



New Zealand Tsunami Vertical Evacuation

National guidance, best practice and design criteria



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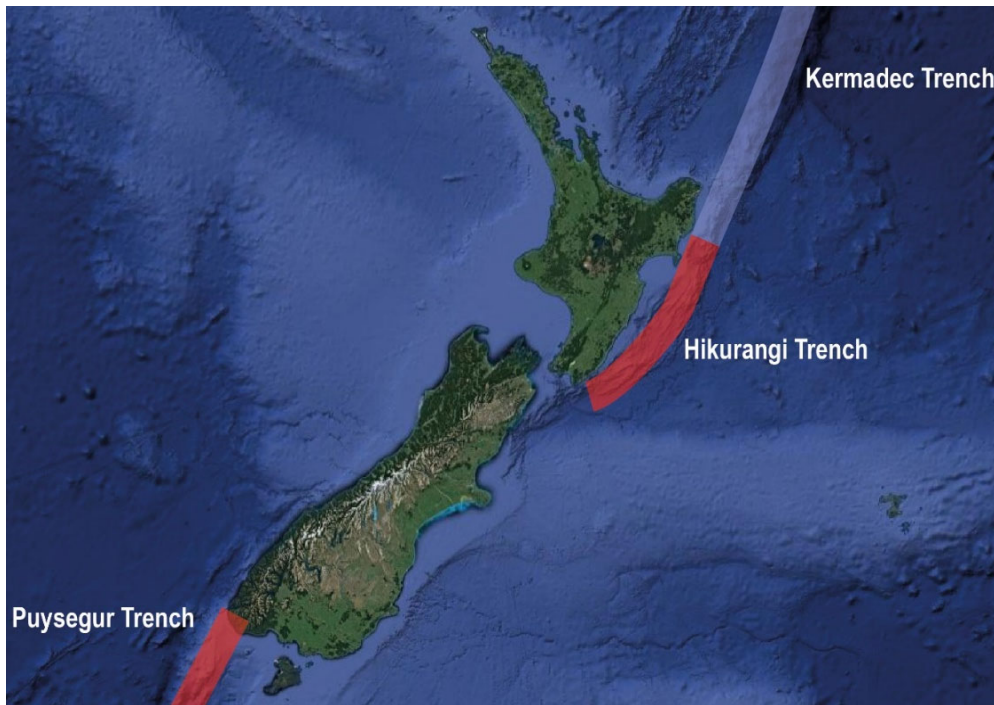


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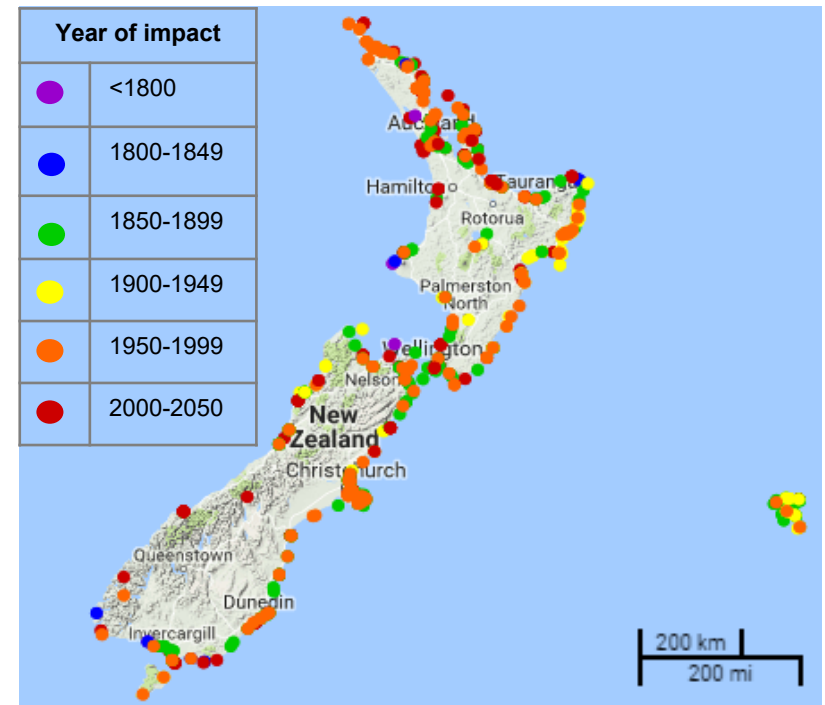


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New Zealand's Tsunami Risk



New Zealand's subduction zone boundaries, capable of generating large tsunami.



800 records of locations where tsunami have been recorded in New Zealand. Some events are recorded at multiple sites, e.g. the 2011 Tohoku tsunami was observed as unusual, surging currents at several locations (60/800 records).



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Two Phased Approach

Two Phased approach

1. Phase 1: Assessing and Planning for Tsunami Vertical Evacuation

*Ministry of Civil Defence & Emergency Management lead,
Ministry of Business Innovation & Employment supported*

2. Phase 2: Building Performance and Design Criteria for Tsunami Vertical Evacuation

*Ministry of Business Innovation & Employment lead,
Ministry of Civil Defence & Emergency Management supported*



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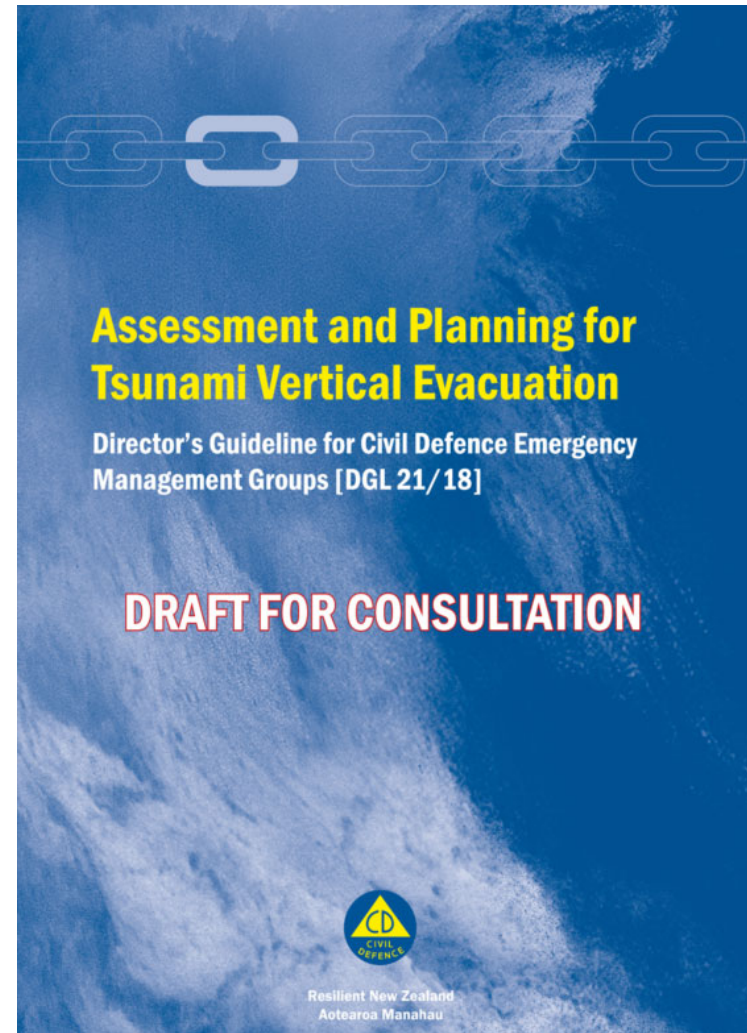
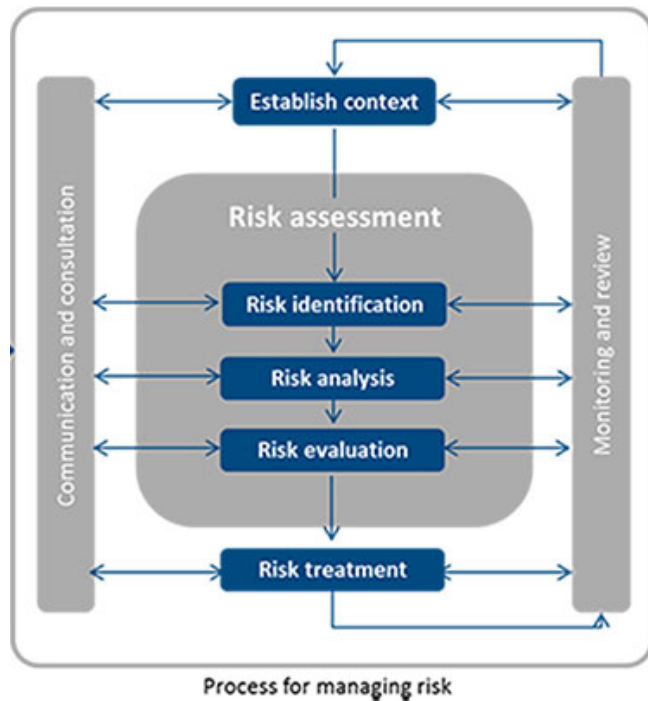


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Phase One : Risk based approach to assessing risk



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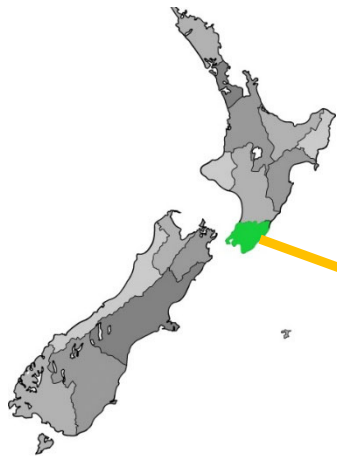


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Phase One : Some challenges and considerations



Wellington City and Petone, Wellington



REGION STATISTICS

Total Population	461,590
Exposed population at risk	80,000
Landward extent of evacuation zone	1.3km
Modelled MCE wave height	10m

Retrofit?



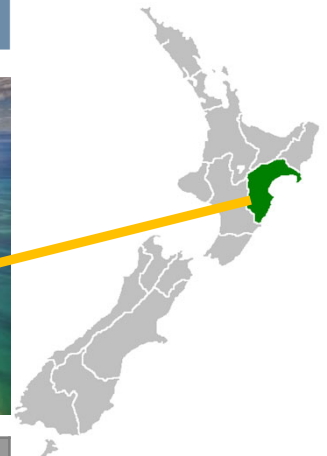
Napier, Hawkes Bay



CITY STATISTICS

Total Population	57,240
Exposed population at risk	9,500
Landward extent of evacuation zone	6 km
Modelled MCE wave height	12m

Purpose built?



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Phase One : Some challenges and considerations



Public Messaging – difficulties associated with ensuring advice is not conflicting or confusing for the public. It requires a reasonable level of technical expertise to determine whether building damage is superficial or structural.



Building Stock/Standards – Buildings must have the ability to withstand seismic shaking and tsunami forces. It may be impossible or prohibitively expensive to retrofit existing structures or build new structures.



Differing exposure/vulnerability – geographic and demographic variance results in differing exposures/vulnerabilities e.g. coastal plains modelled evacuation zones can extend several km's inland, making rapid evacuation on foot impractical. Some coastal communities may have a less mobile population or CBD's where high density populations live/work in high-rise structures, resulting in congestion.



Legislative framework – Emergency and building management guidance and standards will have to be reviewed/updated to reflect tsunami evacuation. It will need to ensure it is fit-for purpose and able to be used by all, despite differing geographic or demographic requirements.



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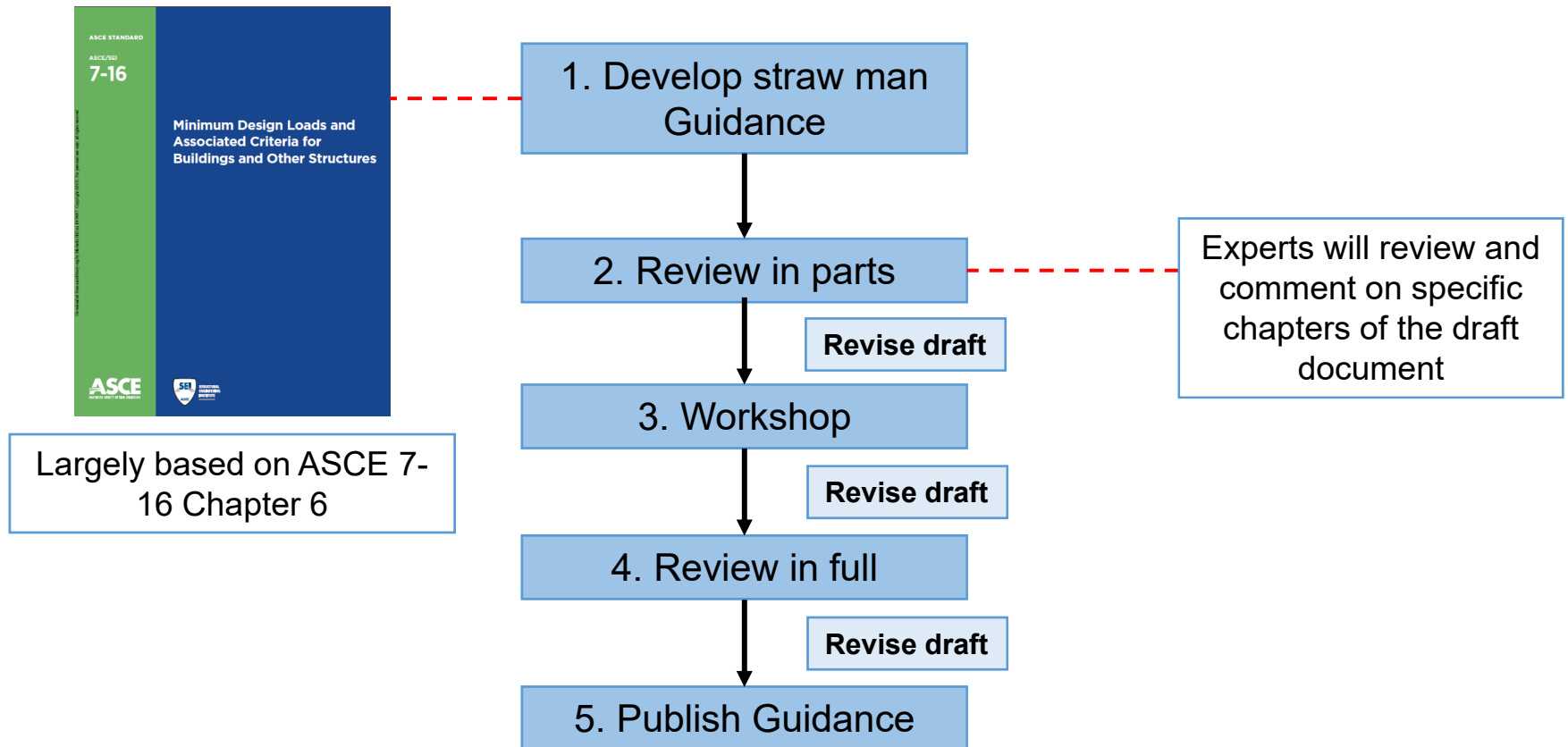


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Phase Two : Project Approach



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Phase Two : Proposed Structure

<i>Section/Chapter</i>	<i>Proposed Lead reviewers</i>
1. Introduction	
1.1 Purpose and Scope of the Guide	MBIE
1.2 Background	MBIE
2. Tsunami Load Determination and Structural Design Criteria	
2.1 Performance Objectives	All
2.2 General Design Criteria	All
2.3 Design Inundation Depth and Flow Velocity	GNS/NIWA
2.4 Hydrostatic Loads	UoA
2.5 Hydrodynamic Loads	UoA
2.6 Debris Impact Loads	UoA/Structural Engineer
2.7 Structural Design Procedure	Structural Engineer/UoA
2.8 Foundation Design	MBIE/UoA
3. Structural Design Concepts and Additional Considerations	All



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Phase Two : Considerations for the NZ context

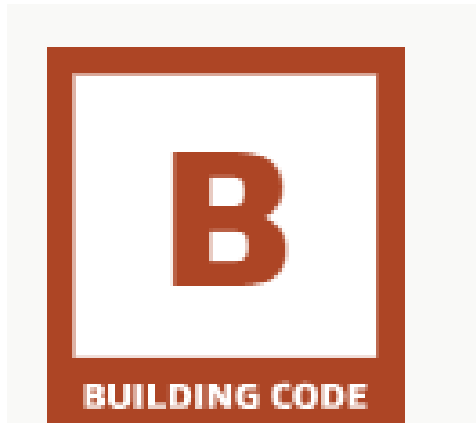
Tsunami modelling

- Probabilistic or scenario-based - what is more appropriate?
- Alignment with modelling already commissioned by CDEM groups

Structural performance objectives

- 'Translation' of US terminology eg Life Safety Limit State to achieve the same performance intent in NZ
- Performance objectives for the preceding earthquake shaking

Phase Two : NZ Building Code requirements for tsunami loading



B1.3.3 Account shall be taken of all physical conditions likely to affect the stability of *buildings, building elements and sitework*, including:

- (a) Self-weight,
- (b) Imposed gravity loads arising from use,
- (c) Temperature,
- (d) Earth pressure,
- (e) Water and other liquids,
- (f) Earthquake,
- (g) Snow,
- (h) Wind,
- (i) *Fire*,
- (j) Impact,
- (k) Explosion,
- (l) Reversing or fluctuating effects,

Tsunami ???



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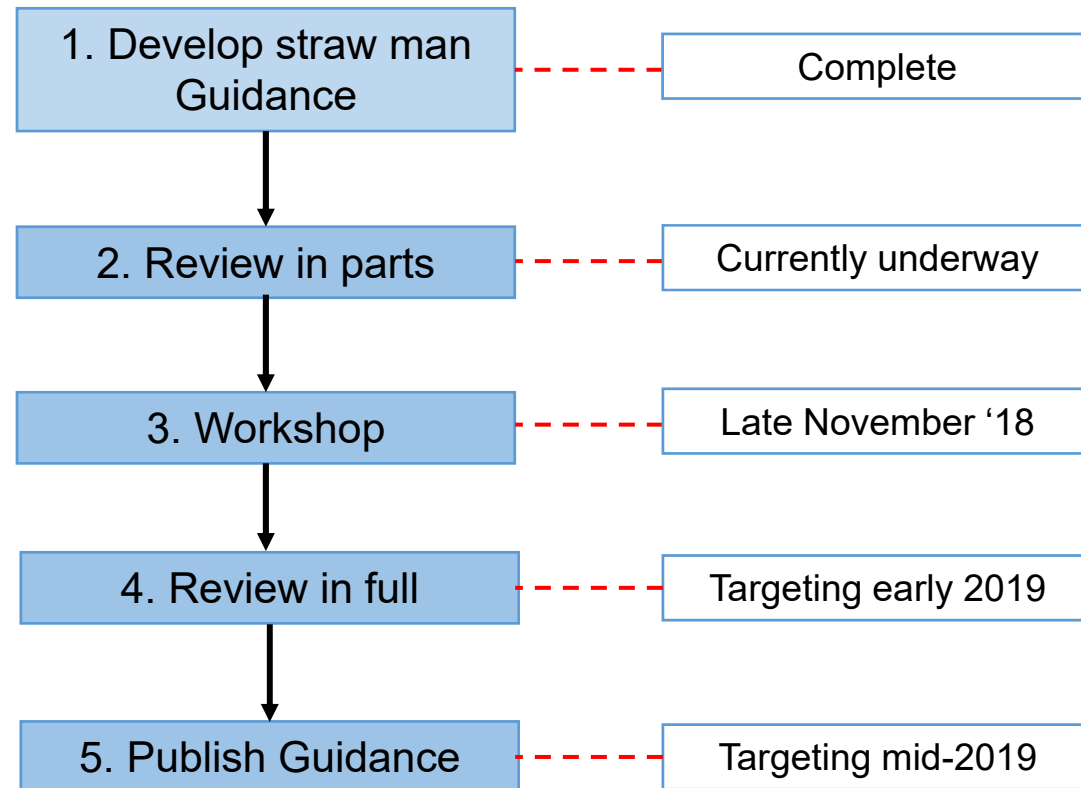


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Phase Two : Current status and next steps



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Thank you!

Questions?

If you want to get in touch, or find out more...



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