VULNERABILITY ANALYSIS OF WOODEN-FRAMED HOUSES IN WELLINGTON

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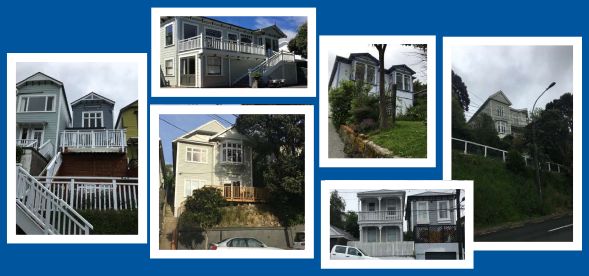


Background

Observations of damage after major earthquakes align with the design philosophy of international standards. However, poor performance has been reported with respect to how society expects the built environment to perform in an earthquake.

Data Collection

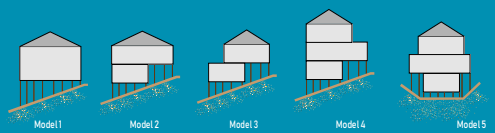
Three thousand questionnaires were distributed in 21 different suburbs in the Wellington region targeting owner occupied wooden framed housing.

From the 3000 questionnaires, 80 participated in the structural survey, where data on structural elements, plan and vertical shape, materials and strengthening techniques was collected.

Typology

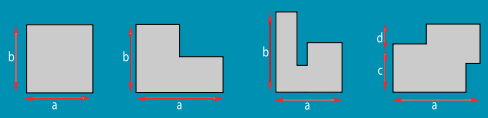
Vertical Shape

Five simple geometries were used to classify houses vertically.



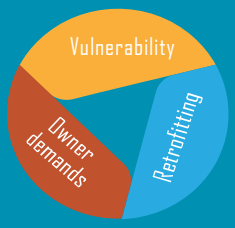
Plan Shape

Four simple geometries commonly used were selected, including rectangle, L, T, and Z-shapes.



Retrofitting

The results will be presented by using fragility curves of the developed typology considering the application of different retrofit solutions, which varying from engineered solutions to builder and owners instigated ideas.



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Objectives

Align performance levels in major seismic events with expected damage from the perception of homeowners.

Carry out a systematic analysis examining social demands of damage.

Assess retrofit solucions against structural performance considering the seismic vulnerability of existing houses located on slopes in the Wellington region.

Findings

Although more than 50% have a rectangular plan shape, they often have a concentration of openings,mainly on the downslope side, which results in an irregular stiffness distrubution.

Foundations
25% only timber piles.
25% only concrete piles.
50% mix of concrete and timber piles.

More than 90% were built before the introduction of NZ timber standards.

85 % have vertical irregularities.

41% self identified as having some level of seismic strengthening.

70% are two-story houses, which exclude them of the scope of the EQPB provisions.

Vulnerability Analysis

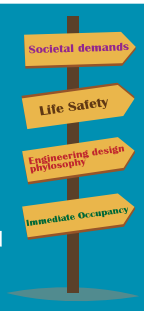
Using the typologies, numerical models will be used to investigate the effects of these variables on the performance measures.

An Incremental Dynamic Analysis (IDA) will facilitate the evaluation of the probability distribution of a structural demand parameter, the maximum inter-story drift, for a given seismic intensity level, pseudo acceleration (Sa (T=0.3s)).

Conclusions

The future seismic performance of existing wooden framed houses obtained will be compared with homeowners' expectations of damage to houses, revealing the extent of the gap between engineering current design and community expectations.

This multidisciplinary and innovative research will contribute to the suite of research being conducted around the Wellington Scenario and to the ongoing work on building a resilient community.



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