.08	0.2	0.7	0.09	0.24	0.8
Te Awamutu	6.9	n/a	0.05	0.1	0.5	0.06	0.13	0.6	0.07	0.16	0.6	0.08	0.19	0.7	0.09	0.22	0.7	0.09	0.25	0.8
Opotiki	6.8	n/a	0.21	0.46	0.3	0.24	0.52	0.3	0.27	0.58	0.4	0.28	0.62	0.5	0.29	0.64	0.5	0.3	0.68	0.6
Kihikihi	6.9	n/a	0.05	0.1	0.5	0.06	0.13	0.6	0.07	0.16	0.6	0.08	0.19	0.7	0.09	0.22	0.7	0.09	0.26	0.8
Putaruru	7.0	n/a	0.07	0.13	0.5	0.08	0.16	0.5	0.09	0.2	0.6	0.1	0.24	0.7	0.11	0.27	0.7	0.12	0.31	0.8
Ngongotaha	6.9	n/a	0.1	0.2	0.4	0.11	0.24	0.5	0.13	0.29	0.5	0.14	0.33	0.6	0.15	0.37	0.6	0.16	0.41	0.7
Kawerau	6.7	n/a	0.15	0.33	0.3	0.18	0.39	0.4	0.2	0.44	0.4	0.22	0.49	0.5	0.22	0.52	0.6	0.23	0.56	0.6
Rotorua	6.9	n/a	0.1	0.22	0.4	0.12	0.26	0.4	0.14	0.3	0.5	0.15	0.35	0.6	0.16	0.38	0.6	0.17	0.43	0.7
Otorohanga	6.9	n/a	0.05	0.1	0.5	0.06	0.13	0.6	0.07	0.16	0.6	0.08	0.2	0.7	0.09	0.22	0.7	0.1	0.26	0.8
Tokoroa	7.0	n/a	0.08	0.16	0.4	0.09	0.19	0.5	0.1	0.23	0.6	0.12	0.28	0.6	0.12	0.31	0.7	0.13	0.35	0.7
Te Kuiti	7.0	n/a	0.05	0.11	0.5	0.06	0.14	0.6	0.08	0.17	0.6	0.09	0.2	0.7	0.09	0.23	0.7	0.1	0.27	0.8
Mangakino	7.0	n/a	0.08	0.16	0.4	0.09	0.2	0.5	0.11	0.24	0.6	0.12	0.28	0.6	0.13	0.31	0.7	0.13	0.36	0.7
Murupara	7.0	n/a	0.17	0.37	0.3	0.2	0.42	0.4	0.22	0.48	0.4	0.24	0.52	0.5	0.24	0.55	0.5	0.25	0.59	0.6
Gisborne	7.0	n/a	0.23	0.51	0.3	0.26	0.57	0.3	0.29	0.62	0.4	0.31	0.65	0.5	0.31	0.67	0.5	0.32	0.69	0.6
Taupo	6.9	n/a	0.12	0.26	0.3	0.14	0.31	0.4	0.16	0.36	0.5	0.18	0.4	0.6	0.19	0.43	0.6	0.2	0.48	0.7
Taumarunui	7.0	n/a	0.08	0.17	0.4	0.1	0.2	0.5	0.11	0.25	0.5	0.12	0.29	0.6	0.13	0.32	0.7	0.14	0.36	0.7
Turangi	7.0	n/a	0.16	0.35	0.3	0.19	0.4	0.4	0.21	0.45	0.4	0.23	0.5	0.5	0.23	0.53	0.6	0.24	0.57	0.6
Waitara	6.8	n/a	0.05	0.11	0.5	0.07	0.14	0.6	0.08	0.17	0.6	0.09	0.2	0.7	0.09	0.23	0.7	0.1	0.27	0.8
Wairoa	7.1	n/a	0.21	0.46	0.3	0.24	0.51	0.3	0.26	0.56	0.4	0.28	0.6	0.5	0.29	0.62	0.5	0.3	0.65	0.6
New Plymouth	6.8	n/a	0.05	0.11	0.5	0.06	0.13	0.6	0.08	0.17	0.6	0.09	0.2	0.7	0.09	0.23	0.7	0.1	0.26	0.8
Oakura (New Plymouth District)	6.8	n/a	0.05	0.11	0.5	0.06	0.14	0.5	0.08	0.17	0.6	0.09	0.2	0.7	0.09	0.23	0.7	0.1	0.26	0.8
Inglewood	6.9	n/a	0.06	0.12	0.5	0.07	0.15	0.5	0.08	0.18	0.6	0.09	0.22	0.7	0.1	0.24	0.7	0.11	0.28	0.8
Stratford	7.0	n/a	0.07	0.14	0.5	0.08	0.17	0.5	0.09	0.2	0.6	0.1	0.24	0.7	0.11	0.27	0.7	0.12	0.31	0.8
Ohakune	7.1	n/a	0.15	0.34	0.3	0.18	0.39	0.4	0.2	0.44	0.4	0.22	0.48	0.5	0.23	0.51	0.6	0.24	0.56	0.6
Raetihi	7.1	n/a	0.15	0.32	0.3	0.17	0.37	0.4	0.2	0.42	0.4	0.21	0.47	0.5	0.22	0.5	0.6	0.23	0.54	0.6

TABLE 3.4(c) part 4: Site demand parameters for an annual probability of exceedance of 1/100

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	***Sas***	***Tc***	***PGA***	***Sas***	***Tc***	***PGA***	***Sas***	***Tc***	***PGA***	***Sas***	***Tc***	***PGA***	***Sas***	***Tc***	***PGA***	***Sas***	***Tc***
Eltham	7.0	n/a	0.07	0.14	0.5	0.08	0.18	0.5	0.1	0.21	0.6	0.11	0.25	0.6	0.11	0.28	0.7	0.12	0.32	0.8
Opunake	6.9	n/a	0.06	0.13	0.5	0.08	0.16	0.5	0.09	0.19	0.6	0.1	0.23	0.7	0.1	0.26	0.7	0.11	0.3	0.8
Waiouru	7.1	n/a	0.17	0.38	0.3	0.2	0.43	0.4	0.22	0.48	0.4	0.24	0.53	0.5	0.25	0.55	0.6	0.26	0.6	0.6
Napier	7.2	n/a	0.22	0.49	0.3	0.26	0.55	0.4	0.28	0.6	0.4	0.3	0.64	0.5	0.31	0.66	0.5	0.31	0.69	0.6
Clive	7.2	n/a	0.23	0.51	0.3	0.27	0.57	0.4	0.29	0.62	0.4	0.31	0.66	0.5	0.31	0.68	0.5	0.32	0.7	0.6
Hawera	7.1	n/a	0.08	0.16	0.4	0.09	0.19	0.5	0.1	0.23	0.6	0.12	0.27	0.6	0.12	0.3	0.7	0.13	0.34	0.8
Hastings	7.2	n/a	0.24	0.52	0.3	0.27	0.58	0.4	0.3	0.63	0.4	0.32	0.67	0.5	0.32	0.69	0.5	0.32	0.71	0.6
Taihape	7.2	n/a	0.2	0.43	0.3	0.23	0.48	0.4	0.25	0.53	0.4	0.27	0.57	0.5	0.27	0.6	0.6	0.28	0.64	0.6
Havelock North	7.2	n/a	0.24	0.53	0.3	0.28	0.59	0.4	0.3	0.64	0.4	0.32	0.68	0.5	0.32	0.69	0.5	0.33	0.72	0.6
Patea	7.1	n/a	0.1	0.2	0.4	0.11	0.24	0.5	0.13	0.28	0.5	0.14	0.32	0.6	0.15	0.36	0.6	0.16	0.4	0.7
Whanganui	7.1	n/a	0.18	0.38	0.3	0.2	0.43	0.4	0.23	0.49	0.4	0.24	0.53	0.5	0.25	0.56	0.6	0.26	0.6	0.6
Waipawa	7.3	n/a	0.27	0.59	0.3	0.31	0.65	0.4	0.33	0.7	0.4	0.35	0.73	0.5	0.35	0.74	0.6	0.35	0.76	0.6
Waipukurau	7.3	n/a	0.27	0.6	0.3	0.31	0.66	0.4	0.34	0.71	0.4	0.35	0.74	0.5	0.35	0.75	0.6	0.35	0.77	0.6
Marton	7.2	n/a	0.21	0.46	0.3	0.24	0.51	0.4	0.27	0.57	0.4	0.28	0.61	0.5	0.29	0.63	0.6	0.29	0.66	0.6
Bulls	7.2	n/a	0.22	0.48	0.3	0.25	0.54	0.4	0.28	0.59	0.4	0.3	0.63	0.5	0.3	0.65	0.6	0.31	0.69	0.6
Dannevirke	7.4	n/a	0.29	0.63	0.3	0.33	0.69	0.4	0.35	0.74	0.4	0.37	0.76	0.5	0.37	0.77	0.6	0.36	0.78	0.6
Feilding	7.3	n/a	0.24	0.52	0.3	0.27	0.57	0.4	0.3	0.63	0.4	0.31	0.66	0.5	0.32	0.68	0.6	0.32	0.71	0.6
Ashhurst	7.4	7	0.27	0.58	0.3	0.31	0.64	0.4	0.33	0.69	0.4	0.34	0.72	0.5	0.35	0.73	0.6	0.34	0.75	0.6
Woodville	7.4	6	0.29	0.63	0.3	0.33	0.69	0.4	0.35	0.74	0.4	0.36	0.76	0.5	0.36	0.77	0.6	0.36	0.78	0.6
Palmerston North	7.4	6	0.26	0.57	0.3	0.3	0.63	0.4	0.33	0.68	0.4	0.34	0.71	0.5	0.34	0.73	0.6	0.34	0.75	0.6
Pahiatua	7.4	7	0.3	0.66	0.3	0.34	0.72	0.4	0.37	0.77	0.4	0.38	0.79	0.5	0.38	0.79	0.6	0.37	0.8	0.6
Foxton Beach	7.3	n/a	0.25	0.54	0.3	0.28	0.6	0.4	0.31	0.65	0.4	0.32	0.69	0.5	0.33	0.7	0.6	0.33	0.73	0.6
Foxton	7.3	n/a	0.25	0.55	0.3	0.29	0.61	0.4	0.32	0.66	0.4	0.33	0.7	0.5	0.33	0.71	0.6	0.33	0.74	0.6
Shannon	7.4	15	0.28	0.6	0.3	0.31	0.66	0.4	0.34	0.71	0.4	0.35	0.74	0.5	0.35	0.75	0.6	0.35	0.76	0.6
Levin	7.4	18	0.28	0.6	0.3	0.31	0.66	0.4	0.34	0.71	0.4	0.35	0.74	0.5	0.35	0.75	0.6	0.35	0.77	0.6
Otaki Beach	7.4	n/a	0.28	0.61	0.3	0.32	0.67	0.4	0.34	0.72	0.4	0.35	0.74	0.5	0.36	0.75	0.6	0.35	0.77	0.7
Otaki	7.4	n/a	0.28	0.61	0.3	0.32	0.67	0.4	0.35	0.72	0.4	0.36	0.75	0.5	0.36	0.76	0.6	0.36	0.77	0.7
Waikanae	7.4	n/a	0.29	0.63	0.3	0.33	0.69	0.4	0.35	0.74	0.4	0.36	0.76	0.5	0.36	0.77	0.6	0.36	0.78	0.7
Takaka	7.2	n/a	0.12	0.25	0.3	0.13	0.29	0.4	0.15	0.33	0.5	0.17	0.38	0.5	0.18	0.41	0.6	0.19	0.46	0.6
Paraparaumu	7.4	18	0.29	0.63	0.3	0.33	0.69	0.4	0.36	0.74	0.4	0.37	0.76	0.5	0.37	0.77	0.6	0.36	0.78	0.7

TABLE 3.4(c) part 5: Site demand parameters for an annual probability of exceedance of 1/100

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Masterton	7.5	6	0.35	0.76	0.3	0.39	0.82	0.4	0.42	0.85	0.4	0.42	0.86	0.5	0.42	0.85	0.6	0.41	0.85	0.7
Paekakariki	7.4	16	0.3	0.64	0.3	0.34	0.71	0.4	0.36	0.75	0.4	0.37	0.78	0.5	0.37	0.78	0.6	0.37	0.79	0.7
Carterton	7.5	4	0.35	0.76	0.3	0.39	0.82	0.4	0.42	0.86	0.4	0.42	0.86	0.5	0.42	0.85	0.6	0.41	0.85	0.7
Greytown	7.5	4	0.34	0.74	0.3	0.39	0.81	0.4	0.41	0.85	0.4	0.42	0.85	0.5	0.41	0.85	0.6	0.4	0.84	0.7
Porirua	7.4	6	0.31	0.66	0.3	0.35	0.72	0.4	0.37	0.77	0.4	0.38	0.79	0.5	0.38	0.8	0.6	0.37	0.8	0.7
Featherston	7.5	0	0.34	0.74	0.3	0.39	0.81	0.4	0.41	0.84	0.4	0.42	0.85	0.5	0.41	0.85	0.6	0.4	0.84	0.7
Motueka	7.2	n/a	0.14	0.3	0.3	0.16	0.35	0.4	0.18	0.4	0.5	0.2	0.45	0.5	0.21	0.48	0.6	0.22	0.52	0.6
Upper Hutt	7.5	0	0.33	0.71	0.3	0.37	0.77	0.4	0.39	0.81	0.4	0.4	0.83	0.5	0.4	0.83	0.6	0.39	0.83	0.7
Lower Hutt	7.5	0	0.32	0.69	0.3	0.36	0.75	0.4	0.39	0.8	0.4	0.39	0.81	0.5	0.39	0.82	0.6	0.38	0.82	0.7
Martinborough	7.6	16	0.33	0.72	0.3	0.38	0.78	0.4	0.4	0.82	0.4	0.41	0.83	0.5	0.41	0.83	0.6	0.4	0.83	0.7
Mapua	7.2	n/a	0.16	0.34	0.3	0.18	0.39	0.4	0.2	0.44	0.5	0.22	0.48	0.5	0.23	0.52	0.6	0.24	0.56	0.6
Wainuiomata	7.5	0	0.32	0.69	0.3	0.36	0.75	0.4	0.39	0.8	0.4	0.39	0.81	0.5	0.39	0.82	0.6	0.38	0.82	0.7
Nelson	7.2	n/a	0.17	0.36	0.3	0.2	0.42	0.4	0.22	0.47	0.5	0.24	0.52	0.5	0.24	0.55	0.6	0.25	0.59	0.6
Picton	7.3	n/a	0.24	0.52	0.3	0.28	0.58	0.4	0.3	0.64	0.4	0.32	0.68	0.5	0.32	0.7	0.6	0.32	0.72	0.6
Wellington CBD	7.5	0	0.32	0.69	0.3	0.36	0.75	0.4	0.38	0.8	0.4	0.39	0.81	0.5	0.39	0.82	0.6	0.38	0.82	0.7
Wellington	7.5	0	0.32	0.69	0.3	0.36	0.75	0.4	0.38	0.8	0.4	0.39	0.81	0.5	0.39	0.82	0.6	0.38	0.82	0.7
Eastbourne	7.5	0	0.32	0.69	0.3	0.36	0.75	0.4	0.39	0.8	0.4	0.39	0.81	0.5	0.39	0.82	0.6	0.38	0.82	0.7
Richmond	7.2	n/a	0.17	0.36	0.3	0.2	0.42	0.4	0.22	0.47	0.5	0.24	0.52	0.5	0.24	0.55	0.6	0.25	0.59	0.6
Hope	7.2	n/a	0.17	0.37	0.3	0.2	0.42	0.4	0.22	0.47	0.5	0.24	0.52	0.5	0.24	0.55	0.6	0.25	0.59	0.6
Brightwater	7.2	n/a	0.17	0.36	0.3	0.2	0.41	0.4	0.22	0.47	0.5	0.23	0.52	0.5	0.24	0.55	0.6	0.25	0.59	0.6
Wakefield	7.2	n/a	0.17	0.36	0.3	0.2	0.41	0.4	0.22	0.47	0.5	0.23	0.51	0.5	0.24	0.55	0.6	0.25	0.59	0.6
Renwick	7.2	n/a	0.25	0.53	0.3	0.28	0.6	0.4	0.31	0.65	0.4	0.32	0.69	0.5	0.33	0.71	0.6	0.33	0.74	0.7
Blenheim	7.3	11	0.26	0.57	0.3	0.3	0.63	0.4	0.32	0.68	0.4	0.34	0.72	0.5	0.34	0.74	0.6	0.34	0.76	0.7
Seddon	7.2	5	0.3	0.65	0.3	0.34	0.72	0.4	0.37	0.77	0.4	0.38	0.8	0.5	0.38	0.81	0.6	0.37	0.82	0.7
Westport	6.8	n/a	0.13	0.28	0.3	0.15	0.32	0.4	0.17	0.37	0.5	0.19	0.42	0.5	0.2	0.45	0.6	0.2	0.5	0.6
St Arnaud	7.1	0	0.2	0.44	0.3	0.23	0.5	0.4	0.26	0.56	0.4	0.28	0.6	0.5	0.28	0.63	0.6	0.29	0.67	0.6
Murchison	6.9	n/a	0.18	0.39	0.3	0.21	0.44	0.4	0.23	0.5	0.4	0.25	0.55	0.5	0.25	0.58	0.6	0.26	0.62	0.6
Ward	7.2	5	0.31	0.67	0.3	0.35	0.74	0.4	0.38	0.79	0.4	0.39	0.81	0.5	0.39	0.82	0.6	0.38	0.83	0.7
Reefton	6.9	n/a	0.17	0.36	0.3	0.2	0.42	0.4	0.22	0.47	0.4	0.23	0.52	0.5	0.24	0.55	0.6	0.25	0.59	0.7
Springs Junction	7.1	2	0.22	0.47	0.3	0.25	0.53	0.4	0.28	0.59	0.4	0.29	0.63	0.5	0.29	0.66	0.6	0.3	0.69	0.7

TABLE 3.4(c) part 6: Site demand parameters for an annual probability of exceedance of 1/100

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Runanga	7.1	n/a	0.13	0.27	0.3	0.15	0.32	0.4	0.17	0.37	0.5	0.18	0.41	0.6	0.19	0.45	0.6	0.2	0.49	0.7
Kaikoura	7.2	6	0.24	0.53	0.3	0.28	0.59	0.4	0.31	0.65	0.4	0.32	0.68	0.5	0.32	0.7	0.6	0.32	0.72	0.7
Greymouth	7.1	n/a	0.13	0.28	0.3	0.15	0.33	0.4	0.17	0.38	0.5	0.19	0.43	0.5	0.2	0.46	0.6	0.21	0.5	0.7
Hanmer Springs	6.9	4	0.29	0.64	0.3	0.33	0.71	0.3	0.36	0.77	0.4	0.38	0.8	0.5	0.37	0.82	0.6	0.37	0.83	0.7
Hokitika	7.1	n/a	0.15	0.31	0.3	0.17	0.36	0.4	0.19	0.41	0.5	0.21	0.46	0.5	0.21	0.49	0.6	0.22	0.53	0.7
Cheviot	6.9	n/a	0.19	0.41	0.3	0.22	0.47	0.4	0.24	0.52	0.4	0.26	0.57	0.5	0.26	0.6	0.6	0.27	0.64	0.6
Otira	7.1	1	0.23	0.49	0.3	0.26	0.56	0.4	0.29	0.61	0.4	0.3	0.65	0.5	0.3	0.67	0.6	0.3	0.69	0.7
Arthurs Pass	6.9	13	0.22	0.48	0.3	0.25	0.54	0.4	0.28	0.6	0.4	0.3	0.64	0.5	0.3	0.66	0.6	0.3	0.69	0.7
Harihari	7.0	0	0.15	0.33	0.3	0.18	0.38	0.4	0.2	0.43	0.4	0.22	0.47	0.5	0.22	0.5	0.6	0.23	0.54	0.7
Amberley	6.9	n/a	0.14	0.29	0.3	0.16	0.34	0.4	0.18	0.39	0.5	0.2	0.45	0.5	0.2	0.48	0.6	0.21	0.53	0.7
Oxford	6.8	n/a	0.14	0.29	0.3	0.16	0.34	0.4	0.18	0.39	0.5	0.2	0.45	0.5	0.21	0.48	0.6	0.21	0.53	0.7
Rangiora	6.8	n/a	0.13	0.28	0.3	0.15	0.33	0.4	0.17	0.38	0.5	0.19	0.43	0.5	0.2	0.46	0.6	0.21	0.51	0.7
Pegasus	6.7	n/a	0.13	0.28	0.3	0.15	0.33	0.4	0.17	0.38	0.5	0.19	0.43	0.5	0.2	0.46	0.6	0.21	0.51	0.7
Woodend	6.7	n/a	0.13	0.28	0.3	0.15	0.33	0.4	0.17	0.38	0.5	0.19	0.43	0.5	0.2	0.46	0.6	0.21	0.51	0.7
Franz Josef	7.1	0	0.13	0.28	0.3	0.15	0.32	0.4	0.17	0.37	0.5	0.19	0.42	0.5	0.19	0.45	0.6	0.2	0.48	0.7
Kaiapoi	6.6	n/a	0.13	0.29	0.3	0.16	0.34	0.4	0.18	0.39	0.4	0.19	0.44	0.5	0.2	0.47	0.6	0.21	0.52	0.7
Fox Glacier	7.1	0	0.13	0.27	0.3	0.15	0.32	0.4	0.17	0.37	0.5	0.19	0.41	0.5	0.19	0.44	0.6	0.2	0.48	0.7
Darfield	6.6	n/a	0.13	0.28	0.3	0.15	0.33	0.4	0.17	0.38	0.4	0.19	0.43	0.5	0.2	0.46	0.6	0.21	0.51	0.7
West Melton	6.4	n/a	0.14	0.29	0.3	0.16	0.34	0.4	0.18	0.39	0.4	0.2	0.44	0.5	0.2	0.47	0.6	0.21	0.52	0.6
Christchurch	6.3	n/a	0.15	0.32	0.3	0.17	0.37	0.3	0.2	0.42	0.4	0.21	0.47	0.5	0.22	0.49	0.5	0.22	0.54	0.6
Prebbleton	6.3	n/a	0.14	0.3	0.3	0.16	0.35	0.3	0.18	0.4	0.4	0.2	0.45	0.5	0.21	0.48	0.5	0.22	0.52	0.6
Lyttelton	6.2	n/a	0.14	0.3	0.3	0.16	0.35	0.3	0.19	0.4	0.4	0.2	0.45	0.5	0.21	0.47	0.5	0.22	0.52	0.6
Rolleston	6.4	n/a	0.13	0.29	0.3	0.15	0.33	0.4	0.18	0.38	0.4	0.19	0.43	0.5	0.2	0.46	0.6	0.21	0.51	0.6
Methven	6.8	n/a	0.11	0.23	0.3	0.13	0.28	0.4	0.15	0.32	0.5	0.16	0.37	0.5	0.17	0.41	0.6	0.18	0.46	0.7
Diamond Harbour	6.2	n/a	0.13	0.29	0.3	0.16	0.33	0.3	0.18	0.38	0.4	0.19	0.43	0.5	0.2	0.46	0.5	0.21	0.5	0.6
Lincoln	6.3	n/a	0.13	0.28	0.3	0.15	0.33	0.4	0.17	0.38	0.4	0.19	0.43	0.5	0.2	0.46	0.5	0.21	0.5	0.6
Mt Cook Village	7.1	n/a	0.12	0.25	0.3	0.14	0.3	0.4	0.16	0.34	0.5	0.17	0.39	0.5	0.18	0.42	0.6	0.19	0.46	0.7
Rakaia	6.6	n/a	0.1	0.22	0.3	0.12	0.26	0.4	0.14	0.3	0.5	0.15	0.35	0.5	0.16	0.38	0.6	0.17	0.43	0.7
Leeston	6.5	n/a	0.11	0.23	0.3	0.13	0.27	0.4	0.14	0.31	0.5	0.16	0.36	0.5	0.16	0.39	0.6	0.17	0.44	0.6
Akaroa	6.4	n/a	0.09	0.2	0.3	0.11	0.23	0.4	0.13	0.28	0.5	0.14	0.32	0.5	0.14	0.35	0.6	0.15	0.4	0.6

TABLE 3.4(c) part 7: Site demand parameters for an annual probability of exceedance of 1/100

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	***Sas***	***Tc***	***PGA***	***Sas***	***Tc***	***PGA***	***Sas***	***Tc***	***PGA***	***Sas***	***Tc***	***PGA***	***Sas***	***Tc***	***PGA***	***Sas***	***Tc***
Ashburton	6.6	n/a	0.09	0.19	0.3	0.11	0.23	0.4	0.12	0.27	0.5	0.14	0.32	0.6	0.14	0.35	0.6	0.15	0.4	0.7
Geraldine	6.6	n/a	0.09	0.19	0.3	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.31	0.6	0.14	0.34	0.6	0.15	0.38	0.7
Fairlie	6.8	n/a	0.1	0.2	0.3	0.11	0.23	0.4	0.13	0.28	0.5	0.14	0.32	0.6	0.15	0.35	0.6	0.16	0.4	0.7
Temuka	6.6	n/a	0.09	0.18	0.3	0.1	0.21	0.4	0.12	0.25	0.5	0.13	0.29	0.6	0.13	0.32	0.6	0.14	0.37	0.7
Pleasant Point	6.6	n/a	0.09	0.18	0.3	0.1	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.33	0.6	0.15	0.37	0.7
Twizel	7.0	n/a	0.11	0.22	0.3	0.12	0.26	0.4	0.14	0.3	0.5	0.15	0.35	0.6	0.16	0.38	0.6	0.17	0.42	0.7
Timaru	6.5	n/a	0.09	0.17	0.3	0.1	0.21	0.4	0.11	0.25	0.5	0.13	0.29	0.6	0.13	0.32	0.6	0.14	0.36	0.7
Lake Hawea	7.2	n/a	0.13	0.28	0.3	0.15	0.32	0.4	0.17	0.37	0.5	0.19	0.42	0.6	0.2	0.45	0.6	0.21	0.49	0.7
Milford Sound	7.4	16	0.33	0.73	0.3	0.38	0.79	0.4	0.41	0.84	0.4	0.41	0.84	0.5	0.41	0.84	0.6	0.39	0.83	0.7
Wanaka	7.2	n/a	0.13	0.29	0.3	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.43	0.6	0.2	0.46	0.6	0.21	0.51	0.7
Waimate	6.4	n/a	0.08	0.17	0.3	0.1	0.2	0.4	0.11	0.24	0.5	0.12	0.28	0.5	0.13	0.31	0.6	0.14	0.35	0.7
Arrowtown	7.2	n/a	0.14	0.29	0.3	0.16	0.34	0.4	0.18	0.39	0.5	0.2	0.44	0.6	0.21	0.47	0.6	0.21	0.51	0.7
Arthurs Point	7.3	n/a	0.14	0.31	0.3	0.17	0.36	0.4	0.19	0.41	0.5	0.21	0.46	0.6	0.21	0.49	0.6	0.22	0.53	0.7
Lake Hayes	7.2	n/a	0.14	0.29	0.3	0.16	0.34	0.4	0.18	0.38	0.5	0.2	0.43	0.6	0.2	0.47	0.6	0.21	0.51	0.7
Queenstown	7.2	n/a	0.14	0.3	0.3	0.16	0.34	0.4	0.18	0.39	0.5	0.2	0.44	0.6	0.21	0.47	0.6	0.22	0.52	0.7
Cromwell	7.0	n/a	0.12	0.24	0.4	0.13	0.28	0.4	0.15	0.33	0.5	0.17	0.38	0.6	0.18	0.41	0.6	0.19	0.46	0.7
Oamaru	6.3	n/a	0.08	0.16	0.3	0.09	0.2	0.4	0.11	0.23	0.5	0.12	0.27	0.5	0.12	0.3	0.6	0.13	0.34	0.6
Clyde	6.9	n/a	0.11	0.22	0.4	0.12	0.26	0.4	0.14	0.3	0.5	0.15	0.35	0.6	0.16	0.38	0.6	0.17	0.43	0.7
Alexandra	6.9	n/a	0.1	0.21	0.4	0.12	0.25	0.4	0.14	0.3	0.5	0.15	0.34	0.6	0.16	0.38	0.6	0.17	0.42	0.7
Te Anau	7.4	n/a	0.19	0.41	0.3	0.22	0.47	0.4	0.25	0.52	0.5	0.26	0.56	0.6	0.27	0.59	0.6	0.27	0.63	0.7
Palmerston	6.3	n/a	0.08	0.16	0.3	0.09	0.19	0.4	0.11	0.23	0.5	0.12	0.27	0.5	0.12	0.3	0.6	0.13	0.34	0.6
Waikouaiti	6.3	n/a	0.08	0.16	0.3	0.09	0.19	0.4	0.1	0.23	0.5	0.12	0.27	0.5	0.12	0.29	0.6	0.13	0.34	0.6
Mosgiel	6.3	n/a	0.08	0.16	0.3	0.09	0.19	0.4	0.11	0.23	0.5	0.12	0.27	0.5	0.12	0.3	0.6	0.13	0.34	0.6
Dunedin	6.2	n/a	0.08	0.16	0.3	0.09	0.19	0.4	0.1	0.23	0.5	0.12	0.27	0.5	0.12	0.29	0.6	0.13	0.33	0.6
Brighton	6.3	n/a	0.08	0.16	0.3	0.09	0.19	0.4	0.11	0.23	0.5	0.12	0.27	0.5	0.12	0.29	0.6	0.13	0.34	0.6
Gore	6.7	n/a	0.09	0.2	0.4	0.11	0.23	0.4	0.12	0.27	0.5	0.14	0.32	0.6	0.15	0.35	0.6	0.16	0.39	0.7
Milton	6.3	n/a	0.08	0.17	0.3	0.09	0.2	0.4	0.11	0.23	0.5	0.12	0.27	0.5	0.13	0.3	0.6	0.13	0.34	0.6
Winton	7.0	n/a	0.11	0.23	0.4	0.13	0.27	0.4	0.14	0.32	0.5	0.16	0.36	0.6	0.17	0.39	0.6	0.18	0.44	0.7
Mataura	6.7	n/a	0.09	0.2	0.4	0.11	0.23	0.4	0.12	0.27	0.5	0.14	0.32	0.6	0.15	0.35	0.6	0.16	0.39	0.7
Balclutha	6.4	n/a	0.08	0.17	0.3	0.1	0.2	0.4	0.11	0.24	0.5	0.12	0.28	0.5	0.13	0.3	0.6	0.14	0.35	0.6

TABLE 3.4(c) part 8: Site demand parameters for an annual probability of exceedance of 1/100

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Riverton	7.1	n/a	0.12	0.25	0.4	0.14	0.29	0.4	0.16	0.34	0.5	0.17	0.39	0.6	0.18	0.42	0.6	0.19	0.46	0.7
Invercargill	6.9	n/a	0.11	0.22	0.4	0.12	0.26	0.4	0.14	0.3	0.5	0.15	0.35	0.6	0.16	0.38	0.6	0.17	0.43	0.7
Bluff	6.9	n/a	0.1	0.22	0.4	0.12	0.25	0.4	0.14	0.3	0.5	0.15	0.34	0.6	0.16	0.37	0.6	0.17	0.42	0.7
Oban	6.9	n/a	0.11	0.22	0.4	0.12	0.26	0.4	0.14	0.31	0.5	0.15	0.35	0.6	0.16	0.38	0.6	0.17	0.42	0.7

TABLE 3.4(d) part 1: Site demand parameters for an annual probability of exceedance of 1/250

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Kaitaia	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Kerikeri	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Haruru	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Paihia	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Opua	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Kawakawa	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Moerewa	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Kaikohe	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Hikurangi	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Ngunguru	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Whangarei	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
One Tree Point	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Ruakaka	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Dargaville	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Waipu	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Mangawhai Heads	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Wellsford	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Warkworth	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Snells Beach	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Hibiscus Coast	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Parakai	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Helensville	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Coromandel	6.5	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Riverhead	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Kumeu-Huapai	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Waimauku	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Waiheke West	6.3	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Whitianga	6.6	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Muriwai	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Auckland	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7

TABLE 3.4(d) part 2: Site demand parameters for an annual probability of exceedance of 1/250

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Maraetai	6.3	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Beachlands-Pine Harbour	6.3	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Manukau City	6.2	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Tairua	6.8	n/a	0.09	0.19	0.4	0.11	0.22	0.5	0.12	0.26	0.6	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.8
Pauanui	6.8	n/a	0.09	0.19	0.4	0.11	0.22	0.5	0.12	0.26	0.6	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.8
Clarks Beach	6.3	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Thames	6.7	n/a	0.09	0.19	0.4	0.11	0.22	0.5	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Patumahoe	6.4	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Pukekohe	6.4	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Whangamata	6.9	n/a	0.09	0.19	0.4	0.11	0.22	0.5	0.12	0.26	0.6	0.13	0.3	0.7	0.14	0.34	0.7	0.15	0.39	0.8
Pokeno	6.5	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Waiuku	6.3	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Tuakau	6.4	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Ngatea	6.7	n/a	0.09	0.19	0.4	0.11	0.22	0.5	0.12	0.26	0.6	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.8
Paeroa	6.8	n/a	0.09	0.19	0.4	0.11	0.22	0.5	0.12	0.26	0.6	0.13	0.3	0.7	0.14	0.34	0.7	0.15	0.39	0.8
Waihi	6.9	n/a	0.09	0.19	0.5	0.11	0.22	0.5	0.12	0.26	0.6	0.13	0.31	0.7	0.14	0.34	0.8	0.15	0.39	0.8
Te Kauwhata	6.6	n/a	0.09	0.19	0.4	0.11	0.22	0.4	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Waihi Beach-Bowentown	7.0	n/a	0.09	0.19	0.5	0.11	0.23	0.5	0.12	0.28	0.6	0.14	0.33	0.7	0.14	0.37	0.7	0.15	0.42	0.8
Te Aroha	6.9	n/a	0.09	0.19	0.5	0.11	0.22	0.6	0.12	0.26	0.6	0.13	0.31	0.7	0.14	0.34	0.8	0.15	0.39	0.8
Huntly	6.6	n/a	0.09	0.19	0.4	0.11	0.22	0.5	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Katikati	7.0	n/a	0.1	0.2	0.5	0.11	0.24	0.5	0.13	0.29	0.6	0.14	0.34	0.7	0.15	0.38	0.7	0.16	0.43	0.8
Omokoroa	7.0	n/a	0.11	0.22	0.5	0.12	0.27	0.5	0.14	0.32	0.6	0.16	0.38	0.7	0.17	0.41	0.7	0.18	0.47	0.8
Mount Maunganui	7.0	n/a	0.12	0.26	0.4	0.14	0.31	0.5	0.16	0.37	0.6	0.18	0.42	0.6	0.19	0.46	0.7	0.2	0.52	0.8
Morrinsville	6.9	n/a	0.09	0.19	0.5	0.11	0.22	0.5	0.12	0.26	0.6	0.13	0.3	0.7	0.14	0.34	0.8	0.15	0.39	0.8
Ngaruawahia	6.7	n/a	0.09	0.19	0.4	0.11	0.22	0.5	0.12	0.26	0.6	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.8
Tauranga	7.0	n/a	0.12	0.26	0.4	0.14	0.31	0.5	0.16	0.37	0.6	0.18	0.42	0.6	0.19	0.46	0.7	0.2	0.52	0.8
Te Puke	7.0	n/a	0.15	0.32	0.4	0.18	0.38	0.5	0.2	0.45	0.5	0.22	0.5	0.6	0.22	0.54	0.7	0.23	0.59	0.8
Hamilton	6.8	n/a	0.09	0.19	0.4	0.11	0.22	0.5	0.12	0.26	0.6	0.13	0.3	0.7	0.14	0.34	0.7	0.15	0.39	0.8
Raglan	6.6	n/a	0.09	0.19	0.4	0.11	0.22	0.5	0.12	0.26	0.5	0.13	0.3	0.6	0.14	0.34	0.7	0.15	0.39	0.7
Matamata	7.0	n/a	0.1	0.2	0.5	0.12	0.25	0.5	0.13	0.3	0.6	0.15	0.35	0.7	0.15	0.39	0.7	0.16	0.44	0.8

TABLE 3.4(d) part 3: Site demand parameters for an annual probability of exceedance of 1/250

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Cambridge	7.0	n/a	0.09	0.19	0.5	0.11	0.22	0.6	0.12	0.27	0.6	0.13	0.31	0.7	0.14	0.35	0.8	0.15	0.4	0.8
Ruatoria	7.4	n/a	0.37	0.81	0.3	0.41	0.87	0.3	0.44	0.92	0.4	0.45	0.93	0.5	0.44	0.93	0.6	0.44	0.93	0.6
Whakatane	7.0	n/a	0.34	0.76	0.3	0.39	0.84	0.4	0.42	0.9	0.4	0.43	0.93	0.5	0.43	0.95	0.6	0.42	0.96	0.7
Edgecumbe	6.8	n/a	0.3	0.66	0.3	0.34	0.75	0.4	0.37	0.81	0.5	0.39	0.85	0.6	0.38	0.87	0.6	0.38	0.89	0.7
Ohope	7.0	n/a	0.34	0.76	0.3	0.39	0.84	0.4	0.42	0.9	0.4	0.43	0.93	0.5	0.43	0.94	0.6	0.42	0.96	0.7
Pirongia	6.9	n/a	0.09	0.19	0.5	0.11	0.22	0.5	0.12	0.26	0.6	0.13	0.3	0.7	0.14	0.34	0.8	0.15	0.39	0.8
Te Awamutu	7.0	n/a	0.09	0.19	0.5	0.11	0.22	0.6	0.12	0.26	0.6	0.13	0.31	0.7	0.14	0.35	0.8	0.15	0.4	0.8
Opotiki	7.1	n/a	0.34	0.76	0.3	0.39	0.84	0.4	0.42	0.9	0.4	0.43	0.93	0.5	0.43	0.94	0.6	0.42	0.96	0.7
Kihikihi	7.0	n/a	0.09	0.19	0.5	0.11	0.22	0.6	0.12	0.27	0.6	0.13	0.31	0.7	0.14	0.35	0.8	0.15	0.4	0.8
Putaruru	7.1	n/a	0.11	0.23	0.5	0.13	0.28	0.5	0.15	0.33	0.6	0.16	0.39	0.7	0.17	0.42	0.7	0.18	0.48	0.8
Ngongotaha	7.1	n/a	0.16	0.35	0.4	0.19	0.41	0.5	0.22	0.48	0.5	0.23	0.53	0.6	0.24	0.57	0.7	0.25	0.62	0.8
Kawerau	7.0	n/a	0.26	0.58	0.3	0.3	0.66	0.4	0.33	0.72	0.5	0.35	0.77	0.6	0.35	0.79	0.6	0.35	0.82	0.7
Rotorua	7.1	n/a	0.18	0.39	0.4	0.21	0.45	0.4	0.23	0.51	0.5	0.25	0.57	0.6	0.26	0.61	0.7	0.26	0.65	0.8
Otorohanga	7.0	n/a	0.09	0.19	0.5	0.11	0.22	0.6	0.12	0.27	0.6	0.13	0.32	0.7	0.14	0.35	0.8	0.15	0.4	0.8
Tokoroa	7.1	n/a	0.13	0.28	0.4	0.15	0.33	0.5	0.17	0.39	0.6	0.19	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Te Kuiti	7.0	n/a	0.09	0.19	0.5	0.11	0.23	0.6	0.12	0.28	0.6	0.14	0.33	0.7	0.14	0.37	0.8	0.16	0.42	0.8
Mangakino	7.1	n/a	0.13	0.29	0.4	0.16	0.34	0.5	0.18	0.4	0.6	0.2	0.46	0.6	0.2	0.49	0.7	0.21	0.54	0.8
Murupara	7.2	n/a	0.28	0.63	0.3	0.32	0.7	0.4	0.35	0.76	0.5	0.37	0.8	0.5	0.37	0.82	0.6	0.37	0.85	0.7
Gisborne	7.3	n/a	0.42	0.92	0.3	0.46	0.98	0.3	0.49	1.02	0.4	0.5	1.02	0.5	0.49	1.0	0.6	0.47	1.0	0.7
Taupo	7.1	n/a	0.22	0.47	0.3	0.25	0.54	0.4	0.27	0.6	0.5	0.29	0.65	0.6	0.3	0.68	0.6	0.3	0.72	0.7
Taumarunui	7.2	n/a	0.14	0.29	0.4	0.16	0.35	0.5	0.18	0.4	0.6	0.2	0.46	0.6	0.21	0.5	0.7	0.22	0.55	0.8
Turangi	7.1	n/a	0.27	0.59	0.3	0.31	0.66	0.4	0.33	0.72	0.5	0.35	0.77	0.5	0.35	0.8	0.6	0.36	0.83	0.7
Waitara	6.9	n/a	0.1	0.2	0.5	0.11	0.24	0.5	0.13	0.29	0.6	0.14	0.33	0.7	0.15	0.37	0.7	0.16	0.42	0.8
Wairoa	7.3	n/a	0.36	0.8	0.3	0.41	0.87	0.4	0.44	0.92	0.4	0.45	0.93	0.5	0.45	0.93	0.6	0.44	0.94	0.7
New Plymouth	6.8	n/a	0.1	0.2	0.5	0.11	0.24	0.5	0.13	0.29	0.6	0.14	0.34	0.7	0.15	0.37	0.7	0.16	0.42	0.8
Oakura (New Plymouth District)	6.8	n/a	0.1	0.2	0.5	0.12	0.25	0.5	0.13	0.29	0.6	0.14	0.34	0.7	0.15	0.38	0.7	0.16	0.42	0.8
Inglewood	7.0	n/a	0.1	0.22	0.5	0.12	0.26	0.5	0.14	0.31	0.6	0.15	0.36	0.7	0.16	0.4	0.7	0.17	0.45	0.8
Stratford	7.1	n/a	0.12	0.24	0.4	0.14	0.29	0.5	0.15	0.34	0.6	0.17	0.4	0.7	0.18	0.44	0.7	0.19	0.48	0.8
Ohakune	7.3	n/a	0.26	0.57	0.3	0.29	0.64	0.4	0.32	0.69	0.5	0.34	0.74	0.5	0.34	0.77	0.6	0.35	0.81	0.7
Raetihi	7.2	n/a	0.25	0.55	0.3	0.28	0.61	0.4	0.31	0.67	0.5	0.33	0.72	0.5	0.34	0.75	0.6	0.34	0.79	0.7

TABLE 3.4(d) part 4: Site demand parameters for an annual probability of exceedance of 1/250

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Eltham	7.1	n/a	0.12	0.25	0.4	0.14	0.3	0.5	0.16	0.36	0.6	0.18	0.41	0.7	0.19	0.45	0.7	0.2	0.5	0.8
Opunake	6.9	n/a	0.12	0.24	0.4	0.13	0.29	0.5	0.15	0.34	0.6	0.17	0.39	0.7	0.18	0.43	0.7	0.19	0.48	0.8
Waiouru	7.3	n/a	0.29	0.64	0.3	0.33	0.71	0.4	0.36	0.76	0.5	0.37	0.81	0.5	0.38	0.83	0.6	0.38	0.86	0.7
Napier	7.4	n/a	0.4	0.88	0.3	0.45	0.95	0.4	0.48	0.99	0.4	0.48	1.0	0.5	0.48	0.99	0.6	0.46	0.99	0.7
Clive	7.4	n/a	0.42	0.92	0.3	0.47	0.99	0.4	0.49	1.02	0.5	0.5	1.02	0.5	0.49	1.01	0.6	0.48	1.01	0.7
Hawera	7.2	n/a	0.13	0.27	0.4	0.15	0.33	0.5	0.17	0.38	0.6	0.19	0.44	0.7	0.2	0.48	0.7	0.21	0.53	0.8
Hastings	7.4	n/a	0.43	0.94	0.3	0.48	1.01	0.4	0.5	1.05	0.5	0.51	1.04	0.5	0.5	1.03	0.6	0.48	1.02	0.7
Taihape	7.4	n/a	0.33	0.74	0.3	0.38	0.8	0.4	0.41	0.86	0.5	0.42	0.89	0.5	0.42	0.9	0.6	0.41	0.92	0.7
Havelock North	7.5	n/a	0.44	0.96	0.3	0.49	1.03	0.4	0.51	1.06	0.5	0.51	1.06	0.5	0.51	1.04	0.6	0.49	1.03	0.7
Patea	7.2	n/a	0.17	0.35	0.4	0.19	0.41	0.5	0.22	0.47	0.5	0.23	0.52	0.6	0.24	0.56	0.7	0.25	0.61	0.8
Whanganui	7.2	n/a	0.29	0.65	0.3	0.33	0.71	0.4	0.36	0.77	0.5	0.38	0.81	0.5	0.38	0.83	0.6	0.38	0.86	0.7
Waipawa	7.5	n/a	0.49	1.07	0.3	0.54	1.14	0.4	0.56	1.16	0.5	0.56	1.14	0.6	0.54	1.11	0.6	0.52	1.09	0.8
Waipukurau	7.6	n/a	0.5	1.1	0.3	0.55	1.16	0.4	0.58	1.18	0.5	0.57	1.15	0.6	0.55	1.13	0.6	0.53	1.1	0.8
Marton	7.4	n/a	0.36	0.79	0.3	0.4	0.86	0.4	0.43	0.91	0.5	0.44	0.93	0.5	0.44	0.94	0.6	0.43	0.95	0.7
Bulls	7.4	n/a	0.38	0.84	0.3	0.43	0.91	0.4	0.46	0.96	0.5	0.46	0.97	0.6	0.46	0.98	0.6	0.45	0.98	0.7
Dannevirke	7.6	n/a	0.53	1.16	0.3	0.58	1.22	0.4	0.6	1.23	0.5	0.59	1.19	0.6	0.57	1.16	0.6	0.54	1.12	0.8
Feilding	7.5	n/a	0.42	0.91	0.3	0.46	0.98	0.4	0.49	1.02	0.5	0.5	1.03	0.6	0.49	1.02	0.6	0.47	1.02	0.8
Ashhurst	7.6	7	0.49	1.07	0.3	0.54	1.13	0.4	0.56	1.15	0.5	0.56	1.13	0.6	0.54	1.11	0.6	0.52	1.08	0.8
Woodville	7.6	6	0.53	1.16	0.3	0.58	1.22	0.4	0.6	1.23	0.5	0.59	1.19	0.6	0.57	1.16	0.6	0.54	1.12	0.8
Palmerston North	7.6	6	0.48	1.04	0.3	0.53	1.11	0.4	0.55	1.13	0.5	0.55	1.11	0.6	0.53	1.1	0.6	0.51	1.07	0.8
Pahiatua	7.6	7	0.55	1.21	0.3	0.61	1.27	0.4	0.63	1.27	0.5	0.61	1.23	0.6	0.59	1.19	0.7	0.56	1.14	0.8
Foxton Beach	7.5	n/a	0.43	0.95	0.3	0.48	1.01	0.4	0.51	1.05	0.5	0.51	1.06	0.6	0.5	1.05	0.6	0.49	1.04	0.8
Foxton	7.6	n/a	0.45	0.98	0.3	0.5	1.04	0.4	0.52	1.08	0.5	0.52	1.08	0.6	0.51	1.07	0.6	0.5	1.05	0.8
Shannon	7.6	15	0.5	1.09	0.3	0.55	1.15	0.4	0.57	1.17	0.5	0.57	1.15	0.6	0.55	1.12	0.6	0.53	1.1	0.8
Levin	7.6	18	0.5	1.09	0.3	0.55	1.15	0.4	0.57	1.17	0.5	0.57	1.15	0.6	0.55	1.13	0.7	0.53	1.1	0.8
Otaki Beach	7.6	n/a	0.5	1.1	0.3	0.55	1.17	0.4	0.58	1.18	0.5	0.57	1.16	0.6	0.55	1.13	0.7	0.53	1.1	0.8
Otaki	7.6	n/a	0.51	1.11	0.3	0.56	1.18	0.4	0.58	1.19	0.5	0.58	1.17	0.6	0.56	1.14	0.7	0.53	1.11	0.8
Waikanae	7.7	n/a	0.53	1.15	0.3	0.58	1.21	0.4	0.6	1.22	0.5	0.59	1.19	0.6	0.57	1.16	0.7	0.54	1.12	0.9
Takaka	7.3	n/a	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.54	0.5	0.27	0.59	0.6	0.27	0.63	0.6	0.28	0.68	0.7
Paraparaumu	7.7	18	0.53	1.15	0.3	0.58	1.22	0.4	0.6	1.22	0.5	0.59	1.19	0.6	0.57	1.16	0.7	0.54	1.12	0.9

TABLE 3.4(d) part 5: Site demand parameters for an annual probability of exceedance of 1/250

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Masterton	7.8	6	0.66	1.44	0.3	0.72	1.49	0.4	0.73	1.45	0.5	0.7	1.36	0.6	0.66	1.29	0.7	0.62	1.21	0.9
Paekakariki	7.7	16	0.54	1.19	0.3	0.6	1.25	0.4	0.62	1.25	0.5	0.6	1.21	0.6	0.58	1.18	0.7	0.55	1.14	0.9
Carterton	7.8	4	0.66	1.44	0.3	0.72	1.49	0.4	0.73	1.45	0.5	0.7	1.36	0.6	0.66	1.3	0.7	0.61	1.21	0.9
Greytown	7.8	4	0.64	1.4	0.3	0.7	1.45	0.4	0.71	1.42	0.5	0.68	1.34	0.6	0.65	1.28	0.7	0.61	1.21	0.9
Porirua	7.7	6	0.56	1.21	0.3	0.61	1.28	0.4	0.63	1.28	0.5	0.62	1.24	0.6	0.59	1.2	0.7	0.56	1.15	0.9
Featherston	7.8	0	0.65	1.41	0.3	0.7	1.46	0.4	0.71	1.43	0.5	0.69	1.34	0.6	0.65	1.29	0.7	0.61	1.21	0.9
Motueka	7.4	n/a	0.24	0.51	0.3	0.27	0.58	0.4	0.3	0.64	0.5	0.32	0.69	0.6	0.32	0.72	0.6	0.33	0.76	0.8
Upper Hutt	7.7	0	0.61	1.32	0.3	0.66	1.38	0.4	0.68	1.36	0.5	0.65	1.3	0.6	0.63	1.25	0.7	0.59	1.18	0.9
Lower Hutt	7.7	0	0.58	1.27	0.3	0.64	1.33	0.4	0.66	1.32	0.5	0.64	1.27	0.6	0.61	1.23	0.7	0.58	1.17	0.9
Martinborough	7.8	16	0.63	1.36	0.3	0.68	1.41	0.4	0.69	1.38	0.5	0.67	1.31	0.6	0.64	1.26	0.7	0.6	1.19	0.9
Mapua	7.4	n/a	0.26	0.57	0.3	0.3	0.64	0.4	0.33	0.7	0.5	0.34	0.75	0.6	0.35	0.78	0.6	0.35	0.81	0.8
Wainuiomata	7.7	0	0.58	1.27	0.3	0.64	1.33	0.4	0.66	1.32	0.5	0.64	1.27	0.6	0.61	1.23	0.7	0.58	1.17	0.9
Nelson	7.4	n/a	0.29	0.62	0.3	0.32	0.69	0.4	0.35	0.75	0.5	0.37	0.8	0.6	0.37	0.82	0.6	0.37	0.85	0.8
Picton	7.5	n/a	0.41	0.89	0.3	0.46	0.97	0.4	0.49	1.01	0.5	0.49	1.03	0.6	0.48	1.03	0.6	0.47	1.03	0.8
Wellington CBD	7.7	0	0.58	1.26	0.3	0.63	1.33	0.4	0.65	1.32	0.5	0.64	1.27	0.6	0.61	1.23	0.7	0.57	1.17	0.9
Wellington	7.7	0	0.58	1.26	0.3	0.63	1.33	0.4	0.65	1.32	0.5	0.64	1.27	0.6	0.61	1.23	0.7	0.57	1.17	0.9
Eastbourne	7.7	0	0.58	1.27	0.3	0.64	1.33	0.4	0.66	1.32	0.5	0.64	1.27	0.6	0.61	1.23	0.7	0.58	1.17	0.9
Richmond	7.4	n/a	0.28	0.62	0.3	0.32	0.69	0.4	0.35	0.75	0.5	0.37	0.8	0.6	0.37	0.82	0.6	0.37	0.85	0.8
Hope	7.4	n/a	0.28	0.62	0.3	0.32	0.69	0.4	0.35	0.75	0.5	0.37	0.8	0.6	0.37	0.82	0.6	0.37	0.85	0.8
Brightwater	7.4	n/a	0.28	0.61	0.3	0.32	0.69	0.4	0.35	0.75	0.5	0.37	0.79	0.6	0.37	0.82	0.6	0.37	0.85	0.8
Wakefield	7.4	n/a	0.28	0.61	0.3	0.32	0.69	0.4	0.35	0.74	0.5	0.37	0.79	0.6	0.37	0.82	0.6	0.37	0.85	0.8
Renwick	7.5	n/a	0.42	0.92	0.3	0.47	1.0	0.4	0.5	1.04	0.5	0.51	1.06	0.6	0.5	1.05	0.7	0.48	1.05	0.8
Blenheim	7.5	11	0.45	0.98	0.3	0.5	1.06	0.4	0.53	1.1	0.5	0.53	1.1	0.6	0.52	1.09	0.7	0.5	1.08	0.8
Seddon	7.5	5	0.5	1.11	0.3	0.56	1.19	0.4	0.59	1.22	0.5	0.58	1.2	0.6	0.56	1.18	0.7	0.54	1.15	0.9
Westport	7.0	n/a	0.22	0.47	0.3	0.25	0.53	0.4	0.28	0.6	0.5	0.29	0.65	0.6	0.3	0.69	0.6	0.3	0.73	0.8
St Arnaud	7.3	0	0.34	0.74	0.3	0.38	0.82	0.4	0.41	0.88	0.5	0.43	0.91	0.6	0.42	0.93	0.7	0.42	0.95	0.8
Murchison	7.1	n/a	0.29	0.63	0.3	0.33	0.71	0.4	0.36	0.77	0.5	0.38	0.82	0.6	0.38	0.85	0.6	0.38	0.88	0.8
Ward	7.5	5	0.53	1.16	0.3	0.59	1.25	0.4	0.61	1.26	0.5	0.6	1.24	0.6	0.58	1.21	0.7	0.55	1.17	0.9
Reefton	7.1	n/a	0.28	0.6	0.3	0.32	0.68	0.4	0.35	0.75	0.5	0.36	0.8	0.6	0.36	0.82	0.7	0.36	0.85	0.8
Springs Junction	7.4	2	0.38	0.83	0.3	0.43	0.93	0.4	0.46	0.98	0.5	0.47	1.01	0.6	0.46	1.01	0.8	0.44	1.01	1.0

TABLE 3.4(d) part 6: Site demand parameters for an annual probability of exceedance of 1/250

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Runanga	7.4	n/a	0.22	0.47	0.3	0.26	0.55	0.4	0.28	0.61	0.5	0.3	0.67	0.6	0.3	0.7	0.7	0.31	0.73	0.9
Kaikoura	7.5	6	0.43	0.94	0.3	0.49	1.03	0.4	0.51	1.07	0.5	0.51	1.07	0.6	0.5	1.06	0.7	0.48	1.04	0.9
Greymouth	7.4	n/a	0.23	0.49	0.3	0.27	0.57	0.4	0.3	0.64	0.5	0.31	0.69	0.6	0.31	0.72	0.7	0.31	0.75	0.9
Hanmer Springs	7.2	4	0.48	1.06	0.3	0.55	1.17	0.4	0.58	1.22	0.5	0.57	1.22	0.6	0.55	1.19	0.7	0.52	1.17	0.9
Hokitika	7.4	n/a	0.27	0.57	0.3	0.31	0.66	0.4	0.34	0.72	0.5	0.35	0.77	0.6	0.35	0.79	0.8	0.34	0.81	0.9
Cheviot	7.2	n/a	0.31	0.68	0.3	0.36	0.76	0.4	0.39	0.82	0.5	0.4	0.87	0.6	0.4	0.89	0.7	0.39	0.91	0.8
Otira	7.5	1	0.44	0.96	0.3	0.5	1.07	0.4	0.53	1.11	0.5	0.52	1.11	0.7	0.5	1.08	0.9	0.47	1.06	1.1
Arthurs Pass	7.2	13	0.37	0.82	0.3	0.43	0.92	0.4	0.46	0.98	0.5	0.47	1.0	0.6	0.45	1.0	0.8	0.44	1.0	1.0
Harihari	7.6	0	0.33	0.7	0.3	0.38	0.79	0.4	0.4	0.85	0.5	0.41	0.87	0.7	0.4	0.87	0.8	0.38	0.87	1.1
Amberley	7.0	n/a	0.22	0.48	0.3	0.26	0.55	0.4	0.29	0.62	0.5	0.3	0.68	0.6	0.31	0.72	0.7	0.31	0.76	0.8
Oxford	6.9	n/a	0.23	0.48	0.3	0.26	0.56	0.4	0.29	0.63	0.5	0.31	0.69	0.6	0.31	0.72	0.7	0.31	0.76	0.8
Rangiora	6.9	n/a	0.21	0.45	0.3	0.24	0.53	0.4	0.27	0.59	0.5	0.29	0.65	0.6	0.3	0.69	0.7	0.3	0.74	0.8
Pegasus	6.9	n/a	0.21	0.45	0.3	0.25	0.53	0.4	0.27	0.59	0.5	0.29	0.65	0.6	0.3	0.69	0.7	0.3	0.73	0.8
Woodend	6.8	n/a	0.21	0.46	0.3	0.25	0.53	0.4	0.27	0.59	0.5	0.29	0.65	0.6	0.3	0.69	0.7	0.3	0.74	0.8
Franz Josef	7.8	0	0.31	0.66	0.4	0.36	0.75	0.4	0.38	0.81	0.5	0.39	0.83	0.7	0.38	0.82	0.9	0.36	0.83	1.1
Kaiapoi	6.7	n/a	0.22	0.47	0.3	0.25	0.54	0.4	0.28	0.61	0.5	0.3	0.66	0.6	0.3	0.7	0.6	0.31	0.74	0.8
Fox Glacier	7.8	0	0.31	0.67	0.4	0.36	0.76	0.4	0.39	0.81	0.6	0.39	0.83	0.7	0.38	0.83	0.9	0.36	0.83	1.1
Darfield	6.6	n/a	0.21	0.46	0.3	0.25	0.53	0.4	0.28	0.6	0.5	0.29	0.65	0.6	0.3	0.69	0.7	0.3	0.73	0.8
West Melton	6.5	n/a	0.22	0.48	0.3	0.26	0.55	0.4	0.29	0.62	0.5	0.3	0.67	0.6	0.31	0.7	0.6	0.31	0.75	0.8
Christchurch	6.3	n/a	0.24	0.53	0.3	0.28	0.6	0.4	0.31	0.67	0.4	0.33	0.71	0.5	0.33	0.74	0.6	0.33	0.78	0.7
Prebbleton	6.4	n/a	0.23	0.5	0.3	0.26	0.57	0.4	0.29	0.63	0.4	0.31	0.68	0.5	0.31	0.71	0.6	0.31	0.75	0.7
Lyttelton	6.3	n/a	0.23	0.51	0.3	0.27	0.58	0.4	0.3	0.64	0.4	0.31	0.69	0.5	0.32	0.72	0.6	0.32	0.75	0.7
Rolleston	6.4	n/a	0.22	0.47	0.3	0.25	0.54	0.4	0.28	0.6	0.5	0.3	0.66	0.5	0.3	0.69	0.6	0.31	0.73	0.7
Methven	6.9	n/a	0.18	0.39	0.3	0.21	0.45	0.4	0.24	0.52	0.5	0.25	0.58	0.6	0.26	0.62	0.7	0.27	0.67	0.8
Diamond Harbour	6.3	n/a	0.22	0.48	0.3	0.26	0.55	0.4	0.28	0.61	0.4	0.3	0.66	0.5	0.3	0.69	0.6	0.31	0.73	0.7
Lincoln	6.4	n/a	0.21	0.47	0.3	0.25	0.54	0.4	0.28	0.6	0.4	0.29	0.65	0.5	0.3	0.68	0.6	0.3	0.73	0.7
Mt Cook Village	7.6	n/a	0.24	0.51	0.3	0.28	0.59	0.4	0.31	0.65	0.5	0.32	0.7	0.7	0.32	0.71	0.8	0.32	0.74	1.0
Rakaia	6.7	n/a	0.17	0.36	0.3	0.2	0.42	0.4	0.22	0.48	0.5	0.24	0.54	0.6	0.24	0.58	0.7	0.25	0.63	0.8
Leeston	6.5	n/a	0.17	0.37	0.3	0.2	0.43	0.4	0.23	0.49	0.5	0.24	0.55	0.6	0.25	0.59	0.6	0.26	0.64	0.8
Akaroa	6.5	n/a	0.15	0.33	0.3	0.18	0.38	0.4	0.2	0.44	0.5	0.22	0.49	0.6	0.22	0.53	0.6	0.23	0.58	0.7

TABLE 3.4(d) part 7: Site demand parameters for an annual probability of exceedance of 1/250

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Ashburton	6.7	n/a	0.15	0.32	0.4	0.18	0.38	0.4	0.2	0.44	0.5	0.22	0.49	0.6	0.22	0.53	0.7	0.23	0.59	0.8
Geraldine	6.7	n/a	0.15	0.32	0.4	0.17	0.37	0.4	0.2	0.43	0.5	0.21	0.48	0.6	0.22	0.52	0.7	0.23	0.57	0.8
Fairlie	6.9	n/a	0.16	0.34	0.4	0.19	0.4	0.4	0.21	0.46	0.5	0.23	0.51	0.6	0.23	0.55	0.7	0.24	0.6	0.8
Temuka	6.6	n/a	0.14	0.3	0.3	0.17	0.36	0.4	0.19	0.41	0.5	0.21	0.47	0.6	0.21	0.5	0.7	0.22	0.56	0.8
Pleasant Point	6.6	n/a	0.14	0.31	0.3	0.17	0.36	0.4	0.19	0.42	0.5	0.21	0.47	0.6	0.22	0.51	0.7	0.23	0.56	0.8
Twizel	7.1	n/a	0.18	0.38	0.4	0.21	0.44	0.4	0.23	0.5	0.5	0.25	0.56	0.6	0.26	0.59	0.7	0.26	0.64	0.9
Timaru	6.5	n/a	0.14	0.3	0.3	0.16	0.35	0.4	0.19	0.4	0.5	0.2	0.46	0.6	0.21	0.5	0.7	0.22	0.55	0.8
Lake Hawea	7.4	n/a	0.22	0.47	0.4	0.26	0.55	0.4	0.29	0.61	0.5	0.3	0.66	0.6	0.31	0.7	0.7	0.31	0.74	0.9
Milford Sound	7.6	16	0.59	1.3	0.3	0.65	1.38	0.4	0.67	1.37	0.5	0.66	1.31	0.6	0.63	1.26	0.7	0.58	1.18	1.0
Wanaka	7.4	n/a	0.23	0.49	0.4	0.27	0.56	0.4	0.3	0.63	0.5	0.31	0.68	0.6	0.32	0.71	0.7	0.32	0.75	0.8
Waimate	6.4	n/a	0.14	0.29	0.3	0.16	0.34	0.4	0.18	0.4	0.5	0.2	0.45	0.6	0.21	0.48	0.7	0.22	0.54	0.8
Arrowtown	7.4	n/a	0.23	0.5	0.3	0.27	0.57	0.4	0.3	0.63	0.5	0.32	0.68	0.6	0.32	0.72	0.7	0.32	0.76	0.8
Arthurs Point	7.4	n/a	0.25	0.53	0.3	0.28	0.6	0.4	0.31	0.66	0.5	0.33	0.71	0.6	0.33	0.74	0.7	0.34	0.78	0.8
Lake Hayes	7.4	n/a	0.23	0.49	0.3	0.27	0.56	0.4	0.29	0.62	0.5	0.31	0.68	0.6	0.32	0.71	0.7	0.32	0.75	0.8
Queenstown	7.4	n/a	0.24	0.5	0.3	0.27	0.57	0.4	0.3	0.63	0.5	0.32	0.69	0.6	0.32	0.72	0.7	0.33	0.76	0.8
Cromwell	7.2	n/a	0.19	0.41	0.4	0.22	0.47	0.4	0.25	0.54	0.5	0.27	0.59	0.6	0.27	0.63	0.7	0.28	0.68	0.8
Oamaru	6.3	n/a	0.13	0.29	0.3	0.16	0.33	0.4	0.18	0.39	0.5	0.19	0.44	0.6	0.2	0.47	0.6	0.21	0.52	0.7
Clyde	7.0	n/a	0.18	0.37	0.4	0.21	0.43	0.4	0.23	0.49	0.5	0.25	0.55	0.6	0.25	0.59	0.7	0.26	0.64	0.8
Alexandra	7.0	n/a	0.17	0.36	0.4	0.2	0.42	0.4	0.22	0.48	0.5	0.24	0.54	0.6	0.25	0.58	0.7	0.26	0.63	0.8
Te Anau	7.6	n/a	0.33	0.71	0.3	0.37	0.78	0.4	0.4	0.84	0.5	0.41	0.87	0.6	0.41	0.89	0.7	0.41	0.91	0.8
Palmerston	6.3	n/a	0.13	0.28	0.3	0.15	0.33	0.4	0.18	0.38	0.5	0.19	0.43	0.5	0.2	0.47	0.6	0.21	0.52	0.7
Waikouaiti	6.3	n/a	0.13	0.28	0.3	0.15	0.33	0.4	0.17	0.38	0.5	0.19	0.43	0.5	0.2	0.46	0.6	0.21	0.51	0.7
Mosgiel	6.4	n/a	0.13	0.29	0.3	0.15	0.33	0.4	0.18	0.39	0.5	0.19	0.44	0.5	0.2	0.47	0.6	0.21	0.52	0.7
Dunedin	6.3	n/a	0.13	0.28	0.3	0.15	0.33	0.4	0.17	0.38	0.5	0.19	0.43	0.5	0.2	0.46	0.6	0.21	0.51	0.7
Brighton	6.3	n/a	0.13	0.28	0.3	0.15	0.33	0.4	0.18	0.38	0.5	0.19	0.43	0.5	0.2	0.47	0.6	0.21	0.52	0.7
Gore	6.7	n/a	0.15	0.33	0.4	0.18	0.38	0.4	0.2	0.44	0.5	0.22	0.49	0.6	0.23	0.53	0.7	0.24	0.58	0.8
Milton	6.4	n/a	0.14	0.29	0.3	0.16	0.34	0.4	0.18	0.39	0.5	0.2	0.44	0.6	0.2	0.48	0.6	0.21	0.53	0.7
Winton	7.0	n/a	0.18	0.38	0.4	0.21	0.44	0.4	0.23	0.5	0.5	0.25	0.56	0.6	0.26	0.6	0.7	0.27	0.65	0.8
Mataura	6.7	n/a	0.15	0.33	0.4	0.18	0.38	0.4	0.2	0.44	0.5	0.22	0.49	0.6	0.23	0.53	0.7	0.24	0.58	0.8
Balclutha	6.4	n/a	0.14	0.29	0.3	0.16	0.34	0.4	0.18	0.39	0.5	0.2	0.45	0.6	0.21	0.48	0.6	0.21	0.53	0.7

TABLE 3.4(d) part 8: Site demand parameters for an annual probability of exceedance of 1/250

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Riverton	7.2	n/a	0.2	0.42	0.4	0.23	0.48	0.4	0.25	0.54	0.5	0.27	0.6	0.6	0.28	0.64	0.7	0.29	0.68	0.8
Invercargill	7.0	n/a	0.17	0.37	0.4	0.2	0.43	0.4	0.22	0.48	0.5	0.24	0.54	0.6	0.25	0.58	0.7	0.26	0.63	0.8
Bluff	7.0	n/a	0.17	0.36	0.4	0.2	0.42	0.4	0.22	0.48	0.5	0.24	0.53	0.6	0.25	0.57	0.7	0.26	0.62	0.8
Oban	7.0	n/a	0.18	0.38	0.3	0.21	0.44	0.4	0.23	0.5	0.5	0.25	0.55	0.6	0.26	0.58	0.7	0.27	0.63	0.8

TABLE 3.4(e) part 1: Site demand parameters for an annual probability of exceedance of 1/500

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Kaitaia	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Kerikeri	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Haruru	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Paihia	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Opua	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Kawakawa	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Moerewa	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Kaikohe	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Hikurangi	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Ngunguru	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Whangarei	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
One Tree Point	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Ruakaka	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Dargaville	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Waipu	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Mangawhai Heads	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Wellsford	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Warkworth	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Snells Beach	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Hibiscus Coast	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Parakai	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Helensville	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Coromandel	6.5	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Riverhead	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Kumeu-Huapai	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Waimauku	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Waiheke West	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Whitianga	6.6	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Muriwai	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Auckland	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8

TABLE 3.4(e) part 2: Site demand parameters for an annual probability of exceedance of 1/500

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Maraetai	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Beachlands-Pine Harbour	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Manukau City	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Tairua	6.8	>20	0.13	0.29	0.4	0.16	0.33	0.5	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Pauanui	6.8	>20	0.13	0.29	0.4	0.16	0.33	0.5	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Clarks Beach	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Thames	6.7	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Patumahoe	6.4	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Pukekohe	6.4	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Whangamata	6.9	>20	0.13	0.29	0.4	0.16	0.33	0.5	0.18	0.38	0.6	0.2	0.44	0.7	0.2	0.48	0.7	0.21	0.53	0.8
Pokeno	6.5	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Waiuku	6.3	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Tuakau	6.4	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Ngatea	6.7	>20	0.13	0.29	0.4	0.16	0.33	0.5	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Paeroa	6.9	>20	0.13	0.29	0.4	0.16	0.33	0.5	0.18	0.38	0.6	0.2	0.44	0.7	0.2	0.48	0.7	0.21	0.53	0.8
Waihi	7.0	>20	0.13	0.29	0.4	0.16	0.33	0.5	0.18	0.38	0.6	0.2	0.44	0.7	0.2	0.48	0.8	0.21	0.53	0.9
Te Kauwhata	6.6	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Waihi Beach-Bowentown	7.0	>20	0.13	0.29	0.4	0.16	0.33	0.5	0.18	0.39	0.6	0.2	0.45	0.7	0.2	0.5	0.8	0.21	0.56	0.9
Te Aroha	7.0	>20	0.13	0.29	0.4	0.16	0.33	0.5	0.18	0.38	0.6	0.2	0.44	0.7	0.2	0.48	0.8	0.21	0.53	0.9
Huntly	6.6	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Katikati	7.1	>20	0.14	0.29	0.5	0.16	0.34	0.5	0.18	0.41	0.6	0.2	0.47	0.7	0.21	0.51	0.8	0.22	0.57	0.9
Omokoroa	7.1	>20	0.15	0.32	0.4	0.18	0.38	0.5	0.2	0.45	0.6	0.22	0.52	0.7	0.23	0.56	0.8	0.24	0.62	0.9
Mount Maunganui	7.1	>20	0.17	0.37	0.4	0.2	0.44	0.5	0.23	0.51	0.6	0.25	0.58	0.7	0.25	0.62	0.7	0.26	0.68	0.8
Morrinsville	6.9	>20	0.13	0.29	0.4	0.16	0.33	0.5	0.18	0.38	0.6	0.2	0.44	0.7	0.2	0.48	0.8	0.21	0.53	0.9
Ngaruawahia	6.7	>20	0.13	0.29	0.4	0.16	0.33	0.5	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Tauranga	7.1	>20	0.17	0.37	0.4	0.2	0.44	0.5	0.23	0.51	0.6	0.25	0.58	0.7	0.25	0.62	0.7	0.26	0.68	0.8
Te Puke	7.1	>20	0.21	0.46	0.4	0.25	0.54	0.5	0.28	0.62	0.5	0.3	0.68	0.6	0.3	0.72	0.7	0.31	0.77	0.8
Hamilton	6.8	>20	0.13	0.29	0.4	0.16	0.33	0.5	0.18	0.38	0.6	0.2	0.44	0.7	0.2	0.48	0.7	0.21	0.53	0.8
Raglan	6.6	>20	0.13	0.29	0.4	0.16	0.33	0.4	0.18	0.38	0.5	0.2	0.44	0.6	0.2	0.48	0.7	0.21	0.53	0.8
Matamata	7.1	>20	0.14	0.3	0.5	0.17	0.36	0.5	0.19	0.42	0.6	0.21	0.49	0.7	0.22	0.53	0.8	0.23	0.59	0.9

TABLE 3.4(e) part 3: Site demand parameters for an annual probability of exceedance of 1/500

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Cambridge	7.0	>20	0.13	0.29	0.4	0.16	0.33	0.5	0.18	0.38	0.6	0.2	0.44	0.7	0.2	0.48	0.8	0.21	0.54	0.9
Ruatoria	7.6	>20	0.56	1.24	0.3	0.61	1.29	0.3	0.63	1.3	0.4	0.62	1.26	0.5	0.6	1.22	0.6	0.58	1.19	0.7
Whakatane	7.1	>20	0.48	1.07	0.3	0.54	1.18	0.4	0.57	1.22	0.5	0.57	1.23	0.6	0.56	1.23	0.7	0.54	1.21	0.8
Edgecumbe	7.0	>20	0.43	0.95	0.3	0.48	1.06	0.4	0.52	1.11	0.5	0.52	1.13	0.6	0.51	1.13	0.7	0.49	1.13	0.9
Ohope	7.2	>20	0.48	1.08	0.3	0.54	1.17	0.4	0.57	1.22	0.5	0.57	1.22	0.6	0.56	1.22	0.6	0.54	1.21	0.8
Pirongia	6.9	>20	0.13	0.29	0.4	0.16	0.33	0.5	0.18	0.38	0.6	0.2	0.44	0.7	0.2	0.48	0.7	0.21	0.53	0.8
Te Awamutu	7.0	>20	0.13	0.29	0.4	0.16	0.33	0.5	0.18	0.38	0.6	0.2	0.44	0.7	0.2	0.48	0.8	0.21	0.53	0.9
Opotiki	7.2	>20	0.48	1.08	0.3	0.54	1.17	0.4	0.57	1.21	0.5	0.57	1.22	0.6	0.56	1.21	0.6	0.54	1.2	0.8
Kihikihi	7.0	>20	0.13	0.29	0.4	0.16	0.33	0.5	0.18	0.38	0.6	0.2	0.44	0.7	0.2	0.48	0.8	0.21	0.54	0.9
Putaruru	7.2	>20	0.16	0.34	0.4	0.19	0.4	0.5	0.21	0.47	0.6	0.23	0.53	0.7	0.24	0.58	0.8	0.25	0.64	0.9
Ngongotaha	7.2	>20	0.24	0.51	0.4	0.27	0.6	0.5	0.3	0.67	0.5	0.32	0.73	0.6	0.32	0.77	0.7	0.33	0.81	0.8
Kawerau	7.1	>20	0.39	0.86	0.3	0.44	0.96	0.4	0.47	1.02	0.5	0.48	1.05	0.6	0.47	1.05	0.7	0.46	1.06	0.9
Rotorua	7.2	>20	0.26	0.57	0.4	0.3	0.66	0.4	0.33	0.73	0.5	0.35	0.78	0.6	0.35	0.81	0.7	0.35	0.85	0.9
Otorohanga	7.0	>20	0.13	0.29	0.4	0.16	0.33	0.5	0.18	0.38	0.6	0.2	0.44	0.7	0.2	0.48	0.8	0.21	0.54	0.9
Tokoroa	7.2	>20	0.19	0.4	0.4	0.22	0.47	0.5	0.24	0.55	0.6	0.26	0.61	0.7	0.27	0.65	0.7	0.28	0.71	0.8
Te Kuiti	7.1	>20	0.13	0.29	0.5	0.16	0.33	0.5	0.18	0.39	0.6	0.2	0.46	0.7	0.2	0.5	0.8	0.21	0.56	0.9
Mangakino	7.2	>20	0.2	0.42	0.4	0.23	0.49	0.5	0.25	0.56	0.6	0.27	0.62	0.7	0.28	0.66	0.7	0.29	0.72	0.8
Murupara	7.4	>20	0.41	0.9	0.3	0.46	0.98	0.4	0.49	1.04	0.5	0.49	1.06	0.6	0.49	1.07	0.6	0.48	1.08	0.8
Gisborne	7.5	>20	0.63	1.4	0.3	0.69	1.45	0.4	0.7	1.44	0.5	0.68	1.38	0.6	0.66	1.32	0.6	0.62	1.27	0.8
Taupo	7.2	>20	0.32	0.7	0.3	0.36	0.78	0.4	0.39	0.84	0.5	0.4	0.89	0.6	0.4	0.91	0.7	0.4	0.93	0.8
Taumarunui	7.2	>20	0.2	0.43	0.4	0.23	0.49	0.5	0.26	0.56	0.6	0.27	0.63	0.6	0.28	0.67	0.7	0.29	0.72	0.8
Turangi	7.2	>20	0.38	0.85	0.3	0.43	0.94	0.4	0.46	0.99	0.5	0.47	1.03	0.6	0.47	1.04	0.6	0.46	1.06	0.8
Waitara	6.9	>20	0.14	0.29	0.5	0.16	0.35	0.5	0.18	0.41	0.6	0.2	0.47	0.7	0.21	0.51	0.8	0.22	0.57	0.9
Wairoa	7.5	>20	0.54	1.21	0.3	0.6	1.27	0.4	0.62	1.28	0.5	0.61	1.26	0.6	0.6	1.23	0.6	0.57	1.2	0.8
New Plymouth	6.9	>20	0.14	0.3	0.4	0.16	0.36	0.5	0.19	0.42	0.6	0.2	0.48	0.7	0.21	0.52	0.8	0.22	0.57	0.9
Oakura (New Plymouth District)	6.8	>20	0.14	0.31	0.4	0.17	0.37	0.5	0.19	0.43	0.6	0.21	0.49	0.7	0.22	0.53	0.8	0.23	0.58	0.9
Inglewood	7.0	>20	0.15	0.33	0.4	0.18	0.39	0.5	0.2	0.45	0.6	0.22	0.51	0.7	0.23	0.56	0.8	0.24	0.61	0.9
Stratford	7.1	>20	0.17	0.36	0.4	0.2	0.42	0.5	0.22	0.49	0.6	0.24	0.55	0.7	0.25	0.59	0.8	0.26	0.65	0.9
Ohakune	7.4	>20	0.37	0.82	0.3	0.41	0.89	0.4	0.44	0.95	0.5	0.46	0.99	0.6	0.46	1.0	0.6	0.45	1.03	0.7
Raetihi	7.3	>20	0.35	0.79	0.3	0.4	0.86	0.4	0.43	0.92	0.5	0.44	0.96	0.6	0.44	0.98	0.6	0.44	1.01	0.7

TABLE 3.4(e) part 4: Site demand parameters for an annual probability of exceedance of 1/500

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Eltham	7.2	>20	0.17	0.37	0.4	0.2	0.44	0.5	0.23	0.5	0.6	0.25	0.57	0.7	0.25	0.61	0.7	0.26	0.67	0.9
Opunake	7.0	>20	0.18	0.37	0.4	0.21	0.44	0.5	0.23	0.51	0.6	0.25	0.57	0.7	0.25	0.6	0.8	0.26	0.65	0.9
Waiouru	7.4	>20	0.41	0.92	0.3	0.46	0.99	0.4	0.49	1.05	0.5	0.5	1.07	0.6	0.5	1.08	0.6	0.49	1.09	0.8
Napier	7.6	>20	0.61	1.35	0.3	0.66	1.4	0.4	0.68	1.39	0.5	0.66	1.34	0.6	0.64	1.3	0.7	0.61	1.26	0.8
Clive	7.6	>20	0.64	1.41	0.3	0.69	1.46	0.4	0.71	1.44	0.5	0.69	1.38	0.6	0.66	1.33	0.7	0.62	1.28	0.9
Hawera	7.3	>20	0.19	0.4	0.4	0.22	0.47	0.5	0.24	0.54	0.6	0.26	0.6	0.7	0.27	0.64	0.7	0.28	0.69	0.9
Hastings	7.6	>20	0.65	1.44	0.3	0.71	1.49	0.4	0.72	1.47	0.5	0.7	1.41	0.6	0.67	1.35	0.7	0.63	1.3	0.9
Taihape	7.5	>20	0.48	1.07	0.3	0.53	1.14	0.4	0.56	1.18	0.5	0.56	1.18	0.6	0.55	1.17	0.6	0.54	1.17	0.8
Havelock North	7.6	>20	0.66	1.46	0.3	0.72	1.51	0.4	0.73	1.49	0.5	0.71	1.42	0.6	0.68	1.37	0.7	0.64	1.31	0.9
Patea	7.3	>20	0.24	0.53	0.4	0.28	0.6	0.5	0.31	0.66	0.5	0.32	0.72	0.6	0.33	0.76	0.7	0.33	0.8	0.8
Whanganui	7.3	>20	0.42	0.93	0.3	0.47	1.0	0.4	0.5	1.05	0.5	0.5	1.08	0.6	0.5	1.08	0.6	0.49	1.1	0.8
Waipawa	7.7	>20	0.74	1.63	0.3	0.79	1.67	0.4	0.8	1.62	0.5	0.77	1.52	0.6	0.73	1.45	0.7	0.68	1.37	0.9
Waipukurau	7.7	>20	0.76	1.68	0.3	0.82	1.72	0.4	0.82	1.65	0.5	0.78	1.55	0.6	0.74	1.47	0.7	0.69	1.39	0.9
Marton	7.5	>20	0.51	1.14	0.3	0.57	1.22	0.4	0.59	1.24	0.5	0.59	1.24	0.6	0.58	1.22	0.6	0.56	1.21	0.8
Bulls	7.5	>20	0.55	1.23	0.3	0.61	1.3	0.4	0.63	1.31	0.5	0.63	1.29	0.6	0.61	1.27	0.7	0.58	1.24	0.8
Dannevirke	7.8	>20	0.79	1.75	0.3	0.85	1.78	0.4	0.85	1.71	0.5	0.81	1.59	0.6	0.76	1.51	0.7	0.71	1.41	1.0
Feilding	7.6	>20	0.61	1.36	0.3	0.67	1.42	0.4	0.69	1.41	0.5	0.67	1.37	0.6	0.65	1.33	0.7	0.62	1.29	0.9
Ashhurst	7.7	7	0.73	1.61	0.3	0.78	1.65	0.4	0.79	1.61	0.5	0.76	1.51	0.6	0.72	1.45	0.7	0.67	1.37	1.0
Woodville	7.7	6	0.79	1.76	0.3	0.85	1.79	0.4	0.85	1.72	0.5	0.81	1.6	0.6	0.77	1.51	0.8	0.71	1.42	1.0
Palmerston North	7.7	6	0.7	1.55	0.3	0.76	1.6	0.4	0.77	1.57	0.5	0.74	1.49	0.6	0.71	1.43	0.7	0.66	1.36	1.0
Pahiatua	7.7	7	0.82	1.82	0.3	0.88	1.85	0.4	0.88	1.77	0.5	0.83	1.64	0.6	0.79	1.55	0.8	0.72	1.44	1.0
Foxton Beach	7.6	>20	0.63	1.39	0.3	0.68	1.45	0.4	0.7	1.45	0.5	0.69	1.4	0.6	0.66	1.36	0.7	0.63	1.31	0.9
Foxton	7.7	>20	0.65	1.44	0.3	0.71	1.5	0.4	0.72	1.49	0.5	0.71	1.43	0.6	0.68	1.38	0.7	0.64	1.33	0.9
Shannon	7.7	15	0.73	1.63	0.3	0.79	1.67	0.4	0.8	1.63	0.5	0.77	1.53	0.6	0.73	1.46	0.7	0.68	1.38	1.0
Levin	7.7	18	0.73	1.63	0.3	0.79	1.67	0.4	0.8	1.63	0.5	0.77	1.53	0.6	0.73	1.47	0.7	0.68	1.39	1.0
Otaki Beach	7.7	>20	0.74	1.64	0.3	0.8	1.69	0.4	0.81	1.64	0.5	0.77	1.54	0.6	0.74	1.47	0.7	0.69	1.39	1.0
Otaki	7.7	>20	0.75	1.66	0.3	0.81	1.7	0.4	0.82	1.65	0.5	0.78	1.55	0.6	0.74	1.48	0.8	0.69	1.4	1.0
Waikanae	7.8	>20	0.78	1.72	0.3	0.83	1.76	0.4	0.84	1.69	0.5	0.8	1.59	0.6	0.76	1.51	0.8	0.7	1.42	1.0
Takaka	7.4	>20	0.27	0.6	0.3	0.31	0.68	0.4	0.34	0.74	0.5	0.36	0.8	0.6	0.37	0.83	0.7	0.37	0.87	0.8
Paraparaumu	7.8	18	0.78	1.73	0.3	0.84	1.76	0.4	0.84	1.7	0.5	0.8	1.59	0.6	0.76	1.51	0.8	0.71	1.42	1.0

TABLE 3.4(e) part 5: Site demand parameters for an annual probability of exceedance of 1/500

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Masterton	7.9	6	1.0	2.21	0.3	1.05	2.19	0.4	1.03	2.03	0.5	0.95	1.82	0.6	0.89	1.68	0.8	0.8	1.53	1.1
Paekakariki	7.8	16	0.8	1.78	0.3	0.86	1.81	0.4	0.86	1.74	0.5	0.82	1.62	0.6	0.78	1.54	0.8	0.72	1.44	1.0
Carterton	7.9	4	1.0	2.2	0.3	1.04	2.18	0.4	1.02	2.03	0.5	0.95	1.82	0.7	0.88	1.69	0.8	0.8	1.54	1.1
Greytown	7.9	4	0.96	2.12	0.3	1.01	2.12	0.4	1.0	1.98	0.5	0.93	1.79	0.6	0.87	1.67	0.8	0.79	1.53	1.1
Porirua	7.8	6	0.82	1.82	0.3	0.88	1.86	0.4	0.88	1.78	0.5	0.84	1.66	0.6	0.79	1.56	0.8	0.73	1.46	1.1
Featherston	7.9	0	0.97	2.14	0.3	1.02	2.14	0.4	1.01	2.0	0.5	0.94	1.81	0.7	0.87	1.68	0.8	0.79	1.54	1.1
Motueka	7.4	>20	0.34	0.74	0.3	0.38	0.82	0.4	0.41	0.88	0.5	0.42	0.92	0.6	0.43	0.95	0.7	0.42	0.98	0.8
Upper Hutt	7.8	0	0.9	1.98	0.3	0.95	2.01	0.4	0.95	1.9	0.5	0.89	1.74	0.7	0.83	1.63	0.8	0.76	1.51	1.1
Lower Hutt	7.8	0	0.86	1.9	0.3	0.92	1.93	0.4	0.92	1.85	0.5	0.87	1.7	0.7	0.81	1.6	0.8	0.74	1.49	1.1
Martinborough	7.9	16	0.94	2.07	0.3	0.99	2.06	0.4	0.98	1.93	0.5	0.91	1.75	0.6	0.85	1.63	0.8	0.78	1.5	1.1
Mapua	7.4	>20	0.38	0.82	0.3	0.42	0.91	0.4	0.45	0.96	0.5	0.46	1.0	0.6	0.46	1.02	0.7	0.46	1.04	0.9
Wainuiomata	7.8	0	0.86	1.9	0.3	0.92	1.93	0.4	0.92	1.85	0.5	0.87	1.7	0.7	0.81	1.6	0.8	0.74	1.49	1.1
Nelson	7.5	>20	0.41	0.89	0.3	0.46	0.98	0.4	0.49	1.03	0.5	0.5	1.06	0.6	0.49	1.08	0.7	0.48	1.09	0.9
Picton	7.6	>20	0.58	1.28	0.3	0.64	1.36	0.4	0.66	1.38	0.5	0.65	1.35	0.6	0.63	1.33	0.7	0.6	1.29	0.9
Wellington CBD	7.8	0	0.85	1.88	0.3	0.91	1.93	0.4	0.91	1.84	0.5	0.86	1.71	0.7	0.81	1.6	0.8	0.74	1.49	1.1
Wellington	7.8	0	0.85	1.88	0.3	0.91	1.93	0.4	0.91	1.84	0.5	0.86	1.71	0.7	0.81	1.6	0.8	0.74	1.49	1.1
Eastbourne	7.8	0	0.86	1.9	0.3	0.92	1.93	0.4	0.92	1.85	0.5	0.87	1.7	0.7	0.81	1.6	0.8	0.74	1.49	1.1
Richmond	7.5	>20	0.41	0.89	0.3	0.46	0.98	0.4	0.49	1.03	0.5	0.5	1.06	0.6	0.49	1.08	0.7	0.48	1.09	0.9
Hope	7.5	>20	0.41	0.89	0.3	0.46	0.98	0.4	0.49	1.03	0.5	0.5	1.06	0.6	0.49	1.08	0.7	0.48	1.09	0.9
Brightwater	7.5	>20	0.4	0.88	0.3	0.45	0.97	0.4	0.48	1.02	0.5	0.49	1.06	0.6	0.49	1.07	0.7	0.48	1.08	0.9
Wakefield	7.5	>20	0.4	0.88	0.3	0.45	0.97	0.4	0.48	1.02	0.5	0.49	1.05	0.6	0.49	1.07	0.7	0.48	1.08	0.9
Renwick	7.6	>20	0.61	1.35	0.3	0.67	1.43	0.4	0.7	1.44	0.5	0.68	1.41	0.6	0.65	1.37	0.8	0.62	1.32	1.0
Blenheim	7.7	11	0.65	1.43	0.3	0.71	1.51	0.4	0.73	1.5	0.5	0.71	1.46	0.6	0.68	1.42	0.8	0.64	1.36	1.0
Seddon	7.6	5	0.72	1.6	0.3	0.79	1.68	0.4	0.81	1.66	0.5	0.78	1.58	0.6	0.74	1.52	0.8	0.69	1.45	1.0
Westport	7.0	>20	0.3	0.66	0.3	0.35	0.75	0.4	0.38	0.82	0.5	0.4	0.87	0.6	0.4	0.9	0.7	0.39	0.93	0.9
St Arnaud	7.5	0	0.48	1.06	0.3	0.54	1.16	0.4	0.57	1.2	0.5	0.57	1.22	0.6	0.56	1.21	0.8	0.53	1.2	1.0
Murchison	7.2	>20	0.4	0.88	0.3	0.45	0.98	0.4	0.49	1.04	0.5	0.5	1.08	0.6	0.49	1.1	0.7	0.48	1.11	0.9
Ward	7.7	5	0.77	1.7	0.3	0.84	1.78	0.4	0.85	1.73	0.5	0.81	1.64	0.7	0.76	1.56	0.8	0.71	1.47	1.1
Reefton	7.2	>20	0.39	0.84	0.3	0.44	0.95	0.4	0.47	1.02	0.5	0.48	1.06	0.6	0.48	1.07	0.8	0.46	1.09	1.0
Springs Junction	7.6	2	0.57	1.24	0.4	0.64	1.37	0.4	0.67	1.41	0.6	0.65	1.4	0.8	0.62	1.35	0.9	0.58	1.33	1.2

TABLE 3.4(e) part 6: Site demand parameters for an annual probability of exceedance of 1/500

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Runanga	7.5	>20	0.32	0.68	0.4	0.37	0.78	0.4	0.4	0.86	0.6	0.41	0.91	0.7	0.41	0.93	0.8	0.4	0.96	1.0
Kaikoura	7.6	6	0.64	1.41	0.3	0.71	1.5	0.4	0.73	1.5	0.5	0.7	1.44	0.7	0.67	1.39	0.8	0.62	1.33	1.1
Greymouth	7.5	>20	0.33	0.71	0.4	0.38	0.82	0.5	0.42	0.89	0.6	0.43	0.95	0.7	0.42	0.96	0.8	0.41	0.99	1.0
Hanmer Springs	7.4	4	0.69	1.52	0.3	0.77	1.65	0.4	0.79	1.67	0.6	0.76	1.62	0.7	0.72	1.55	0.9	0.66	1.5	1.2
Hokitika	7.6	>20	0.39	0.85	0.4	0.45	0.96	0.5	0.49	1.03	0.6	0.49	1.07	0.7	0.47	1.06	0.9	0.46	1.08	1.1
Cheviot	7.3	>20	0.44	0.97	0.3	0.5	1.07	0.4	0.53	1.13	0.5	0.53	1.15	0.6	0.52	1.15	0.7	0.5	1.15	0.9
Otira	7.7	1	0.68	1.49	0.4	0.77	1.65	0.5	0.79	1.67	0.6	0.75	1.59	0.8	0.7	1.52	1.0	0.63	1.46	1.4
Arthurs Pass	7.3	13	0.53	1.16	0.3	0.6	1.29	0.4	0.63	1.35	0.6	0.62	1.35	0.7	0.6	1.31	0.9	0.56	1.3	1.1
Harihari	7.9	0	0.56	1.2	0.4	0.63	1.34	0.5	0.66	1.39	0.6	0.63	1.35	0.9	0.59	1.3	1.1	0.54	1.25	1.5
Amberley	7.1	>20	0.31	0.67	0.4	0.36	0.77	0.4	0.39	0.85	0.5	0.41	0.91	0.6	0.4	0.93	0.8	0.4	0.97	0.9
Oxford	7.0	>20	0.32	0.68	0.3	0.36	0.78	0.4	0.4	0.86	0.5	0.41	0.92	0.7	0.41	0.94	0.8	0.4	0.98	1.0
Rangiora	7.0	>20	0.29	0.63	0.3	0.34	0.73	0.4	0.37	0.8	0.5	0.39	0.87	0.6	0.39	0.9	0.7	0.39	0.94	0.9
Pegasus	7.0	>20	0.29	0.64	0.3	0.34	0.73	0.4	0.37	0.8	0.5	0.39	0.86	0.6	0.39	0.9	0.7	0.39	0.94	0.9
Woodend	6.9	>20	0.29	0.64	0.3	0.34	0.73	0.4	0.37	0.81	0.5	0.39	0.87	0.6	0.39	0.9	0.7	0.39	0.94	0.9
Franz Josef	8.1	0	0.6	1.27	0.4	0.67	1.42	0.5	0.69	1.46	0.7	0.65	1.4	0.9	0.61	1.35	1.2	0.55	1.27	1.6
Kaiapoi	6.8	>20	0.3	0.66	0.3	0.35	0.75	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.91	0.7	0.39	0.94	0.9
Fox Glacier	8.1	0	0.61	1.3	0.4	0.69	1.45	0.5	0.71	1.49	0.7	0.67	1.43	0.9	0.62	1.37	1.2	0.55	1.28	1.6
Darfield	6.7	>20	0.3	0.65	0.3	0.34	0.74	0.4	0.37	0.81	0.5	0.39	0.87	0.6	0.39	0.9	0.7	0.39	0.94	0.9
West Melton	6.5	>20	0.31	0.67	0.3	0.35	0.76	0.4	0.39	0.83	0.5	0.4	0.89	0.6	0.4	0.91	0.7	0.4	0.94	0.9
Christchurch	6.3	>20	0.33	0.74	0.3	0.39	0.83	0.4	0.42	0.9	0.5	0.43	0.94	0.6	0.43	0.96	0.7	0.42	0.98	0.8
Prebbleton	6.4	>20	0.31	0.69	0.3	0.36	0.78	0.4	0.39	0.85	0.5	0.41	0.9	0.6	0.4	0.92	0.7	0.4	0.95	0.8
Lyttelton	6.3	>20	0.32	0.71	0.3	0.37	0.8	0.4	0.4	0.87	0.5	0.42	0.91	0.6	0.41	0.93	0.6	0.41	0.96	0.8
Rolleston	6.4	>20	0.3	0.66	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.87	0.6	0.39	0.9	0.7	0.39	0.93	0.8
Methven	6.9	>20	0.25	0.54	0.4	0.29	0.63	0.4	0.32	0.71	0.5	0.34	0.77	0.7	0.34	0.81	0.8	0.35	0.86	0.9
Diamond Harbour	6.3	>20	0.31	0.68	0.3	0.35	0.76	0.4	0.39	0.83	0.5	0.4	0.88	0.6	0.4	0.9	0.6	0.39	0.93	0.8
Lincoln	6.4	>20	0.3	0.65	0.3	0.34	0.74	0.4	0.37	0.81	0.5	0.39	0.86	0.6	0.39	0.89	0.7	0.39	0.92	0.8
Mt Cook Village	7.9	>20	0.39	0.83	0.4	0.44	0.94	0.5	0.48	1.0	0.6	0.48	1.02	0.8	0.46	1.01	0.9	0.44	1.02	1.2
Rakaia	6.7	>20	0.23	0.5	0.3	0.27	0.57	0.4	0.3	0.65	0.5	0.31	0.71	0.6	0.32	0.75	0.7	0.32	0.81	0.9
Leeston	6.6	>20	0.24	0.51	0.3	0.27	0.59	0.4	0.31	0.66	0.5	0.32	0.73	0.6	0.33	0.77	0.7	0.33	0.82	0.9
Akaroa	6.5	>20	0.21	0.46	0.3	0.24	0.53	0.4	0.27	0.6	0.5	0.29	0.66	0.6	0.3	0.7	0.7	0.3	0.75	0.8

TABLE 3.4(e) part 7: Site demand parameters for an annual probability of exceedance of 1/500

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Ashburton	6.7	>20	0.21	0.45	0.4	0.24	0.52	0.4	0.27	0.59	0.5	0.29	0.66	0.7	0.3	0.7	0.7	0.3	0.76	0.9
Geraldine	6.7	>20	0.21	0.45	0.4	0.24	0.52	0.4	0.27	0.59	0.5	0.29	0.66	0.7	0.3	0.7	0.8	0.3	0.75	0.9
Fairlie	6.9	>20	0.23	0.49	0.4	0.27	0.57	0.4	0.3	0.64	0.5	0.31	0.7	0.7	0.32	0.74	0.8	0.32	0.79	1.0
Temuka	6.6	>20	0.2	0.43	0.4	0.23	0.5	0.4	0.26	0.57	0.5	0.28	0.63	0.6	0.28	0.67	0.7	0.29	0.72	0.9
Pleasant Point	6.6	>20	0.21	0.44	0.4	0.24	0.51	0.4	0.27	0.58	0.5	0.29	0.64	0.7	0.29	0.68	0.8	0.3	0.73	0.9
Twizel	7.2	>20	0.25	0.54	0.4	0.3	0.63	0.5	0.33	0.7	0.6	0.34	0.76	0.7	0.34	0.8	0.8	0.35	0.84	1.0
Timaru	6.5	>20	0.2	0.42	0.3	0.23	0.49	0.4	0.26	0.56	0.5	0.27	0.62	0.6	0.28	0.66	0.7	0.29	0.71	0.9
Lake Hawea	7.5	>20	0.32	0.68	0.4	0.36	0.77	0.4	0.4	0.84	0.6	0.41	0.9	0.7	0.41	0.92	0.8	0.41	0.95	1.0
Milford Sound	7.7	16	0.85	1.9	0.3	0.92	1.95	0.4	0.92	1.87	0.5	0.88	1.73	0.7	0.82	1.62	0.9	0.75	1.5	1.2
Wanaka	7.5	>20	0.33	0.7	0.4	0.37	0.79	0.4	0.41	0.86	0.5	0.42	0.92	0.7	0.42	0.94	0.8	0.42	0.97	1.0
Waimate	6.4	>20	0.2	0.42	0.3	0.23	0.49	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.9
Arrowtown	7.4	>20	0.33	0.71	0.4	0.38	0.8	0.4	0.41	0.87	0.5	0.42	0.92	0.7	0.43	0.94	0.8	0.42	0.97	0.9
Arthurs Point	7.5	>20	0.35	0.75	0.3	0.39	0.84	0.4	0.43	0.9	0.5	0.44	0.95	0.7	0.44	0.97	0.8	0.44	0.99	0.9
Lake Hayes	7.5	>20	0.32	0.7	0.4	0.37	0.79	0.4	0.4	0.85	0.5	0.42	0.91	0.7	0.42	0.93	0.8	0.42	0.96	0.9
Queenstown	7.5	>20	0.33	0.72	0.3	0.38	0.8	0.4	0.41	0.87	0.5	0.43	0.92	0.7	0.43	0.94	0.8	0.42	0.97	0.9
Cromwell	7.2	>20	0.27	0.58	0.4	0.31	0.67	0.4	0.34	0.74	0.5	0.36	0.8	0.7	0.37	0.83	0.8	0.37	0.88	0.9
Oamaru	6.4	>20	0.19	0.41	0.3	0.22	0.48	0.4	0.25	0.54	0.5	0.27	0.6	0.6	0.27	0.63	0.7	0.28	0.68	0.8
Clyde	7.1	>20	0.25	0.53	0.4	0.29	0.61	0.5	0.32	0.68	0.5	0.34	0.75	0.7	0.34	0.78	0.8	0.34	0.83	0.9
Alexandra	7.0	>20	0.24	0.52	0.4	0.28	0.6	0.4	0.31	0.67	0.5	0.33	0.73	0.7	0.33	0.77	0.8	0.34	0.82	0.9
Te Anau	7.7	>20	0.46	1.01	0.3	0.52	1.1	0.4	0.55	1.14	0.5	0.55	1.15	0.6	0.55	1.15	0.8	0.53	1.15	1.0
Palmerston	6.4	>20	0.19	0.41	0.3	0.22	0.48	0.4	0.25	0.54	0.5	0.27	0.6	0.6	0.27	0.63	0.7	0.28	0.68	0.8
Waikouaiti	6.4	>20	0.19	0.41	0.3	0.22	0.47	0.4	0.25	0.54	0.5	0.26	0.59	0.6	0.27	0.63	0.7	0.27	0.68	0.8
Mosgiel	6.4	>20	0.19	0.42	0.3	0.23	0.48	0.4	0.25	0.55	0.5	0.27	0.6	0.6	0.27	0.64	0.7	0.28	0.68	0.8
Dunedin	6.4	>20	0.19	0.41	0.3	0.22	0.48	0.4	0.25	0.54	0.5	0.26	0.59	0.6	0.27	0.63	0.7	0.28	0.68	0.8
Brighton	6.4	>20	0.19	0.42	0.3	0.23	0.48	0.4	0.25	0.55	0.5	0.27	0.6	0.6	0.27	0.64	0.7	0.28	0.68	0.8
Gore	6.8	>20	0.22	0.47	0.4	0.25	0.54	0.4	0.28	0.6	0.5	0.3	0.66	0.6	0.3	0.7	0.7	0.31	0.75	0.9
Milton	6.5	>20	0.2	0.43	0.3	0.23	0.5	0.4	0.26	0.56	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.69	0.8
Winton	7.1	>20	0.25	0.54	0.4	0.29	0.61	0.4	0.32	0.68	0.5	0.34	0.74	0.7	0.34	0.78	0.8	0.35	0.83	0.9
Mataura	6.8	>20	0.21	0.46	0.4	0.25	0.53	0.4	0.28	0.6	0.5	0.3	0.66	0.6	0.3	0.7	0.7	0.31	0.75	0.9
Balclutha	6.4	>20	0.2	0.43	0.3	0.23	0.49	0.4	0.26	0.56	0.5	0.27	0.61	0.6	0.28	0.64	0.7	0.28	0.69	0.8

TABLE 3.4(e) part 8: Site demand parameters for an annual probability of exceedance of 1/500

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Riverton	7.3	>20	0.27	0.6	0.4	0.31	0.67	0.4	0.35	0.74	0.5	0.37	0.8	0.6	0.37	0.83	0.7	0.38	0.87	0.9
Invercargill	7.0	>20	0.24	0.52	0.4	0.27	0.59	0.4	0.31	0.66	0.5	0.32	0.72	0.6	0.33	0.76	0.7	0.34	0.81	0.9
Bluff	7.0	>20	0.23	0.51	0.4	0.27	0.58	0.4	0.3	0.65	0.5	0.32	0.71	0.6	0.33	0.75	0.7	0.33	0.8	0.9
Oban	7.1	>20	0.25	0.54	0.3	0.29	0.62	0.4	0.32	0.68	0.5	0.34	0.74	0.6	0.34	0.77	0.7	0.35	0.82	0.9

TABLE 3.4(f) part 1: Site demand parameters for an annual probability of exceedance of 1/1000

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Kaitaia	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Kerikeri	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Haruru	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Paihia	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Opua	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Kawakawa	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Moerewa	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Kaikohe	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Hikurangi	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Ngunguru	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Whangarei	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
One Tree Point	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Ruakaka	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Dargaville	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Waipu	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Mangawhai Heads	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Wellsford	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Warkworth	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Snells Beach	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Hibiscus Coast	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Parakai	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Helensville	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Coromandel	6.5	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Riverhead	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Kumeu-Huapai	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Waimauku	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Waiheke West	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Whitianga	6.6	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Muriwai	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Auckland	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8

TABLE 3.4(f) part 2: Site demand parameters for an annual probability of exceedance of 1/1000

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Maraetai	6.4	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Beachlands-Pine Harbour	6.4	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Manukau City	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Tairua	6.8	>20	0.19	0.42	0.4	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Pauanui	6.8	>20	0.19	0.42	0.4	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Clarks Beach	6.3	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Thames	6.8	>20	0.19	0.42	0.4	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Patumahoe	6.4	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Pukekohe	6.5	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Whangamata	7.0	>20	0.19	0.42	0.4	0.22	0.48	0.5	0.25	0.55	0.6	0.27	0.61	0.7	0.28	0.65	0.7	0.28	0.7	0.9
Pokeno	6.5	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Waiuku	6.4	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Tuakau	6.5	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Ngatea	6.8	>20	0.19	0.42	0.4	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Paeroa	7.0	>20	0.19	0.42	0.4	0.22	0.48	0.5	0.25	0.55	0.6	0.27	0.61	0.7	0.28	0.65	0.8	0.28	0.7	0.9
Waihi	7.0	>20	0.19	0.42	0.4	0.22	0.48	0.5	0.25	0.55	0.6	0.27	0.61	0.7	0.28	0.65	0.8	0.28	0.7	0.9
Te Kauwhata	6.6	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Waihi Beach-Bowentown	7.1	>20	0.19	0.42	0.4	0.22	0.48	0.5	0.25	0.55	0.6	0.27	0.61	0.7	0.28	0.65	0.8	0.28	0.73	0.9
Te Aroha	7.0	>20	0.19	0.42	0.4	0.22	0.48	0.5	0.25	0.55	0.6	0.27	0.61	0.7	0.28	0.65	0.8	0.28	0.7	0.9
Huntly	6.7	>20	0.19	0.42	0.4	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Katikati	7.2	>20	0.19	0.42	0.4	0.22	0.48	0.5	0.25	0.56	0.6	0.27	0.63	0.7	0.28	0.67	0.8	0.29	0.75	0.9
Omokoroa	7.2	>20	0.21	0.45	0.4	0.25	0.53	0.5	0.27	0.62	0.6	0.29	0.69	0.7	0.3	0.73	0.8	0.31	0.8	0.9
Mount Maunganui	7.2	>20	0.24	0.52	0.4	0.28	0.61	0.5	0.31	0.69	0.6	0.33	0.77	0.7	0.33	0.81	0.8	0.34	0.87	0.9
Morrinsville	7.0	>20	0.19	0.42	0.4	0.22	0.48	0.5	0.25	0.55	0.6	0.27	0.61	0.7	0.28	0.65	0.8	0.28	0.7	0.9
Ngaruawahia	6.7	>20	0.19	0.42	0.4	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Tauranga	7.2	>20	0.24	0.52	0.4	0.28	0.61	0.5	0.31	0.69	0.6	0.33	0.77	0.7	0.33	0.81	0.8	0.34	0.87	0.9
Te Puke	7.2	>20	0.3	0.64	0.4	0.34	0.74	0.5	0.37	0.83	0.6	0.39	0.89	0.7	0.39	0.93	0.7	0.39	0.98	0.9
Hamilton	6.9	>20	0.19	0.42	0.4	0.22	0.48	0.5	0.25	0.55	0.6	0.27	0.61	0.7	0.28	0.65	0.7	0.28	0.7	0.9
Raglan	6.6	>20	0.19	0.42	0.3	0.22	0.48	0.4	0.25	0.55	0.5	0.27	0.61	0.6	0.28	0.65	0.7	0.28	0.7	0.8
Matamata	7.2	>20	0.2	0.43	0.4	0.24	0.51	0.5	0.26	0.59	0.6	0.28	0.66	0.7	0.29	0.71	0.8	0.3	0.78	0.9

TABLE 3.4(f) part 3: Site demand parameters for an annual probability of exceedance of 1/1000

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	***Sas***	***Tc***	***PGA***	***Sas***	***Tc***	***PGA***	***Sas***	***Tc***	***PGA***	***Sas***	***Tc***	***PGA***	***Sas***	***Tc***	***PGA***	***Sas***	***Tc***
Cambridge	7.1	>20	0.19	0.42	0.4	0.22	0.48	0.5	0.25	0.55	0.6	0.27	0.61	0.7	0.28	0.65	0.8	0.28	0.7	0.9
Ruatoria	7.7	>20	0.82	1.84	0.3	0.88	1.86	0.4	0.88	1.78	0.5	0.83	1.66	0.6	0.79	1.57	0.6	0.74	1.49	0.8
Whakatane	7.2	>20	0.66	1.49	0.3	0.73	1.6	0.4	0.76	1.62	0.5	0.74	1.59	0.6	0.71	1.54	0.8	0.67	1.5	1.0
Edgecumbe	7.2	>20	0.59	1.33	0.3	0.66	1.45	0.4	0.69	1.49	0.5	0.68	1.48	0.6	0.65	1.44	0.8	0.62	1.42	1.0
Ohope	7.3	>20	0.66	1.49	0.3	0.73	1.6	0.4	0.76	1.62	0.5	0.74	1.58	0.6	0.71	1.54	0.7	0.67	1.49	1.0
Pirongia	6.9	>20	0.19	0.42	0.4	0.22	0.48	0.5	0.25	0.55	0.6	0.27	0.61	0.7	0.28	0.65	0.7	0.28	0.7	0.9
Te Awamutu	7.0	>20	0.19	0.42	0.4	0.22	0.48	0.5	0.25	0.55	0.6	0.27	0.61	0.7	0.28	0.65	0.8	0.28	0.7	0.9
Opotiki	7.4	>20	0.66	1.5	0.3	0.73	1.59	0.4	0.76	1.6	0.5	0.74	1.56	0.6	0.71	1.52	0.7	0.67	1.48	0.9
Kihikihi	7.0	>20	0.19	0.42	0.4	0.22	0.48	0.5	0.25	0.55	0.6	0.27	0.61	0.7	0.28	0.65	0.8	0.28	0.7	0.9
Putaruru	7.3	>20	0.22	0.48	0.4	0.26	0.56	0.5	0.29	0.64	0.6	0.31	0.71	0.7	0.31	0.76	0.8	0.32	0.83	0.9
Ngongotaha	7.3	>20	0.33	0.72	0.4	0.38	0.83	0.5	0.41	0.91	0.6	0.43	0.97	0.7	0.42	0.99	0.8	0.42	1.03	0.9
Kawerau	7.3	>20	0.55	1.24	0.3	0.62	1.36	0.4	0.65	1.4	0.5	0.64	1.4	0.7	0.62	1.36	0.8	0.58	1.35	1.0
Rotorua	7.2	>20	0.37	0.81	0.4	0.42	0.92	0.5	0.45	0.99	0.6	0.46	1.04	0.7	0.46	1.06	0.8	0.45	1.09	0.9
Otorohanga	7.1	>20	0.19	0.42	0.4	0.22	0.48	0.5	0.25	0.55	0.6	0.27	0.61	0.7	0.28	0.65	0.8	0.28	0.71	0.9
Tokoroa	7.3	>20	0.26	0.57	0.4	0.3	0.66	0.5	0.33	0.74	0.6	0.35	0.81	0.7	0.36	0.85	0.8	0.36	0.91	0.9
Te Kuiti	7.1	>20	0.19	0.42	0.4	0.22	0.48	0.5	0.25	0.55	0.6	0.27	0.61	0.7	0.28	0.66	0.8	0.28	0.73	0.9
Mangakino	7.3	>20	0.27	0.59	0.4	0.31	0.68	0.5	0.34	0.76	0.6	0.36	0.83	0.7	0.37	0.87	0.8	0.37	0.92	0.9
Murupara	7.5	>20	0.56	1.27	0.3	0.63	1.36	0.4	0.65	1.39	0.5	0.65	1.38	0.6	0.63	1.37	0.7	0.6	1.35	0.9
Gisborne	7.7	>20	0.93	2.07	0.3	0.98	2.08	0.4	0.97	1.96	0.5	0.91	1.8	0.6	0.86	1.69	0.7	0.79	1.58	0.9
Taupo	7.3	>20	0.45	1.0	0.3	0.5	1.1	0.4	0.53	1.15	0.5	0.54	1.18	0.6	0.53	1.18	0.8	0.51	1.19	0.9
Taumarunui	7.3	>20	0.28	0.61	0.4	0.32	0.69	0.5	0.35	0.77	0.6	0.37	0.83	0.7	0.37	0.87	0.7	0.38	0.92	0.9
Turangi	7.3	>20	0.53	1.2	0.3	0.59	1.29	0.4	0.62	1.33	0.5	0.62	1.33	0.6	0.6	1.33	0.7	0.58	1.31	0.9
Waitara	7.0	>20	0.2	0.42	0.4	0.23	0.49	0.5	0.25	0.57	0.6	0.27	0.63	0.7	0.28	0.68	0.8	0.29	0.74	0.9
Wairoa	7.7	>20	0.79	1.77	0.3	0.85	1.81	0.4	0.85	1.75	0.5	0.82	1.65	0.6	0.78	1.57	0.7	0.73	1.5	0.9
New Plymouth	6.9	>20	0.2	0.43	0.4	0.23	0.51	0.5	0.26	0.58	0.6	0.28	0.65	0.7	0.29	0.69	0.8	0.29	0.75	0.9
Oakura (New Plymouth District)	6.9	>20	0.21	0.45	0.4	0.24	0.53	0.5	0.27	0.6	0.6	0.29	0.67	0.7	0.3	0.71	0.8	0.3	0.76	0.9
Inglewood	7.0	>20	0.23	0.49	0.4	0.26	0.57	0.5	0.29	0.65	0.6	0.31	0.71	0.7	0.31	0.75	0.8	0.32	0.81	0.9
Stratford	7.2	>20	0.24	0.51	0.4	0.27	0.6	0.5	0.3	0.67	0.6	0.32	0.74	0.7	0.33	0.78	0.8	0.33	0.84	0.9
Ohakune	7.4	>20	0.51	1.14	0.3	0.56	1.22	0.4	0.59	1.27	0.5	0.59	1.28	0.6	0.59	1.28	0.7	0.57	1.28	0.8
Raetihi	7.4	>20	0.49	1.1	0.3	0.54	1.19	0.4	0.57	1.23	0.5	0.58	1.25	0.6	0.57	1.25	0.6	0.56	1.25	0.8

TABLE 3.4(f) part 4: Site demand parameters for an annual probability of exceedance of 1/1000

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Eltham	7.3	>20	0.24	0.53	0.4	0.28	0.61	0.5	0.31	0.69	0.6	0.33	0.76	0.7	0.34	0.8	0.8	0.34	0.86	0.9
Opunake	7.0	>20	0.27	0.57	0.4	0.31	0.66	0.5	0.34	0.74	0.6	0.35	0.79	0.7	0.35	0.82	0.8	0.35	0.87	1.0
Waiouru	7.5	>20	0.57	1.29	0.3	0.63	1.36	0.4	0.65	1.39	0.5	0.65	1.38	0.6	0.64	1.37	0.7	0.61	1.36	0.8
Napier	7.7	>20	0.89	2.0	0.3	0.95	2.01	0.4	0.94	1.91	0.5	0.89	1.76	0.6	0.84	1.66	0.7	0.77	1.56	1.0
Clive	7.8	>20	0.94	2.09	0.3	0.99	2.09	0.4	0.98	1.98	0.5	0.92	1.81	0.6	0.86	1.71	0.8	0.79	1.59	1.0
Hawera	7.3	>20	0.26	0.57	0.4	0.3	0.65	0.5	0.33	0.73	0.6	0.35	0.8	0.7	0.36	0.84	0.8	0.36	0.89	0.9
Hastings	7.8	>20	0.95	2.13	0.3	1.01	2.13	0.4	1.0	2.01	0.5	0.93	1.84	0.6	0.88	1.73	0.8	0.8	1.61	1.0
Taihape	7.6	>20	0.67	1.51	0.3	0.73	1.58	0.4	0.75	1.57	0.5	0.74	1.53	0.6	0.71	1.49	0.7	0.68	1.45	0.9
Havelock North	7.8	>20	0.97	2.16	0.3	1.02	2.16	0.4	1.01	2.03	0.5	0.94	1.85	0.6	0.88	1.74	0.8	0.81	1.62	1.0
Patea	7.4	>20	0.34	0.76	0.4	0.39	0.84	0.4	0.42	0.91	0.5	0.43	0.96	0.6	0.44	0.98	0.7	0.43	1.01	0.9
Whanganui	7.4	>20	0.58	1.3	0.3	0.63	1.38	0.4	0.66	1.4	0.5	0.66	1.39	0.6	0.64	1.37	0.7	0.62	1.36	0.8
Waipawa	7.8	>20	1.07	2.4	0.3	1.12	2.37	0.4	1.1	2.2	0.5	1.02	1.98	0.6	0.95	1.85	0.8	0.86	1.7	1.1
Waipukurau	7.8	>20	1.11	2.47	0.3	1.15	2.44	0.4	1.12	2.25	0.5	1.04	2.01	0.6	0.97	1.87	0.8	0.87	1.72	1.1
Marton	7.5	>20	0.72	1.62	0.3	0.78	1.68	0.4	0.79	1.66	0.5	0.77	1.59	0.6	0.74	1.55	0.7	0.7	1.49	0.9
Bulls	7.6	>20	0.77	1.74	0.3	0.83	1.79	0.4	0.84	1.75	0.5	0.81	1.67	0.6	0.78	1.61	0.7	0.73	1.53	0.9
Dannevirke	7.8	>20	1.12	2.52	0.3	1.17	2.48	0.4	1.14	2.29	0.5	1.05	2.05	0.7	0.98	1.9	0.8	0.89	1.75	1.1
Feilding	7.7	>20	0.86	1.94	0.3	0.92	1.97	0.4	0.92	1.89	0.5	0.88	1.77	0.6	0.83	1.68	0.8	0.77	1.59	1.0
Ashhurst	7.8	7	1.03	2.31	0.3	1.08	2.31	0.4	1.07	2.16	0.5	1.0	1.96	0.7	0.93	1.84	0.8	0.85	1.7	1.1
Woodville	7.8	6	1.12	2.53	0.3	1.18	2.51	0.4	1.15	2.31	0.5	1.06	2.07	0.7	0.99	1.92	0.9	0.89	1.77	1.2
Palmerston North	7.8	6	0.99	2.22	0.3	1.04	2.23	0.4	1.03	2.1	0.5	0.97	1.92	0.7	0.91	1.81	0.8	0.83	1.68	1.1
Pahiatua	7.8	7	1.16	2.62	0.3	1.21	2.57	0.4	1.18	2.36	0.5	1.09	2.11	0.7	1.01	1.95	0.9	0.91	1.79	1.2
Foxton Beach	7.7	>20	0.88	1.98	0.3	0.94	2.01	0.4	0.94	1.93	0.5	0.89	1.8	0.6	0.85	1.71	0.8	0.79	1.62	1.0
Foxton	7.7	>20	0.91	2.06	0.3	0.97	2.08	0.4	0.97	1.99	0.5	0.92	1.84	0.6	0.87	1.74	0.8	0.8	1.64	1.0
Shannon	7.8	15	1.03	2.33	0.3	1.09	2.32	0.4	1.07	2.17	0.5	1.0	1.98	0.7	0.94	1.85	0.8	0.85	1.71	1.1
Levin	7.8	18	1.03	2.32	0.3	1.08	2.32	0.4	1.07	2.17	0.5	1.0	1.98	0.7	0.94	1.85	0.8	0.85	1.72	1.1
Otaki Beach	7.8	>20	1.04	2.35	0.3	1.1	2.34	0.4	1.08	2.19	0.5	1.01	1.99	0.7	0.94	1.86	0.8	0.86	1.72	1.1
Otaki	7.8	>20	1.05	2.38	0.3	1.11	2.36	0.4	1.09	2.21	0.5	1.02	2.0	0.7	0.95	1.87	0.8	0.87	1.73	1.1
Waikanae	7.8	>20	1.09	2.46	0.3	1.15	2.44	0.4	1.12	2.27	0.5	1.04	2.05	0.7	0.97	1.91	0.9	0.88	1.77	1.2
Takaka	7.4	>20	0.38	0.84	0.3	0.43	0.93	0.4	0.46	0.99	0.5	0.47	1.04	0.6	0.47	1.06	0.7	0.47	1.09	0.9
Paraparaumu	7.8	18	1.1	2.47	0.3	1.15	2.45	0.4	1.13	2.27	0.5	1.05	2.05	0.7	0.98	1.91	0.9	0.88	1.77	1.2

TABLE 3.4(f) part 5: Site demand parameters for an annual probability of exceedance of 1/1000

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Masterton	7.9	6	1.42	3.19	0.3	1.45	3.05	0.4	1.38	2.71	0.5	1.24	2.35	0.7	1.13	2.12	0.9	1.0	1.92	1.3
Paekakariki	7.8	16	1.13	2.55	0.3	1.18	2.52	0.4	1.16	2.33	0.5	1.07	2.1	0.7	1.0	1.94	0.9	0.9	1.8	1.2
Carterton	7.9	4	1.41	3.17	0.3	1.44	3.04	0.4	1.37	2.71	0.5	1.24	2.35	0.7	1.13	2.12	0.9	1.0	1.93	1.3
Greytown	7.9	4	1.35	3.04	0.3	1.39	2.93	0.4	1.33	2.63	0.5	1.21	2.3	0.7	1.11	2.09	0.9	0.98	1.91	1.3
Porirua	7.8	6	1.15	2.6	0.3	1.21	2.58	0.4	1.18	2.38	0.5	1.09	2.14	0.7	1.01	1.98	0.9	0.91	1.83	1.2
Featherston	7.9	0	1.37	3.06	0.3	1.41	2.97	0.4	1.35	2.68	0.5	1.22	2.34	0.7	1.12	2.12	1.0	0.99	1.94	1.3
Motueka	7.5	>20	0.46	1.03	0.3	0.52	1.12	0.4	0.55	1.17	0.5	0.56	1.2	0.6	0.55	1.21	0.7	0.54	1.22	0.9
Upper Hutt	7.9	0	1.26	2.83	0.3	1.31	2.78	0.4	1.27	2.54	0.5	1.16	2.25	0.7	1.07	2.06	0.9	0.95	1.9	1.3
Lower Hutt	7.9	0	1.2	2.7	0.3	1.26	2.67	0.4	1.22	2.46	0.5	1.12	2.2	0.7	1.04	2.02	0.9	0.93	1.87	1.3
Martinborough	8.0	16	1.34	2.99	0.3	1.37	2.87	0.4	1.31	2.58	0.5	1.19	2.25	0.7	1.09	2.06	0.9	0.97	1.87	1.2
Mapua	7.5	>20	0.52	1.16	0.3	0.58	1.25	0.4	0.61	1.29	0.5	0.61	1.3	0.6	0.6	1.3	0.8	0.58	1.3	1.0
Wainuiomata	7.9	0	1.2	2.7	0.3	1.26	2.67	0.4	1.22	2.46	0.5	1.12	2.2	0.7	1.04	2.02	0.9	0.93	1.87	1.3
Nelson	7.6	>20	0.56	1.26	0.3	0.62	1.34	0.4	0.65	1.38	0.5	0.65	1.38	0.6	0.63	1.37	0.8	0.61	1.35	1.0
Picton	7.7	>20	0.8	1.8	0.3	0.87	1.86	0.4	0.88	1.82	0.5	0.85	1.73	0.6	0.81	1.67	0.8	0.75	1.6	1.0
Wellington CBD	7.8	0	1.19	2.68	0.3	1.25	2.66	0.4	1.22	2.46	0.5	1.12	2.2	0.7	1.04	2.02	0.9	0.93	1.88	1.3
Wellington	7.8	0	1.19	2.68	0.3	1.25	2.66	0.4	1.22	2.46	0.5	1.12	2.2	0.7	1.04	2.02	0.9	0.93	1.88	1.3
Eastbourne	7.9	0	1.2	2.7	0.3	1.26	2.67	0.4	1.22	2.46	0.5	1.12	2.2	0.7	1.04	2.02	0.9	0.93	1.87	1.3
Richmond	7.6	>20	0.56	1.25	0.3	0.62	1.34	0.4	0.65	1.38	0.5	0.65	1.38	0.6	0.63	1.37	0.8	0.61	1.35	1.0
Hope	7.6	>20	0.56	1.25	0.3	0.62	1.34	0.4	0.65	1.38	0.5	0.65	1.38	0.6	0.63	1.37	0.8	0.6	1.35	1.0
Brightwater	7.6	>20	0.56	1.24	0.3	0.62	1.33	0.4	0.65	1.37	0.5	0.64	1.37	0.6	0.63	1.36	0.8	0.6	1.35	1.0
Wakefield	7.5	>20	0.56	1.24	0.3	0.62	1.33	0.4	0.65	1.37	0.5	0.64	1.37	0.6	0.63	1.36	0.8	0.6	1.35	1.0
Renwick	7.7	>20	0.86	1.91	0.3	0.93	1.99	0.4	0.93	1.93	0.5	0.89	1.83	0.7	0.84	1.74	0.9	0.78	1.66	1.1
Blenheim	7.8	11	0.9	2.01	0.3	0.97	2.07	0.4	0.97	2.0	0.5	0.92	1.88	0.7	0.87	1.78	0.9	0.8	1.7	1.2
Seddon	7.7	5	0.99	2.23	0.3	1.06	2.28	0.4	1.06	2.18	0.5	1.0	2.03	0.7	0.93	1.9	0.9	0.85	1.8	1.2
Westport	7.1	>20	0.42	0.92	0.3	0.47	1.03	0.4	0.51	1.1	0.5	0.52	1.14	0.7	0.51	1.15	0.8	0.5	1.17	1.0
St Arnaud	7.6	0	0.67	1.49	0.3	0.74	1.6	0.4	0.77	1.62	0.5	0.75	1.59	0.7	0.71	1.54	0.9	0.67	1.51	1.1
Murchison	7.3	>20	0.54	1.2	0.3	0.61	1.32	0.4	0.64	1.37	0.5	0.64	1.39	0.7	0.62	1.38	0.8	0.59	1.38	1.0
Ward	7.8	5	1.07	2.4	0.3	1.14	2.44	0.4	1.13	2.31	0.5	1.05	2.11	0.7	0.97	1.96	0.9	0.88	1.84	1.3
Reefton	7.3	>20	0.53	1.17	0.3	0.6	1.29	0.4	0.63	1.36	0.6	0.63	1.38	0.7	0.61	1.36	0.9	0.58	1.37	1.1
Springs Junction	7.8	2	0.81	1.8	0.4	0.91	1.96	0.5	0.93	1.97	0.6	0.88	1.88	0.9	0.82	1.81	1.1	0.74	1.73	1.4

TABLE 3.4(f) part 6: Site demand parameters for an annual probability of exceedance of 1/1000

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Runanga	7.5	>20	0.44	0.96	0.4	0.5	1.09	0.5	0.54	1.16	0.6	0.54	1.21	0.8	0.53	1.21	0.9	0.51	1.24	1.1
Kaikoura	7.8	6	0.91	2.03	0.3	0.99	2.1	0.4	0.99	2.02	0.6	0.93	1.88	0.7	0.87	1.76	1.0	0.79	1.68	1.3
Greymouth	7.6	>20	0.46	1.0	0.4	0.53	1.13	0.5	0.56	1.21	0.6	0.56	1.25	0.8	0.55	1.25	0.9	0.52	1.28	1.2
Hanmer Springs	7.6	4	0.94	2.11	0.3	1.04	2.27	0.5	1.06	2.23	0.6	0.99	2.09	0.8	0.92	1.99	1.0	0.83	1.89	1.4
Hokitika	7.7	>20	0.55	1.2	0.4	0.63	1.35	0.5	0.66	1.42	0.6	0.65	1.43	0.8	0.62	1.41	1.0	0.58	1.41	1.3
Cheviot	7.5	>20	0.62	1.36	0.3	0.69	1.47	0.4	0.71	1.5	0.5	0.7	1.49	0.7	0.67	1.45	0.8	0.63	1.43	1.1
Otira	7.8	1	0.98	2.17	0.4	1.08	2.36	0.5	1.1	2.35	0.6	1.02	2.2	0.9	0.92	2.07	1.2	0.81	1.9	1.6
Arthurs Pass	7.4	13	0.71	1.57	0.4	0.8	1.74	0.5	0.84	1.78	0.6	0.81	1.74	0.8	0.75	1.69	1.0	0.69	1.65	1.3
Harihari	8.1	0	0.86	1.86	0.4	0.96	2.05	0.5	0.98	2.08	0.7	0.91	1.98	1.0	0.83	1.88	1.3	0.73	1.72	1.8
Amberley	7.2	>20	0.42	0.93	0.4	0.48	1.04	0.4	0.52	1.12	0.6	0.53	1.17	0.7	0.52	1.18	0.8	0.5	1.22	1.0
Oxford	7.1	>20	0.43	0.95	0.4	0.5	1.08	0.5	0.53	1.16	0.6	0.54	1.21	0.7	0.53	1.21	0.9	0.51	1.24	1.1
Rangiora	7.1	>20	0.39	0.87	0.4	0.45	0.98	0.4	0.49	1.07	0.6	0.5	1.12	0.7	0.49	1.14	0.8	0.48	1.18	1.0
Pegasus	7.0	>20	0.4	0.87	0.4	0.45	0.99	0.4	0.49	1.07	0.5	0.5	1.12	0.7	0.49	1.14	0.8	0.48	1.17	1.0
Woodend	7.0	>20	0.4	0.87	0.4	0.45	0.99	0.4	0.49	1.07	0.5	0.5	1.12	0.7	0.49	1.14	0.8	0.48	1.18	1.0
Franz Josef	8.2	0	0.97	2.11	0.4	1.08	2.31	0.5	1.09	2.33	0.7	1.0	2.2	1.0	0.9	2.04	1.3	0.78	1.87	1.9
Kaiapoi	6.8	>20	0.4	0.89	0.3	0.46	1.01	0.4	0.5	1.08	0.5	0.51	1.13	0.7	0.5	1.15	0.8	0.49	1.18	1.0
Fox Glacier	8.2	0	1.0	2.17	0.4	1.11	2.37	0.6	1.12	2.39	0.7	1.02	2.25	1.0	0.92	2.08	1.4	0.79	1.91	1.9
Darfield	6.7	>20	0.4	0.88	0.3	0.46	1.0	0.4	0.49	1.07	0.5	0.5	1.13	0.7	0.49	1.14	0.8	0.48	1.17	1.0
West Melton	6.6	>20	0.41	0.91	0.3	0.47	1.02	0.4	0.51	1.1	0.5	0.51	1.14	0.6	0.5	1.15	0.8	0.49	1.18	1.0
Christchurch	6.4	>20	0.45	1.0	0.3	0.51	1.12	0.4	0.55	1.18	0.5	0.56	1.21	0.6	0.54	1.21	0.7	0.52	1.22	0.9
Prebbleton	6.4	>20	0.42	0.93	0.3	0.48	1.04	0.4	0.52	1.11	0.5	0.52	1.15	0.6	0.51	1.16	0.7	0.5	1.18	0.9
Lyttelton	6.4	>20	0.43	0.96	0.3	0.49	1.07	0.4	0.53	1.14	0.5	0.53	1.17	0.6	0.52	1.17	0.7	0.51	1.19	0.9
Rolleston	6.5	>20	0.4	0.89	0.3	0.46	1.0	0.4	0.49	1.07	0.5	0.5	1.11	0.6	0.49	1.13	0.7	0.48	1.16	0.9
Methven	7.0	>20	0.34	0.74	0.4	0.39	0.85	0.5	0.43	0.93	0.6	0.44	1.0	0.7	0.44	1.03	0.9	0.43	1.08	1.0
Diamond Harbour	6.4	>20	0.41	0.92	0.3	0.47	1.02	0.4	0.51	1.09	0.5	0.52	1.13	0.6	0.5	1.14	0.7	0.49	1.16	0.9
Lincoln	6.4	>20	0.4	0.88	0.3	0.45	0.99	0.4	0.49	1.06	0.5	0.5	1.11	0.6	0.49	1.12	0.7	0.48	1.15	0.9
Mt Cook Village	8.0	>20	0.57	1.22	0.4	0.64	1.38	0.5	0.68	1.43	0.6	0.66	1.41	0.9	0.62	1.38	1.1	0.58	1.37	1.4
Rakaia	6.7	>20	0.31	0.67	0.4	0.36	0.77	0.4	0.39	0.86	0.5	0.41	0.92	0.7	0.41	0.96	0.8	0.41	1.01	1.0
Leeston	6.6	>20	0.32	0.7	0.3	0.36	0.8	0.4	0.4	0.88	0.5	0.42	0.94	0.7	0.41	0.97	0.8	0.41	1.02	0.9
Akaroa	6.6	>20	0.28	0.63	0.3	0.33	0.72	0.4	0.36	0.79	0.5	0.38	0.86	0.6	0.38	0.89	0.7	0.38	0.94	0.9

TABLE 3.4(f) part 7: Site demand parameters for an annual probability of exceedance of 1/1000

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Ashburton	6.7	>20	0.28	0.61	0.4	0.33	0.71	0.4	0.36	0.79	0.6	0.38	0.86	0.7	0.38	0.9	0.8	0.38	0.95	1.0
Geraldine	6.7	>20	0.28	0.62	0.4	0.33	0.71	0.4	0.36	0.79	0.6	0.38	0.86	0.7	0.38	0.9	0.8	0.38	0.95	1.0
Fairlie	7.0	>20	0.31	0.67	0.4	0.36	0.78	0.5	0.4	0.86	0.6	0.41	0.93	0.7	0.41	0.95	0.9	0.41	1.01	1.1
Temuka	6.6	>20	0.27	0.6	0.3	0.32	0.69	0.4	0.35	0.76	0.5	0.37	0.83	0.7	0.37	0.87	0.8	0.37	0.92	1.0
Pleasant Point	6.6	>20	0.28	0.61	0.4	0.33	0.7	0.4	0.36	0.78	0.6	0.38	0.85	0.7	0.38	0.88	0.8	0.38	0.93	1.0
Twizel	7.3	>20	0.35	0.75	0.4	0.4	0.86	0.5	0.44	0.94	0.6	0.45	1.01	0.8	0.45	1.03	0.9	0.44	1.08	1.1
Timaru	6.5	>20	0.27	0.59	0.3	0.31	0.68	0.4	0.35	0.75	0.5	0.36	0.82	0.7	0.36	0.85	0.8	0.36	0.91	1.0
Lake Hawea	7.5	>20	0.43	0.93	0.4	0.49	1.05	0.5	0.53	1.12	0.6	0.54	1.17	0.7	0.53	1.18	0.9	0.52	1.21	1.1
Milford Sound	7.8	16	1.16	2.65	0.3	1.23	2.64	0.4	1.21	2.44	0.5	1.12	2.2	0.8	1.04	2.01	1.0	0.93	1.88	1.3
Wanaka	7.5	>20	0.44	0.96	0.4	0.5	1.08	0.5	0.54	1.15	0.6	0.55	1.19	0.7	0.54	1.2	0.9	0.53	1.23	1.1
Waimate	6.5	>20	0.27	0.59	0.3	0.31	0.68	0.4	0.35	0.75	0.5	0.36	0.81	0.7	0.36	0.84	0.8	0.36	0.89	0.9
Arrowtown	7.5	>20	0.45	0.98	0.4	0.51	1.09	0.4	0.54	1.15	0.6	0.55	1.19	0.7	0.55	1.2	0.8	0.53	1.22	1.1
Arthurs Point	7.6	>20	0.47	1.03	0.3	0.53	1.14	0.4	0.57	1.19	0.6	0.57	1.23	0.7	0.57	1.24	0.8	0.55	1.25	1.1
Lake Hayes	7.5	>20	0.44	0.96	0.4	0.5	1.07	0.4	0.53	1.13	0.6	0.55	1.17	0.7	0.54	1.19	0.8	0.53	1.21	1.0
Queenstown	7.6	>20	0.45	0.98	0.4	0.51	1.09	0.4	0.54	1.15	0.6	0.55	1.19	0.7	0.55	1.2	0.8	0.54	1.22	1.0
Cromwell	7.3	>20	0.37	0.81	0.4	0.43	0.92	0.5	0.46	0.99	0.6	0.48	1.05	0.7	0.47	1.07	0.8	0.47	1.11	1.0
Oamaru	6.4	>20	0.27	0.58	0.3	0.31	0.67	0.4	0.34	0.74	0.5	0.36	0.79	0.6	0.36	0.83	0.7	0.36	0.87	0.9
Clyde	7.2	>20	0.34	0.74	0.4	0.39	0.85	0.5	0.43	0.92	0.6	0.44	0.98	0.7	0.44	1.01	0.8	0.44	1.06	1.0
Alexandra	7.1	>20	0.33	0.72	0.4	0.38	0.82	0.5	0.42	0.9	0.6	0.43	0.96	0.7	0.43	0.99	0.8	0.43	1.04	1.0
Te Anau	7.8	>20	0.63	1.4	0.3	0.7	1.49	0.4	0.72	1.51	0.5	0.72	1.48	0.7	0.7	1.46	0.8	0.67	1.42	1.1
Palmerston	6.5	>20	0.27	0.59	0.3	0.31	0.68	0.4	0.34	0.74	0.5	0.36	0.8	0.6	0.36	0.83	0.7	0.36	0.87	0.9
Waikouaiti	6.5	>20	0.26	0.58	0.3	0.31	0.66	0.4	0.34	0.73	0.5	0.35	0.79	0.6	0.35	0.82	0.7	0.35	0.86	0.9
Mosgiel	6.5	>20	0.27	0.6	0.3	0.32	0.69	0.4	0.35	0.76	0.5	0.36	0.81	0.6	0.36	0.84	0.7	0.36	0.87	0.9
Dunedin	6.5	>20	0.27	0.59	0.3	0.31	0.67	0.4	0.34	0.74	0.5	0.36	0.8	0.6	0.36	0.83	0.7	0.36	0.86	0.9
Brighton	6.5	>20	0.28	0.61	0.3	0.32	0.69	0.4	0.35	0.76	0.5	0.36	0.81	0.6	0.36	0.84	0.7	0.36	0.87	0.9
Gore	6.8	>20	0.3	0.65	0.4	0.34	0.74	0.4	0.38	0.81	0.5	0.39	0.87	0.7	0.39	0.91	0.8	0.4	0.95	1.0
Milton	6.6	>20	0.28	0.62	0.3	0.33	0.71	0.4	0.36	0.78	0.5	0.37	0.83	0.6	0.37	0.86	0.7	0.37	0.89	0.9
Winton	7.1	>20	0.33	0.73	0.4	0.38	0.82	0.4	0.42	0.9	0.6	0.44	0.96	0.7	0.44	0.99	0.8	0.44	1.04	1.0
Mataura	6.8	>20	0.29	0.64	0.4	0.34	0.73	0.4	0.37	0.8	0.5	0.39	0.86	0.7	0.39	0.9	0.8	0.39	0.95	1.0
Balclutha	6.5	>20	0.28	0.61	0.3	0.32	0.69	0.4	0.35	0.76	0.5	0.37	0.81	0.6	0.37	0.85	0.7	0.37	0.88	0.9

TABLE 3.4(f) part 8: Site demand parameters for an annual probability of exceedance of 1/1000

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	***S_{as}***	***T_c***	***PGA***	***S_{as}***	***T_c***	***PGA***	***S_{as}***	***T_c***	***PGA***	***S_{as}***	***T_c***	***PGA***	***S_{as}***	***T_c***	***PGA***	***S_{as}***	***T_c***
Riverton	7.3	>20	0.37	0.81	0.4	0.42	0.91	0.4	0.46	0.98	0.5	0.47	1.03	0.7	0.48	1.06	0.8	0.47	1.09	1.0
Invercargill	7.1	>20	0.32	0.7	0.4	0.37	0.79	0.4	0.4	0.87	0.5	0.42	0.93	0.7	0.42	0.96	0.8	0.43	1.01	1.0
Bluff	7.1	>20	0.32	0.7	0.4	0.36	0.79	0.4	0.4	0.86	0.5	0.42	0.92	0.7	0.42	0.95	0.8	0.42	1.0	1.0
Oban	7.2	>20	0.34	0.74	0.3	0.39	0.83	0.4	0.42	0.91	0.5	0.44	0.96	0.7	0.44	0.99	0.8	0.44	1.02	1.0

TABLE 3.4(g) part 1: Site demand parameters for an annual probability of exceedance of 1/2500

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Kaitaia	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Kerikeri	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Haruru	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Paihia	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Opua	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Kawakawa	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Moerewa	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Kaikohe	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Hikurangi	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Ngunguru	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Whangarei	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
One Tree Point	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Ruakaka	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Dargaville	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Waipu	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Mangawhai Heads	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Wellsford	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Warkworth	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Snells Beach	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Hibiscus Coast	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Parakai	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Helensville	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Coromandel	6.5	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Riverhead	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Kumeu-Huapai	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Waimauku	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Waiheke West	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Whitianga	6.7	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Muriwai	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Auckland	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9

TABLE 3.4(g) part 2: Site demand parameters for an annual probability of exceedance of 1/2500

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	Sas	***T*c**	***PGA***	Sas	***T*c**	***PGA***	Sas	***T*c**	***PGA***	Sas	***T*c**	***PGA***	Sas	***T*c**	***PGA***	Sas	***T*c**
Maraetai	6.5	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Beachlands-Pine Harbour	6.5	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Manukau City	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Tairua	6.9	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Pauanui	6.9	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Clarks Beach	6.4	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Thames	6.9	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Patumahoe	6.5	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Pukekohe	6.6	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Whangamata	7.0	>20	0.29	0.65	0.4	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.7	0.39	0.92	0.8	0.39	0.96	0.9
Pokeno	6.7	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Waiuku	6.5	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Tuakau	6.6	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Ngatea	6.9	>20	0.29	0.65	0.4	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.7	0.39	0.92	0.8	0.39	0.96	1.0
Paeroa	7.0	>20	0.29	0.65	0.4	0.34	0.74	0.5	0.38	0.82	0.6	0.39	0.88	0.7	0.39	0.92	0.8	0.39	0.96	1.0
Waihi	7.1	>20	0.29	0.65	0.4	0.34	0.74	0.5	0.38	0.82	0.6	0.39	0.88	0.7	0.39	0.92	0.8	0.39	0.96	1.0
Te Kauwhata	6.7	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Waihi Beach-Bowentown	7.2	>20	0.29	0.65	0.4	0.34	0.74	0.5	0.38	0.82	0.6	0.39	0.88	0.7	0.39	0.92	0.8	0.39	1.0	1.0
Te Aroha	7.1	>20	0.29	0.65	0.4	0.34	0.74	0.5	0.38	0.82	0.6	0.39	0.88	0.7	0.39	0.92	0.9	0.39	0.98	1.0
Huntly	6.7	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Katikati	7.3	>20	0.29	0.65	0.4	0.34	0.74	0.5	0.38	0.82	0.6	0.39	0.89	0.7	0.39	0.93	0.9	0.39	1.03	1.0
Omokoroa	7.3	>20	0.32	0.69	0.4	0.36	0.8	0.5	0.4	0.89	0.6	0.42	0.97	0.7	0.42	1.01	0.8	0.42	1.1	1.0
Mount Maunganui	7.3	>20	0.36	0.79	0.4	0.41	0.9	0.5	0.45	1.0	0.6	0.46	1.07	0.7	0.46	1.1	0.8	0.46	1.18	1.0
Morrinsville	7.1	>20	0.29	0.65	0.4	0.34	0.74	0.5	0.38	0.82	0.6	0.39	0.88	0.7	0.39	0.92	0.8	0.39	0.96	1.0
Ngaruawahia	6.8	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Tauranga	7.3	>20	0.36	0.79	0.4	0.41	0.9	0.5	0.45	1.0	0.6	0.46	1.07	0.7	0.46	1.1	0.8	0.46	1.18	1.0
Te Puke	7.3	>20	0.44	0.96	0.4	0.5	1.09	0.5	0.53	1.18	0.6	0.54	1.24	0.7	0.53	1.26	0.8	0.52	1.31	1.0
Hamilton	6.9	>20	0.29	0.65	0.4	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.7	0.39	0.92	0.8	0.39	0.96	0.9
Raglan	6.6	>20	0.29	0.65	0.3	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.6	0.39	0.92	0.8	0.39	0.96	0.9
Matamata	7.3	>20	0.32	0.69	0.4	0.37	0.8	0.5	0.4	0.89	0.6	0.42	0.96	0.8	0.42	1.0	0.9	0.42	1.08	1.0

TABLE 3.4(g) part 3: Site demand parameters for an annual probability of exceedance of 1/2500

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Cambridge	7.1	>20	0.29	0.65	0.4	0.34	0.74	0.5	0.38	0.82	0.6	0.39	0.88	0.7	0.39	0.92	0.8	0.39	0.97	1.0
Ruatoria	7.9	>20	1.3	2.94	0.3	1.34	2.85	0.4	1.28	2.6	0.5	1.17	2.3	0.6	1.08	2.12	0.7	0.98	1.95	1.0
Whakatane	7.4	>20	0.96	2.2	0.3	1.05	2.32	0.4	1.07	2.28	0.6	1.01	2.16	0.7	0.94	2.04	0.9	0.87	1.98	1.2
Edgecumbe	7.3	>20	0.87	1.98	0.3	0.96	2.13	0.4	0.98	2.12	0.6	0.94	2.03	0.7	0.88	1.94	0.9	0.8	1.89	1.2
Ohope	7.5	>20	0.97	2.23	0.3	1.06	2.34	0.4	1.07	2.28	0.5	1.01	2.15	0.7	0.95	2.03	0.9	0.87	1.96	1.2
Pirongia	7.0	>20	0.29	0.65	0.4	0.34	0.74	0.4	0.38	0.82	0.5	0.39	0.88	0.7	0.39	0.92	0.8	0.39	0.96	0.9
Te Awamutu	7.1	>20	0.29	0.65	0.4	0.34	0.74	0.5	0.38	0.82	0.6	0.39	0.88	0.7	0.39	0.92	0.8	0.39	0.96	1.0
Opotiki	7.5	>20	0.97	2.23	0.3	1.05	2.31	0.4	1.06	2.24	0.5	1.0	2.11	0.7	0.94	2.0	0.8	0.87	1.91	1.1
Kihikihi	7.1	>20	0.29	0.65	0.4	0.34	0.74	0.5	0.38	0.82	0.6	0.39	0.88	0.7	0.39	0.92	0.8	0.39	0.97	1.0
Putaruru	7.4	>20	0.34	0.74	0.4	0.39	0.85	0.5	0.42	0.94	0.6	0.44	1.01	0.7	0.44	1.05	0.8	0.44	1.13	1.0
Ngongotaha	7.4	>20	0.49	1.09	0.4	0.55	1.22	0.5	0.59	1.3	0.6	0.59	1.34	0.7	0.58	1.34	0.8	0.56	1.39	1.0
Kawerau	7.4	>20	0.85	1.94	0.3	0.94	2.07	0.4	0.96	2.06	0.6	0.91	1.97	0.8	0.85	1.88	1.0	0.78	1.83	1.2
Rotorua	7.4	>20	0.55	1.23	0.4	0.62	1.36	0.5	0.65	1.43	0.6	0.65	1.45	0.7	0.63	1.43	0.9	0.6	1.47	1.1
Otorohanga	7.1	>20	0.29	0.65	0.4	0.34	0.74	0.5	0.38	0.82	0.6	0.39	0.88	0.7	0.39	0.92	0.8	0.39	0.97	1.0
Tokoroa	7.4	>20	0.39	0.87	0.4	0.45	0.98	0.5	0.48	1.07	0.6	0.5	1.13	0.7	0.49	1.16	0.8	0.49	1.23	1.0
Te Kuiti	7.2	>20	0.29	0.65	0.4	0.34	0.74	0.5	0.38	0.82	0.6	0.39	0.88	0.7	0.39	0.92	0.8	0.39	1.0	1.0
Mangakino	7.4	>20	0.41	0.9	0.4	0.46	1.01	0.5	0.5	1.1	0.6	0.51	1.16	0.7	0.51	1.18	0.8	0.5	1.25	1.0
Murupara	7.6	>20	0.84	1.93	0.3	0.92	2.01	0.4	0.93	1.97	0.5	0.89	1.89	0.6	0.85	1.82	0.8	0.79	1.75	1.0
Gisborne	7.9	>20	1.46	3.3	0.3	1.49	3.17	0.4	1.41	2.83	0.5	1.27	2.47	0.6	1.17	2.26	0.8	1.04	2.05	1.1
Taupo	7.4	>20	0.67	1.54	0.3	0.75	1.65	0.4	0.77	1.67	0.5	0.75	1.64	0.7	0.72	1.6	0.8	0.68	1.6	1.1
Taumarunui	7.5	>20	0.42	0.94	0.4	0.48	1.04	0.5	0.51	1.12	0.6	0.52	1.16	0.7	0.52	1.19	0.8	0.51	1.24	1.0
Turangi	7.4	>20	0.79	1.82	0.3	0.87	1.92	0.4	0.88	1.9	0.5	0.85	1.83	0.6	0.82	1.78	0.8	0.77	1.72	1.0
Waitara	7.0	>20	0.29	0.65	0.4	0.34	0.74	0.5	0.38	0.83	0.6	0.39	0.91	0.7	0.39	0.94	0.8	0.4	1.02	1.0
Wairoa	7.8	>20	1.25	2.83	0.3	1.29	2.77	0.4	1.25	2.54	0.5	1.14	2.27	0.6	1.06	2.11	0.8	0.96	1.95	1.0
New Plymouth	7.0	>20	0.31	0.67	0.4	0.35	0.77	0.5	0.38	0.86	0.6	0.4	0.93	0.7	0.4	0.96	0.8	0.4	1.03	1.0
Oakura (New Plymouth District)	7.0	>20	0.32	0.69	0.4	0.36	0.81	0.5	0.4	0.89	0.6	0.41	0.96	0.7	0.41	0.99	0.8	0.41	1.06	1.0
Inglewood	7.1	>20	0.37	0.81	0.4	0.42	0.93	0.5	0.46	1.01	0.6	0.47	1.07	0.7	0.46	1.08	0.9	0.46	1.15	1.0
Stratford	7.3	>20	0.36	0.79	0.4	0.41	0.9	0.5	0.44	0.98	0.6	0.46	1.05	0.7	0.46	1.08	0.8	0.46	1.14	1.0
Ohakune	7.5	>20	0.75	1.73	0.3	0.82	1.8	0.4	0.83	1.79	0.5	0.81	1.74	0.6	0.79	1.7	0.7	0.75	1.66	0.9
Raetihi	7.5	>20	0.73	1.68	0.3	0.79	1.75	0.4	0.81	1.74	0.5	0.8	1.7	0.6	0.77	1.66	0.7	0.73	1.63	0.9

TABLE 3.4(g) part 4: Site demand parameters for an annual probability of exceedance of 1/2500

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Eltham	7.4	>20	0.37	0.81	0.4	0.42	0.92	0.5	0.45	1.0	0.6	0.47	1.06	0.7	0.47	1.1	0.8	0.47	1.16	1.0
Opunake	7.1	>20	0.44	0.96	0.4	0.5	1.09	0.5	0.53	1.16	0.6	0.53	1.19	0.7	0.52	1.19	0.9	0.5	1.23	1.1
Waiouru	7.6	>20	0.85	1.95	0.3	0.91	2.0	0.4	0.92	1.97	0.5	0.89	1.88	0.6	0.85	1.82	0.7	0.8	1.75	1.0
Napier	7.9	>20	1.41	3.2	0.3	1.44	3.07	0.4	1.37	2.76	0.5	1.24	2.42	0.7	1.14	2.22	0.8	1.02	2.03	1.1
Clive	7.9	>20	1.46	3.33	0.3	1.5	3.2	0.4	1.42	2.86	0.5	1.28	2.49	0.7	1.17	2.28	0.9	1.04	2.08	1.2
Hawera	7.4	>20	0.4	0.89	0.4	0.45	0.99	0.5	0.49	1.07	0.6	0.5	1.12	0.7	0.5	1.15	0.8	0.49	1.2	1.0
Hastings	7.9	>20	1.49	3.39	0.3	1.52	3.25	0.4	1.44	2.9	0.5	1.3	2.52	0.7	1.19	2.31	0.9	1.06	2.11	1.2
Taihape	7.7	>20	1.01	2.31	0.3	1.07	2.32	0.4	1.06	2.23	0.5	1.01	2.07	0.6	0.95	1.97	0.8	0.88	1.87	1.0
Havelock North	7.9	>20	1.51	3.43	0.3	1.53	3.28	0.4	1.45	2.92	0.5	1.31	2.54	0.7	1.2	2.32	0.9	1.06	2.12	1.2
Patea	7.4	>20	0.53	1.2	0.3	0.59	1.28	0.4	0.62	1.33	0.5	0.62	1.34	0.7	0.61	1.34	0.8	0.59	1.36	1.0
Whanganui	7.5	>20	0.86	1.98	0.3	0.92	2.02	0.4	0.93	1.98	0.5	0.9	1.89	0.6	0.86	1.82	0.7	0.81	1.75	0.9
Waipawa	7.9	>20	1.65	3.76	0.3	1.67	3.57	0.4	1.57	3.14	0.5	1.4	2.69	0.7	1.28	2.44	0.9	1.12	2.23	1.3
Waipukurau	7.9	>20	1.7	3.87	0.3	1.72	3.66	0.4	1.61	3.21	0.5	1.43	2.74	0.7	1.3	2.47	0.9	1.14	2.26	1.3
Marton	7.6	>20	1.07	2.47	0.3	1.13	2.47	0.4	1.12	2.34	0.5	1.05	2.16	0.6	0.99	2.04	0.8	0.91	1.92	1.0
Bulls	7.7	>20	1.15	2.66	0.3	1.21	2.64	0.4	1.19	2.48	0.5	1.11	2.25	0.6	1.04	2.12	0.8	0.95	1.98	1.1
Dannevirke	7.9	>20	1.67	3.85	0.3	1.69	3.65	0.4	1.6	3.21	0.5	1.43	2.76	0.7	1.3	2.49	1.0	1.15	2.29	1.3
Feilding	7.8	>20	1.29	2.98	0.3	1.34	2.91	0.4	1.3	2.68	0.5	1.2	2.39	0.7	1.11	2.22	0.9	1.01	2.06	1.2
Ashhurst	7.9	7	1.52	3.52	0.3	1.57	3.4	0.4	1.5	3.04	0.5	1.35	2.65	0.7	1.24	2.42	1.0	1.1	2.24	1.3
Woodville	7.9	6	1.67	3.85	0.3	1.71	3.69	0.4	1.62	3.26	0.5	1.45	2.81	0.8	1.32	2.53	1.0	1.16	2.34	1.4
Palmerston North	7.8	6	1.46	3.38	0.3	1.5	3.27	0.4	1.44	2.94	0.5	1.31	2.59	0.7	1.21	2.37	0.9	1.08	2.2	1.3
Pahiatua	7.9	7	1.73	3.98	0.3	1.74	3.76	0.4	1.64	3.3	0.5	1.47	2.82	0.8	1.33	2.55	1.0	1.17	2.34	1.4
Foxton Beach	7.8	>20	1.31	3.02	0.3	1.36	2.95	0.4	1.32	2.71	0.5	1.21	2.42	0.7	1.13	2.25	0.9	1.02	2.1	1.2
Foxton	7.8	>20	1.36	3.14	0.3	1.41	3.05	0.4	1.36	2.79	0.5	1.25	2.47	0.7	1.15	2.29	0.9	1.04	2.13	1.2
Shannon	7.9	15	1.53	3.54	0.3	1.57	3.4	0.4	1.5	3.05	0.5	1.36	2.66	0.7	1.25	2.43	1.0	1.1	2.25	1.3
Levin	7.9	18	1.53	3.52	0.3	1.56	3.39	0.4	1.49	3.04	0.5	1.35	2.65	0.7	1.24	2.42	1.0	1.1	2.25	1.3
Otaki Beach	7.9	>20	1.54	3.56	0.3	1.58	3.42	0.4	1.51	3.06	0.5	1.36	2.67	0.7	1.25	2.43	1.0	1.11	2.26	1.3
Otaki	7.9	>20	1.56	3.6	0.3	1.6	3.45	0.4	1.52	3.08	0.5	1.38	2.69	0.7	1.26	2.45	1.0	1.12	2.27	1.3
Waikanae	7.9	>20	1.62	3.72	0.3	1.65	3.57	0.4	1.57	3.18	0.5	1.42	2.76	0.8	1.29	2.5	1.0	1.14	2.32	1.3
Takaka	7.5	>20	0.56	1.26	0.3	0.62	1.36	0.4	0.65	1.4	0.5	0.65	1.42	0.6	0.64	1.43	0.8	0.62	1.43	1.0
Paraparaumu	7.9	18	1.62	3.74	0.3	1.66	3.58	0.4	1.57	3.18	0.5	1.42	2.76	0.8	1.29	2.5	1.0	1.14	2.32	1.3

TABLE 3.4(g) part 5: Site demand parameters for an annual probability of exceedance of 1/2500

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Masterton	8.0	6	2.12	4.88	0.3	2.09	4.46	0.4	1.92	3.78	0.5	1.67	3.14	0.8	1.5	2.76	1.1	1.29	2.52	1.5
Paekakariki	7.9	16	1.67	3.85	0.3	1.71	3.68	0.4	1.62	3.26	0.5	1.45	2.82	0.8	1.32	2.55	1.0	1.16	2.36	1.4
Carterton	8.0	4	2.1	4.82	0.3	2.07	4.44	0.4	1.91	3.77	0.6	1.67	3.14	0.8	1.49	2.77	1.1	1.29	2.54	1.5
Greytown	8.0	4	2.01	4.61	0.3	2.0	4.27	0.4	1.85	3.66	0.6	1.62	3.07	0.8	1.46	2.73	1.1	1.26	2.5	1.5
Porirua	7.9	6	1.7	3.91	0.3	1.74	3.75	0.4	1.65	3.33	0.6	1.47	2.88	0.8	1.34	2.59	1.1	1.17	2.41	1.4
Featherston	8.0	0	2.02	4.63	0.3	2.02	4.33	0.4	1.88	3.73	0.6	1.65	3.14	0.8	1.48	2.79	1.1	1.28	2.56	1.5
Motueka	7.6	>20	0.68	1.55	0.3	0.75	1.64	0.4	0.77	1.66	0.5	0.76	1.64	0.7	0.74	1.62	0.8	0.7	1.6	1.0
Upper Hutt	7.9	0	1.85	4.25	0.3	1.87	4.04	0.4	1.76	3.54	0.6	1.56	3.02	0.8	1.41	2.71	1.1	1.23	2.5	1.5
Lower Hutt	7.9	0	1.77	4.06	0.3	1.8	3.88	0.4	1.7	3.42	0.6	1.51	2.95	0.8	1.37	2.65	1.1	1.2	2.46	1.5
Martinborough	8.1	16	2.01	4.58	0.3	1.98	4.21	0.4	1.83	3.6	0.5	1.61	3.01	0.8	1.45	2.68	1.0	1.26	2.44	1.4
Mapua	7.6	>20	0.78	1.76	0.3	0.85	1.85	0.4	0.87	1.84	0.5	0.84	1.79	0.7	0.81	1.74	0.9	0.76	1.71	1.1
Wainuiomata	7.9	0	1.77	4.06	0.3	1.8	3.88	0.4	1.7	3.42	0.6	1.51	2.95	0.8	1.37	2.65	1.1	1.2	2.46	1.5
Nelson	7.6	>20	0.83	1.89	0.3	0.91	1.98	0.4	0.92	1.95	0.5	0.89	1.88	0.7	0.85	1.82	0.9	0.8	1.78	1.1
Picton	7.8	>20	1.17	2.68	0.3	1.24	2.69	0.4	1.22	2.53	0.5	1.14	2.33	0.7	1.06	2.19	0.9	0.97	2.08	1.2
Wellington CBD	7.9	0	1.75	4.01	0.3	1.79	3.85	0.4	1.69	3.42	0.6	1.51	2.96	0.8	1.37	2.67	1.1	1.2	2.48	1.5
Wellington	7.9	0	1.75	4.01	0.3	1.79	3.85	0.4	1.69	3.42	0.6	1.51	2.96	0.8	1.37	2.67	1.1	1.2	2.48	1.5
Eastbourne	7.9	0	1.77	4.06	0.3	1.8	3.88	0.4	1.7	3.42	0.6	1.51	2.95	0.8	1.37	2.65	1.1	1.2	2.46	1.5
Richmond	7.6	>20	0.83	1.88	0.3	0.9	1.97	0.4	0.92	1.95	0.5	0.89	1.88	0.7	0.85	1.82	0.9	0.79	1.78	1.1
Hope	7.6	>20	0.83	1.88	0.3	0.9	1.97	0.4	0.92	1.95	0.5	0.89	1.88	0.7	0.85	1.82	0.9	0.79	1.78	1.1
Brightwater	7.6	>20	0.83	1.87	0.3	0.9	1.96	0.4	0.92	1.94	0.5	0.88	1.87	0.7	0.84	1.81	0.9	0.79	1.78	1.1
Wakefield	7.6	>20	0.83	1.87	0.3	0.9	1.96	0.4	0.92	1.94	0.5	0.88	1.87	0.7	0.84	1.81	0.9	0.79	1.78	1.1
Renwick	7.8	>20	1.28	2.9	0.3	1.35	2.93	0.4	1.33	2.75	0.6	1.22	2.5	0.8	1.13	2.31	1.0	1.01	2.2	1.4
Blenheim	7.8	11	1.32	3.01	0.3	1.39	3.01	0.4	1.36	2.8	0.6	1.25	2.54	0.8	1.15	2.35	1.0	1.03	2.23	1.3
Seddon	7.8	5	1.45	3.31	0.3	1.51	3.28	0.4	1.47	3.02	0.6	1.34	2.71	0.8	1.22	2.49	1.0	1.09	2.35	1.4
Westport	7.2	>20	0.62	1.39	0.3	0.69	1.52	0.4	0.72	1.56	0.5	0.71	1.57	0.7	0.69	1.54	0.9	0.65	1.55	1.1
St Arnaud	7.8	0	1.01	2.27	0.3	1.09	2.38	0.4	1.1	2.32	0.6	1.04	2.19	0.8	0.97	2.08	1.0	0.88	2.02	1.3
Murchison	7.4	>20	0.77	1.76	0.3	0.86	1.88	0.4	0.88	1.9	0.6	0.86	1.86	0.7	0.82	1.8	0.9	0.76	1.8	1.2
Ward	7.9	5	1.58	3.61	0.3	1.64	3.55	0.4	1.58	3.22	0.6	1.42	2.83	0.8	1.28	2.59	1.1	1.13	2.41	1.5
Reefton	7.4	>20	0.78	1.75	0.3	0.87	1.9	0.5	0.89	1.92	0.6	0.86	1.89	0.8	0.82	1.83	1.0	0.76	1.82	1.3
Springs Junction	7.9	2	1.22	2.75	0.4	1.35	2.94	0.5	1.36	2.91	0.7	1.24	2.71	1.0	1.12	2.56	1.2	0.99	2.34	1.7

TABLE 3.4(g) part 6: Site demand parameters for an annual probability of exceedance of 1/2500

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	Sas	***Tc***	***PGA***	Sas	***Tc***	***PGA***	Sas	***Tc***	***PGA***	Sas	***Tc***	***PGA***	Sas	***Tc***	***PGA***	Sas	***Tc***
Runanga	7.6	>20	0.67	1.47	0.4	0.75	1.63	0.5	0.78	1.7	0.6	0.77	1.69	0.8	0.73	1.66	1.0	0.68	1.67	1.3
Kaikoura	7.9	6	1.37	3.09	0.3	1.44	3.09	0.4	1.4	2.86	0.6	1.27	2.56	0.8	1.16	2.37	1.1	1.02	2.22	1.5
Greymouth	7.6	>20	0.68	1.51	0.4	0.77	1.67	0.5	0.81	1.75	0.6	0.79	1.74	0.9	0.74	1.72	1.0	0.69	1.71	1.3
Hanmer Springs	7.8	4	1.37	3.12	0.4	1.5	3.28	0.5	1.49	3.17	0.6	1.35	2.9	0.9	1.22	2.73	1.2	1.06	2.49	1.7
Hokitika	7.8	>20	0.81	1.79	0.4	0.91	1.98	0.5	0.95	2.05	0.7	0.9	2.0	0.9	0.84	1.96	1.1	0.77	1.9	1.5
Cheviot	7.6	>20	0.93	2.09	0.3	1.01	2.18	0.4	1.02	2.13	0.6	0.96	2.02	0.8	0.9	1.92	0.9	0.83	1.88	1.2
Otira	7.9	1	1.43	3.25	0.4	1.58	3.48	0.5	1.57	3.41	0.7	1.42	3.16	1.0	1.26	2.91	1.3	1.07	2.61	1.8
Arthurs Pass	7.6	13	0.99	2.24	0.4	1.11	2.45	0.5	1.14	2.48	0.6	1.07	2.37	0.9	0.99	2.28	1.1	0.89	2.17	1.5
Harihari	8.2	0	1.31	2.91	0.4	1.46	3.16	0.6	1.46	3.16	0.7	1.33	2.98	1.1	1.19	2.74	1.4	1.01	2.53	2.0
Amberley	7.3	>20	0.62	1.38	0.4	0.7	1.52	0.5	0.73	1.59	0.6	0.72	1.6	0.8	0.69	1.59	0.9	0.66	1.62	1.2
Oxford	7.2	>20	0.65	1.46	0.4	0.74	1.62	0.5	0.77	1.68	0.6	0.76	1.68	0.8	0.72	1.66	1.0	0.67	1.67	1.2
Rangiora	7.2	>20	0.57	1.28	0.4	0.65	1.43	0.5	0.69	1.51	0.6	0.68	1.53	0.8	0.66	1.53	0.9	0.63	1.56	1.2
Pegasus	7.1	>20	0.57	1.28	0.4	0.65	1.43	0.5	0.69	1.5	0.6	0.68	1.53	0.8	0.66	1.52	0.9	0.63	1.55	1.1
Woodend	7.1	>20	0.57	1.29	0.4	0.65	1.43	0.5	0.69	1.5	0.6	0.68	1.53	0.7	0.66	1.52	0.9	0.63	1.55	1.1
Franz Josef	8.3	0	1.55	3.42	0.4	1.72	3.69	0.6	1.71	3.69	0.8	1.53	3.44	1.1	1.36	3.11	1.5	1.14	2.92	2.1
Kaiapoi	6.9	>20	0.57	1.3	0.3	0.65	1.44	0.4	0.69	1.51	0.6	0.69	1.54	0.7	0.66	1.52	0.9	0.63	1.55	1.1
Fox Glacier	8.3	0	1.6	3.53	0.4	1.77	3.8	0.6	1.76	3.79	0.8	1.57	3.53	1.1	1.38	3.17	1.5	1.16	2.99	2.1
Darfield	6.8	>20	0.57	1.29	0.3	0.65	1.44	0.4	0.69	1.51	0.6	0.69	1.53	0.7	0.66	1.52	0.9	0.63	1.55	1.1
West Melton	6.6	>20	0.58	1.32	0.3	0.66	1.46	0.4	0.7	1.52	0.5	0.7	1.54	0.7	0.67	1.52	0.8	0.63	1.54	1.1
Christchurch	6.5	>20	0.64	1.45	0.3	0.72	1.59	0.4	0.76	1.64	0.5	0.75	1.63	0.6	0.71	1.59	0.8	0.67	1.59	1.0
Prebbleton	6.5	>20	0.59	1.34	0.3	0.67	1.48	0.4	0.71	1.54	0.5	0.7	1.55	0.7	0.67	1.53	0.8	0.64	1.54	1.0
Lyttelton	6.5	>20	0.6	1.38	0.3	0.69	1.52	0.4	0.73	1.58	0.5	0.72	1.58	0.6	0.69	1.55	0.8	0.65	1.54	1.0
Rolleston	6.6	>20	0.56	1.28	0.3	0.64	1.42	0.4	0.68	1.48	0.5	0.68	1.5	0.7	0.65	1.49	0.8	0.62	1.5	1.0
Methven	7.0	>20	0.49	1.07	0.4	0.56	1.22	0.5	0.6	1.31	0.6	0.6	1.37	0.8	0.58	1.38	0.9	0.56	1.44	1.2
Diamond Harbour	6.4	>20	0.58	1.33	0.3	0.66	1.46	0.4	0.7	1.52	0.5	0.7	1.53	0.6	0.67	1.5	0.8	0.63	1.51	1.0
Lincoln	6.5	>20	0.56	1.28	0.3	0.64	1.42	0.4	0.68	1.48	0.5	0.68	1.5	0.7	0.65	1.48	0.8	0.62	1.49	1.0
Mt Cook Village	8.1	>20	0.84	1.85	0.4	0.95	2.05	0.5	0.98	2.1	0.7	0.93	2.03	1.0	0.86	1.97	1.2	0.77	1.88	1.6
Rakaia	6.8	>20	0.44	0.98	0.4	0.51	1.11	0.4	0.55	1.2	0.6	0.55	1.26	0.7	0.54	1.27	0.9	0.53	1.33	1.1
Leeston	6.6	>20	0.45	1.01	0.3	0.52	1.14	0.4	0.56	1.22	0.5	0.56	1.28	0.7	0.55	1.29	0.8	0.54	1.33	1.0
Akaroa	6.6	>20	0.41	0.91	0.3	0.47	1.03	0.4	0.51	1.11	0.5	0.52	1.17	0.7	0.51	1.19	0.8	0.5	1.24	1.0

TABLE 3.4(g) part 7: Site demand parameters for an annual probability of exceedance of 1/2500

			Site Class I			Site Class II			Site Class III			Site Class IV			Site Class V			Site Class VI		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Ashburton	6.7	>20	0.4	0.89	0.4	0.46	1.02	0.5	0.5	1.11	0.6	0.51	1.17	0.7	0.51	1.19	0.9	0.5	1.26	1.1
Geraldine	6.8	>20	0.41	0.91	0.4	0.48	1.04	0.5	0.52	1.13	0.6	0.52	1.19	0.8	0.51	1.21	0.9	0.5	1.27	1.1
Fairlie	7.0	>20	0.46	1.0	0.4	0.52	1.14	0.5	0.56	1.23	0.6	0.57	1.29	0.8	0.55	1.3	1.0	0.54	1.36	1.2
Temuka	6.6	>20	0.4	0.89	0.3	0.46	1.01	0.4	0.5	1.09	0.6	0.51	1.15	0.7	0.5	1.17	0.9	0.49	1.22	1.1
Pleasant Point	6.7	>20	0.41	0.91	0.4	0.47	1.03	0.4	0.51	1.12	0.6	0.52	1.18	0.7	0.51	1.19	0.9	0.5	1.25	1.1
Twizel	7.4	>20	0.51	1.11	0.4	0.58	1.26	0.5	0.62	1.35	0.7	0.62	1.4	0.8	0.61	1.41	1.0	0.58	1.46	1.3
Timaru	6.6	>20	0.4	0.88	0.3	0.45	0.99	0.4	0.49	1.08	0.6	0.5	1.13	0.7	0.49	1.15	0.9	0.48	1.2	1.1
Lake Hawea	7.6	>20	0.62	1.37	0.4	0.7	1.52	0.5	0.74	1.58	0.6	0.74	1.61	0.8	0.71	1.59	1.0	0.68	1.62	1.3
Milford Sound	7.9	16	1.67	3.91	0.3	1.72	3.76	0.4	1.65	3.33	0.6	1.49	2.89	0.9	1.35	2.61	1.1	1.19	2.43	1.5
Wanaka	7.6	>20	0.64	1.43	0.4	0.72	1.57	0.5	0.76	1.62	0.6	0.75	1.63	0.8	0.73	1.61	1.0	0.69	1.64	1.2
Waimate	6.6	>20	0.4	0.9	0.3	0.46	1.01	0.4	0.5	1.09	0.5	0.51	1.13	0.7	0.5	1.15	0.9	0.49	1.19	1.1
Arrowtown	7.6	>20	0.65	1.45	0.3	0.72	1.57	0.4	0.76	1.61	0.6	0.76	1.62	0.8	0.73	1.59	0.9	0.7	1.61	1.2
Arthurs Point	7.7	>20	0.68	1.52	0.3	0.75	1.63	0.4	0.79	1.67	0.6	0.78	1.66	0.8	0.76	1.63	0.9	0.72	1.64	1.2
Lake Hayes	7.6	>20	0.64	1.42	0.4	0.71	1.54	0.4	0.75	1.59	0.6	0.75	1.6	0.8	0.72	1.58	0.9	0.69	1.6	1.2
Queenstown	7.6	>20	0.65	1.45	0.3	0.72	1.57	0.4	0.76	1.61	0.6	0.76	1.61	0.8	0.74	1.59	0.9	0.7	1.61	1.2
Cromwell	7.4	>20	0.55	1.22	0.4	0.62	1.35	0.5	0.66	1.41	0.6	0.66	1.45	0.8	0.64	1.44	0.9	0.62	1.49	1.2
Oamaru	6.6	>20	0.4	0.89	0.3	0.46	1.0	0.4	0.5	1.08	0.5	0.51	1.12	0.7	0.49	1.13	0.8	0.48	1.17	1.0
Clyde	7.2	>20	0.51	1.12	0.4	0.58	1.26	0.5	0.62	1.33	0.6	0.62	1.37	0.8	0.6	1.37	0.9	0.58	1.42	1.2
Alexandra	7.2	>20	0.49	1.09	0.4	0.56	1.23	0.5	0.6	1.3	0.6	0.61	1.34	0.8	0.59	1.34	0.9	0.57	1.39	1.1
Te Anau	7.8	>20	0.91	2.07	0.3	0.98	2.14	0.4	1.0	2.1	0.5	0.97	1.98	0.8	0.93	1.91	0.9	0.87	1.86	1.2
Palmerston	6.7	>20	0.41	0.92	0.3	0.47	1.03	0.4	0.51	1.1	0.5	0.51	1.14	0.7	0.5	1.15	0.8	0.49	1.17	1.0
Waikouaiti	6.6	>20	0.4	0.88	0.3	0.46	1.0	0.4	0.49	1.07	0.5	0.5	1.12	0.7	0.49	1.13	0.8	0.48	1.16	1.0
Mosgiel	6.7	>20	0.42	0.94	0.3	0.48	1.05	0.4	0.52	1.13	0.5	0.52	1.16	0.7	0.51	1.16	0.8	0.49	1.19	1.0
Dunedin	6.6	>20	0.41	0.91	0.3	0.47	1.03	0.4	0.51	1.1	0.5	0.51	1.14	0.6	0.5	1.15	0.8	0.48	1.17	1.0
Brighton	6.7	>20	0.43	0.95	0.3	0.49	1.07	0.4	0.53	1.14	0.5	0.53	1.17	0.7	0.51	1.17	0.8	0.5	1.19	1.0
Gore	6.9	>20	0.44	0.97	0.4	0.5	1.09	0.4	0.54	1.17	0.6	0.55	1.21	0.7	0.54	1.23	0.9	0.53	1.27	1.1
Milton	6.8	>20	0.45	0.99	0.3	0.51	1.11	0.4	0.55	1.18	0.5	0.55	1.21	0.7	0.53	1.2	0.8	0.51	1.22	1.0
Winton	7.2	>20	0.47	1.06	0.4	0.54	1.18	0.5	0.58	1.26	0.6	0.6	1.3	0.7	0.59	1.32	0.9	0.58	1.37	1.1
Mataura	6.9	>20	0.42	0.94	0.4	0.48	1.06	0.4	0.52	1.13	0.6	0.53	1.18	0.7	0.53	1.21	0.9	0.52	1.25	1.1
Balclutha	6.7	>20	0.42	0.93	0.3	0.48	1.05	0.4	0.52	1.12	0.5	0.52	1.16	0.7	0.51	1.16	0.8	0.5	1.19	1.0

TABLE 3.4(g) part 8: Site demand parameters for an annual probability of exceedance of 1/2500

			Site Class I			**Site Class II**			**Site Class III**			**Site Class IV**			**Site Class V**			**Site Class VI**		
Location	***M***	***D***	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c	***PGA***	S_{as}	T_c
Riverton	7.4	>20	0.52	1.18	0.4	0.59	1.29	0.4	0.63	1.36	0.6	0.65	1.39	0.7	0.64	1.4	0.9	0.62	1.44	1.1
Invercargill	7.1	>20	0.45	1.02	0.4	0.52	1.13	0.4	0.56	1.21	0.6	0.57	1.26	0.7	0.57	1.28	0.9	0.56	1.33	1.1
Bluff	7.1	>20	0.45	1.01	0.4	0.51	1.13	0.4	0.56	1.2	0.6	0.57	1.25	0.7	0.57	1.27	0.9	0.56	1.32	1.1
Oban	7.3	>20	0.48	1.08	0.3	0.55	1.2	0.4	0.59	1.27	0.6	0.6	1.3	0.7	0.6	1.32	0.9	0.58	1.35	1.1

