

Hospital Building Condition and Seismic Vulnerability

This note assesses the condition and earthquake vulnerability of New Zealand’s hospital buildings using only the dataset provided. The variables available relate mainly to building condition, seismic performance (%NBS, seismic zone, importance level), and gross floor area. The analysis has therefore been framed as a data-limited sandbox exercise focusing on renewal and maintenance needs rather than broader capital planning.

There are two objectives:

- Identify high-need buildings by jointly considering condition and earthquake risk, using a transparent non-weighted Pareto prioritisation method.
- Highlight key data gaps that materially affect investment decisions, particularly for high-importance (IL4) buildings.

Data Overview and Limitations

The dataset contains 1245 buildings across multiple regions, with key fields on condition, seismic performance, and gross floor area. Several variables required cleaning to standardise placeholders such as “-”, “NO DATA”, and “Nil” into missing values.

Missing data is material for decision-making: 48 IL4 buildings lack %NBS and/or condition data, and some fields are incomplete. These gaps reduce confidence in prioritisation and indicate the need for targeted assessments prior to, or as a part of, any investment programme.

Variable	Condition	Gross Floor Area	% NBS	Seismic Importance	Seismic Zone
Missing (n)	278	45	467	6	6

Table 1: Missing data summary for key variables

Descriptive Profiling

Building condition is mixed, with a substantial share in Poor or Very Poor grades. Seismic ratings also vary widely, with some buildings falling below the 34% NBS earthquake-prone threshold. High-importance (IL4) assets are the most critical for maintaining post-disaster health services, and several of these have low seismic ratings.

For IL3 and IL4 buildings, condition and %NBS often point to overlapping risk. Some facilities are both in poor condition and structurally weak, making them strong candidates for renewal. Figure 1 shows this combined view, with buildings in the bottom-right representing the most concerning cases.

Prioritisation Method – Pareto Banding

To identify high-need assets without imposing subjective weights, a non-dominated (Pareto) sorting approach was applied. This method ranks buildings by whether they are outperformed across all dimensions of need, with higher-ranked bands representing assets that are not dominated by any others.

The analysis used three variables: graded %NBS (structural strength), seismic importance level (IL), and seismic zone. Higher need was defined as lower %NBS grade, higher IL, and higher seismic zone risk. Buildings in the top Pareto bands represent those with the greatest combined structural and seismic vulnerability.

Results

Pareto banding places 64 buildings in Bands 1–3, indicating the highest combined need (Table 2). These bands include large IL4 facilities across high seismic risk regions, many with both low seismic grades and

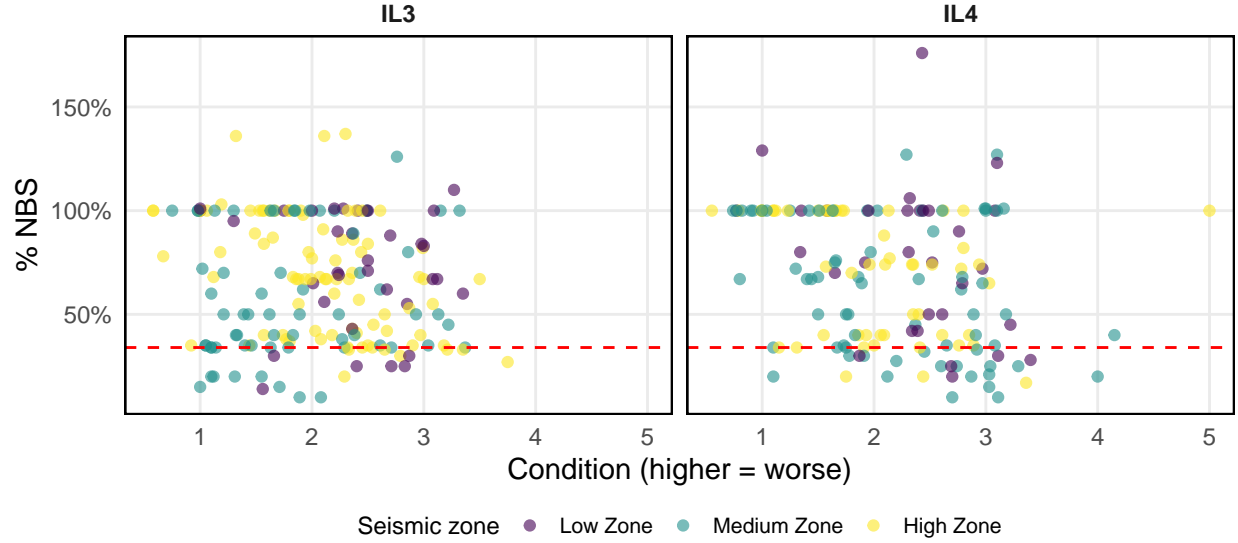


Figure 1: Condition vs %NBS for IL3 and IL4 buildings. Dashed line marks the 34% NBS threshold.

poor condition ratings.

Figure 2 shows the distribution of IL3 and IL4 buildings by condition, %NBS, and Pareto band. Lower bands (1–3) cluster in the high-need area of the plot, combining structural weakness, high seismic importance, and high seismic risk. These assets form the core of an initial investment priority list.

Pareto band	1	2	3	4	5	6	7	8	9	10
Count	1	16	47	99	183	144	145	103	24	15

Table 2: Number of assets in each Pareto band

- Band 1 represents the most critical combination of low seismic capacity, high building importance, and high seismic hazard zone.
- Subsequent bands reflect progressively lower combined need, though individual buildings in lower bands may still warrant investment on other grounds (e.g., condition, strategic location, service demand).

Band	Campus name	Building name	IL	Risk	NBS	Cond.	GFA
1	Palmerston North Hospital	Water Tower	IL4	High	E	Poor	100
2	Taranaki Base Hospital	Clinical Services Block	IL4	Med.	E	Poor	7,510
2	Christchurch Hospital	Boiler House - 235 Antigua St (including boiler & maintenance workshops)	IL4	High	D	Avg.	523
3	Christchurch Hospital	Riverside - West, East, Central	IL3	High	D	Poor	17,722

Table 3: Selected examples of high need buildings, showing seismic and condition attributes, and size (sqm)

Conclusions and recommendations

- Target data collection at critical IL4 buildings lacking %NBS and/or condition data to remove blind spots in risk assessment.
- Use Pareto banding to identify high-need assets for renewal, focusing on Bands 1–2 as the initial investment priority.

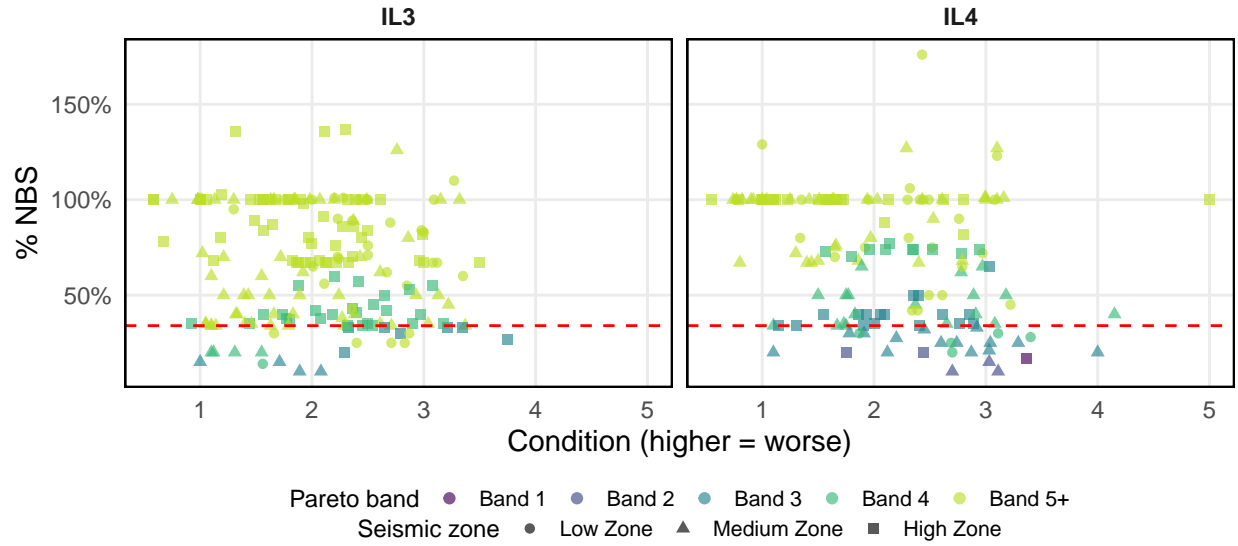


Figure 2: Condition vs %NBS for IL3 and IL4 buildings, coloured by Pareto band and shaped by Seismic Zone. Dashed line marks the 34% NBS threshold.

- Integrate improved data with broader planning inputs (e.g., service demand, location strategy) for future investment programmes.

Better data will sharpen prioritisation and ensure that limited capital is directed to assets with the greatest combined risk and service importance.