Te Tauira Matapae Pūmate Rū i Aotearoa
NSHM The New Zealand National Seismic Hazard Model
A GNS Science Led Research Programme

# National Seismic Hazard Model (NSHM)

The NSHM helps us manage risks to safety, security, and the economy from seismic events.

Knowing how future earthquakes might affect our regions helps us understand the risks to our communities.

The NSHM provides information about how every **different location in New Zealand might behave** in the event of large magnitude earthquakes.

New Zealand continues to be challenged by earthquakes and, because of our geographical make-up, it always will be. Fortunately, **globally, our understanding of earthquake science has improved exponentially.**

We now know a lot more about earthquake hazard and its impacts than we did previously, so we can **prepare better and make good decisions.**

The NSHM provides a vast range of results which must be considered together to understand local earthquake hazard. No one map or data set can summarise the hazard in any region. **It is not useful, or correct, to consider any of the data in isolation.**

**Increased hazard in any location does not always mean increased impact.** While the known hazards may have significantly increased from what was previously known in a location, the expected impacts of that earthquake hazard can remain low – either comparatively across the country, or depending on building types and mitigation measures.

## About the model

- The review of the NSHM was led by GNS Science and funded by MBIE and Toka Tū Ake EQC.
- It is world-leading science, with many local and international scientists and academics involved in its development.
- The NSHM is our future-earthquake knowledge toolkit. It provides a science-based, agreed estimate of the likelihood and strength of earthquake shaking which might occur in different parts of the country.
- The more we know about our earthquake hazard, the better we can prepare, make good decisions, and increase our resilience to earthquake hazard events.
- Since the last data update in 2010, hazard modelling science has greatly advanced and we have learned a lot from New Zealand's recent significant seismic activity, particularly the Canterbury earthquake sequence and the Kaikoura earthquake.

## What it tells us

- The model assesses the earthquake hazard in different locations throughout New Zealand. Hazards vary throughout the country, based on the geography and ground conditions, and the frequency and types of earthquakes that might occur in each location.
- The model presents data in the form of hazard curves, rupture sets, maps, and reports – and you can print, download spreadsheets, and share links from the model.
- The NSHM is available on a web app accessed from the GNS website. While it is intended for a technical audience, explanatory material including questions and answers, fact sheets, and video is also provided.

## Understanding the data

- The NSHM provides multiple data sets for each location and, to properly understand

the information, they must be considered together. One aspect of the results considered on its own cannot reflect the level of hazard for that location.
- A significant increase in earthquake hazard in any location from what we knew previously does not necessarily correspond to a similar increase in likely impact. A location may have doubled its level of hazard in this review of the NSHM, but there may be very low impact associated with that change.
- While the biggest increases and highest hazard are associated with the Hikurangi Subduction Zone, there are many hundreds of faults that can create earthquakes and an earthquake can affect locations far from its source.

## How it is used

- The model is used by a variety of decision makers to estimate the likely impact of earthquakes on New Zealand land, buildings, and infrastructure.
- It helps Civil Defence seismic risk communication and community resilience, road and rail infrastructure planning, assessment of risk for insurance companies and government owned assets. It is also used to determine how buildings need to be built or modified.
- The engineering, building, and insurance industries will all be considering the implications of the revised seismic hazard model data.

## How it might impact New Zealanders

1. Science
2. Considerations
3. Decision making
4. Policy and practice

- Changes are expected to result from the reviewed NSHM, but these won't be determined or applied for some time.
- The different industries and end users will now need to carefully consider the broad range of results before they can determine how the revised hazard information will be applied.
- Any changes will be communicated directly by the responsible agencies.

# Some key findings:

Shaking hazard increase across New Zealand ranges from **approximately no change, to more than doubling. The average is an increase of about 50% or more.**

**Increases do not translate to an equivalent impact** for buildings and other structures.

Seismic hazard has increased almost everywhere throughout New Zealand from what we knew from the 2010 NSHM model. This is not unexpected. **We know a lot more about earthquake behaviour now** due to better global understanding, more sophisticated science, and more than a decade of advancements in technical computing.

While the hazard is now forecast to range from almost no change, to around 2.5 times greater than previously thought, that does not translate to increased impact for all areas, because the **impact does not increase relative to the hazard.**

**A region may have increased in hazard significantly from the 2010 estimates but remain a low-impact area**. Northland is an example with results in that area indicating twice the previously known hazard, yet we know it to be a low-risk region relative to the rest of the country.

Impact is also influenced by **building structure types, local land and ground conditions, and any mitigation** that has occurred.

As expected, the **Hikurangi Subduction Zone** is responsible for most of New Zealand's earthquakes, but we now know of a lot more faults than we did in 2010 and all of them impact. Faults work together, so regions far from an epicentre can still be affected by earthquakes.