Warmer, drier homes: Improving our insulation, heating and ventilation

BRANZ House Condition Surveys 2010–2015

The BRANZ House Condition Survey provides a snapshot of the state of New Zealand's housing at a point in time. This report compares data from the 2010 and 2015 BRANZ House Condition Surveys relating to home heating, insulation, ventilation, mould and damp. Both the 2010 and 2015 surveys were nationwide and included rental properties, enabling us to compare results by tenure.[1]

1. Summary of findings

Results show some encouraging improvements in the levels of insulation and the types of heating present in New Zealand houses. The 2015 survey compared with 2010 shows:

- fewer houses with visible mould – decreasing from 59% in 2010 to 49% in 2015, and less dampness was also experienced
- many more houses meeting minimum insulation levels recommended by the Energy Efficiency and Conservation Authority (EECA) – 37% of houses in 2015 compared with 13% in 2010
- more houses with fixed heat pumps – increasing from 26% in 2010 to 39% in 2015.

The results in this report suggest that policies and programmes aimed at helping improve our indoor environments are starting to have a positive impact, with increases observed in the presence of mechanical ventilation, insulation levels and more efficient heating sources between 2010 and 2015.

However, while results suggest some positive change, there is still room for improvement. Many houses could benefit from improved insulation, more effective installation of insulation and more efficient heating sources. Owner-occupied houses continue to fare better in these areas than rental properties, particularly when it comes to efficient and affordable heating. Two 2017 BRANZ study reports cover these topics in more detail.[2]

2. Changes in the housing landscape between 2010 and 2015

Housing and housing quality have been a focus for recent governments. Several significant policy changes have been implemented in recent years relating to housing in New Zealand. These were designed to positively impact on the quality of housing and our indoor environments. Examples include Warm Up New Zealand and Warmer Kiwi Homes, which provided funding for improved insulation.

[1] Prior to 2010, the House Condition Survey was limited to the three major cities (Auckland, Wellington and Christchurch) and owner-occupied houses only. A separate paper provides further analysis of trends over time, dating back to the first HCS in 1994, within the limitations and context of these survey changes and comparability.
[2] See section 7 for links to further reading.

Results in this report show some early signs of improvement in housing quality particularly in terms of insulation and ventilation.

We expect to see further improvements as a result of other changes implemented more recently such as the Residential Tenancies (Smoke Alarms and Insulation) Regulations 2016 and Healthy Homes Guarantee Act 2017. These policy changes focus on improving the quality of rental housing in New Zealand. Their development was informed by results from the House Condition Survey.

3. Improvements in insulation

Measuring and recording insulation levels in the House Condition Survey relies on assessors being able to gain access to roof spaces, subfloor areas and walls. Similar proportions of roof and subfloor spaces were able to be accessed in both the 2010 and 2015 surveys. Changes to the survey method in 2015 prevented access to wall cavities. Wall insulation is therefore not discussed in this report.

3.1 Ceiling insulation levels are increasing

Roof spaces were able to be accessed in most houses in both survey years (over 80%). Of those, around 80% had at least some insulation in the roof space in both 2010 and 2015. However, differences exist when it comes to the levels of insulation present. EECA recommends insulation at a depth of at least 120 mm covering all accessible roof space.[3]

In 2015, we saw many more houses meeting these coverage and depth specifications than in 2010 – 39% or around 610,000 houses, compared with 13% (171,000 houses) in 2010.

Survey data also shows the average ceiling insulation depth increased from 80 mm in 2010 to 113 mm in 2015. For those that have at least 80% coverage, the average depth has increased from 97 mm in 2010 to 139 mm in 2015.

Of the houses where ceilings could be accessed, 3% had no ceiling insulation at all in both 2010 and 2015. The majority of those were older houses and represented very small numbers of the survey sample.

While most houses had some insulation covering at least 80% of the roof space (72% in 2010 and 73% in 2015), there is still room for improvement. With only around two-fifths (39%) meeting the minimum recommended level (120 mm) in the 2015 survey. This leaves many houses that could still benefit from improved insulation in the roof space.

Owned versus rentals

The 2017 BRANZ study report *Warm, dry, healthy?* showed small differences in levels of ceiling insulation between rented properties and owner-occupied houses. This was also the case in 2010 (Figure 1).

Since then, with increased information campaigns about the benefits of insulation and the government's Warm Up New Zealand programme, improvements have been seen across the board. The number of well-insulated houses increased for both rented and

[3] In this analysis, we use a minimum of 80% coverage of the roof space to allow for inaccessible spaces.

owner-occupied houses (Figure 1). This is a trend we would expect to see continue, particularly in the rental sector following the introduction of new regulations – the Residential Tenancies (Smoke Alarms and Insulation) Regulations 2016 and more recently the Healthy Homes Standards, which set minimum requirements for insulation (among other things) in rental properties.

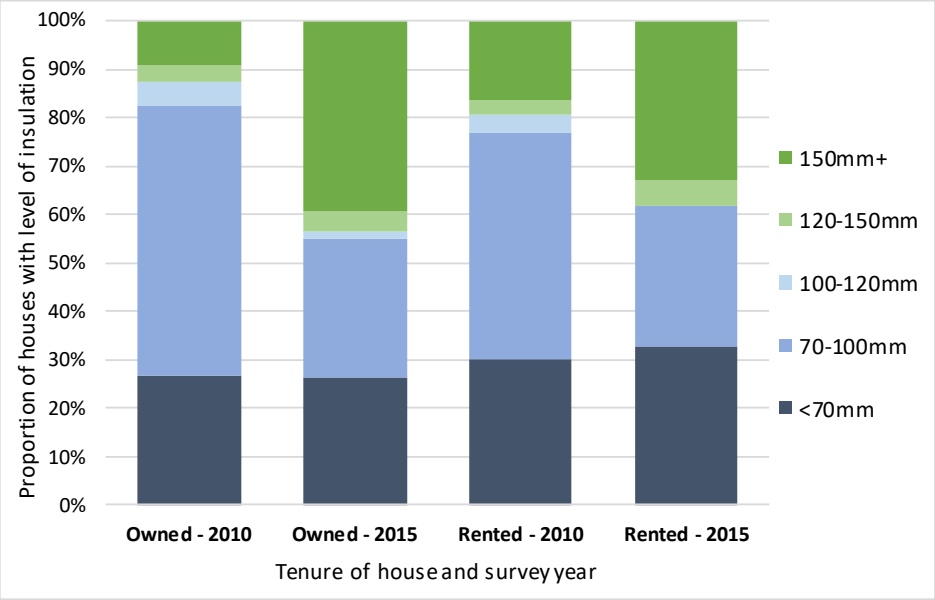


Figure 1. Depth of ceiling insulation – owned and rented houses, 2010 and 2015 (with at least 80% coverage of roof space).

3.2 Subfloor insulation is improving

Data on subfloor insulation was not available for a proportion of houses in both the 2010 and 2015 surveys due to lack of access (7%) or the foundation type (concrete slab, 33%). Results on subfloor insulation are therefore based on a subset of the survey sample in each year and not directly proportionally comparable due to differences in the number of missing observations.

However, despite some limitations with this data, results indicate a positive change. While little difference was observed in the prevalence of foil as the only insulating layer, an increase is evident in the proportion (and number) of houses with bulk insulation along with a subsequent decrease in the proportion and number of houses with no subfloor insulation (**Error! Not a valid bookmark self-reference.**). This positive trend is likely to continue with the introduction of the new rental insulation requirements and the 2016 ban on the installation or repair of foil in existing dwellings.

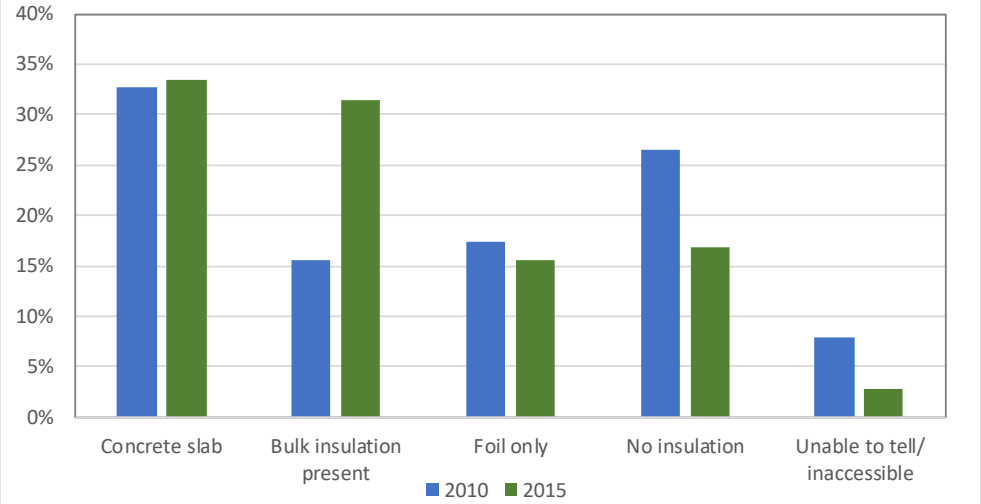
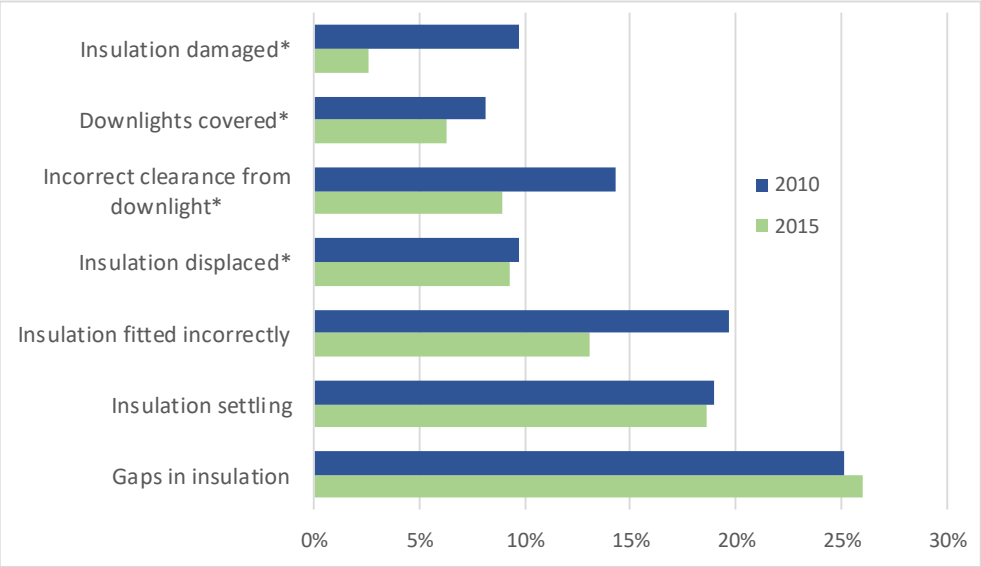


Figure 2. Subfloor insulation types observed, 2010 and 2015.

3.3 Insulation defects are still common but decreasing

Insulation is only effective when installed correctly and maintained over time. More than half of houses surveyed in both 2010 and 2015 had at least one defect in the roof space insulation, indicating that we are seeing installation issues with even recently installed insulation. The most common defect was gaps in the insulation, evident in around one-quarter of houses surveyed. Aside from gaps, the presence of most other types of defects measured in the survey decreased since 2010 (Figure 3), which is a positive result.

Downlights, which are increasingly common in New Zealand in both owned and rented houses, can also impact on a house's thermal performance. Downlights allow heat and moisture into the roof space, and most types of downlights require a minimum clearance to the ceiling insulation for fire safety reasons. The proportion of houses with downlights open to the roof space increased from 26% in 2010 to 33% in 2015.



*Represents fewer than 50 houses surveyed in at least one of the survey years.

Figure 3. Proportion of houses with roof space insulation defects, 2010 and 2015.

4. Changing the way we heat our houses

The 2017 BRANZ study report *Warm, dry, healthy?* discusses in detail the different heating types present and used in New Zealand houses. Information on the latter – how occupants heat their homes – was only collected in the 2015/16 survey through the introduction of a householder appliance-use questionnaire commissioned by EECA. The comparison of heating appliances presented here is therefore limited to the information collected in the House Condition Survey on the types of heating appliances present in the home (i.e. it does not take account of whether/how often the occupant uses them).

4.1 Moving away from portable heating sources …

The 2017 report discussed the prevalence of portable heating sources in New Zealand houses in 2015. However, results suggest a decrease since 2010. This applies to both portable electric heaters, present in 54% of houses in 2010 compared to 49% in 2015, and portable LPG heaters, decreasing from 16% in 2010 to 10% in 2015.

While overall the proportion of houses with portable heaters shows a decrease over time, these heating appliances remain more common in rented homes than owner-occupied. The proportion of rental houses with portable LPG gas heaters has decreased since 2010 from 25% to 17%, but this still equates to more than 96,000 houses.

4.2 … to more cost-effective and efficient heating

Increases in the presence of different types of fixed heating sources since 2010 indicate that New Zealanders are moving to more cost-effective heating. The biggest increase is seen in the proportion of houses with heat pumps. In 2010, around 26% or 340,000 houses had a heat pump. By 2015, this had increased to 39% or more than 600,000 houses. This increasing trend is being driven to a large extent by owner-occupied houses (Figure 4a).

Figures 4a and 4b show a marked decrease in the proportion of houses with no fixed heating sources. By 2015, the number of houses with no fixed heating had approximately halved compared with 2010 (24% to 11% overall). The biggest decrease was seen in rental houses, although the number of rentals with no fixed heating is still more than double that of owner-occupied houses.

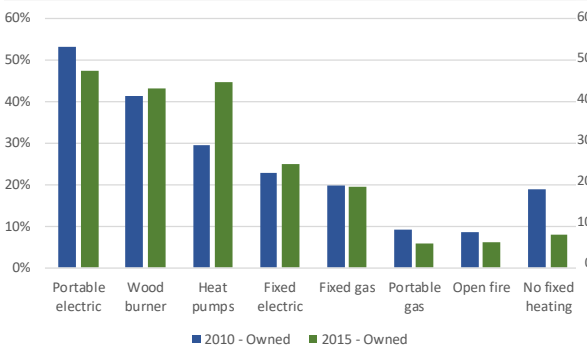


Figure 4a. Proportion of owner-occupied houses with different heating appliances, 2010 and 2015.

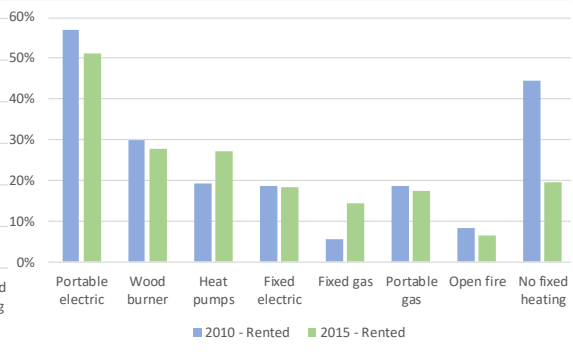


Figure 5b. Proportion of rented houses with different heating appliances, 2010 and 2015.

4.3 Presence of bathroom heating remains consistent

The BRANZ House Condition Survey records heating types present in bathrooms and laundries separately to other areas of the home. Heating these rooms can help to keep them drier and free from damp and mould, as warm air can hold more moisture, helping prevent it from condensing on cold surfaces.

There was little evidence of change in the prevalence of bathroom heating overall in the 2015 survey compared with 2010, with around half of houses surveyed having some form of heating in the main bathroom (52% and 50% respectively). The types of heating appliances in bathrooms also remained relatively consistent, the most common being fan heaters (25% of houses in 2015, a slight increase from 20% in 2010) and heated bulbs (23% in 2015, a slight decrease from 25% in 2010). Underfloor heating in bathrooms was slightly more common in 2015 but represents only small numbers in the survey sample.

However, the story is slightly different when we look at the tenure of the household. Owner-occupied houses were more likely than rented houses to have heating in the main bathroom – in both the 2010 and 2015 surveys. The gap appears to have increased between the two surveys. In 2010, 54% of owner-occupied houses had heating in the main bathroom, compared with 40% of rented. In 2015, 60% of owner-occupied houses had main bathroom heating compared with 37% of rented.

5. More mechanical ventilation available in 2015

Mechanical ventilation that extracts air outside and that is fitted and installed correctly is effective in removing moisture from houses. A higher proportion of houses surveyed in 2015 had mechanical ventilation in the main bathroom than in 2010. In 2015, 47% of main bathrooms had mechanical ventilation to outside compared with 37% in 2010 (Figure 5).

The prevalence of main bathroom mechanical ventilation increased for both owner-occupied and rental properties between 2010 and 2015. This has led to a narrowing of the gap between owner-occupied and rented properties. In 2010, 54% of owner-occupied houses had mechanical ventilation in the main bathroom, compared with just 28% in rented houses. By 2015, the gap had decreased, with 56% of owner-occupied houses and 49% of rented houses having mechanical ventilation in the main bathroom.

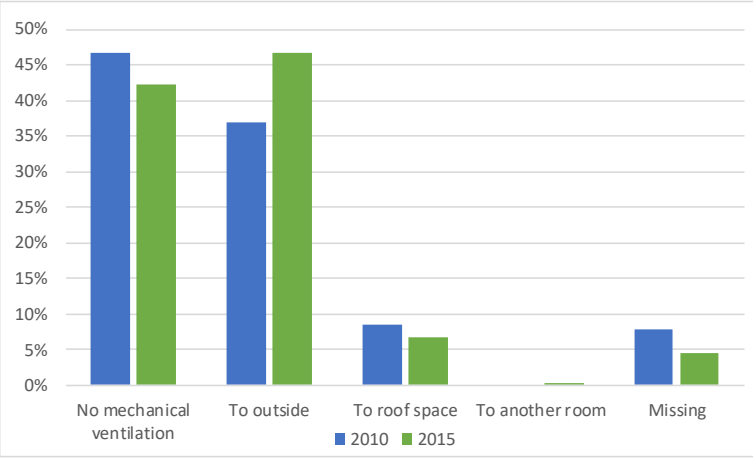


Figure 5. Type of mechanical ventilation in main bathroom, 2010 and 2015.

A similar proportion of kitchens had mechanical ventilation extracting to outside in both 2010 and 2015 – around half of all houses. As with bathroom ventilation above, there is a significant but decreasing gap between owner-occupied and rented houses. In 2010, 57% of owner-occupied kitchens had mechanical ventilation to the outside, compared with 35% of rentals. In 2015, these proportions had moved to 52% of owner-occupied houses and 44% of rentals.

Newer houses are much more likely to have some form of mechanical ventilation in the kitchen and bathroom. All houses built in 2010 or later had some form of mechanical ventilation present in the main bathroom. These newer houses equated to about 4% of the total sample in the 2015 survey.

Automatic clothes dryers were more common in owner-occupied houses than rentals. Those in owner-occupied houses were also more likely to be vented to the outside. Only around a quarter of houses with a clothes dryer had it vented to the outside in 2015 (24% overall – 26% of owner-occupied and 21% of rented houses). This is slightly more than the 21% overall in 2010 (25% of owner-occupied houses and 12% rented houses with clothes dryers).

6. Less visible mould in 2015

As part of the on-site assessment of a property, assessors were required to indicate whether houses felt damp inside or had a musty smell. Results for this measure of a 'damp feel' were similar in 2010 and 2015. However, in 2010, assessors were slightly more likely to report a musty smell (12% of houses in 2010 compared with 8% in 2015).

Assessors were also required to note the presence and levels of mould throughout a property – from none visible to a few specks through to extensive blackened areas present. While there are some missing data limitations in 2010, the overall presence of mould indicator (as determined by combining all mould levels observed in individual rooms) was lower in 2015 than in 2010. In 2015, 49% of houses were recorded as having at least some visible mould inside, lower than the 59% of houses recorded in 2010 (Figure 6). This reduction is seen in both owner-occupied and rental properties. In 2010, 73% of rented houses surveyed had some visible mould. In 2015, this figure was 56%.

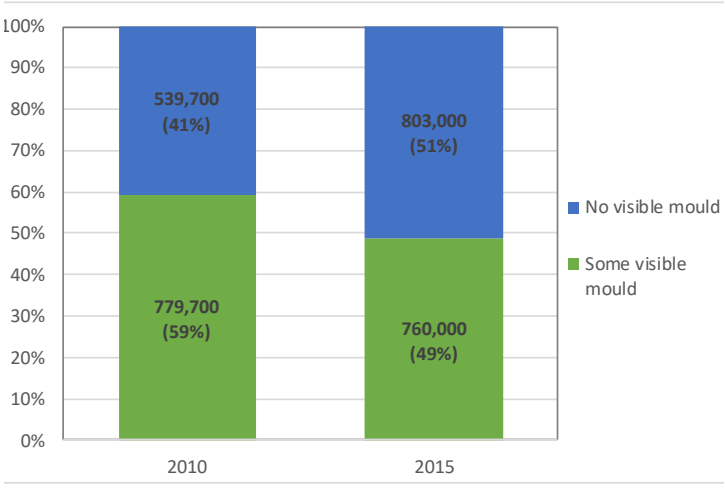


Figure 6. Overall presence of mould indicator, 2010 and 2015.

7. Further reading

For more information on the topics covered in this document, see the following BRANZ publications, available on our website:

Warm, dry, healthy? Insights from the 2015 House Condition Survey on insulation, ventilation, heating and mould in New Zealand houses (BRANZ Study Report SR372)
www.branz.co.nz/cms_show_download.php?id=50335e67bb00f3e0464097be1d4d71ac8a85f6bf

BRANZ 2015 House Condition Survey: Comparison of house condition by tenure (BRANZ Study Report SR370)
www.branz.co.nz/cms_show_download.php?id=a1efff0a2fd9885ecf878ce475631df7025cf3b8

Appendix: Data quality and comparability

Limitations of sample surveys

When interpreting results from the House Condition Survey, it is important to bear in mind the sample size and design. Due to the detailed and time-consuming nature of the on-site assessments of houses, the sample size is limited to around 500–600 surveys in each round (491 in 2010 and 560 in 2015), designed to have an overall sample error of ±5.5% (see Table 1 below for sample and weighted counts).

However, while the sample was designed to be self-weighting and proportionally representative of the owned and rental sector, the sample quota was not achieved for rentals. As a result, the data is weighted and sample errors are slightly higher.[4] All analysis in this report was undertaken with weighted data.

Sample used for analysis	2010 owned	2010 rented	2010 total	2015 owned	2015 rented	2015 total
Surveyed houses	383	108	491	411	149	560
Weighted count	880,195	438,593	1,318,788	1,011,121	550,652	1,561,773

Changes to the survey sample over time

Minor changes to the survey questions and content have occurred over time. This report focuses on areas where consistent information has been collected, with variables harmonised as far as possible. Some data quality issues also exist, especially in terms of missing data in 2010.

The 2010 survey collection coincided with the destructive earthquakes in Christchurch, so Christchurch houses were removed from the data for 2010. In contrast, the 2015 survey contained a larger sample for Christchurch to allow researchers to examine the impact of repairs undertaken in Christchurch housing post-earthquakes.

Differences in surveyed householders

The BRANZ House Condition Survey aims to reach a sample that is representative of all housing in New Zealand using a combination of stratified random sampling and cluster sampling. The socio-demographic make-up of the resulting sample is therefore subject to uptake (beyond the owned/rental target split). Socio-demographic information recorded in the survey shows both 2010 and 2015 included houses with an average of three occupants, most having lived at the house for at least 5 years (70% of the sample in 2010 and 74% in 2015). Household employment status and income distribution were also similar across the two surveys.

The main differences between the two surveys was the age distribution of occupants, with 39% of the sample households in 2015 having a person aged 65 and over, compared with 28% in 2010. This meant household compositions were also slightly different, with a higher proportion of people living alone in the 2015 sample – 24% compared with 20% in 2010. There were also fewer couples with children households in 2015 (23% compared with 32% in 2010) and more solo parents with children (11% in 2015 compared with 7% in 2010).

[4] For further details on the survey sampling method and weighting, see BRANZ Study Report SR370 *BRANZ 2015 House Condition Survey: Comparison of house condition by tenure*.