

STUDY REPORT

SR 240 (2011)

Preliminary BRANZ 2010 House Condition Survey Report – Second Edition

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Preface

This report has been prepared during the in-depth analysis of the condition of New Zealand's housing stock, which was surveyed between July 2010 and February 2011. The data has not had any weighting applied, which is in line with previous surveys. With the 2010 survey process including both rural and rental properties, in future analysis, weightings can be applied which will enable a better representation of the total New Zealand housing stock.

Reviewers

SJ Clark and LJ Amitrano.

Acknowledgments

This work was jointly funded by the Building Research Levy and the Department of Building and Housing (DBH). The Centre for Research Evaluation and Social Assessment (CRESA) undertook the social survey of homeowners on BRANZ Ltd's behalf, and John Jowett provided statistical analysis for the project. The work of Brendan White, Sheng Huei Huang, Desiree Pickering, and the surveyors who worked on the project is gratefully acknowledged.

BRANZ Ltd is very grateful to the many homeowners who allowed access to inspect their houses. Without their assistance this survey would not have been possible.

KEYWORDS

House Condition Survey, house condition, house problems, maintenance, home maintenance.

Note

This report is intended for researchers, manufacturers, economists and maintenance persons.

Preliminary BRANZ 2010 House Condition Survey Report – Second Edition

BRANZ Study Report SR 240

N.R. Buckett (Ed), N.J. Marston (Ed), K. Saville-Smith, J.H. Jowett and M.S. Jones

This report provides the findings on the overall condition of New Zealand houses. The analysis uses the data collected from the fourth *House Condition Survey* study - 2010.

This survey is the first that is nationwide and includes rental properties. Previous surveys were carried out in 1994, 1999 and 2005. For this study 573 houses throughout New Zealand were inspected, and their occupants interviewed on their family circumstances and maintenance practices (Saville-Smith, 2011). This report provides preliminary results for a subsample of 494 houses, including comparisons with the previous surveys' results. The data has not had any weighting applied which is in line with previous surveys.

The BRANZ *House Condition Surveys* provide “snapshots” of New Zealand’s housing stock at different points in time. This has been done by investigating a group of houses (and their occupants) that broadly represent the underlying range of designs, ages and varying conditions of New Zealand houses. As more surveys are completed, and trends and problems identified, a reliable information base is established on which to make comparisons.

Reference

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1. SUMMARY

This report represents the unweighted findings of the fourth House Condition Survey. The 2010 *House Condition Survey* is the first that is nationwide and includes rental properties. Previous surveys were carried out in 1994, 1999 and 2005. Five hundred and seventy-three houses throughout New Zealand were inspected, and occupants interviewed on their family circumstances and maintenance practices (Saville-Smith, 2011).

These surveys provide “snapshots” of New Zealand’s housing stock at different points in time, by investigating a group of houses (and their occupants) that broadly represent the underlying range of designs, ages and varying conditions of New Zealand houses. As more surveys are completed, and trends and problems identified, a reliable information base is established on which to make comparisons.

1.1 Overall condition

The 1994 and 1999 surveys found similar overall average conditions of surveyed houses, with some improvements in the condition of older houses. The 2005 survey indicated that the overall average condition of surveyed houses had improved, mainly due to increasing numbers of newer houses in the sample. The 2010 survey suggests that nationally the average condition of properties is similar to that of the 1999 survey. This decrease compared to the 2005 survey appears to be at least in part due to the incorporation of rentals into the survey set. It may also be influenced by the incorporation of the majority of the country, compared to previous surveys which were based in the three main cities

1.2 Condition for ages of houses

The first survey had indicated a general deterioration with increasing ages of houses, while the next survey showed a slight improvement in the condition of older houses in the Auckland and Wellington regions. The 2005 survey (Clark et al 2005) showed further signs of improvements resulting from renovation remained in the three main cities.

1.3 Common defects

The most common defects found in the structure included poor subfloor ventilation, inadequate clearance of wall claddings from the ground, and poor or missing subfloor fasteners. In general these defects were generally similar to those identified as common defects in past surveys.

Houses typically had at least one component in poor or serious condition.

This is the first year ground-to-wall cladding clearance deficiencies, which are known to contribute to accelerated cladding deterioration, have reduced after previous surveys showed them increasing (Clark et al 2005).

Fifty-five percent of hot water cylinders required replacement, repair or restraint to move out of the poor to serious condition category.

2. INTRODUCTION

This report looks at the findings relating to the overall surveyed sample. The BRANZ *House Condition Survey* is the only systematic survey of the structure, type and condition of dwellings in New Zealand. BRANZ carried out *House Condition Surveys* in 1994, 1999 and 2005 and recently completed the 2010 survey. The surveys provide an overall picture of the condition of housing in New Zealand. Analysis of the survey data provides information that contributes to the understanding of social and economic change in relation to the national housing stock. This is through identifying and examining the correlations between housing condition, housing quality, sustainability of housing, dampness, insulation, heating and other components that impact on the energy use, comfort and health of the occupants.

The fourth *House Condition Survey* is built on the survey methodology used previously to ensure the following:

- Confirm or otherwise the continuance and prevalence of defects found in past surveys.
- Add to the database of condition and maintenance requirements of different house components.
- Assess the levels of maintenance outstanding in the national housing stock, and the implications.
- Strengthen analyses of demographic and geographic data and their causative links to house maintenance.
- To analyse the results at a national level to present a national picture of quality of the housing stock in relation to condition, sustainability and other policy aspects.

2.1 Comparisons with past surveys

New Zealand's housing stock consisted of between 1.6 and 1.7 million¹ houses in 2006 (cf. 1999 1.4 million), with dwellings valued at about \$599 billion² in the third quarter of 2010. The first survey to collect information on the physical condition of this national asset was carried out in 1994 (Page et al 1995) when more than 400 houses were given a detailed inspection, and the condition of a wide variety of components assessed, with visually apparent defects identified where possible. The second, third and fourth surveys have followed a similar pattern (with each survey including additional components or features) so that trends could be considered.

Improvements were made to incorporate key components of the Healthy Housing Index. This index is a tool to assess the degree of house-related health issues, and the incorporation of the key components can assist with its further development and wider use.

The fourth *House Condition Survey* consists of a dataset that better represents the national housing stock because it includes both rental and rural properties around the country. This is a shift from previous *House Condition Surveys* (which focussed on owner-occupied properties in Auckland, Wellington and Christchurch), and responds to feedback from government sponsors and key stakeholders.

The 2010 *House Condition Survey* was affected by the Canterbury Earthquake on 4 September 2010 and the total number of Christchurch houses required could not be surveyed. Therefore, the sample was increased in other areas of New Zealand to make up the shortfall and ensure the statistical strength of the sample was retained.

In common with the 1999 and 2005 surveys, the 2010 survey gathers information on both the house via the inspection survey and on the occupier via a social survey. The social survey

¹ 2006 New Zealand Census, <http://www.stats.govt.nz/Census/2006CensusHomePage/QuickStats/quickstats-about-a-subject/housing/types-of-dwelling.aspx>, accessed 19 January 2011.

² Reserve Bank of New Zealand. Key Graphs – House Prices and Aggregate Dwelling Values, <http://www.rbnz.govt.nz/keygraphs/fig4.html>, accessed 10 February 2011. RBNZ estimates were derived from 2010 third quarter results from QV data.

was a short structured telephone interview undertaken by the Centre for Research Evaluation and Social Assessment (CRESA). It was designed to uncover the key social and economic variables associated with occupant's maintenance practices.

As with previous surveys, the 2010 survey was designed to gain a general impression of common defects within the limited time available for inspections on each house. As a result, the *House Condition Surveys* are not detailed weathertightness or structural surveys, which require specialised inspections using measuring instruments and techniques. Some also need destructive testing in order to establish the condition of inaccessible framing. Such inspection services are available from professional assessors such as members of the New Zealand Institute of Building Surveyors.

3. SURVEY DESIGN

3.1 Statistical framework

The statistical framework for the 2010 survey was modified compared to previous surveys so the overall sample was representative of all New Zealand houses, including rural and rental properties. The result is a robust statistical framework that provides a comprehensive national dataset on both the physical attributes of New Zealand dwellings and the homeowners'/occupiers' perceptions of the quality of their homes.

This work aligns with the review of Statistics NZ's *Housing Statistics Report 2009*³, which presents recommendations from a review of housing statistics carried out under section 7 of the Statistics Act 1975. This identified the need for national information on the physical attributes of the housing stock. The recommendation from this review was for the DBH, Statistics NZ and BRANZ to work together to improve existing data sources (survey and administrative) on the physical quality of the national housing stock, including rural and rental. It is also expected that the survey will also provide further information on substandard housing within the country.

The original sample of 550 houses was divided into two groups in an approximate 50:50 split:

- cities and suburbs of the five main centres (Auckland, Hamilton, Wellington, Christchurch, and Dunedin)
- a series of at least 64 area unit clusters randomly selected across the remainder of the country.

This was done in order to give a representative spread across the sample. In order to incorporate a representative sample of rental homes within the survey, approximately 20-25% of the sample (100-130 houses) needed to be rentals.

The Christchurch earthquakes led to the removal of Christchurch from the sample. Surveyors were working in Christchurch on 4 September 2010, and were forced to move onto other areas in the South Island. The second larger earthquake on 22 February 2011 meant it would not be possible to collect data from the required number of houses within Christchurch. It was therefore decided to abandon the analysis of the 15 houses surveyed prior to the earthquakes and remove Christchurch from the sample. The sample was reworked to enable Christchurch to be removed from the sample without lowering the certainty of the results of the study (Jowett, 2011). Further details on the sampling methods are outlined below.

³ *Housing Statistics Report 2009 - Topic 4 Housing Habitability*, published in 2009 by Statistics NZ.

3.2 Owner-occupied samples – property selection protocol

The owner occupied property selection protocol had two separate groups. The five main centres (Auckland, Wellington, Christchurch, Hamilton and Dunedin) were the first group, stratified by city, and could be surveyed with a simple random sample in each stratum. The rest of the country was put into another group, to be surveyed using a cluster sample based on area unit.

3.2.1 Cities

In the case of the cities, properties were randomly selected (e.g. 29 properties were to be in Manukau City). Required sample numbers for the cities is given below in Table 1. The area unit, physical/postal address, owner name and age of each property were obtained for each property in each city. Then for each of the chosen properties, six more properties within the same area unit and property age were selected to be available as substitutes in case of refusals.

Table 1: Breakdown of city samples

District	No. of Properties
Auckland City	54
Christchurch City	47 ⁴
Dunedin City	17
Hamilton City	22
Lower Hutt City	15
Manukau City	29
North Shore City	30
Porirua City	8
Upper Hutt City	6
Waitakere City	20
Wellington City	31

3.2.2 Clusters

Sixty-nine area units were randomly selected. Table 2 outlines an extract from the full list. Four properties within each area unit were then randomly selected. As in the case of the city properties, six substitute properties were also sourced. Again the area unit, physical/ postal address, owner name and age of each property were obtained for each property.

⁴ Christchurch surveying was abandoned due to the 4 September 2010 earthquake. The 15 already completed surveys were removed from the sample after the destructive 22 February 2011 earthquake.

Table 2: Extract from area unit list

District	Unit No	Unit Name
Far North District	500900	Kerikeri
Far North District	501614	Kapiro
Whangarei District	501819	Bream Head
Kaipara District	504501	Kaipara Coastal
Rodney District	505802	Red Beach
Rodney District	505803	Waiwera
Rodney District	505805	Orewa

The locations of the clusters are shown in Figure 1.



Figure 1: Cluster locations

3.3 Acquiring the sample

3.3.1 Initial sample

After the clusters were randomly selected, the required area units and cities were then sent to Terralink. They were asked to randomly select an age bracket (e.g. 1980-1989) for each property required for the sample, and provide seven names and addresses, one candidate and six substitutes for properties within the candidate's area unit.

The owners of each property on the Terralink data list were sent a letter requesting their cooperation within the *House Condition Survey* study. Local papers were also given a press release to coincide with the mail-out.

Due to privacy laws, Terralink was only able to provide owners' names and addresses, and to find phone numbers for the telephone surveyors tele-matching was carried out on the Terralink results by Veda Advantage. The success for this was relatively low, at around 38% for area units, and 44% for cities. As a result, the process was repeated to acquire more properties through Terralink and Veda Advantage.

3.4 Rental sample – property selection

The majority of the houses recruited under the initial methods were owner-occupied, with only around 2% of the houses being rentals. Therefore a specific sampling process was needed for the rentals in which the phone survey company was asked to obtain required rental sample sizes for applicable area units or strata.

Due to the challenges in obtaining a rental sample for the nationally representative survey, the methodology for recruiting rentals was altered quite considerably from what was first planned. At the end of the second round of telephone surveying a bias towards owner occupiers was quantified and needed to be addressed.

Analysis showed that to incorporate rentals within an acceptable confidence interval (95%), 118 rented houses were required to provide a nationally representative sample.

The method to achieve the least bias in this sample was to recruit renters through the random selection of phone numbers in required area units and strata. This was done for a number of reasons including:

- statistical integrity and reduction of bias
- reduction in barriers to recruitment
- improved efficiency in obtaining the sample.

Had landlords or property agents been involved in the recruitment process, a bias would have been created due to:

- landlords/property agents not wanting to inconvenience their tenants
- landlords/property agents not wanting their properties surveyed due to perceived condition
- landlords/property agents not wanting tenants to demand repairs that they otherwise may not have demanded
- the need to get agreement from both landlords and their tenants, meaning duplication or triplication of recruitment effort.

The randomised rental selection method had the potential for bias from tenants seeking surveys of houses perceived to be in poor condition, potentially to encourage their landlords to improve the property.

The rental sample includes both privately and publically owned rentals.

3.5 Telephone surveying

As for past *House Condition Surveys*, potential participants were called by a telephone research company, and asked to answer a short questionnaire on the maintenance of their home and if they would allow BRANZ to complete a physical inspection of their property. The survey was altered slightly for the rental houses to acknowledge the responsibility of the landlord rather than the tenant for the maintenance of the house.

From the samples returned from telephone surveying, approximately 500 householders agreed to both participate in the telephone survey and allow the physical inspection of their house.

3.6 Age distribution of sample

The ages of the sample obtained is distributed as shown in Figure 2. Nearly 21% of the houses were built after 1990, and around 7% before 1920.

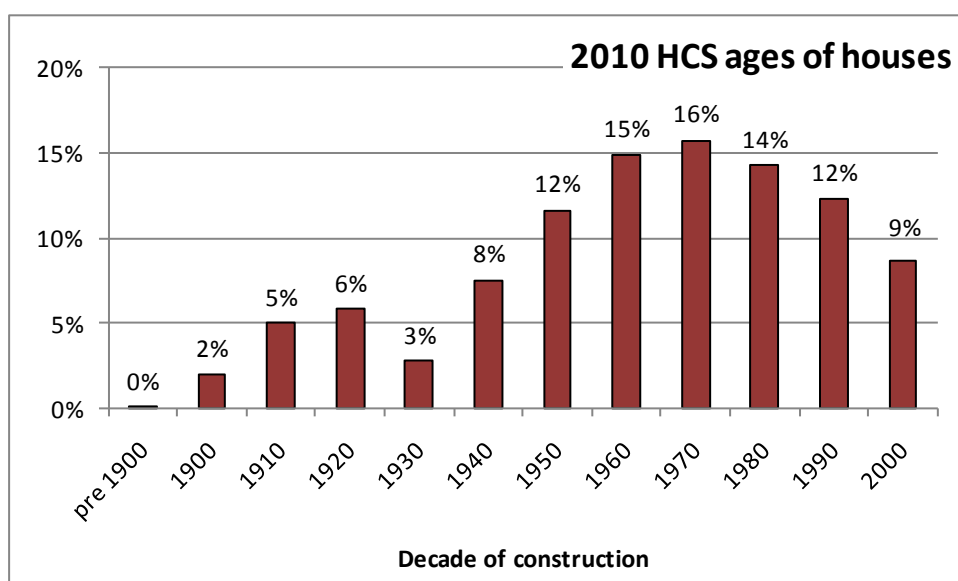


Figure 2: Proportion of sample by age group

3.7 Physical inspections

3.7.1 Training

This was the first survey where a standardised training programme was undertaken by all surveyors involved in the physical surveying of the recruited houses. The training programme involved a day of theory, before going along to watch and participate in surveys being undertaken by two experienced surveyors. At this point three of the six surveyors were selected to proceed with the final training during a trial period where their performance was closely monitored by the Senior Surveyor, Mike O'Malley. Forms from this trial period were audited by staff back at BRANZ as part of the ongoing quality control process.

Digital pens were used to record survey information, in contrast to conventional forms used in previous surveys. Geotagging digital cameras were also used, enabling locations as well as dates to be recorded.

4. ANALYSIS

Ignoring possible bias due to non-response, the sample obtained appears to be effectively equivalent to a simple random sample of approximately 360 properties, ignoring possible gains from stratification. This may be expected to lead to 95% confidence intervals of ± 5.3 percentage points for estimates of mid-range percentages of the total population.

Because of markedly different sampling fractions for owner-occupied and rental properties, the sample cannot be treated as self-weighting. However the analysis in this report is in line with the analysis carried out in previous reports which used un-weighted sample sets. Of the 573 physically surveyed houses, approximately 500 were telephone surveyed, and the results of 494 surveyed properties are used in this report. Data excluded from this analysis include:

- a subset of 60 rentals obtained through self-selection
- the 15 Christchurch houses surveyed before the Canterbury earthquake on 22 September 2010
- four incomplete forms due to download issues with the digital forms and pens.

5. AVERAGE CONDITION

5.1 Overall assessments

As well as assessing individual components, each inspector also made a subjective overall judgement on whether the house was either:

- well maintained
- reasonably maintained, or
- poorly maintained.

This relatively crude, yet highly valuable, subjective assessment indicate the opinions of the surveyors who weight their assessments according to the perceived importance of particular areas that may be in 'poor' condition. The average component ratings may not necessarily align with the averaged assessment from the component ratings. This is because several integral components ranked as being in 'poor' condition may be sufficient to deem a house to be poorly maintained by the inspector, but yet be insufficient to pull the average component condition below a 'good' or 'moderate' level.

As with the 1999 and 2005 surveys, the 2010 survey found marked differences between the subjective assessments of general condition by the surveyor (based on experience) and those of QV. QV's assessments are generally based only on the exterior, as very few houses are inspected inside. The BRANZ surveyors' assessments are made after inspecting both interior and exterior components.

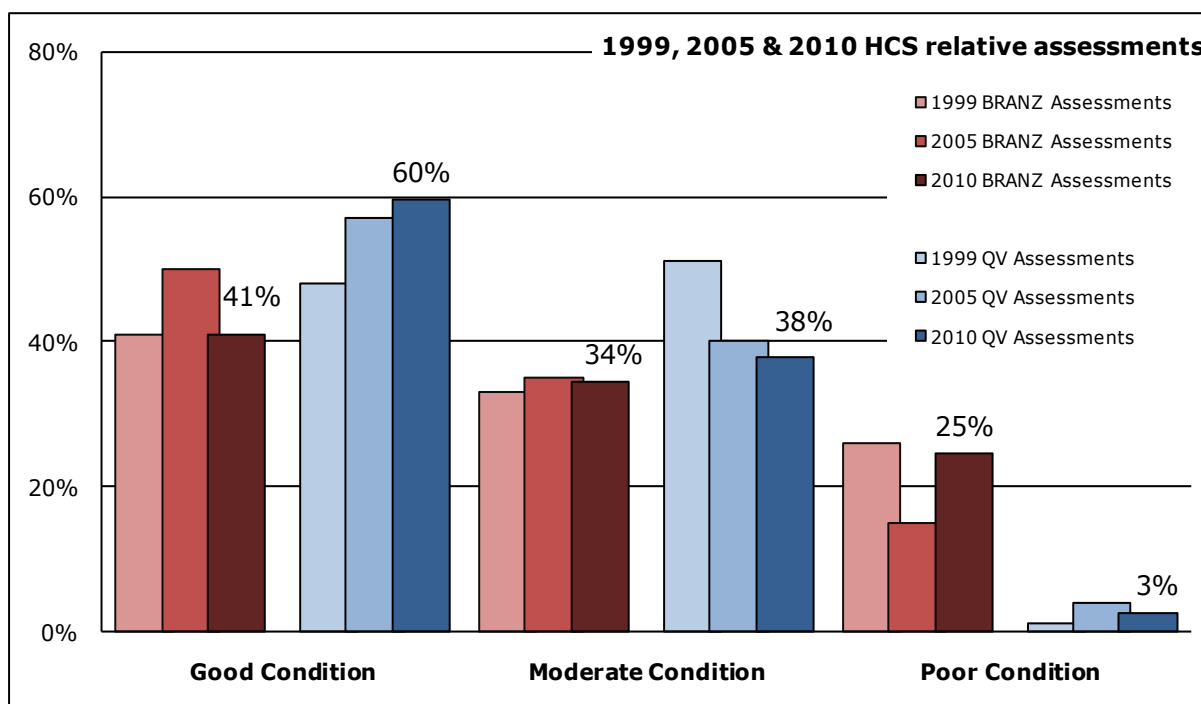


Figure 3: Assessed overall condition

Figure 3 displays the differences between the surveyors' assessments and QV's assessments from 1999 to 2010, compiled into the three condition categories. Over the years, BRANZ's surveyors have been consistently less complimentary about the condition of homes than QV.

As shown, the BRANZ surveyors considered that just over 40% of the surveyed houses were well maintained (in good or excellent condition), as was found in 1999. This is a marked decrease from around 50% in 2005. Although it could be that the overall condition of New Zealand houses has deteriorated over the five year period it is likely to be influenced by the shift to a national sample including rentals.

5.2 Component conditions

5.2.1 Average component conditions

The rating levels used to assess component condition are shown in Table 3.

Table 3: Condition groupings and defect frequencies

CONDITION	Description	Rating
SERIOUS	Health & safety implications, needs immediate attention.	1
POOR	Needs attentions shortly - within the next three months	2
MODERATE	Will need attention within the next two years	3
GOOD	Very few defects - near new condition	4
EXCELLENT	No defects - as new condition	5
Frequency of defect	0-10%	10-25%
	25-50%	50-100%

These were used as the basis for the inspector to provide a condition rating for each component inspected.

To give an overall picture of the sample, one average rating across all the components (average component condition) was also derived for each house in the survey. An explanation of the rating scale is shown in Table 3.

Each surveyed component within the house is separately rated. For the average component condition of the house each component rating is considered of equal importance. However, in reality, each component does not contribute equally to the overall physical condition of the house. For example, a roof in 'poor' condition may have serious flow-on effects, such as damage to internal linings or rotting framing from leaks. However, holes in the interior doors would have a more limited contribution to the overall integrity of the house.

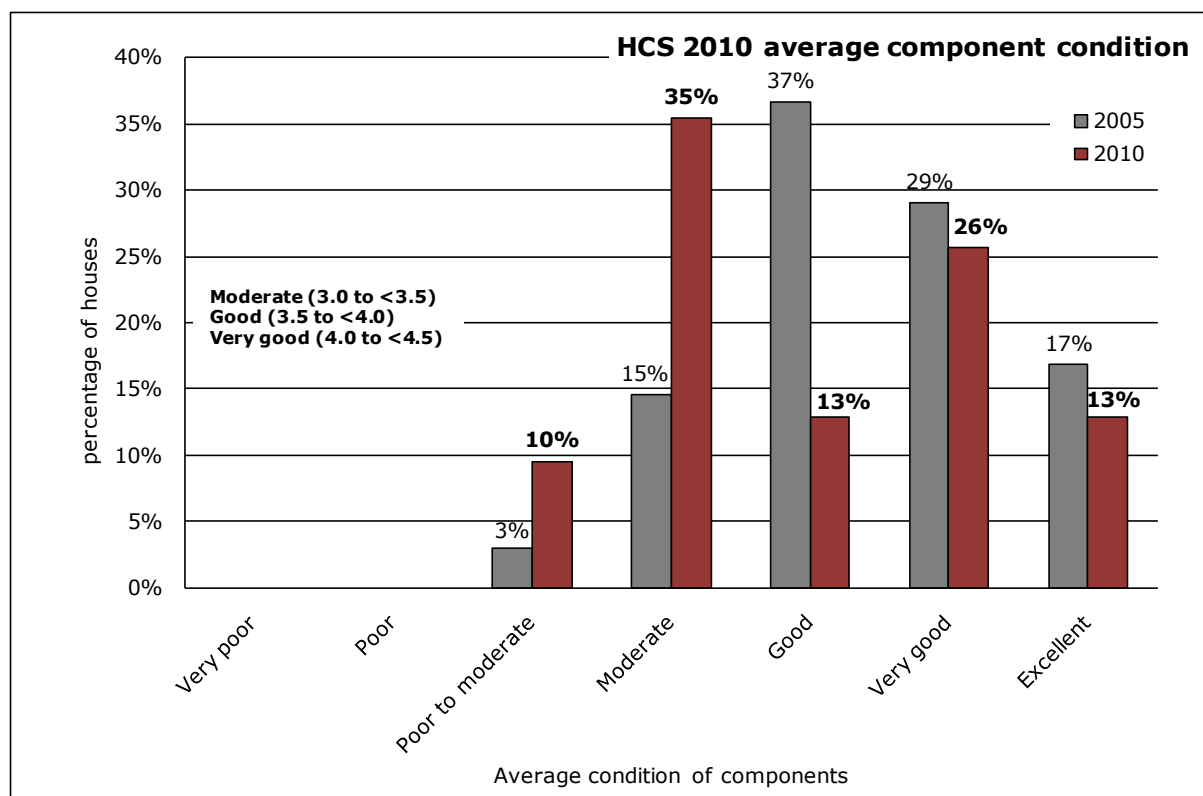


Figure 4: Average component condition – 2010 and 2005

In 2010, around half of all of the houses in the sample had average component ratings of 'good', 'very good' or 'excellent', with 10% in 'poor to moderate' condition, as shown in Figure 4. This is a marked reduction in the number of houses with components in 'good' or better than average condition, which was over 80% in 2005, with only 3% in 'poor' to 'moderate' condition.

As with 2005, no houses in 2010 had enough components in sufficiently poor condition to pull the average component condition into the 'poor' or 'very poor' categories.

5.2.2 Exterior and envelope defect rankings

The following charts give average condition ratings for assessed exterior and envelope components in order of increasing severity, comparing these with the 1994, 1999 and 2005 surveys.

5.2.3 Exterior components

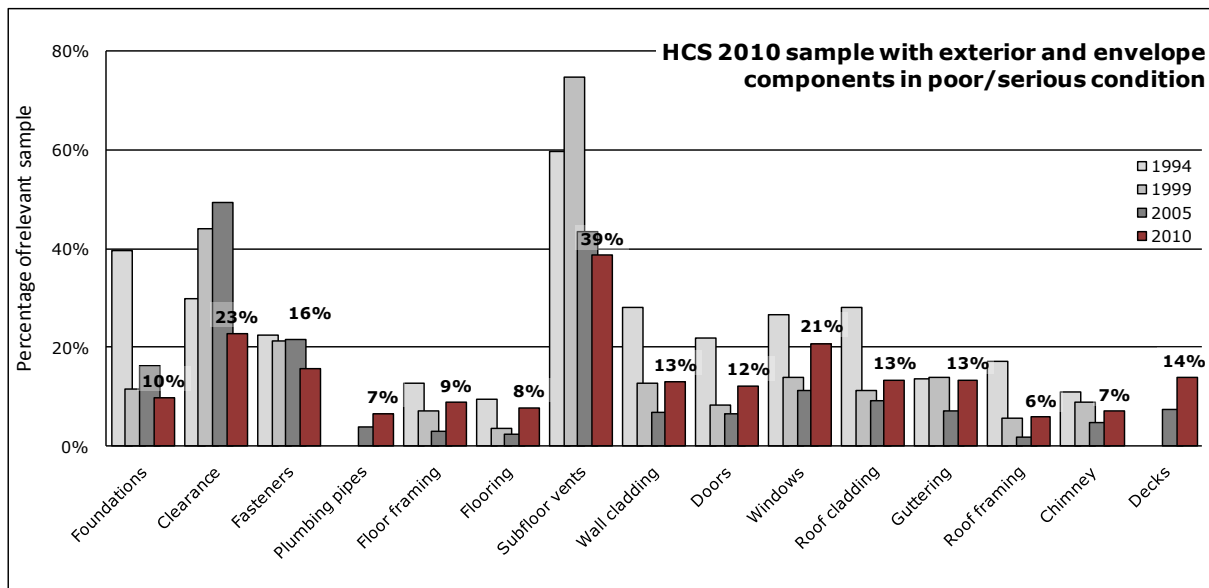


Figure 5: Envelope component condition ratings

Figure 5 shows similar areas with higher percentages of certain components in poor/serious condition. There was an overall reduction in the percentages of poor/serious condition components in most cases but there are some areas where the poor/serious condition category rose including the percentage of decks from around 7% in 2005 to 14% in 2010. Other changes observed between the surveys include:

- The percentage of houses with suspended timber floors with subfloor vents in poor/serious condition has fallen in both surveys since 1999.
- Roof and wall claddings in poor to serious condition increased after consecutive decreases in each of the previous surveys.
- Subfloor plumbing pipes were incorporated into the 2005 survey and carried through to 2010. An increase in the number in the poor/serious condition was observed, although it still represents a small proportion of the sample at 7%.

5.3 Average component condition and house age

Figure 6 shows the average condition rating which was derived for all components of the building envelope segregated by decade of construction.

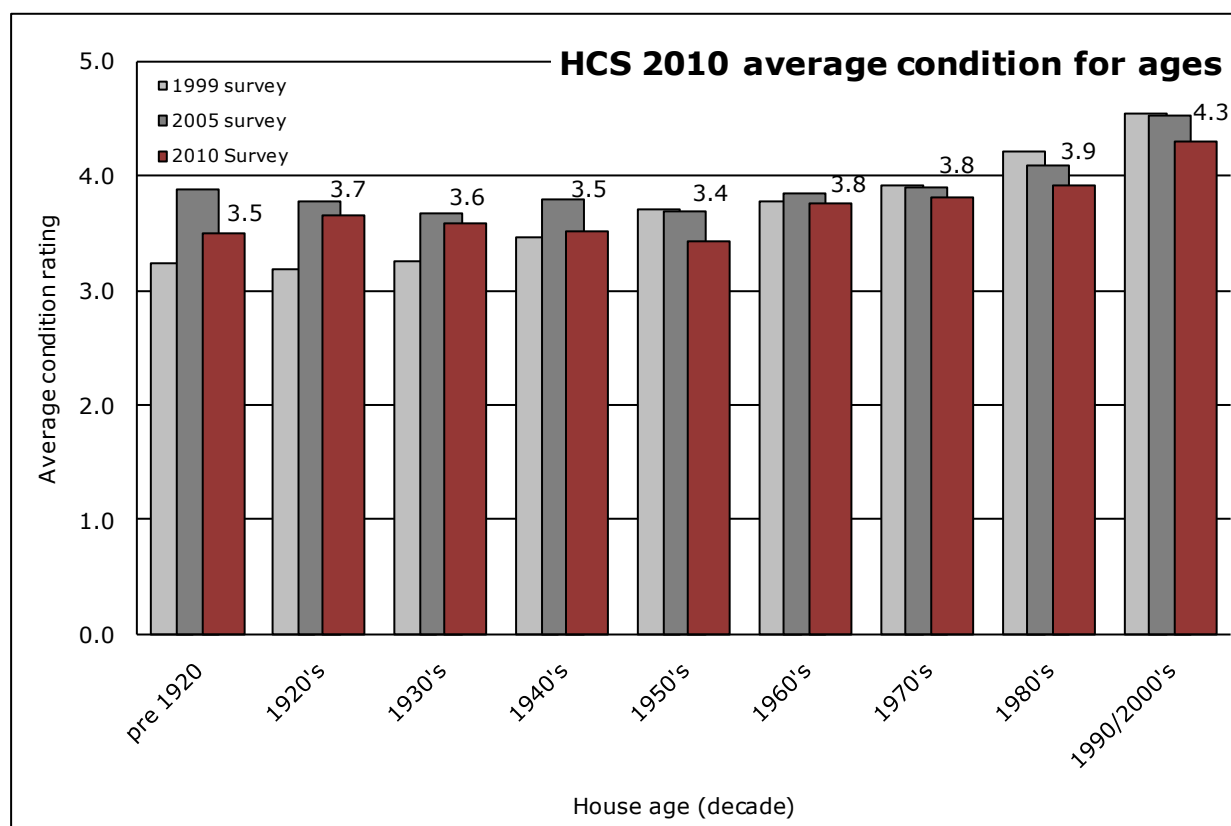


Figure 6: Average conditions by age groups

Figure 6 shows the relationship of average component condition to the age of the house. The lowest average condition was in houses built in the 1950s (3.4), although this was by a very small margin with both the 1940s decade and the pre-1920 group average having a score of 3.5. As would be anticipated the newer homes (those 1990s onwards) have the highest average component condition score of 4.3.

As a whole, the condition of houses in the 2010 sample appeared to decrease compared to the 2005 survey.

Overall, it appears that the difference in the average condition between age groups is lessening, and perhaps indicates a higher level of renovation over the past few years.

5.3.1 Polarisation of conditions

As was the case in 2005 and 1999, the group with the lowest average condition rating was houses around 60 years old. The condition appears to deteriorate for houses from the time they are new through to about 60 years of age, at which point they begin to improve again. However in the 2010 survey the pre-1920s cohort's condition appears to have fallen. It also seems that the range of overall house ratings increases with age, and the 1999 study indicated that the disparity between the best and worst houses generally rose with increasing ages.

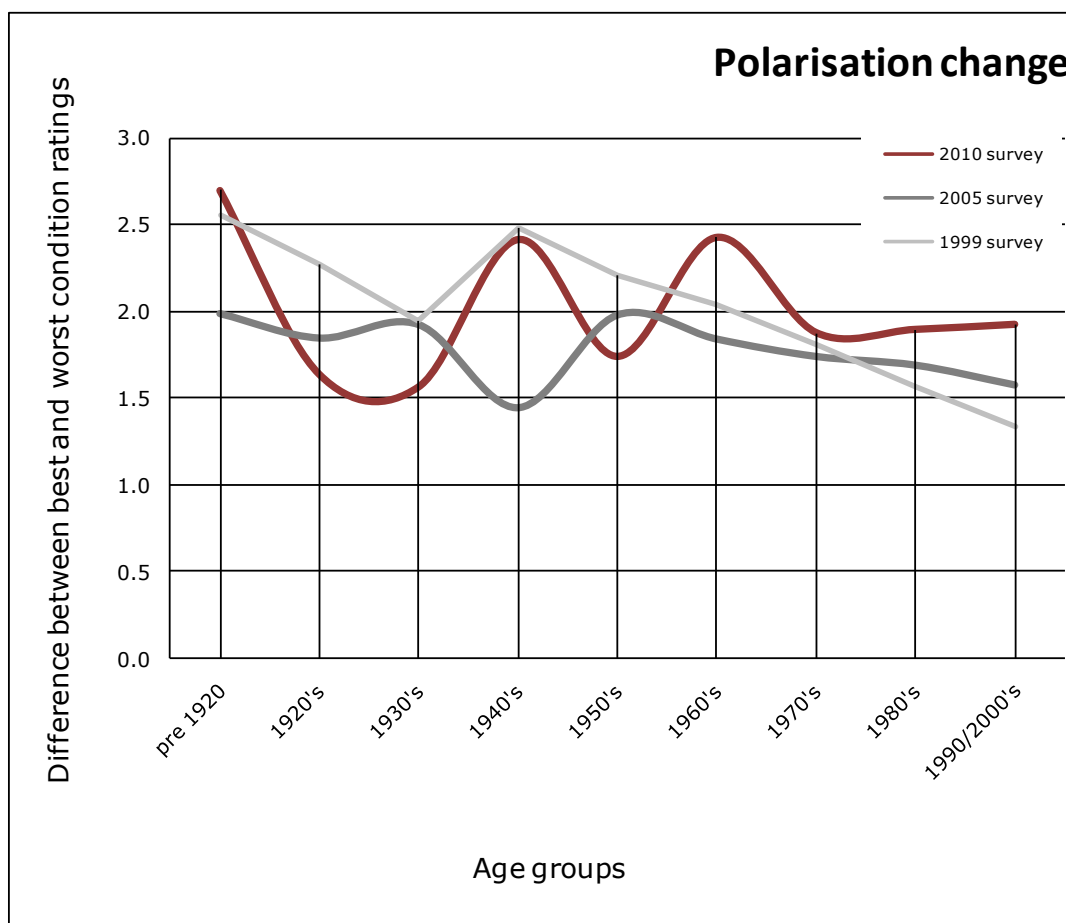


Figure 7: Polarisation of condition with age

The 2010 analysis explored this further, and we can now compare results with 1999 and 2005 as shown in Figure 7. As shown in this survey, the houses show a difference in condition rating between the worst and the best houses of around 1.8 for houses built in the 1990s and 2000s. This difference increases to almost 3 for the oldest houses.

When the condition disparity is compared to past surveys, we can see that the polarisation effect for this survey is greater for post-1980s properties compared to previous years. This could be due to the incorporation of rentals, or perhaps a perception that more modern houses are 'maintenance-free' rather than lower maintenance than older homes. This may also indicate that some parts of newer buildings do not last as long as those in previous generations of housing.

For the very old properties this disparity is likely due to components reaching the end of their useful lives for these age cohorts, with some houses having been renovated and/or upgraded, whilst others have not.

5.3.2 Conclusion

The average condition of houses across all age groups in the 2010 *House Condition Survey* was 3.7. This has fallen since the 2005 survey (3.9), but the same as that of 1999 (3.7), and slightly higher than the 1994 survey (3.6).

At around 60 years of age an apparent decline in condition levels off and improvements to the overall condition begins to take place up until the pre-1920 cohort. The average condition for the pre-1920 group is about the same as for the 1940s group.

As found previously, there is still a larger range of polarisation between the best and worst overall conditions of houses in the pre-1920s, 1940s and 1960s houses. This suggests that certain vintages of houses are more likely to be renovated than others, and some decades show more variation in condition than others.

6. EXTERIOR

6.1 Exterior materials

Materials used for walls, roofs and windows and their proportions in 2010, 2005 and 1999 are shown in Figure 8. Note that each graph does not necessarily add up to 100%, as many homes have a mixture of wall or roof claddings or window systems, either by design or due to additions or renovations.

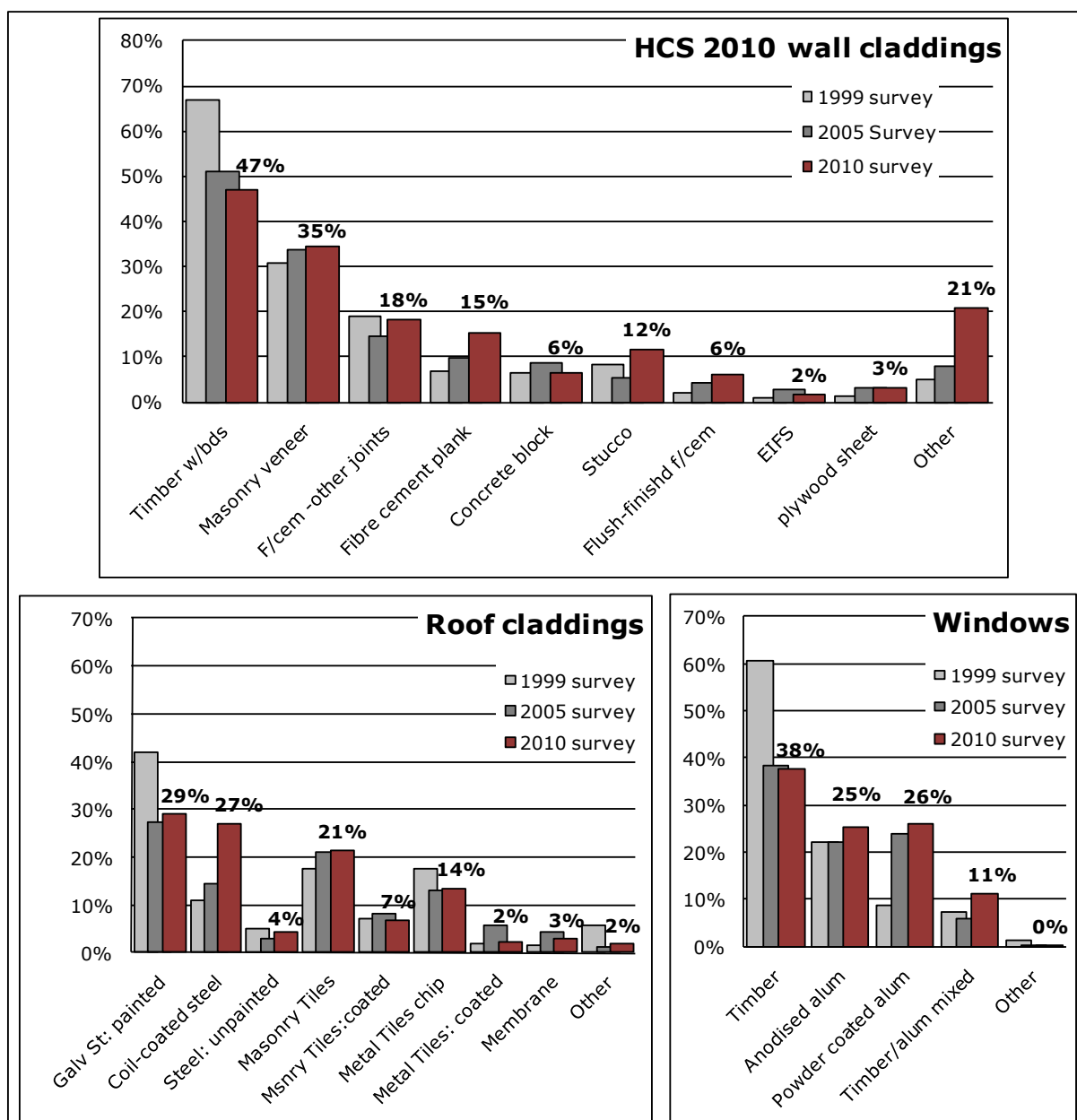


Figure 8: Building materials from sample

The most common building materials used on New Zealand houses remain timber weatherboard walls and painted profiled (i.e. corrugated) steel roofs. With each survey,

however, the proportions of these are decreasing as the housing stock changes with renovations and more new houses built using modern materials. The windows component shows a change compared to 2005 because now aluminium frames (both powder-coated and anodised) are present in more houses than timber frames (see Section 6.1.3).

6.1.1 External walls

Figure 8 shows the most common wall cladding remains timber weatherboards, followed by masonry (i.e. brick) veneer. Timber weatherboards cover more traditional types such as bevel-backed or shiplap weatherboard through to more modern cedar. While timber weatherboards are still the most common cladding, use has continued to decrease, from being present on almost 70% of the houses in the 1999 survey to just less than half in 2010.

Interestingly, only 2% of the sample had EIFS cladding, around the same as in 2003. This may be due to perceived weathertightness risks and/or may be influenced by the sample moving outside just the three main centres.

Around one third of the sample had masonry veneer, which has stayed much the same since 1999 when it was 30% of the sample. There was an increase in the use of fibre-cement cladding products, and a surprising increase in the proportion of the sample with stucco cladding.

6.1.2 Roofs

As seen in Figure 8, just over half of the sample houses had either galvanised or coil-coated profiled metal roofs (the same as in 2005 and 1999). Over half of these were painted galvanised roofs. The proportion of coil-coated steel roofs increased nearly doubled between 2005 and 2010, while the proportion of painted and unpainted galvanised steel roofs stayed much the same.

The most common type of roof cladding in the sample was painted galvanised profiled steel (as in 1999 and 2005). The proportion of coil-coated steel roofs continues to increase, to the point where it is likely to take over as the most common type of roof cladding in the next decade as older galvanised steel roofs are replaced. Masonry tiles are the third most common, while the proportion of metal tiles has fallen since 1999. This may be due in part to the replacement of older chip-coated metal tile roofs with corrugated coil-coated steel. It may also be influenced by the sample no longer solely being based in the main cities.

6.1.3 Windows

Figure 8 shows that aluminium windows (either powder-coated or anodised) are now the most common type of window. Nearly one-quarter of the sample had both aluminium and timber window frames, reflecting renovations and the replacement of timber windows at the end of their useful lives. A higher number of houses in the sample were built after the introduction of aluminium windows in this survey, also contributing to the increase.

6.2 Condition by material

The average condition of all of the more common materials identified by the inspectors has been calculated, and this is shown in Figure 9 together with the equivalent figures for the 2005, 1999 and 1994 surveys.

The average ages of houses using the different types of wall cladding and windows are shown in brackets where the sample of houses with the material was sufficient, so that average condition ratings can be assessed against the likely age of the materials. Roofs are not considered, as their replacement generally has less to do with the age of the house and more with the conditions they are exposed to.

There was considerable evidence within the sample that a large number of properties had been extended using different materials. EIFS and flush-finished fibre-cement were often used in this way, and as such average ages the age of the house tended not to align with the age of the cladding.

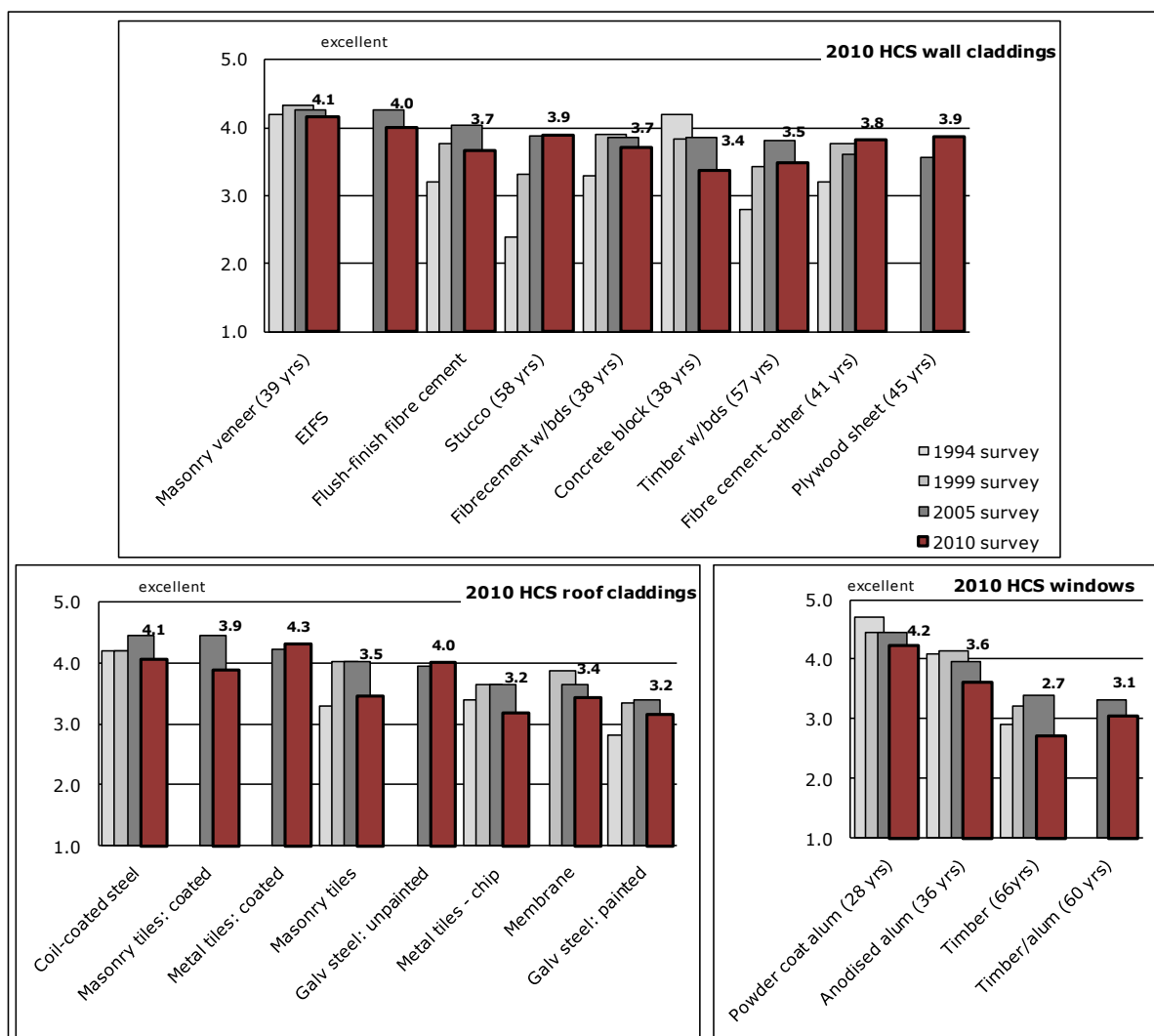


Figure 9: Condition of external materials

6.2.1 External wall cladding condition

The following sections look at the defects in the most common types of wall claddings.

6.2.1.1 Timber weatherboards

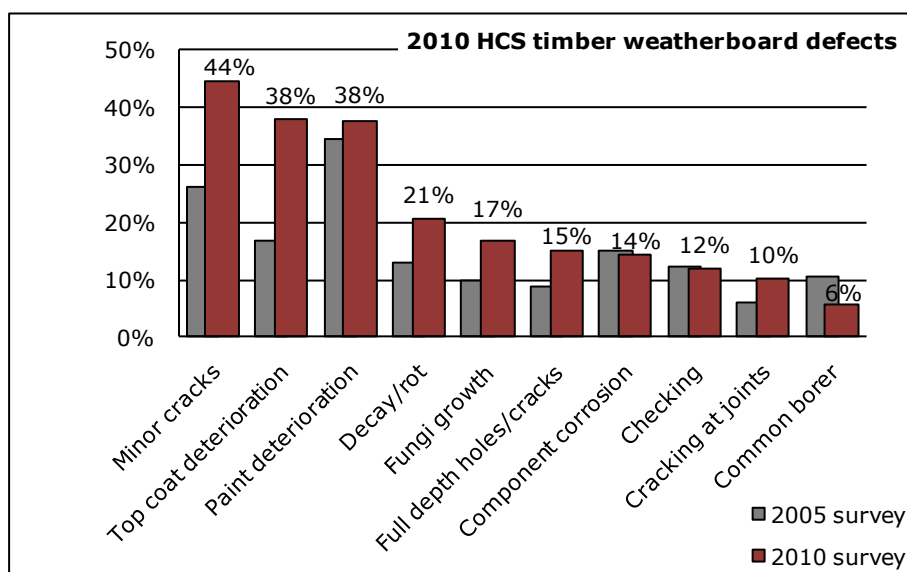


Figure 10: Defects in timber weatherboards

Timber weatherboards were present on approximately half of the sample. The most common defects found in timber weatherboards are shown in Figure 10, and Figure 11 shows the frequency that these defects occur, indicating the level of severity.

The most common defects with the highest frequency are paint deterioration (through more than just the top-coat) and top-coat deterioration. Minor cracks were the most frequently noted defect, although they tended to be of a lower frequency, as shown in Figure 11. Decay and rot was predominantly of a low frequency, as was fungi growth and the corrosion of components.

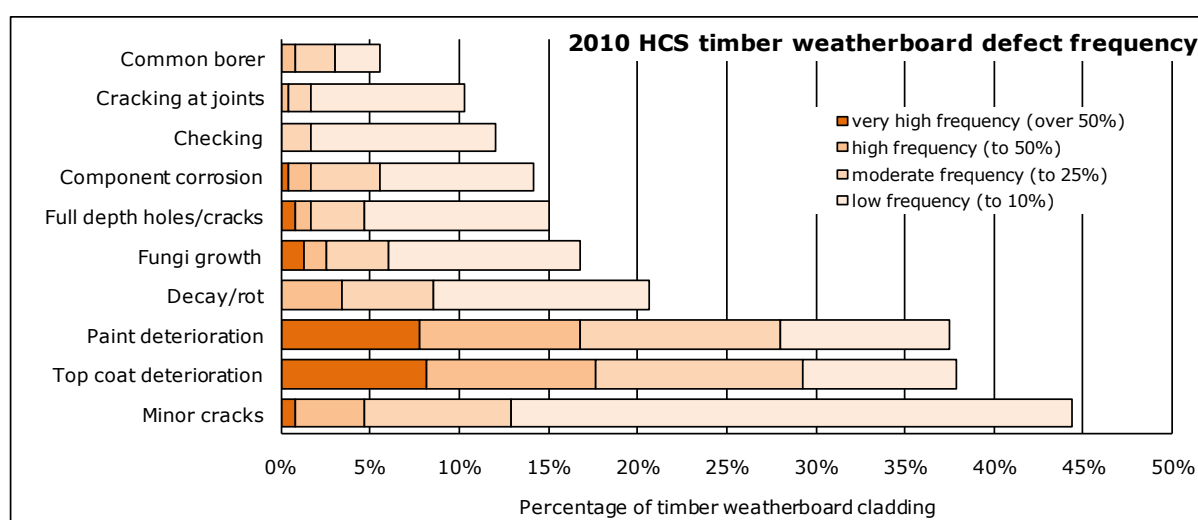


Figure 11: Defect frequency in timber weatherboards

6.2.1.2 Masonry veneer and concrete block

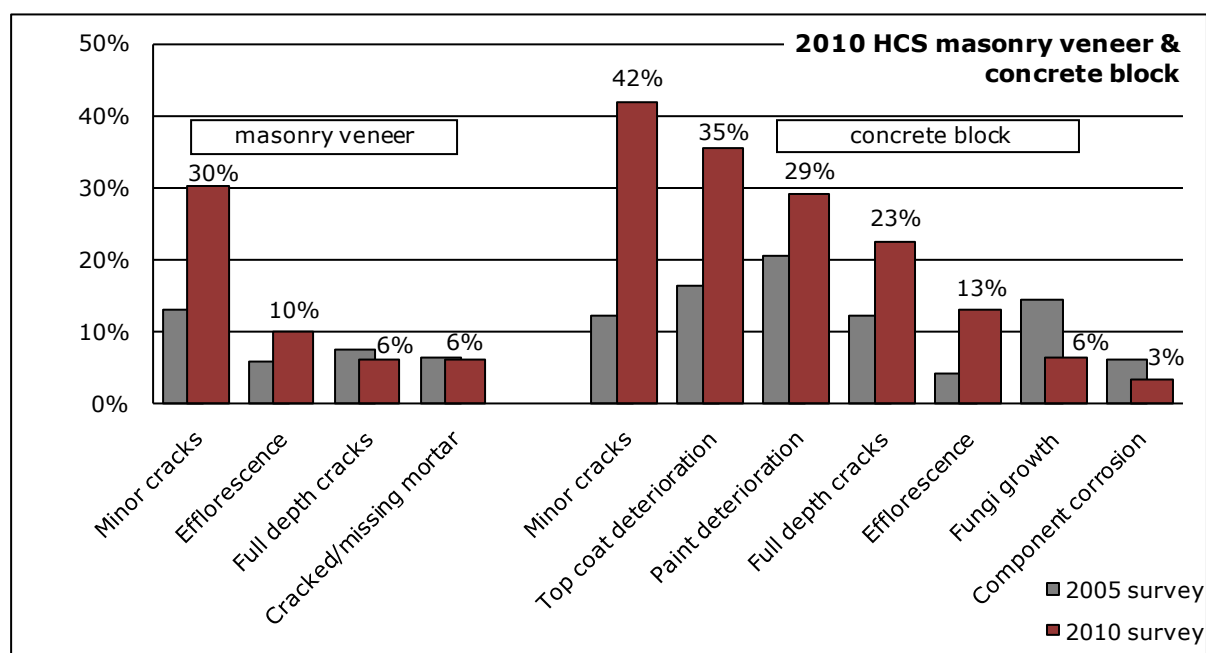


Figure 12: Defects in masonry veneer and concrete block

Around one-third of the houses had at least some masonry veneer cladding, and around 6% had concrete block wall(s). The most common defects for masonry veneer and concrete block are displayed in Figure 12.

The most common defects for both masonry veneer and concrete block walls in this survey were minor cracks. Top-coat and paint deterioration were common cosmetic defects for concrete block walls. Twenty-three percent of the sample of concrete block wall samples exhibited full depth cracks.

6.2.1.3 Monolithic wall claddings

Stucco, flush-finished fibre-cement sheet and EIFS are all common monolithic wall claddings found in New Zealand's housing stock. The proportion of properties with stucco cladding increased from 5% in 2005 (Clark et al 2005) to 12% in 2010. The condition of the stucco remained much the same despite the average age increasing from 54 years in 2005 to 58 years in 2010.

Figure 13 shows the defects found in the 2010 *House Condition Survey* sample. The results from the monolithic cladding defects should be treated with caution, as the *House Condition Survey* assesses the condition of monolithic cladding from the external appearance. This establishes that the true condition of the system requires destructive testing in order to check for issues on the rear face of the cladding. The surface appearance may conceal underlying issues.

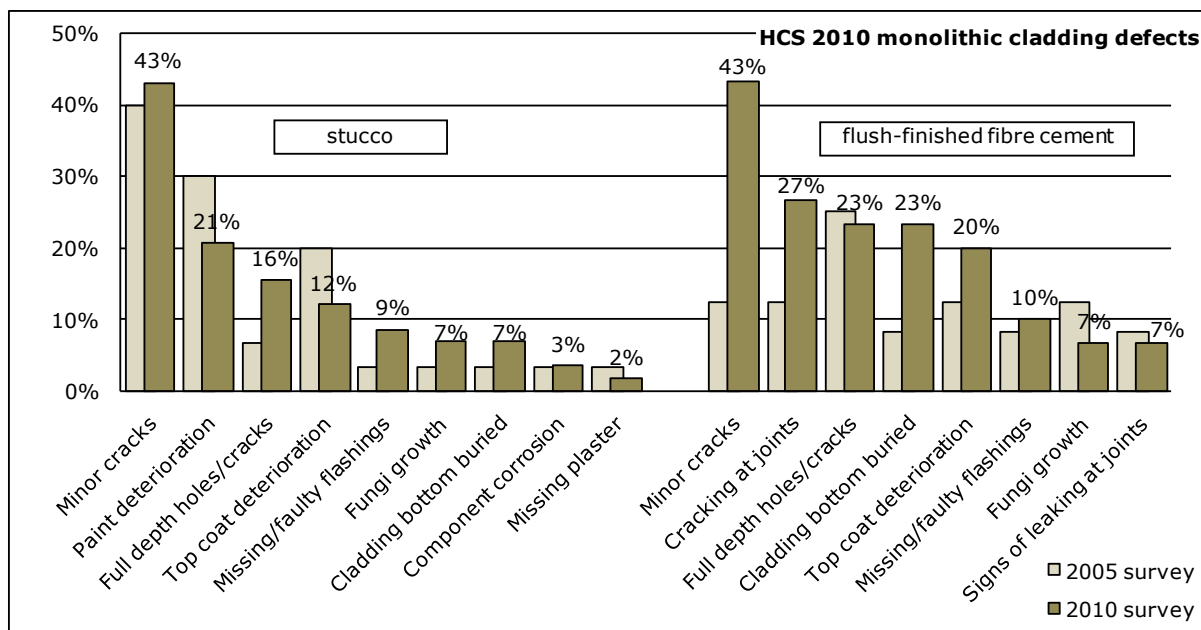


Figure 13: Defects in monolithic claddings

The most common defect for stucco cladding was minor cracks at 43%, followed by paint deterioration on 21%.

Minor cracks were also the main defect in flush-finished fibre-cement, also at 43%, and this was followed by cracking at joints with 27%. These defects may be related to age, and maintenance practices.

Only 3% of the sample had EIFS cladding, and as such was insufficient for analysis.

6.2.1.4 Fibre-cement weatherboards and sheet claddings

The defects in other fibre-cement claddings are shown in Figure 14.

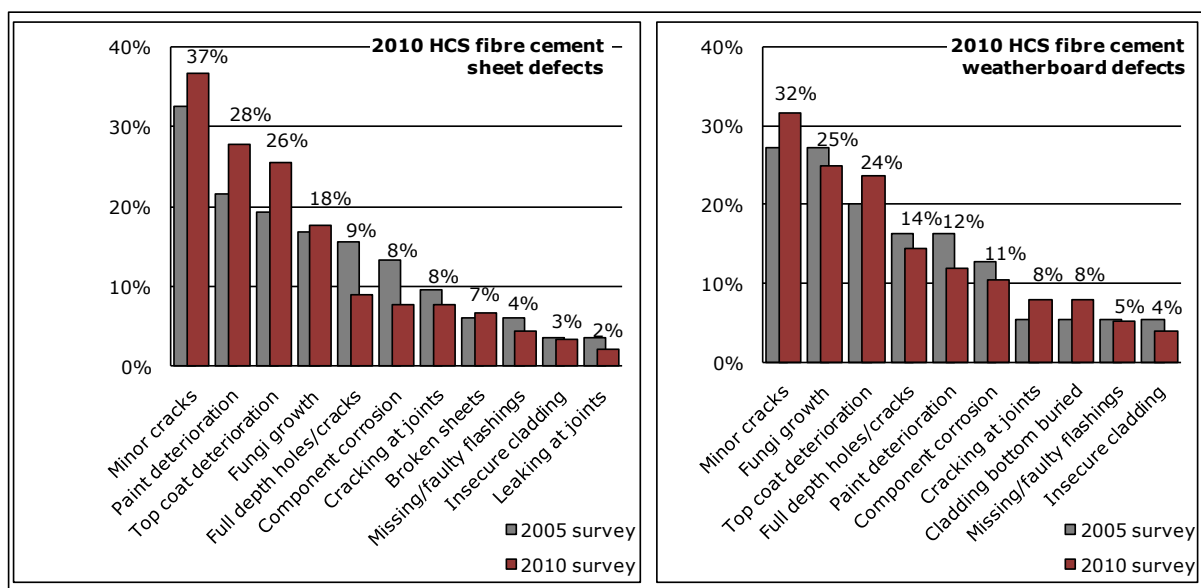


Figure 14: Fibre-cement wall cladding defects – sheet and weatherboard

The most common defect in both fibre-cement sheets and weatherboards was paint deterioration. Interestingly, more fibre-cement weatherboards had fungi growth compared to

fibre-cement sheets. This may be due in part to the prevalence of textured fibre-cement weatherboards, compared to the flat finish of most fibre-cement sheeting. Thirty-seven percent of fibre-cement sheet cladding displayed minor cracks, compared to 32% in the fibre-cement weatherboards.

6.2.2 Roof cladding

The following section looks at the most frequent defects found in the common types of roof claddings.

6.2.2.1 Profiled steel roofing

As shown in Figure 8, profiled steel roofing (both galvanised and coil-coated) is the most common roof cladding, being present on over half of the houses in the sample. The most frequently observed defects are shown in Figure 15.

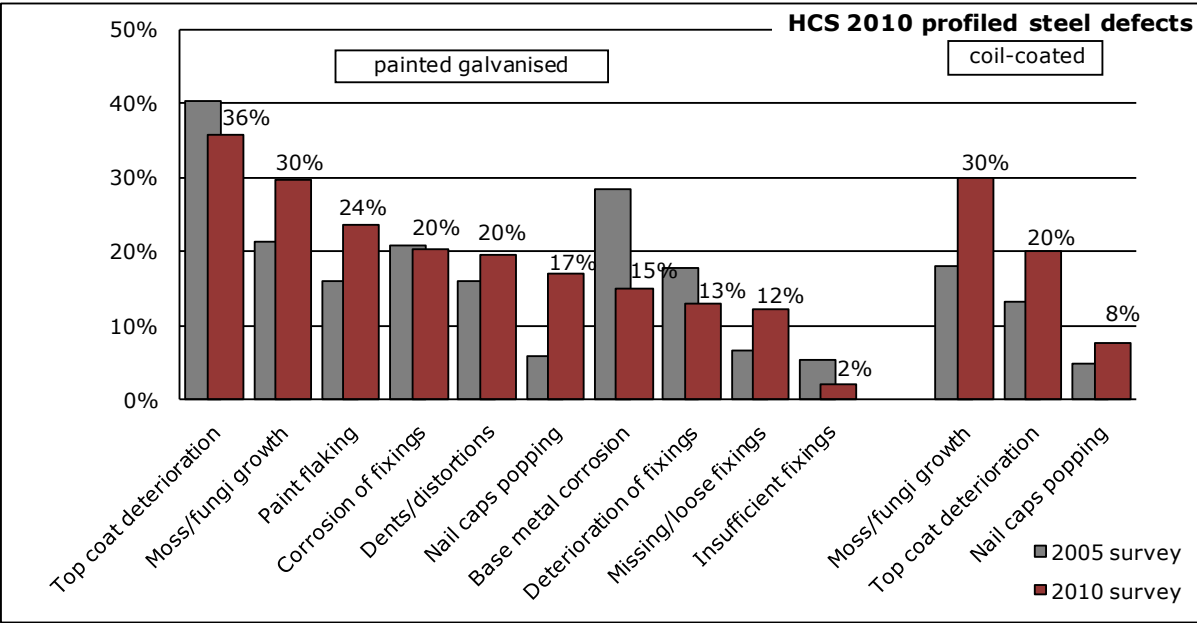


Figure 15: Defects in profiled steel roofing

The most common defects for painted galvanised steel roofing were top-coat deterioration (36%), moss/fungi growth (30%) and paint flaking (24%). With coil-coated steel being a more modern material than galvanised steel, the roofs using it tend to be newer, and the most common defect is moss/fungi growth (30%). The frequency of defects in profiled steel roof cladding is shown in Figure 16.

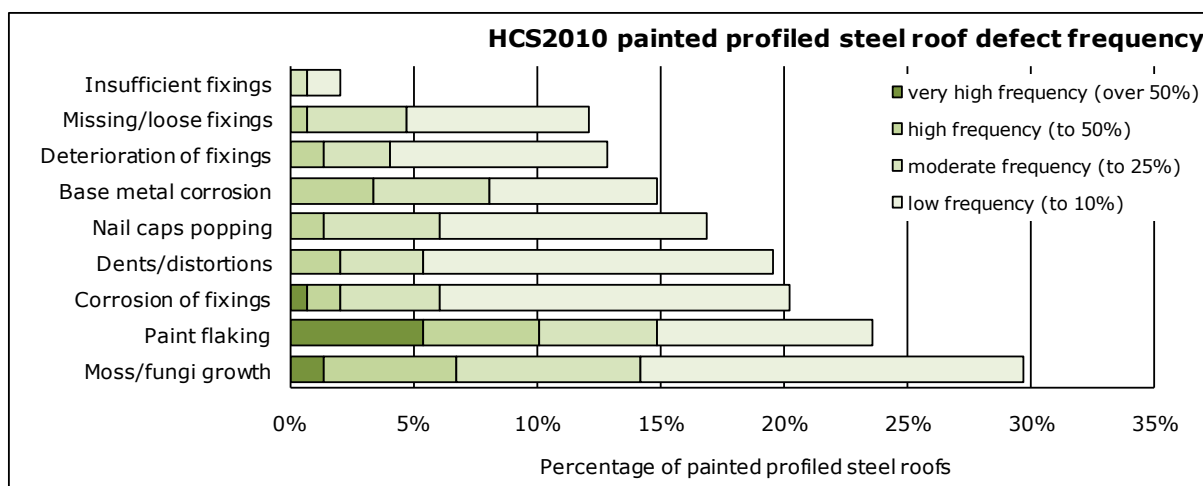


Figure 16: Defect frequency in painted galvanised steel

6.2.2.2 Roof tiles

The next most common roof cladding types were masonry tiles (28%) and metal roof tiles (16%). Figure 17 shows the most common defects found in tiles.

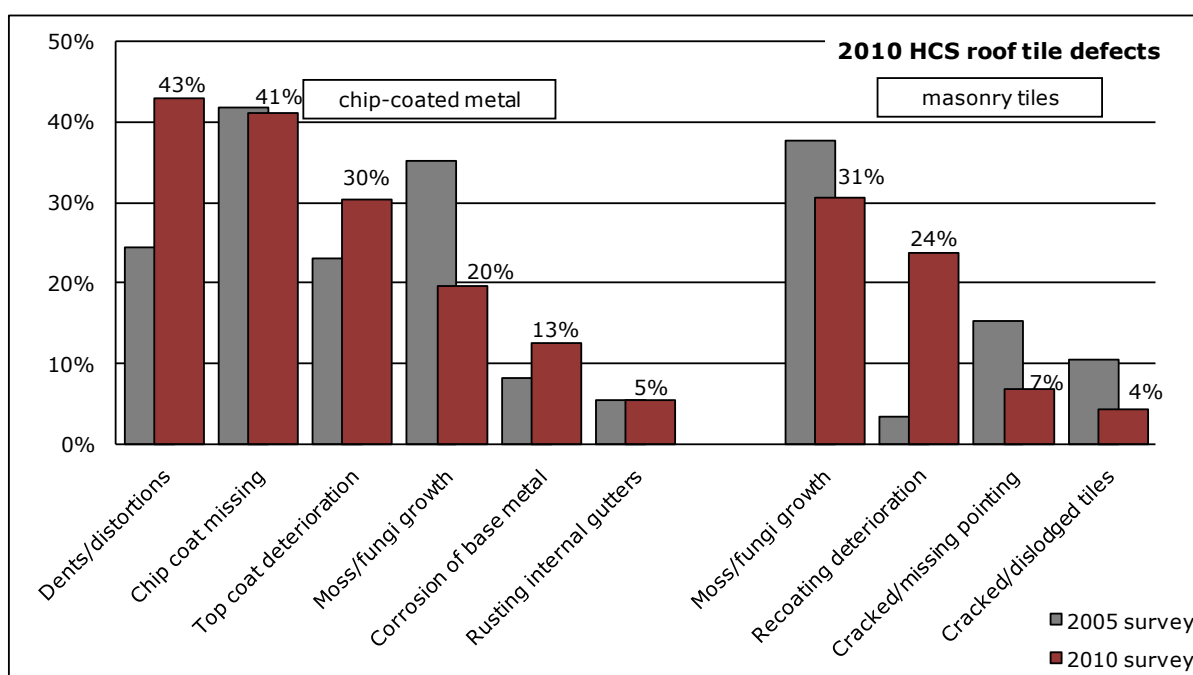


Figure 17: Defects in roof tiles

As shown, the most common defects in chip-coated metal tiles are the erosion of the chip coating, dents and top-coat deterioration. The percentage of chip-coated metal roofs with dents has increased to 43%, which may be related to thinner gauges of steel used on newer tiles, or perhaps increased foot traffic due to maintenance, including moss and fungi removal, or recoating. The reduction in the percentage of chip-coated metal tiles roofs affected by moss and/or fungi suggests this is a strong possibility.

For masonry tiles, the only non-cosmetic defects are cracked or missing pointing and cracked or dislodged tiles.

6.2.2.3 Gutters and downpipes

The most common defects found in guttering and downpipes in the survey can be seen in Figure 18. The most common defects in galvanised steel gutters and downpipes were corrosion and denting/buckling, while the most common defect in coil-coated guttering and downpipes was corrosion.

The most common defect found in uPVC guttering and downpipes was uneven fall in the guttering, affecting 20%. The next most common defects were missing/broken supports (potentially related to uneven fall), and dents/buckling, both at 10%.

The most common copper guttering and downpipe defect was denting/buckling, affecting 55% of the houses with this type of guttering to varying degrees, followed by missing or broken supports at 25%. Both defects may well be associated with age – copper guttering has become more popular since the mid 1990s, and with age comes the need for maintenance – which often includes ladders leaning on guttering. As copper is expensive, it tends to be a thin gauge and is highly malleable - dents and distortions will occur more readily than in coil-coated steel, whereas plastic deflects, or at worst breaks.

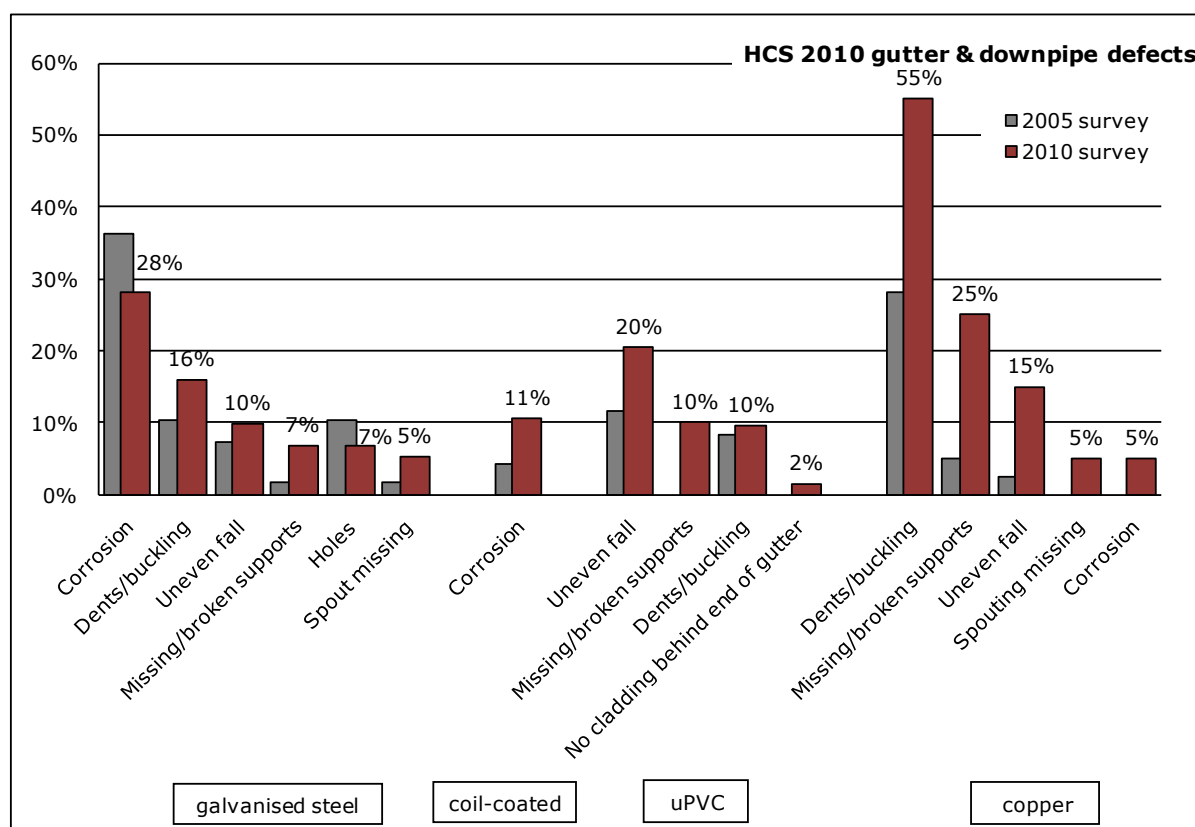


Figure 18: Defects in gutters and downpipes

6.2.3 Roof space

The results in this section are based on the sample with accessible roof spaces. The results are broadly similar to those found in 1999 and 2005.

By far the most common roof space defect was exclusive to houses with roof space header tanks, with 93% of them unrestrained, as seen in Figure 19. This was also the most common defect of the whole sample with accessible roof spaces (with and without header tanks), present in 20% of all homes.

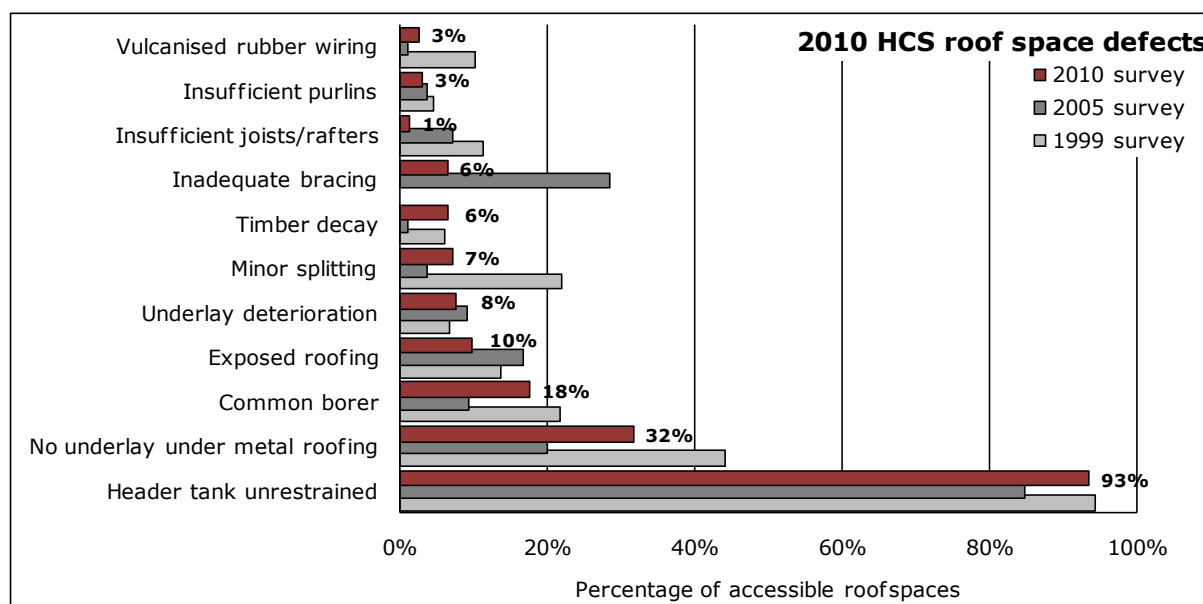


Figure 19: Roof space defects

The most common defect for houses with metal roofs was missing underlay, affecting 32%.

Out of the entire sample, 18% of roof spaces showed signs of common borer, up from 9% in 2005, but down from 22% in 1999. Ten percent had exposed roofing, a reduction from 17% in 2005.

Between 2005 and 2010 there was a reduction in the frequency of houses with exposed roofing, minor splitting, and several structural defects. Since 1999 the percentage of houses surveyed with vulcanised rubber wiring has fallen from 10% to 3%.

See Section 7.2 for ceiling insulation.

6.2.4 Windows

The most frequent defects for each window type are shown in Figure 20.

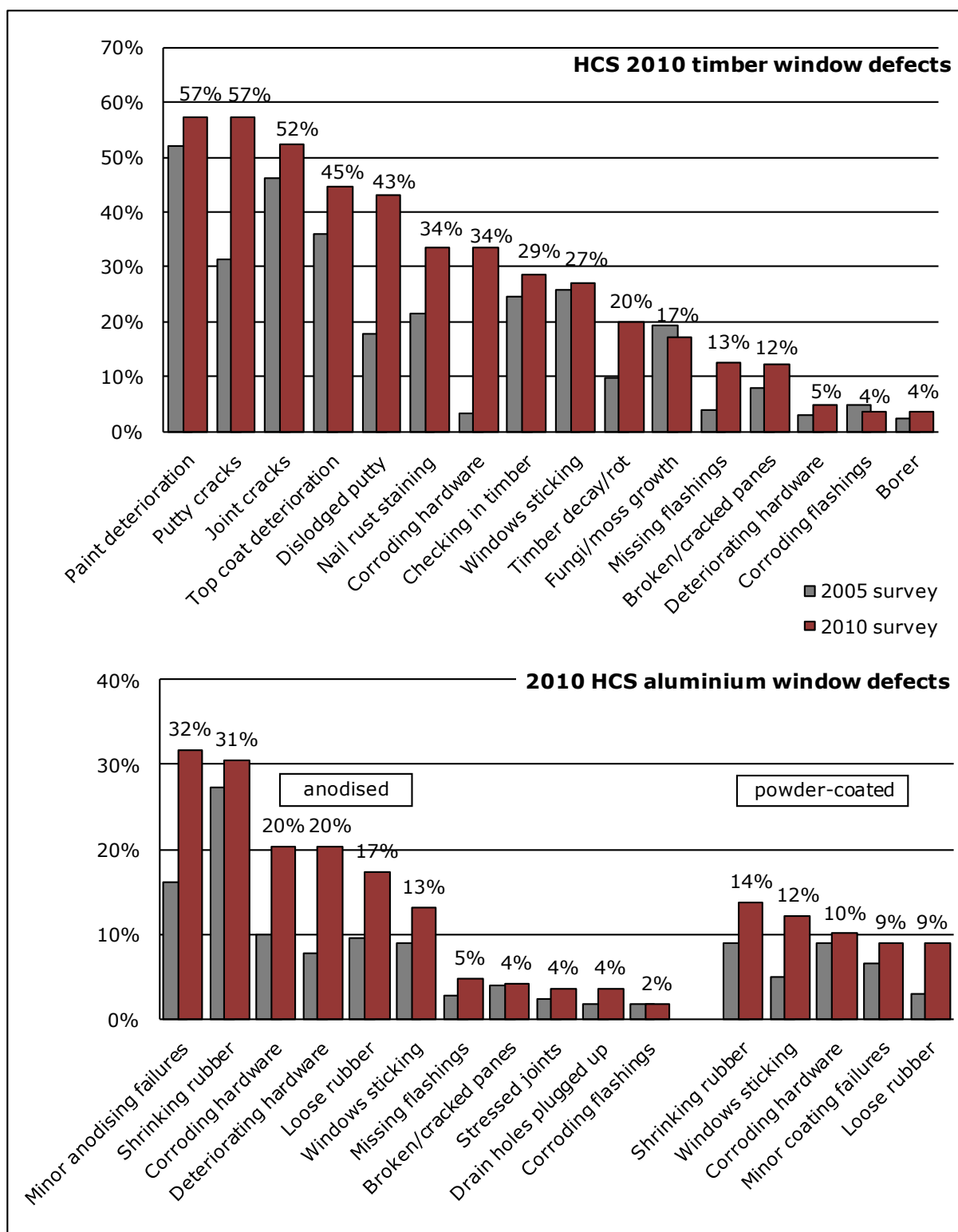


Figure 20: Defects in windows

Figure 20 shows the most common defect for timber windows was the deterioration of paintwork related to the lack of regular/well-executed paint jobs. There was less than 10% of the sample with windows affected by borer, or corroding or missing flashings.

The older-style anodised aluminium windows showed a higher incidence of defects, with over 30% of houses with this type of window displaying shrinking rubber and minor anodising

failures. Twenty percent had corroding or deteriorating hardware, and 17% had loose rubber. Around 5% of anodised windows had missing flashings.

Powder-coated aluminium windows tended to have a lower incidence of defects, probably due to being younger than the anodised types of aluminium windows. The most prevalent defect in this group was shrinking rubber observed at 14% of the houses with powder-coated aluminium windows, which was also a common problem with anodised aluminium windows. The next most common defect was sticking windows (12%), followed by corroding hardware (10%).

6.3 Subfloor area

In common with the 1999 survey, inspectors identified many recurring problems related to subfloor spaces, so these are considered as a separate group of components. Figure 21 gives the characteristics associated with subfloor timbers, and compares these to the 1999 and 2005 surveys.

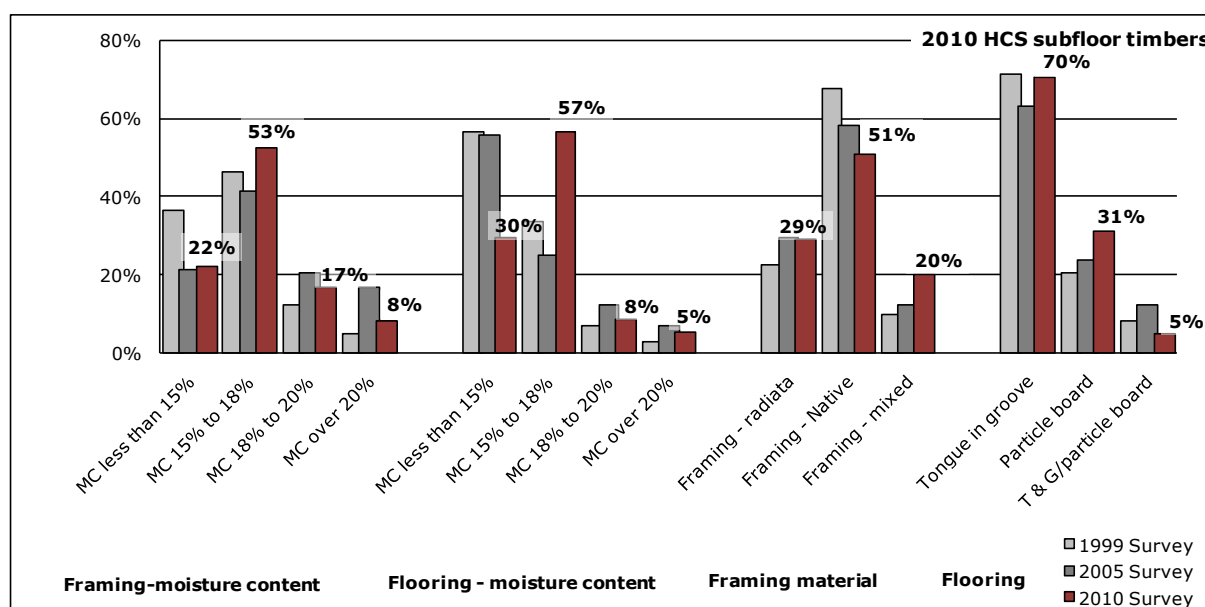


Figure 21: Characteristics of subfloor timbers

As shown, characteristics are similar to those found in the 1999 and 2005 surveys. There is a lower proportion of framing and flooring with moisture content over 18% than observed in 2005, although it is still slightly higher than what was found in 1999. The amount of timber flooring is less than in previous surveys, in part due to the shift in the sample including a higher proportion of concrete slab floors. There was a large increase in the amount of radiata timber, a more modern framing material, and a decrease in native timber framing. This is likely to be due to the increased number of houses in the sample built with modern building materials, and modern alterations to older homes.

6.3.1 Subfloor fasteners

Another common problem identified in the 1999 and 2005 surveys related to the lack of appropriate subfloor fasteners, with many houses having no specialised fasteners between concrete piles and framing timbers. These included more recent post-1940s houses, as well as older houses. Figure 22 gives the same analysis, comparing 2010 results with those from the past studies.

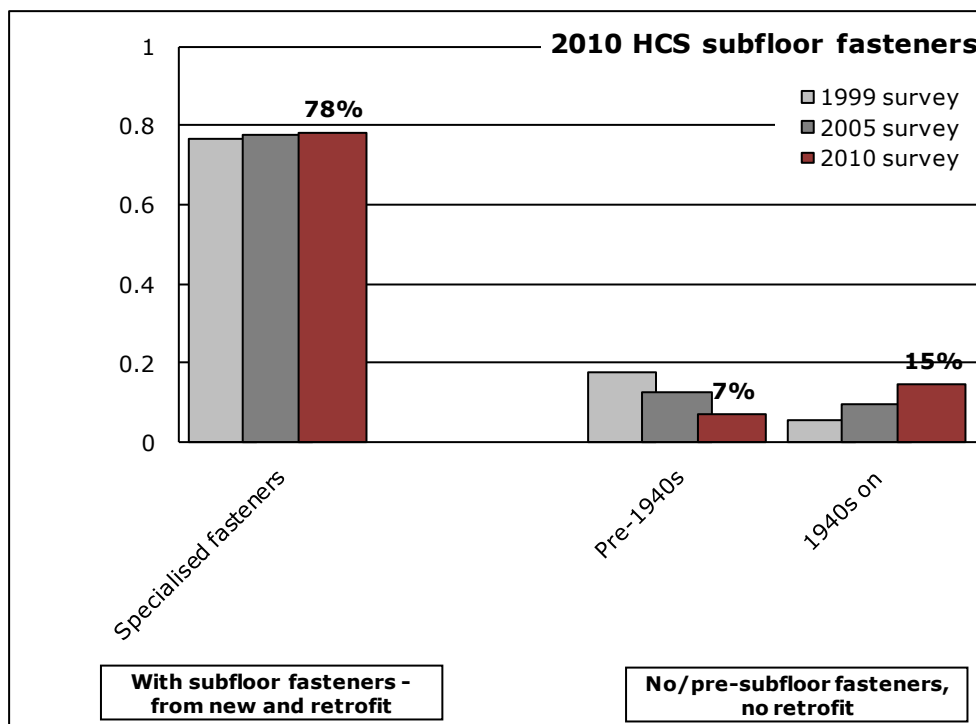


Figure 22: Subfloor fasteners

As seen in Figure 22, nearly one quarter of the houses in the 2010 *House Condition Survey* had no specialised fasteners in their subfloors in line with findings from previous surveys. Houses built before the 1940s were made before specialised fasteners were commonplace. Seven percent of the sample falls into this category and still do not have any or have inadequate subfloor fasteners. However, 15% of the sample was built after the 1940 and do not have specialised fasteners. The breakdown of the sample without adequate subfloor fasteners is shown below in Figure 23.

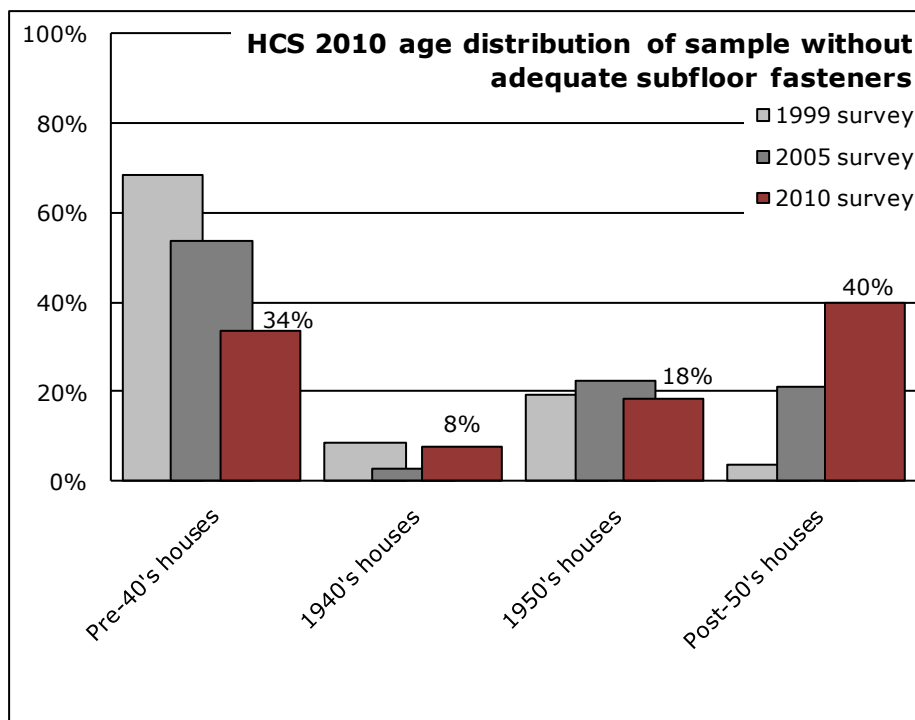


Figure 23: Age distribution of sample without adequate subfloor fasteners

Since the 1999 survey, the percentage of houses without specialised fasteners has fallen from nearly 70% being built pre-1940 to 34%. This could be the result of retrofitting of these subfloor areas, or conversely a larger number of modern homes being built without adequate subfloor fasteners.

6.3.2 Subfloor defects

Subfloor defects were common in the sample of houses with accessible subfloors. The following charts present the most common defects found in accessible subfloor areas, divided into moisture-related and other defects. The 1999 and 2005 results are provided to allow comparison between the two surveys.

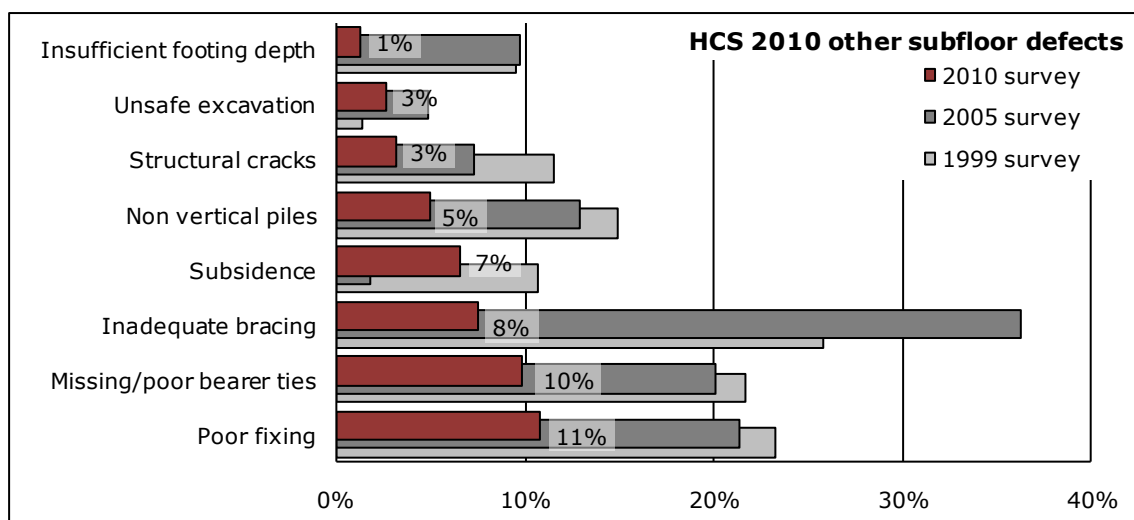


Figure 24: Other subfloor defects

Figure 24 gives non-moisture related defects found in subfloor areas, and compares these to both 2005 and 1999 survey defect findings. The percentages shown reflect the portion of accessible subfloors that exhibit the particular defect, which means that any particular subfloor may have more than one defect.

As previously noted, common structural defects found in the survey included poor fixings and lack of adequate bracing. However, the frequency of all defects had reduced when compared with previous surveys. In 2005 it was found that Auckland houses were more likely to have inadequate bracing than in the other cities that were surveyed (Clark, 2005). Therefore the inclusion of other areas (and comparative reduction in the percentage of the sample in Auckland) may have had an influence on the number of houses found with inadequate bracing.

In the past surveys, inadequate subfloor ventilation was identified as a common issue with suspended timber floors in the samples. The results from 2010 are shown alongside those of 2005, 1999 and 1994 in Figure 25.

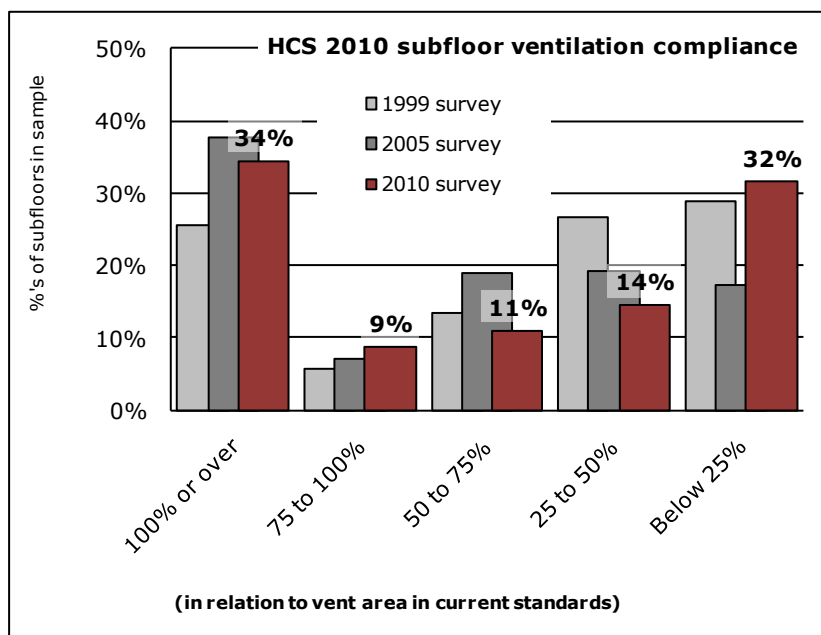


Figure 25: Percentage of current standard subfloor vent requirements

The results are broadly similar to those of previous surveys, with nearly two-thirds of the sample not meeting the current standards for a clear vented area and nearly one-third of the sample with less than one-quarter of the required clear vent area. The percentage of the sample with the least ventilation is around the same as what was found in 1999, and close to twice that of 2005.

Figure 26 displays the prevalence of moisture-related characteristics amongst the relevant sample with accessible subfloors alongside moisture-related defects.

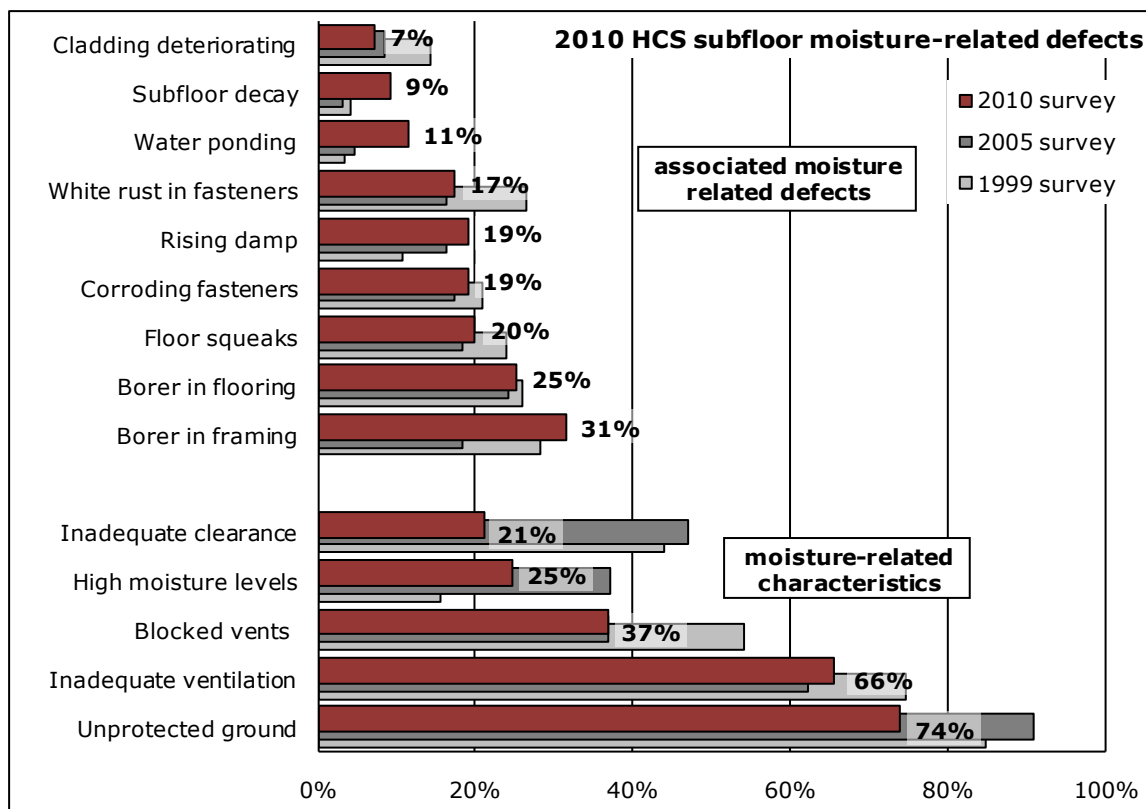


Figure 26: Moisture-related defects in subfloors

The results from 2010 are broadly similar to those of 2005 and 1999. Moisture-related characteristics are higher than the proportion of moisture-related defects, illustrating that there is not a direct correlation. However, there is an influence with increased likelihood of the defects occurring over time if the situation is not remedied.

The following was found in the 2010 results:

- borer in framing was observed in more suspended timber subfloors in 2010 than in 2005, but were similar in frequency to 1999.
- there was a reduction in the percentage of suspended timber floor houses with high (>18%) moisture content between 2005 and 2010, although it remains slightly higher than those found in 1999
- there was less inadequate clearance between framing and the ground than what was found in 2005 or 1999

6.4 Attached decks

Since 2005, the *House Condition Survey* has inspected and recorded details on decks attached to the houses in the samples. The numbers, types and characteristics of these decks are shown in Figure 27 for both 2005 and 2010.

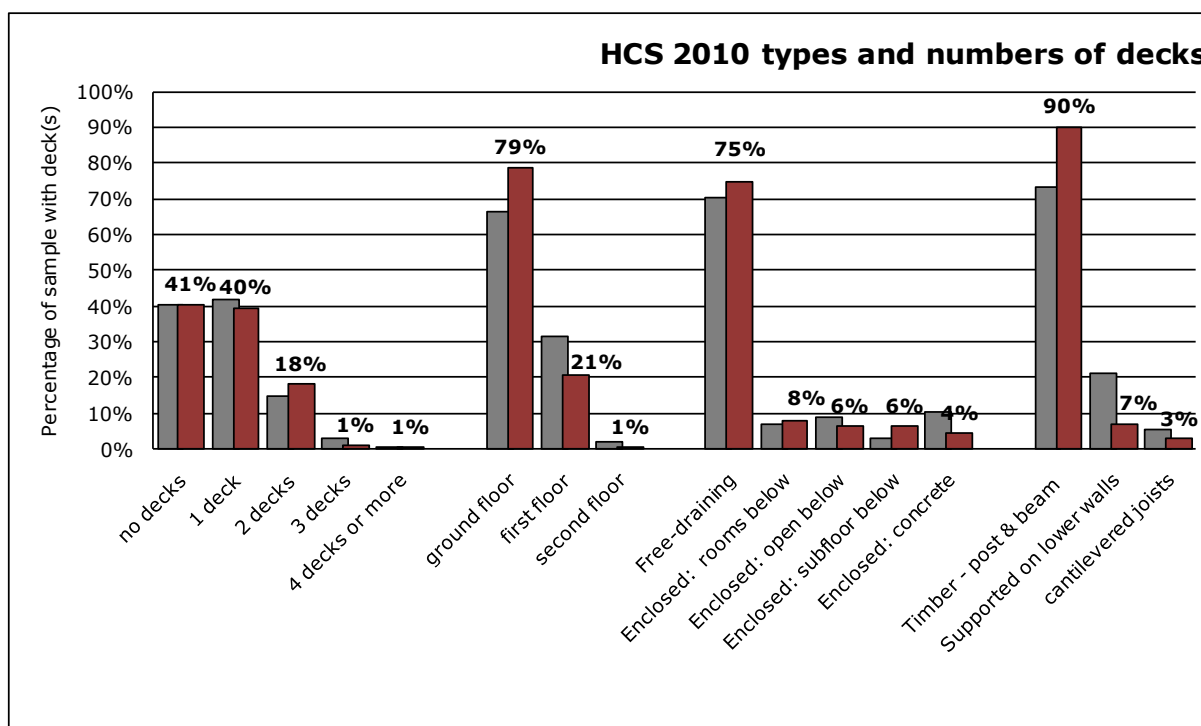


Figure 27: Types and numbers of attached decks

Figure 27 shows the following characteristics for attached decks:

- 60% of the houses in the 2010 sample had at least one deck, and 18% had two or more
- 79% of decks are located at ground floor level
- three-quarters of decks were free draining, with enclosed floor decks with rooms below a distant second at 8% of the sample
- the vast majority, 90% of the decks, were of timber post and beam type, up from three-quarters seen in 2005; 7% of decks were supported on lower walls with the remainder on cantilevered joists.

6.4.1 Deck materials

The materials used for deck surfaces and balustrades in the 2010 sample are shown in Figure 28. As shown, three-quarters of decks had spaced timber slat flooring which matched the number of free-draining decks in Figure 27. Figure 28 shows the characteristics for deck barriers assessed in the sample.

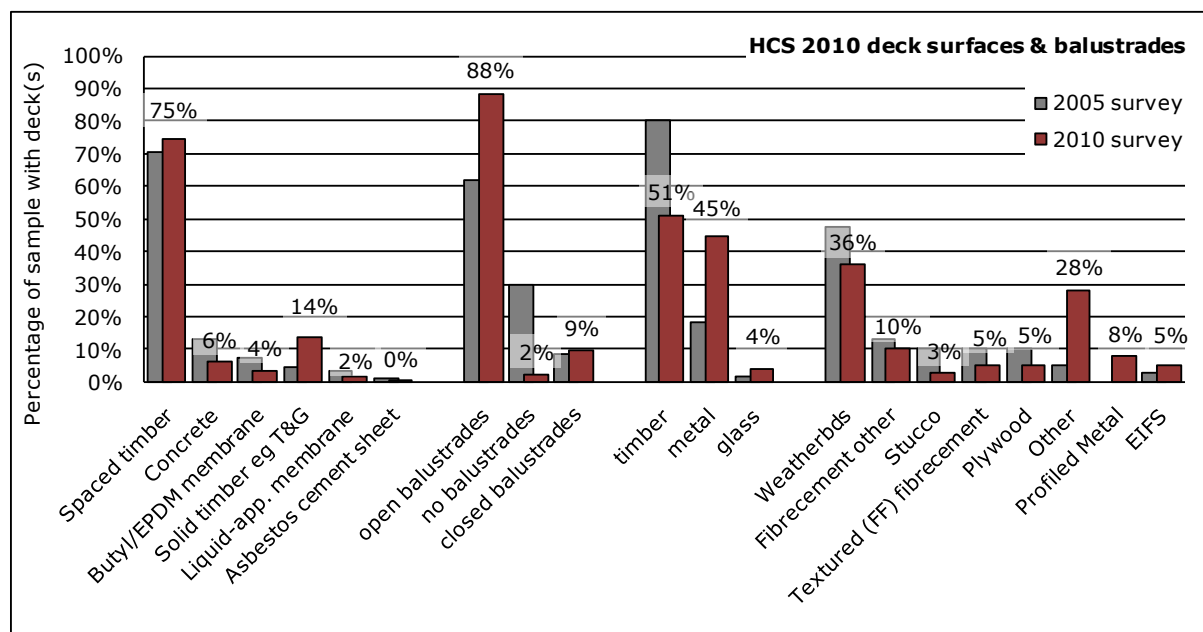


Figure 28: Deck surfaces and balustrades

Eighty-eight percent of decks over 1000 mm high had open balustrades (handrails with spaced rails or balusters), 2% had no balustrades and 9% had closed (solid) balustrades. Thirty-six percent of the closed balusters in the sample were timber, 28% were other (which includes glass), and 5% were clad with EIFS. Fourteen percent of balustrades were climbable types, such as horizontal rails.

6.4.2 Defects in attached decks

Defects found in decks are shown in Figure 29, and are separated into the structure and deck types.

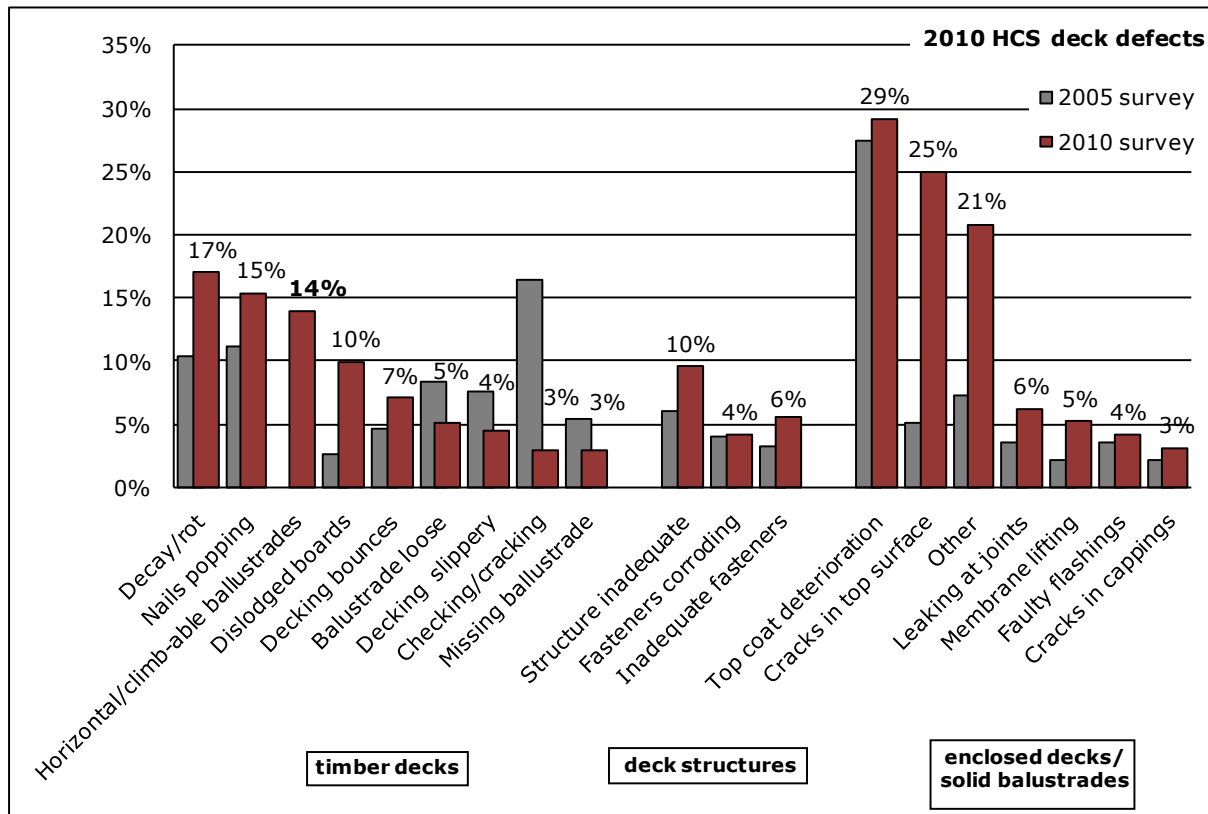


Figure 29: Defects in attached decks

The most common defects in timber spaced decks were decay, nails popping and dislodged boards. For enclosed decks, the most common defect affecting 29% of this type of deck was deterioration of the top-coat. This is mostly cosmetic, unless the paint is a moisture barrier. Ten percent of the deck structures were inadequate by today's standards, and 6% had inadequate fasteners.

14% of timber decks were non-compliant due to having either horizontal balustrades or rails which could be climbed (the data label highlighted in bold). The next section (6.4.3) looks at the compliance of the decks in the sample to current standards.

6.4.3 Deck barrier compliance

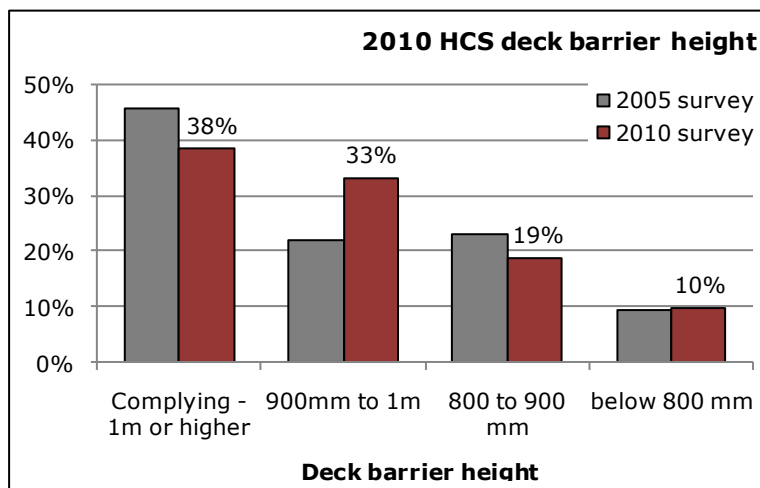


Figure 30: Deck barrier heights – 2010 and 2005

Deck barriers or balustrades were assessed for compliance with Clause F4 of the New Zealand Building Code (Building Code) (BIA 1992), and the results can be seen in Figure 30. The percentage of complying balustrades has fallen from 46% in 2005 to 38% in 2010, at least in part due to the larger number of post-1992 houses in the sample. The other 62% of barriers were non-compliant by modern standards due to either missing balustrades (either removed or never attached to decks above 1000 mm high), balustrades that were too low, openings that were too wide, or balustrades that could be climbed by small children (i.e. horizontal rails).

6.5 Defects in other components

Figure 31 shows the common defects identified in carports, chimneys and steps or ramps.

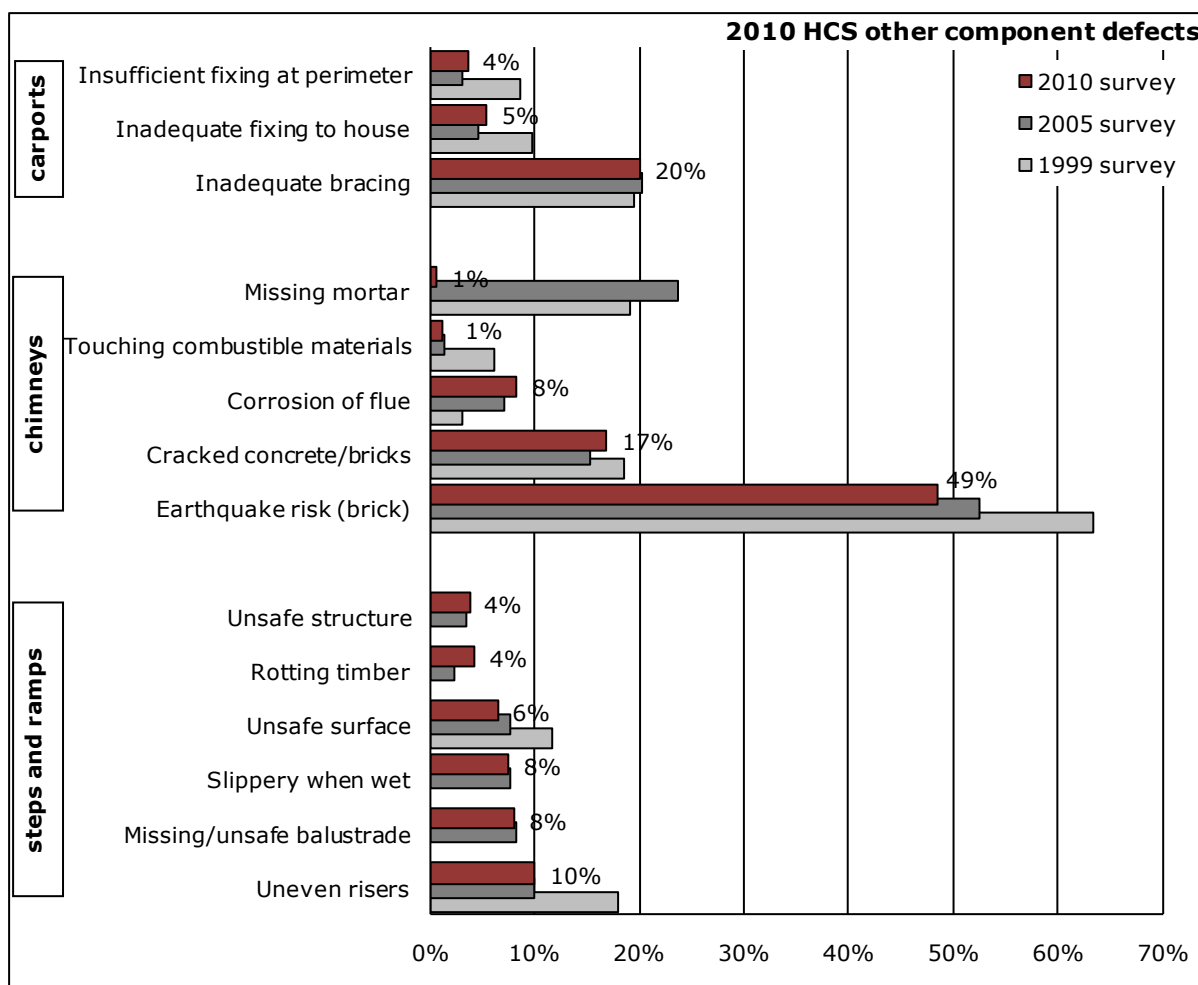


Figure 31: Defects in other components

As shown in Figure 31, defects are generally similar to those found in 2005. The main defect in carports remains the lack of adequate bracing. In common with past surveys, the most frequent defect in chimneys is generally associated with unreinforced brick chimneys in older houses. The decrease compared to past surveys reflects the increase in the number of newer houses in the sample, together with the removal of chimneys in a number of the older houses, rather than an improvement in chimney condition. The large decrease in missing mortar recorded in the 2010 survey is unexplained.

These chimneys were in line with building practices of the time (and are often still in good condition), they do not meet current earthquake standards, and are likely to be unsafe in a major earthquake. The incidence of cracked concrete or bricks in newer chimneys with cement-based mortars is also high (at 17%), providing a potential fire hazard if full-depth cracks are within the house envelope.

7. INSULATION

A higher percentage of homes in the 2010 survey had at least some insulation than in any of the previous surveys, as seen in Figure 32. There were a higher percentage of insulated suspended floors (37% of all suspended floors, up from 27% in 2005). Ignoring the inaccessible suspended floors, this figure increases to 57%.

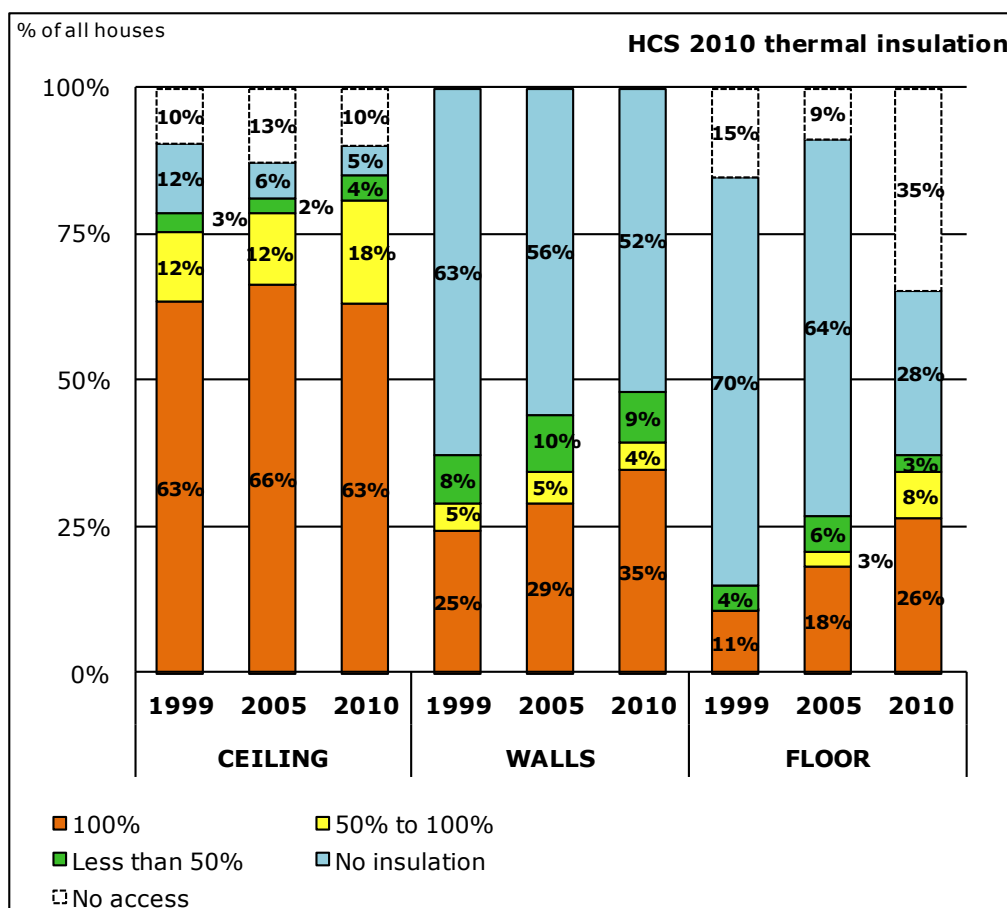


Figure 32: Presence of insulation

Wall insulation figures are based to a large degree on common sense assessments. In line with previous surveys, where a house was built before 1979 and the occupants did not know if the walls were insulated, the walls are assumed to be un-insulated.

7.1 Subfloor

The percentage of insulated accessible suspended floors has risen between 1999 and 2010, as seen in Figure 33.

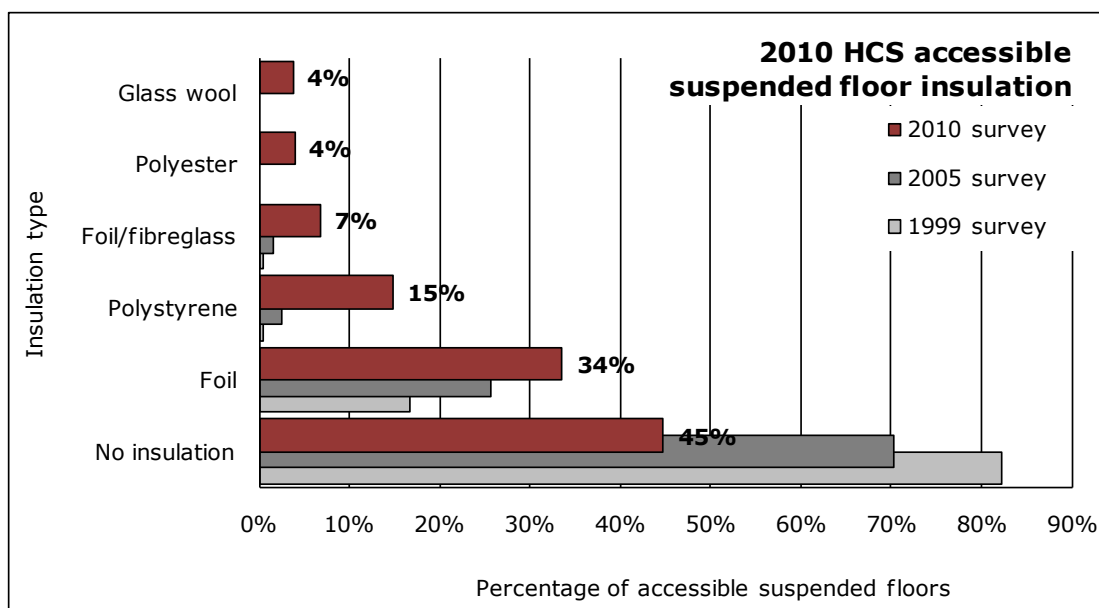


Figure 33: Insulation of suspended floors

Although the surveys indicate continuing increases in floor insulation over time, 45% of accessible suspended floors (in houses of any age) remain uninsulated, despite some form of underfloor insulation being required since insulation standards were introduced in 1978. Although more houses are being built, a large percentage of predominantly pre-1978 homes still have uninsulated floors, despite being a target of recent insulation subsidy schemes. However, there is likely to be polarisation between rentals and owner-occupied houses in regard to the presence of insulation, which will be further explored in later work.

7.2 Ceiling insulation

As seen in Figure 34, the percentage of homes with less than 20% ceiling insulation has remained around the same between 2005 and 2010, despite the aforementioned insulation subsidy schemes. The incorporation of rentals may be a prime cause of the lack of movement in this figure.

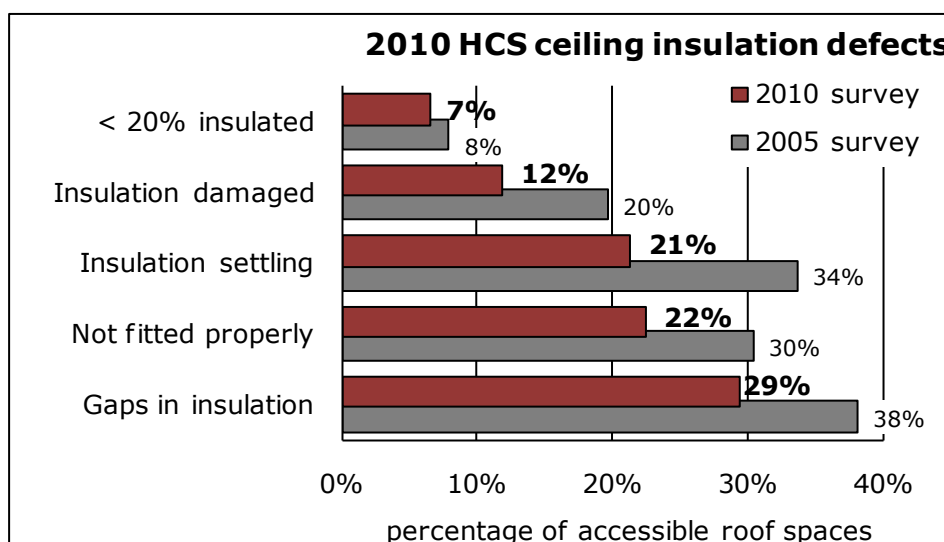


Figure 34: Defects in ceiling insulation

Although defects appear to be decreasing since the last survey, the prevalence of ceiling insulation issues is still notable. Twenty-nine percent of homes with accessible roof spaces had gaps in insulation, 22% had poorly fitted insulation, and 21% had insulation settling

(making it less effective at preventing heat loss). Twelve percent of accessible roof spaces had damaged insulation, predominantly caused by tradespeople or occupants.

With increasing awareness of the benefits of insulation, and the recent schemes set up to insulate existing homes, the bands of insulation thickness were increased from what was used in previous surveys to allow the infiltration of thicker insulation to be examined.

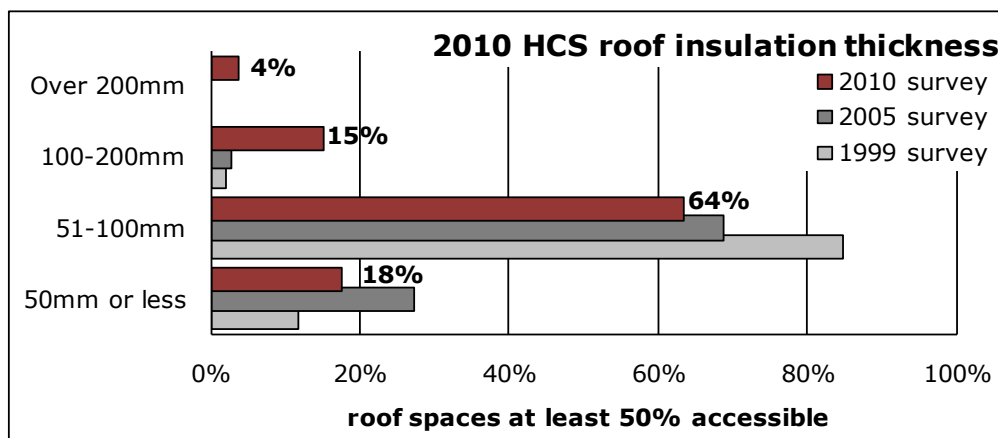


Figure 35: Thickness of existing roof insulation

There appears to be an upwards trend in insulation thickness. As seen in Figure 35, 3% of the sample in 2005 had insulation between 100 and 200mm thick, compared to 19% over 100mm thick in 2010. Four percent of ceiling insulation in 2010 was over 200mm thick.

8. INTERIORS

The interior of a house is arguably of the highest concern with regards to occupant health and safety. It is where most people spend at least one third of their day. For elderly, those with severe health issues, the disabled and the very young, much of the day may be spent within the home. Therefore the most vulnerable members of the population are subject to the greatest impacts of the indoor environmental quality of the home they inhabit.

This section of the report assesses the conditions of internal components within the house, and looks at factors which can detrimentally affect the living conditions inside the home.

8.1 Average interior condition

The average interior condition looks at the condition of assessed interior components, and for the purposes of this section, considers each component to be of equal importance.

8.1.1 Interior versus exterior condition by age

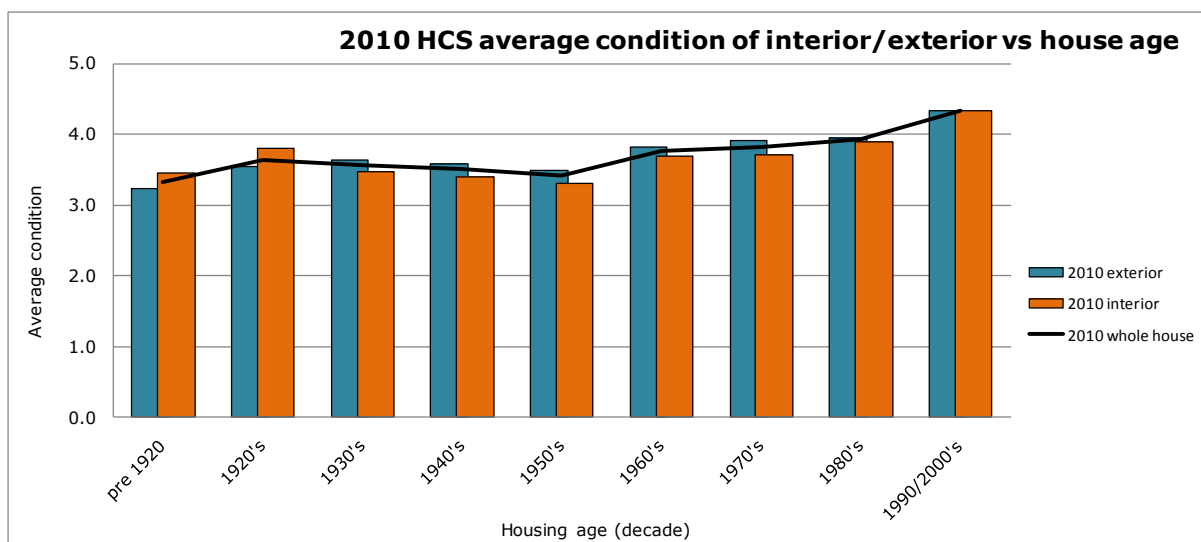


Figure 36: Interior versus exterior average condition by age of house

As seen in Figure 37, the condition of both the exterior and interior of houses is likely to be higher the newer the house. The condition of the interior is predominantly higher for houses built before 1920, however this trend reversed for houses built between the 1930s and 2010. This is in contrast to previous surveys, although the disparity between inside and outside condition had notably decreased between 1999 and 2005 surveys. This may indicate a trend of increased emphasis on the exterior condition of houses.

8.1.2 Interior component conditions

As shown in Figure 37, there percentage of interior components found to be in poor or serious condition was higher than in 2005, although in most not as high as in 1999. This increase may reflect the inclusion of rentals in the 2010 survey sample.

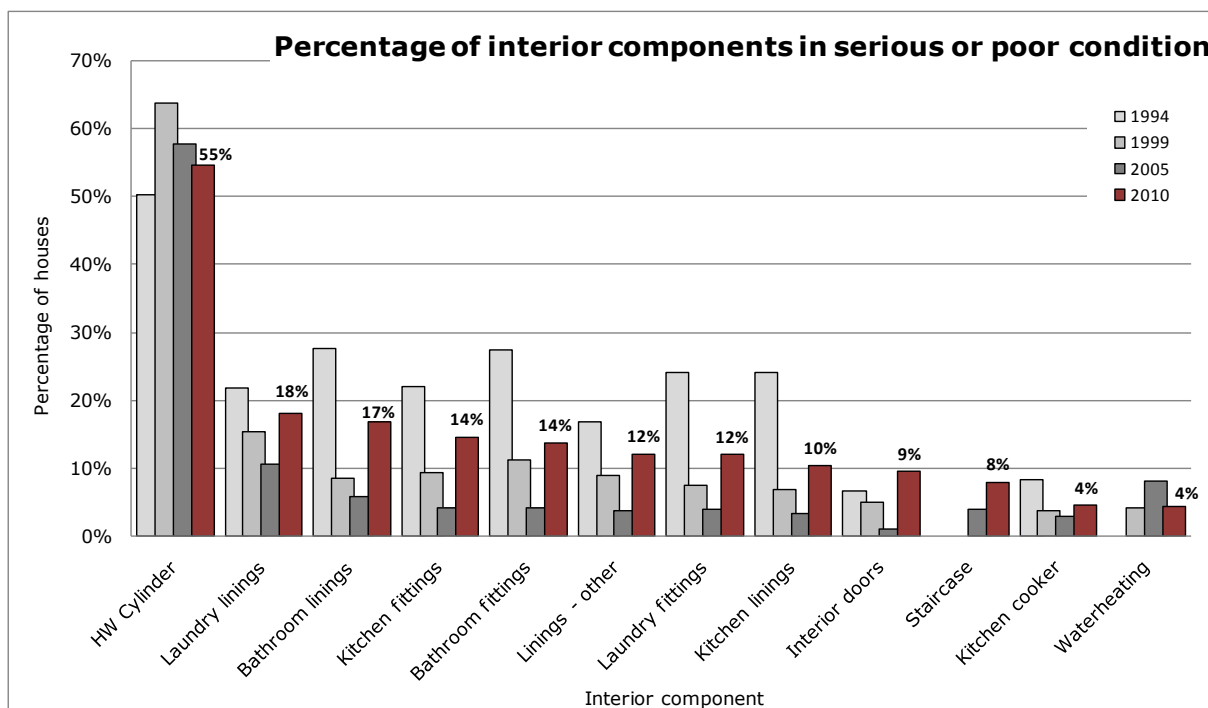


Figure 37: Percentage of interior components in serious or poor condition

Of all interior components, hot water cylinders are the most likely to be in poor or serious condition, at 55% of all hot water cylinders in 2010. A key reason for this is the number of cylinders without seismic restraints (50%).

Laundry, bathroom and other linings were in poor to serious condition in between 12% and 18% of houses. This may be due to mould, holes or missing linings, all a risk to occupant health and safety.

Plumbing fittings also rated quite highly among the components in poor to serious condition, which may indicate broken or missing fittings, damage or malfunctioning fittings. This potentially compromises the sanitation of the affected homes.

8.2 Space heating

8.2.1 Heating fuels

The most common heating fuel in New Zealand is electricity, with 72% of the *House Condition Survey* houses using this for space heating (Figure 38). Wood/coal followed at 47%. However, this does not necessarily mean that the bulk of heat produced comes from electricity. The Household Energy End-use Project (HEEP) found that more than half of New Zealand's residential heating was done with solid fuel (wood or coal)⁵.

Seventy-two percent of the sample used electric heating types, followed by wood or coal at 47%.

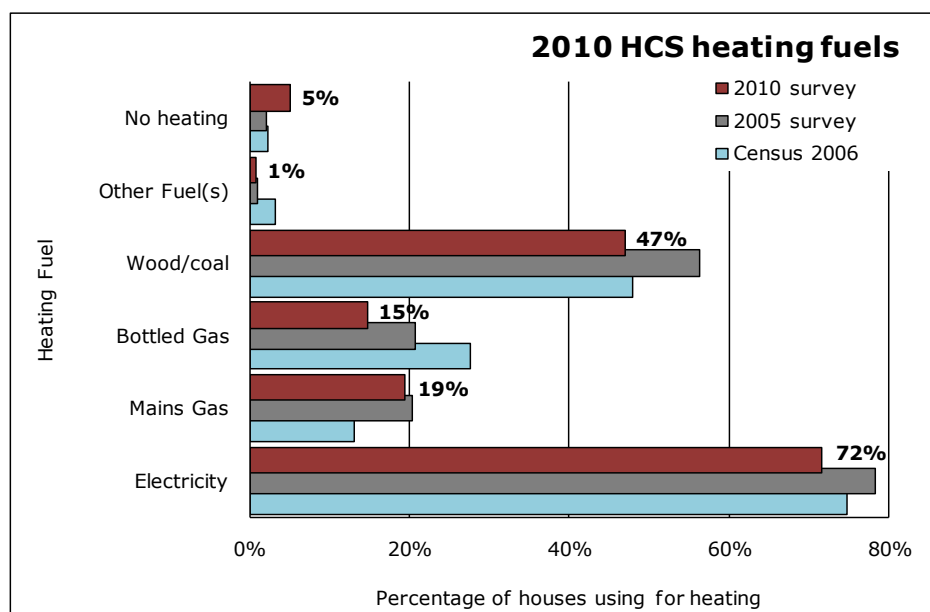


Figure 38: Heating fuels used

New Zealand's houses deploy a range of predominantly localised forms of heating in cooler parts of the year. The percentage of the sample with each form of heating is shown below in Figure 39, along with moisture control measures.

⁵ Isaacs NP (editor), Camilleri M, Burrough L, Pollard A, Saville-Smith K, Fraser R, Rossouw P and Jowett J. 2010. 'Energy Use in New Zealand Households: Final Report on the Household Energy End-use Project (HEEP). BRANZ Study Report 221. BRANZ Ltd, Judgeford, New Zealand. Pg 160. Isaacs NP (editor), Camilleri M, Burrough L, Pollard A, Saville-Smith K, Fraser R, Rossouw P and Jowett J. 2010. 'Energy Use in New Zealand Households: Final Report on the Household Energy End-use Project (HEEP). BRANZ Study Report 221. BRANZ Ltd, Judgeford, New Zealand. Pg 160.

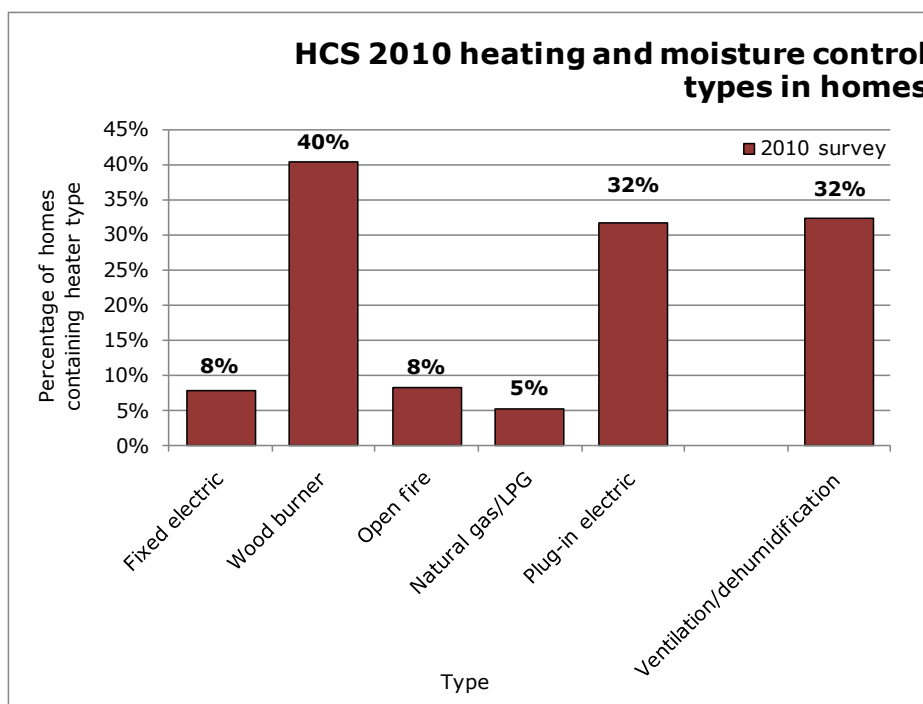


Figure 39: Heater and active moisture control types found

The most common type of heater found in the survey was plug-in electric heaters. This graph provides a view of the infiltration of the heating types into New Zealand homes as opposed to the most used, highest energy consuming, or highest heat output heating types.

Thirty-two percent of homes had either a dehumidifier or a forced air ventilation system (often roof space-sourced with ducted ceiling outlets).

8.2.2 Zonal differences

Appendix B of New Zealand Standard 4218: 2004 (Energy Efficiency – housing and small building envelope) divides New Zealand into three climate zones, which are used in the New Zealand Building Code;

- Zone 1: Districts north of and including Franklin and Thames-Coromandel Districts
- Zone 2: Districts in the North Island that are south of the Franklin and Thames-Coromandel Districts, and excluding the North Island's Central Plateau
- Zone 3: The Central Plateau and the whole of the South Island and Stewart Island.

When broken down into these zones, there are clear differences in the distribution of heater types, as shown below in Figure 40.

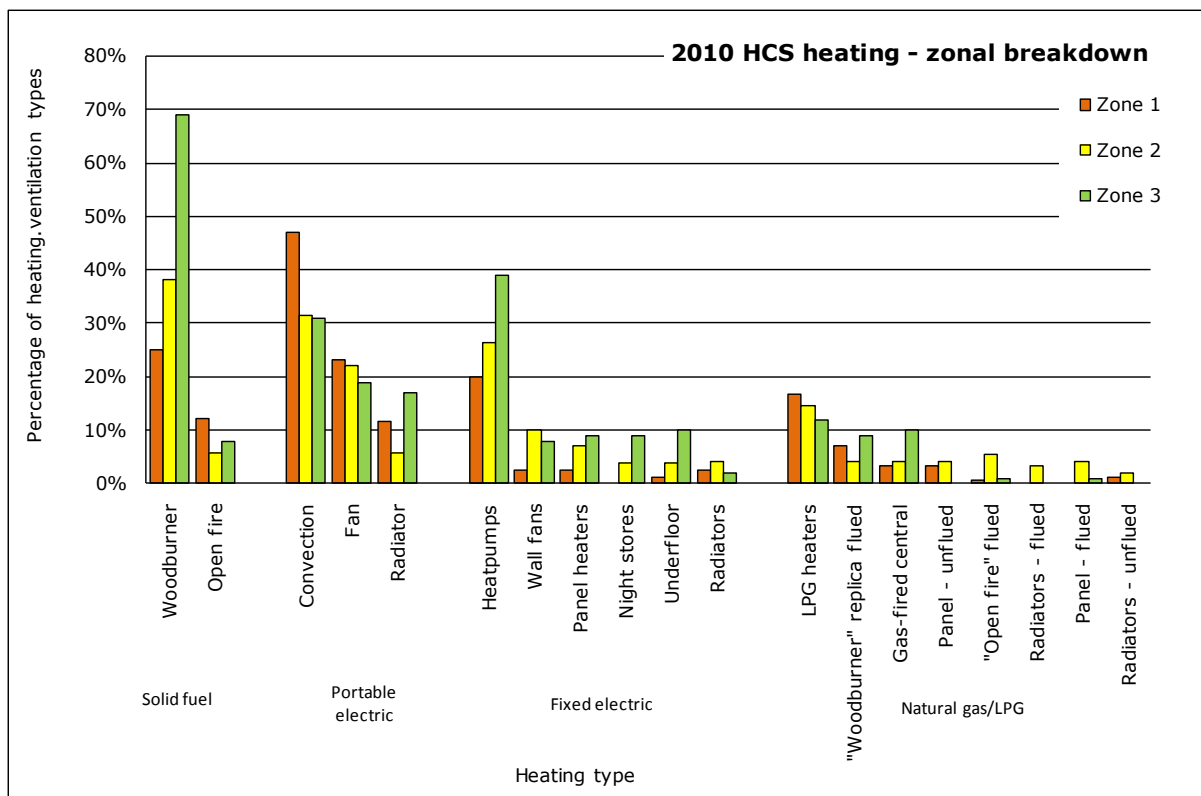


Figure 40: Heating systems by zone

The most common heater types vary by location. Solid fuel burners and portable electric heaters are the most prevalent across all zones. Woodburners are the most common single type of heater in households in both Zone 2 and 3.

8.3 Dampness and mould

8.3.1 Subjective assessments

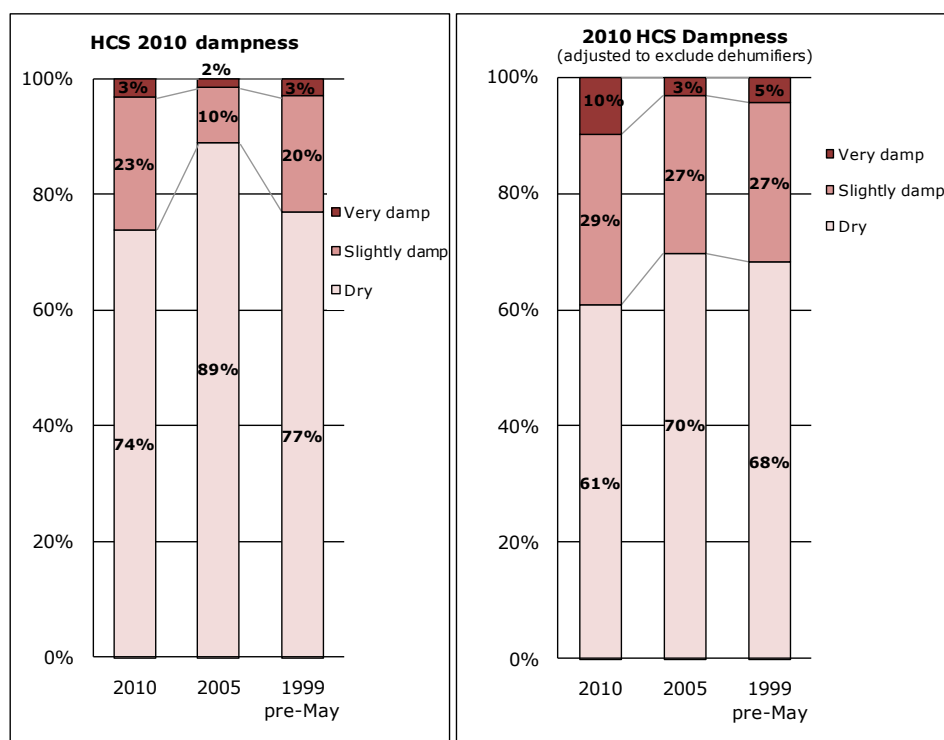


Figure 41: Subjective dampness assessments

Figure 41 shows the subjective dampness assessments from 2010 back to 1999⁶. Without taking into account dehumidifier use, over one quarter of the homes in 2010 exhibited at least some degree of dampness to the surveyors. To exclude the effect of dehumidifiers, an adjustment to push houses up the scale of dampness by one point out of five, the number of houses exhibiting dampness rose to nearly one in four houses (39%).

Dampness increases the likelihood of mould, which is looked at further on in Section 8.6.

8.4 Air treatment systems

The use of technology to mitigate moisture issues within the home has been on the increase since 1999, as shown in Figure 42.

⁶ In 1999 notable differences were apparent between houses surveyed in 'summer' and winter', therefore houses inspected after May were excluded from the analysis.

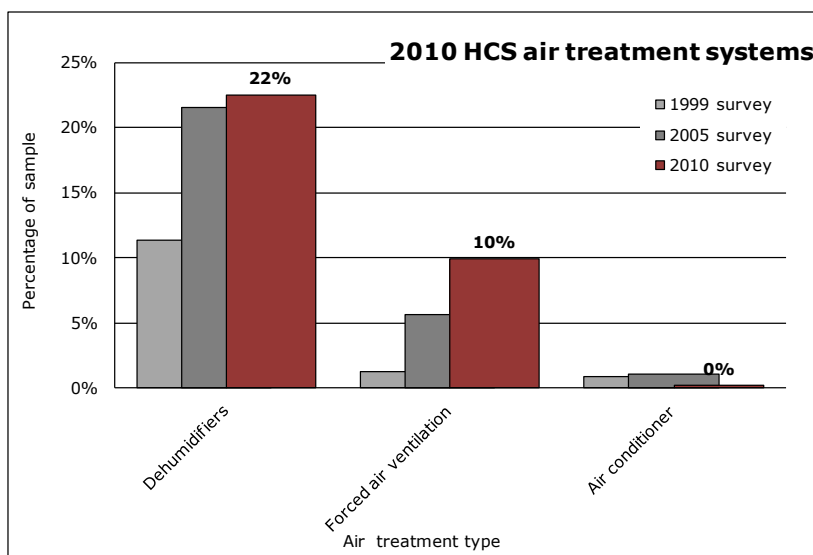


Figure 42: Air treatment types

A large area of growth has been the infiltration of forced air ventilation into New Zealand homes, with a percentage of homes with at least one system rising from 1% to 10%. This is likely to be due in part to the aggressive marketing campaigns that have been run over the past few years.

8.5 Dehumidifier use

As can be seen in Figure 43, the percentage of the sample with dehumidifiers was 21%, about the same as in 2005. However, the distribution across the country appears to have changed.

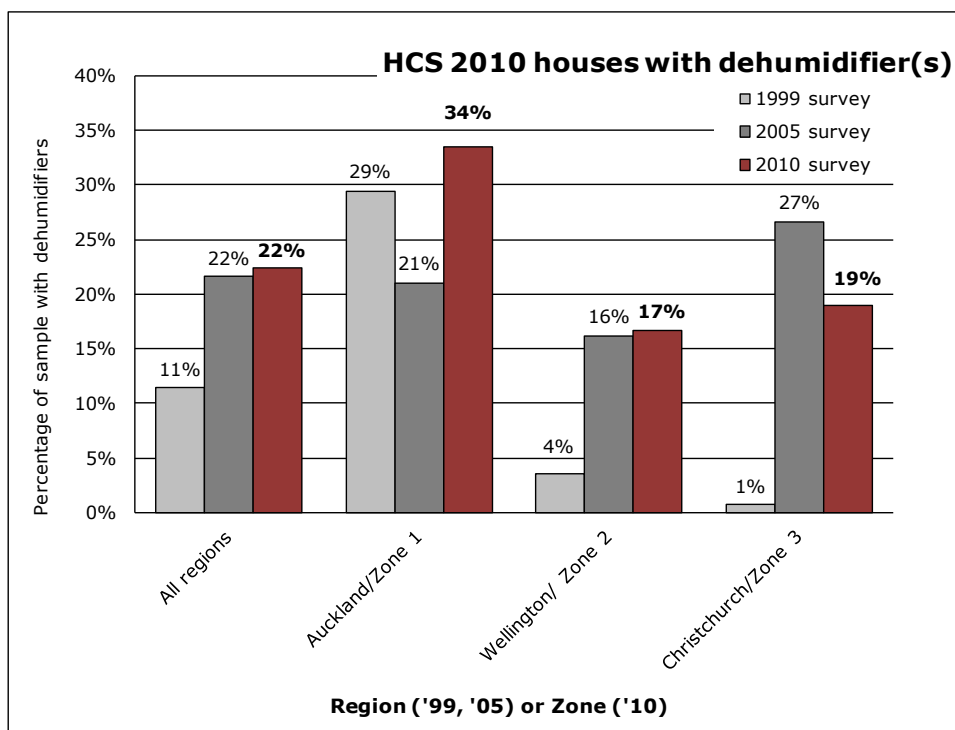


Figure 43: Dehumidifier prevalence by zone

In 2005, 21% of the Auckland sample had a dehumidifier; however this rose in 2010 to 34% of Zone 1 houses (which includes Auckland). The dehumidifier use remained about the same in Zone 2 (including Wellington), and decreased in Zone 3 (formerly including

Christchurch) since 2005. However the figures for Christchurch in 1999 and 2005 appear to be of a dubious nature due to an unexplained overall jump between 1999 and 2005. This may be in part due to the 2005 survey being conducted mainly in warmer seasons when dehumidifier use is expected to be lower, and appliance may therefore be in storage.

8.5.1 Dehumidifiers and unflued gas heaters

Unflued gas heaters, both natural gas and LPG, emit moisture as a by-product of combustion when they are operating. This leads to significant amounts of moisture being released into heated spaces, which may then travel into other parts of the house and be absorbed into the fabric of the building. Figure 44 shows the likelihood of dehumidifiers being present in surveyed homes with unflued gas heating types.

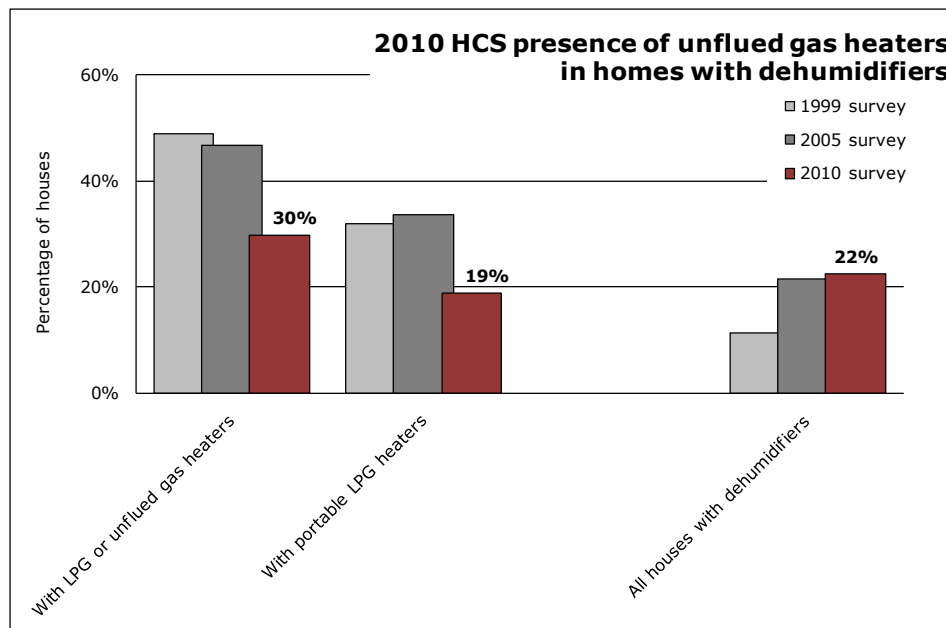


Figure 44: The relationship between the presence of dehumidifiers with unflued gas heating types

Houses with unflued (portable and fixed) natural or LPG gas heaters are more likely to have a dehumidifier, at nearly one third. Out of the entire sample, more than one house in five had a dehumidifier. Interestingly, homes with only portable LPG heaters were slightly less likely to have a dehumidifier, which on the surface contradicts what could be expected. However, the prepay nature of LPG heaters may lead to a higher presence in lower income homes where cost of purchase or operation of dehumidifiers may be prohibitive. Due to their portability, prepay nature and cost of operation, LPG heaters may also be used predominantly as supplementary or occasional usage. There may also be a relationship between the use of the heaters with location (climate and predominant heating types) and fuel availability.

8.6 Mould

Dampness and cold surfaces can lead to the growth of mould inside houses, which can be dangerous to the health of occupants. Exposure to mould spores can lead to and trigger a variety of health issues in humans, such as asthma and allergies⁷.

⁷ *Workplace Health Bulletin - Risks to Health from Mould and Other Fungi*. Bulletin No.17, November 2002. *Occupational Health and Safety*, Department of Labour, New Zealand Government.. <http://www.osh.dol.govt.nz/order/catalogue/pdfs/healthi017.pdf>, accessed 31 May 2011.

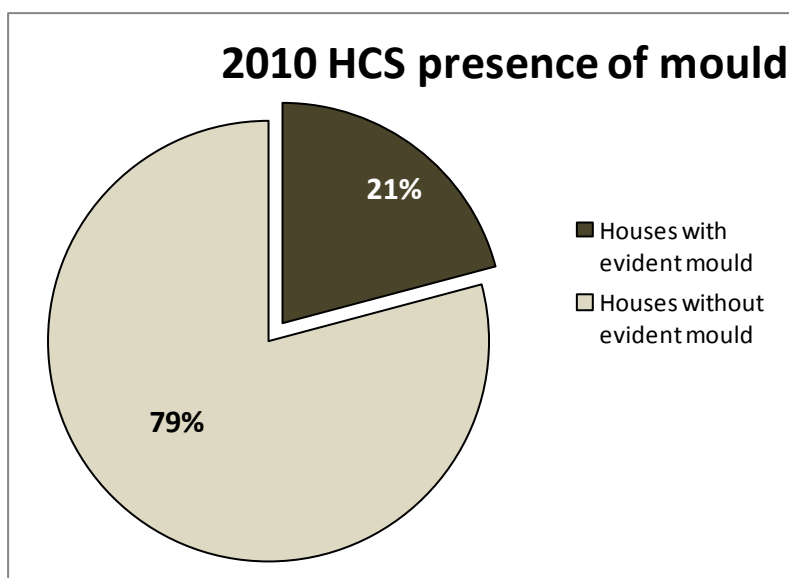


Figure 45: Mould evident during surveys

As seen in Figure 45, the 2010 *House Condition Survey* revealed that 21% of the houses had mould evident in at least one room at the time of inspection, ranging from specks to extensive coverage. This is likely to be a conservative figure, as householders may have “spring-cleaned” upon the making of an appointment for the physical inspection of the house.

These figures may well be conservative - although the bulk of surveying was done in the cooler months to November 2010 (when mould is most likely to occur), surveys continued at a slower rate through until February 2011.

9. DISCUSSION

9.1 Condition of houses

9.1.1 Average condition ratings

The average overall condition of the houses in the 2010 *House Condition Survey* was slightly lower than in the 2005 survey, and slightly higher than in the 1999 survey. The average condition ratings have moved down to 3.8 (between 'moderate' and 'good') from 4.0 ('good') in the 2005 survey.

9.1.1.1 Condition over different age groups

The 1994 survey found that the average condition continued to deteriorate with age throughout all age groups. However, the 1999 survey showed a stabilising of condition for the pre-1940s cohorts, with these older houses showing improvement in condition in comparison with those of the 1994 survey.

The 2005 survey showed further improvement in the oldest houses, with the lowest rating of 3.7 aligned to 1930s and 1950s houses. Houses built prior to the 1920s were in similar condition to those built in the 1960s and 1970s.

The 2010 survey shows that the lowest ratings are still associated mainly with 1940s and 1950s properties. House built prior to 1920 are similar to these.

9.1.1.2 Incidence of defects

Components with the lowest average condition ratings are similar to those of past surveys, and these include subfloor ventilation and subfloor fasteners. About 45% of houses have one of these, 25% have two, and 15% have three or four of these components in 'poor' or 'serious' condition.

9.1.1.3 Subfloor ventilation

More than 65% (2005: 62%, 1999:75%, 1994: 60%) of houses with timber-framed floors have poor or seriously deficient ventilation of subfloor spaces. As noted in the previous reports, it is surprising to find this level of serious inadequacy as the current Building Code requirement for ventilation has been in existence since the 1940s. It seems that few local authorities were using or enforcing these vent requirements. In addition to the inadequacy of constructed vents, owners themselves have often contributed to the problem by blocking vents.

Despite Building Code non-compliance, houses will not necessarily have problems in other components as factors such as exposure, soil condition, wind zone, ground clearance and alternative air leakage paths will affect the impact. However, there is anecdotal evidence that damp subfloor conditions can be related to the poor health of the house occupants.

9.1.1.4 Ground clearance

The provision of adequate clearance from the bottom of the wall cladding to the adjacent ground or paving level is another subfloor problem, with 40% of the surveyed houses having poor or seriously deficient clearance. The last survey identified a disturbing trend that this average rating was decreasing markedly in younger post-1960s houses due to changes in the way that New Zealanders use their houses, and the increasing attention given to achieving outdoor links where changes in levels are minimised at the expense of good building practice.

The trend appears to have reversed to some degree – with ‘poor’ to ‘serious’ clearance deficiencies increasing from 30% in 1994 to 44% in 1999 to 49% in 2005. This continues to be an area that could do with some attention in terms of educating the building trades. However, it may well be more important to educate landscapers, gardeners and owners themselves. The problem may be that later effects of inadequate clearance, while possibly severe, are too far in the future to engender immediate concern.

10. CONCLUSIONS

10.1 What is the average physical condition?

The average overall condition rating was 3.8 out of 5.0 (between ‘moderate’ and ‘good’) for the approximately 40 components inspected for the 2010 *House Condition Survey*. Consistent with the findings in 2005, the condition of houses tended to reduce with age, up until around 60 years old when conditions began to improve again. This survey showed there was a slight decline in the pre-1920s age cohort.

The newest houses had the highest overall condition ratings, with 4.3 out of 5 (between ‘good’ and ‘excellent’), while houses in the 1950s cohort had an average overall condition rating of 3.4 (between ‘moderate’ and ‘good’). The 1920s cohort had an overall average condition of 3.7, while the next and oldest age cohort (the pre-1920 group) had an average overall condition rating of 3.5 (between ‘moderate’ and ‘good’).

10.2 Has the condition of New Zealand’s housing stock changed since 2005?

The average condition of the national sample was 3.8, down from 4.0 in the 2005 survey, and up from 3.6 in the 1999 survey. The decline may be attributable to two changes to the sampling method in the 2010 survey: the selection of a national sample; and the simultaneous incorporation of an increased number of rental properties.

As was found in the 2005 survey, renovation appears to be pushing up the average condition of the oldest age cohorts, with the renovated properties pushing the average to above that of some more recent houses. With the recent downturn in building due to the economic recession, it appears that renovation has become more popular as people avoid moving in uncertain times. In common with 2005, the age cohort in the lowest average condition was the 1950s.

The 2010s sample showed a higher degree of polarisation of condition than either 2005 or 1999, which suggests that the improvement of the older age cohorts is not universal. Not all houses are done up when they reach a certain condition. This may be influenced by length of ownership, fashion trends in the renovation and the property market. The recent unfavourable economic conditions may also have had a two-fold impact, with renovations becoming more popular and pushing up the average condition of some, while others may have put renovation plans on hold, potentially leading to further deterioration.

The greatest polarisation was in the pre-1920s cohort, where the maximum difference between ratings was 2.7. This shows that while some of the cohort has been improved, there are still some which remain in a deteriorated state.

The least polarisation was in the 1920s cohort, with a maximum difference between the ratings of just under 1.5. This is likely due to the renovation of ‘character’ homes of this era. There was also large polarisation in the 1940s (post-war) and 1960s (modernist) age cohorts, which may be related to current trends in renovation.

10.3 Common maintenance problems

The 2010 survey showed similar common problems to those observed in 2005. The exterior or envelope components with the main problems in order of defect severity were:

- inadequate subfloor ventilation (or blocked existing vents)
- inadequate clearance from the ground level to wall cladding
- missing or corroding subfloor fasteners
- poor maintenance and deterioration of timber windows.

Other defects included deterioration of wall and roof claddings, and inadequate bracing, high moisture levels, borer and decay in subfloor timbers, and a lack of insulation.

Common interior maintenance issues included:

- hot water cylinders requiring repair, replacement, or effective seismic restraint (55%)
- mould and dampness
- damaged linings
- sanitary fittings requiring repair and/or replacement.

Other defects included damage to interior doors, and staircases in poor or serious condition.

10.4 Change since 2005 survey

The problems highlighted in the 2010 survey remain much the same as those shown up in the 2005 survey. Subfloor ventilation and lack of ground clearance remain the major areas of concern with very high percentages of houses being rated as 'poor' or 'serious' for these components.

The incidence of inadequate clearance from ground-to-wall cladding continues to increase, with the clearances decreasing markedly in houses built from the 1980s onwards. The 2010 results showed that these houses continued to have the greatest inadequacy of clearances of all age groups.

The 2010 survey has also found an increased incidence of serious defects with claddings, windows and doors and roof framing compared to the 2005 survey. However these incidences are comparable to those observed in the 1994 to 1999 surveys, and the root cause of this has not yet been clearly identified.

The percentage of hot water cylinders in poor or serious condition remains high at 55%. Half of all cylinders lacked effective seismic restraint.

There is a continuing upward trend in the presence of insulation in homes. However there are still 6% of accessible roof spaces that remain entirely uninsulated, and 45% of accessible subfloors.

10.5 What else can be learned from the database?

The survey information is maintained in the *House Condition Survey* database and will continue to provide a valuable resource for analysing component performance, and as a yardstick against which to measure future developments. This report covers only the general aspects of the structure of the properties.

Subsequent reports in the series will explore the data in more detail to uncover more information than has previously been pulled out. Social variables will be explored further, economic variables associated with homeowners' practices will be looked at, and weightings will be applied to enable the differences between owner-occupied and public and private rental homes to be examined.

11. PRELIMINARY SOCIAL AND DEMOGRAPHIC ANALYSIS

The following is a preliminary report on the socio-demographic profile of participants and potential sample bias from the Repairs and Maintenance Survey 2010 (Saville-Smith, 2011), undertaken by CRESA.

11.1 The socio-demographic profile of study participants

The unit data from the dwelling condition assessment and the *Repairs and Maintenance Survey* have yet to be matched and subject to integrated analysis. The socio-demographic profile of study participants, however, provides a preliminary insight into the robustness and representativeness of the dwellings subject to condition assessment by BRANZ. This provides a platform for future analysis around the particular populations subject to the burden of under investment in repairs and maintenance and the relative condition of stock in different market and tenure segments.

Profiling the socio-demographic characteristics of the households participating in the *House Condition Survey* is complicated by the inability to retain some households in the study between the time of their participation in the repairs and maintenance surveying and the dwelling condition assessment. Of the 657 household participants in this survey, 152 (23%) did not have their dwellings condition surveyed. Sixteen of these were Christchurch dwellings. It should be noted that the Christchurch earthquake in September meant that most Christchurch dwellings were not assessed despite having been recruited into the study through the *Repairs and Maintenance Survey*. All Christchurch participants whether in assessed or non-assessed dwellings have been excluded from the socio-demographic profile.

The following discussion is of a preliminary nature. It:

- Presents two sets of comparative data. The first analysis of the socio-demographic profile of the participants in the study compares the socio-demographic characteristics of those participants whose dwellings were subject to a dwelling assessment (assessed dwellings) with those who only participated in the *Repairs and Maintenance Survey*. The second compares the profile of study participants with the national population.
- Comments on potential for sample bias in the set of assessed dwellings which will require further exploration in subsequent analysis.

11.2 Socio-demographics of participant households

Households participating in the study fall into two categories: first, households that participated in the repairs and maintenance telephone survey and had their dwellings assessed through a physical, on-site survey; and, secondly, those households that participated in the *Repairs and Maintenance Survey* but did not have their dwellings assessed through the physical onsite survey. Those households that were retained in both phases of the study are referred to as householders or households in assessed dwellings. The second category of participants is referred to as householders or households in non-assessed dwellings.

The profile of participant households in assessed dwellings and participant households in non-assessed dwellings can be directly compared in relation to the following socio-demographic characteristics:

- Tenure
- Residential stability measured by durations of residence and intention to move
- Household age structure and life stage
- Household size and composition
- Occupation

- Householder income.

11.2.1 Tenure

There is considerable difference between the tenure profile of households whose dwellings were assessed compare to those that only participated in the *Repairs and Maintenance Survey*. Among the latter, 31.3% were renting their house from a private landlord, while only 11.7% of the assessed dwellings were in the private rental market (Table 4).

Table 4: Tenure of assessed and non-assessed dwellings

Tenure Status	% Assessed Dwellings	% Non-Assessed Dwellings
Owned dwellings	76.7	60.3
Rented dwellings ⁸	23.3	39.7

Moreover, with the rented dwellings, there was a higher proportion of Housing New Zealand and local authority dwellings among the assessed dwellings compared to households whose dwellings that were not assessed. This means that the comparative profile of assessed rented dwellings and non-assessed rental dwellings is distinctly different (Table 5).

Table 5: Landlord profile of assessed and non-assessed dwellings

Landlord	% Assessed Dwellings (n=114)	% Non-Assessed Dwellings (n=52)
HNZC	19.3	7.7
Local authority	3.5	0
Private landlord	50.0	78.8
Other	27.2	13.5

11.2.2 Residential stability

The higher proportion of rentals among non-assessed dwellings explains, in part, why there is lower residential stability among households in non-assessed dwellings. Over half (53.4 percent) of the households in assessed dwellings had been living in that dwelling for more than seven years. By comparison, 45.8% of households in non-assessed dwellings had lived in their dwelling for more than seven years (Table 6).

Table 6: Residence at current address for assessed and non-assessed dwellings

Period	Assessed Dwellings		Non-Assessed Dwellings	
	Households	%	Households	%
Less than one year	31	6.3	19	14.5
1-4 years	112	22.9	33	25.2
5-7 years	85	17.4	19	14.5
More than 7 years	261	53.4	60	45.8
Total	489	100.0	131	100.0

The non-assessed dwelling households have higher proportions of short residency with 39.7% in residence four years or less, compared to 29.2% of households in assessed dwellings. For non-assessed dwellings, 15.3% of households reported an intention to move within the twelve months subsequent to surveying, while 9% of households in assessed dwellings reported such an intention (Table 7).

⁸ Included not owned but provided rent free.

Table 7: Moving in next 12 months for assessed and non-assessed dwellings

Moving Intention	Assessed Dwellings		Non-Assessed Dwellings	
	Households	%	Households	%
Yes	44	9.0	20	15.3
No	419	85.7	104	79.4
Unsure/don't know	26	5.3	7	5.3
<i>Total</i>	<i>489</i>	<i>100.0</i>	<i>131</i>	<i>100.0</i>

11.2.3 Age structure and life stage

Consistent with these differences in tenure and residential stability, there are differences in the age profile of the householders in assessed and non-assessed dwellings.

As Table 8 shows, there is a lower proportion of under 25 year old householders in the assessed dwellings. However, the greatest difference between the households in assessed and non-assessed dwellings is between the householders in the 25-49 year old age group. In the assessed dwellings, 35.8% of householders are in that age group compared to 45% of householders in the non-assessed dwellings.

Table 8: Age of householders in assessed and non-assessed dwellings

Age Group	Assessed Dwellings		Non-Assessed Dwellings	
	Householders	%	Householders	%
Under 25 years	8	1.6	5	3.8
25-49 years	175	35.8	59	45.0
50-64 years	161	32.9	38	29.0
65 years or over	145	29.7	29	22.1
<i>Total</i>	<i>489</i>	<i>100.0</i>	<i>131</i>	<i>99.9</i>

The older age profile of households in assessed dwellings is associated with a higher proportion of householders living alone (18.2%) compared to 8.4% of householders in non-assessed dwellings. For multi-person households, it is also associated with assessed dwellings showing a lower proportion of households involved in the early child rearing life stage. Also 18.5% of the multi-person assessed dwellings had one or more children under the age of five years of age, while 25% of multi-person non-assessed dwellings had one or more under five year old residents.

The difference between assessed and non-assessed multi-person dwellings shows the inverse of this pattern when considering the prevalence of households with member 65 years with members or more. Over one quarter (27.6%) of assessed dwellings have an older household member compared to 22.5% of non-assessed dwellings.

11.2.4 Household size and composition

The households in non-assessed dwellings tend to be larger than the households in assessed dwellings. The average household size in assessed dwellings is 2.7 people, and in non-assessed dwellings it is larger at 3.1 people. As Table 9 and Figure 46 show, there is a pronounced skew in assessed dwellings to one-person and two-person households.

Table 9: Size of households in assessed and non-assessed dwellings

Household Members	Assessed Dwellings		Non-Assessed Households	
	Households	%	Households	%
1 person	89	18.2	11	8.4
2 people	187	38.3	46	35.1
3 people	65	13.2	31	23.7
4 people	101	20.7	18	13.7
5 people	35	7.2	17	13.0
6 people	8	1.6	4	3.1
7 people	0	0.0	2	1.5
8 people	2	0.4	2	1.5
9 people	0	0.0	0	0.0
10 people	2	0.4	0	0.0
<i>Total</i>	<i>489</i>	<i>100</i>	<i>131</i>	<i>100</i>

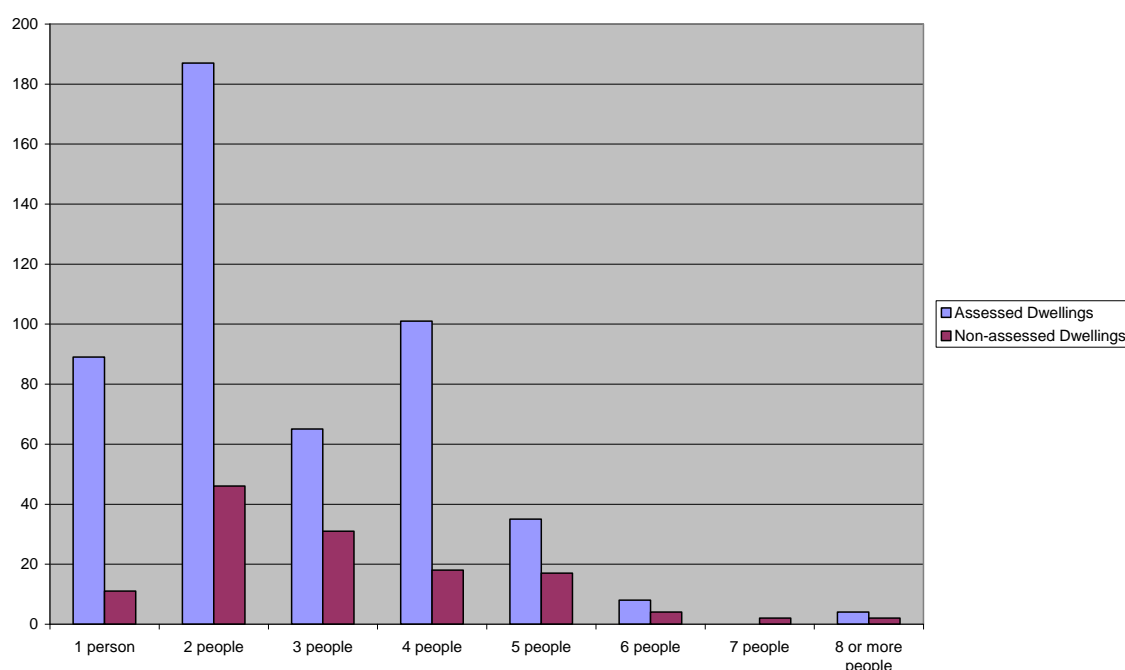


Figure 46: Size of households in assessed and non-assessed dwellings

The differences in household composition for assessed and non-assessed dwellings are set out in Table 10. The households in non-assessed dwellings tend to have higher proportions of “couples with children”, “sole parent”, and “non-related” households.

Table 10: Household composition in assessed and non-assessed dwellings

Composition	Assessed Dwellings		Non-Assessed Households	
	Households	%	Households	%
Living alone	89	18.2	11	8.4
Couple	165	33.7	37	28.2
Couple & children	161	32.9	53	40.5
Couple, children & non-related	8	1.6	3	2.3
Couple & non-related	7	1.4	3	2.3
Sole parent & child(ren)	31	6.3	11	8.4
Sole parent, child(ren) & non-related	6	1.2	2	1.5
Extended family	13	2.7	6	4.6
Extended family & non-related	2	0.4	1	0.8
Non-related	7	1.4	4	3.1
<i>Total</i>	<i>489</i>	<i>99.8</i>	<i>131</i>	<i>100.1</i>

11.2.5 Employment

Associated with the older age structure of householders in assessed dwellings is the higher proportion of retirees. Over one quarter (27.2%) of assessed dwelling householders reported that they themselves were retired. 19% report that their partner was retired. Among the non-assessed dwelling householders only 19.1% reported that they were retired with 17% reporting that their partner was retired. In both population sets, however, the largest single categories of householders were wage and salary earners and among householder partners over half were wage and salary earners for both assessed and non-assessed dwellings (Table 11).

Table 11: Householder employment in assessed and non-assessed dwellings

Employment Group	Assessed Dwellings		Non-Assessed Households	
	Households	%	Households	%
A wage or salary earner	212	43.4	55	42.0
Self-employed with no employees	60	12.3	15	11.5
Self-employed with employees	22	4.5	10	7.6
A homemaker	33	6.7	14	10.7
Unemployed	10	2.0	4	3.1
Retired	133	27.2	25	19.1
Other (Specify)	19	3.9	8	6.1
<i>Total</i>	<i>489</i>	<i>100.0</i>	<i>131</i>	<i>100.1</i>

11.2.6 Householder incomes

The higher proportion of one-person householders among assessed dwellings (18.2%) tends to depress their household incomes compared to non-assessed dwellings. Only 8.4% of non-assessed dwellings were one-person households.

The householders and householder couples' incomes for non-assessed and assessed dwellings are set out in Figure 47. However, when the households with un-partnered householders are excluded it can be seen that the assessed dwellings have a slightly higher proportion (43.3%) of couples whose combined income is above \$70,000 (Figure 48).

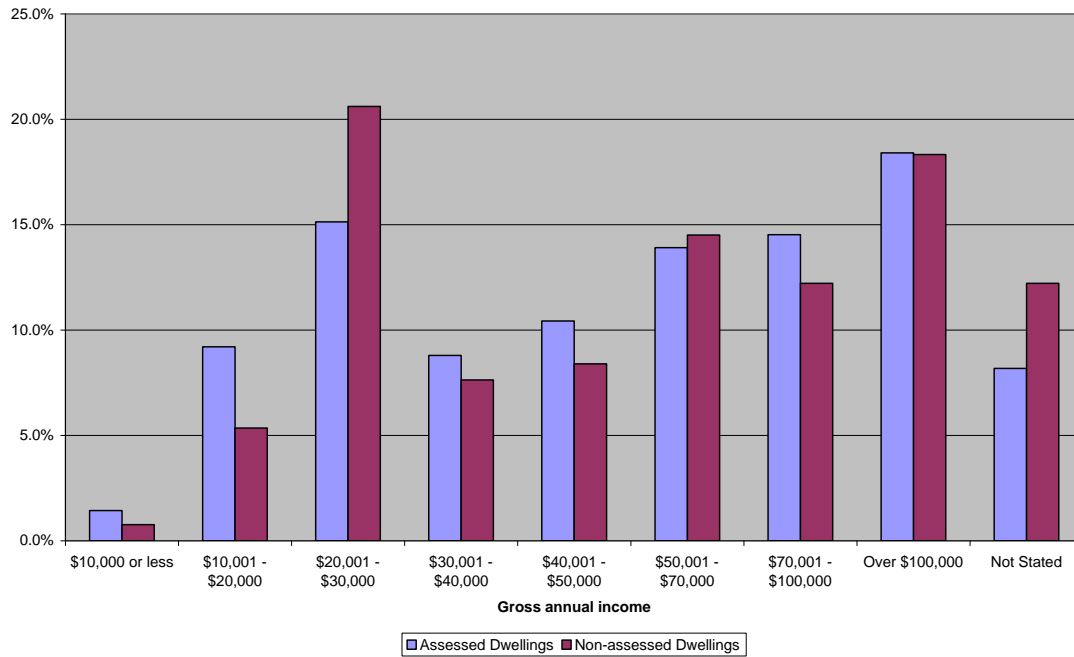


Figure 47: Combined incomes of assessed and non-assessed dwellings

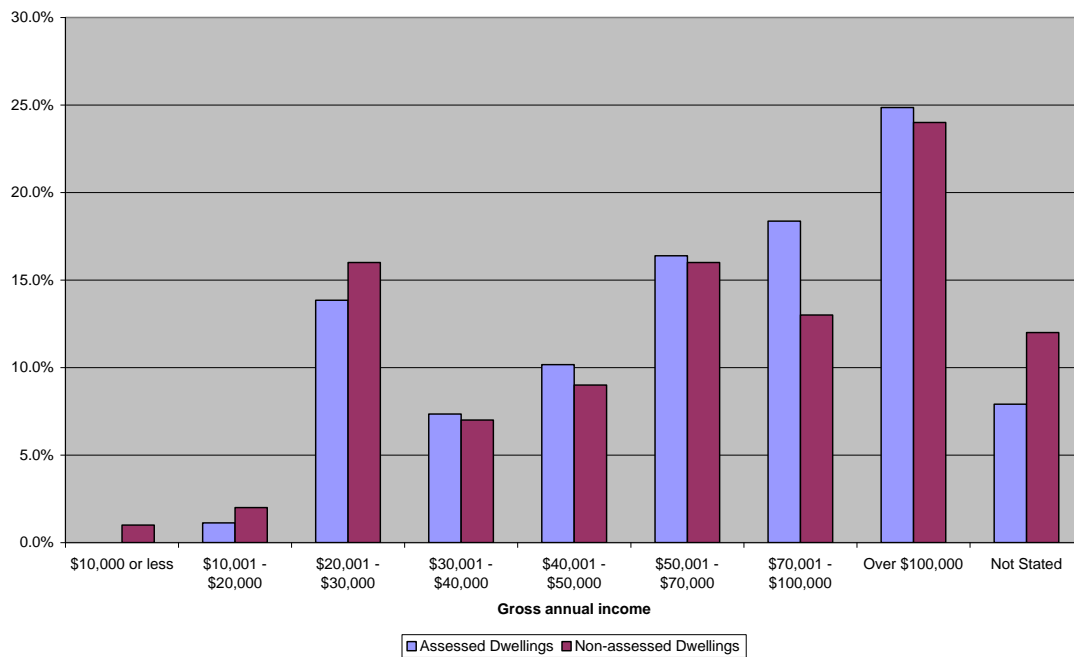


Figure 48: Combined incomes of assessed and non-assessed dwellings excluding un-partnered householders

11.3 Study participants and the national population

Study participants are compared with the national population in relation to:

- Tenure
- Household size
- Household income

With the exception of household income comparative socio-economic data is drawn from the 2006 census.

11.3.1 Tenure

The tenure characteristics evident in the 2006 census (Table 12) shows that study participants in non-assessed dwellings tend to have profile more akin to the national tenure profile. Overall, 73.2% of study participants (including both those in assessed dwellings and non-assessed dwellings) were in owner occupied dwellings compared to 66.9 percent of householders in the 2006 census. 27.8% of study participants occupied non-owned dwelling compared to 33.1% in the 2006 census.

Table 12: Tenure characteristics of the national dwelling stock in the 2006 Census

Tenure Characteristics	% New Zealand Dwellings
Tenure	
• Owned	66.9
• Not owned	33.1
Mortgage status	
• With a mortgage	52.4
• Without a mortgage	43.4
• Mortgage payments not defined	4.4
Sector of landlord	
• Private landlord	77.2
• Territorial authority	2.8
• HNZN	12.7
• Other	7.3

The difference between the national profile and the study participants is most apparent in relation to the rented dwellings. While 59% of study participants (combining the assessed and non-assessed dwelling households) were in private rentals, nationally it could be expected to find 77.2% in the private landlord category.

It has previously been noted that the assessed rental dwellings have a relatively low proportion (50%) of households in the private landlord segment of the market. By way of contrast, among the households in non-assessed rental dwellings 78.8% were in the private rental market.

11.3.2 Household size

It has already been noted that the non-assessed dwellings have a higher average household size relative to the assessed dwellings. This suggests that dwellings with larger households tended not to be captured in the study.

Table 13 shows, 56.6% of New Zealand Households consisted of two people or less in the 2006 census, and 53.7% of the study households had one or two residents.

Table 13: Size of study households and New Zealand households in 2006 Census

Household Members	Study Dwellings		New Zealand Households	
	Households	%	Households	%
1 person	100	16.1	328,313	22.6
2 people	233	37.6	494,044	34.0
3 people	96	15.5	240,291	16.5
4 people	119	19.2	221,667	15.2
5 people	52	8.4	102,714	7.1
6 people	12	1.9	39,259	2.7
7 people	2	0.3	14,766	1.0
8 or more people	6	1.0	13,121	0.9
<i>Total</i>	<i>620</i>	<i>100.0</i>	<i>1,454,175</i>	<i>100.0</i>

11.3.3 Household income

Table 14 compares the annual household incomes of New Zealand households estimated on the basis of incomes in the 2010 June quarter with the household incomes in assessed and non-assessed dwellings. For both households consisting of people under 18 years and 65 years and older have been excluded which suggests the national income profile has a higher proportion of households in the very low income group that the study households.

Table 14: National and study working age household income profiles

Household Income Groups	% NZ Working Age Households	% Study Working Age Households
\$0 - \$21,000^	12.3	7.1
\$21,000° - \$30,000	7.1	13.6
\$30,001 - \$50,000	17.6	17.9
\$50,001 - \$70,000	17.5	15.10
\$70,000 - \$100,000	19.7	16.7
More than \$100,000	25.4	22.2
Not stated	0.2	7.5
<i>Total</i>	<i>99.8*</i>	<i>100</i>

* Due to rounding ^\$20, 000 for study households °\$20,001 for study households

11.4 A comment on the study dwellings and households

The dwellings assessed for house condition are occupied by a population that exhibits some differences to households in the non-assessed dwellings. Moreover, the whole sample of participants shows some differences to household characteristics evident in the 2006 census. In particular the socio-demographic profile of national households compared to households participating in this study suggests an over-representation of older households, smaller households, higher income households and owner occupied households. Within the non-owned dwellings there appears to be an under-representation of dwellings in the private rented sector.

Those patterns are even more pronounced in the sample of assessed dwellings because of the different socio-demographic profiles of study households in assessed dwellings and non-

assessed dwellings respectively. The materiality of any sample bias in the assessed dwellings, probably arising from non-retention will need to be fully explored as subsequent analysis is developed.

In the meantime it needs to be noted that assessed dwelling and non-assessed dwelling status has a statistical association with the following variables in the *Repairs and Maintenance Survey*:

- Tenure
- Duration of residence
- Intention to move
- Installation of insulation
- Payment for insulation
- Reliance on self for repair information
- Reliance on tradespeople for repair information
- Expenditure on repairs and maintenance
- National superannuation as an income source
- Number of household residents
- Household life stage

Many of those variables have a direct impact on the condition and performance of dwellings, as well as the propensity to undertake, and the effectiveness of, repairs and maintenance.

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