

Study Report

SR419 [2019]



A consumer survey of attitudes to exceeding minimum standards for refurbishments and retrofits

Casimir MacGregor, Caleb Magan and Nick Brunsdon



 Funded from the
Building Research Levy



1222 Moonshine Rd, RD1, Porirua 5381
Private Bag 50 908, Porirua 5240
New Zealand
branz.nz

© BRANZ 2019
ISSN: 1179-6197



Preface

This is one in a series of reports centred around the issue of building beyond Code – high-performance housing that exceeds the minimum standards as set out in the New Zealand Building Code – that is a part of the BRANZ research programme 'Exceeding the minimum' led by Dr David Dowdell.

Acknowledgements

We would like to thank the Building Research Levy for funding this research.



A consumer survey of attitudes to exceeding minimum standards for refurbishments and retrofits

BRANZ Study Report SR419

Authors

Casimir MacGregor, Caleb Magan and Nick Brunsdon

Reference

MacGregor, C., Magan, C. & Brunsdon, N. (2019). *A consumer survey of attitudes to exceeding minimum standards for refurbishments and retrofits*. BRANZ Study Report SR419. Judgeford, New Zealand: BRANZ Ltd.

Abstract

This report outlines a survey of consumers' attitudes and experiences of undertaking refurbishments and retrofits and their choices to go beyond the requirements of the New Zealand Building Code (NZBC) or not. The report focuses on existing residential buildings that had recently been or were in the process of undergoing a refurbishment/retrofit.

A social survey was undertaken to collect the attitudes and experiences of consumers who had undertaken a refurbishment/retrofit. The social survey sought to learn more about consumer choices and decisions around exceeding the requirements of the NZBC. A nationwide online survey was distributed to 2,952 randomly selected individuals who had applied for an additions or alterations building consent (excluding garages) from their building consent authority. A total of 245 completed surveys were collected from around New Zealand – these represent the results presented in this report.

The survey highlighted a number of issues for the building and construction industry and New Zealand housing market. The survey results outline that consumer motivation to undertake a refurbishment/retrofit was strongly aligned with changing life stages, such as the creation and expanding of families. The vast majority of refurbishments/retrofits were undertaken by building professionals. However, these building professionals were in high demand, which created pressure within the market in terms of workflow for industry and created frustration and delays for consumers. For example, our survey found that Auckland recorded the highest amount of jobs that took at least 2 years to complete due to a lack of capability from industry.

Our survey also suggested that, within the New Zealand housing market, exceeding the minimum is predominantly the concern of individuals and families on higher incomes. Further, the decision to incorporate higher-performing building features and design into the refurbishment/retrofit was limited. For example, a large section of our sample did not plan on exceeding the minimum. However, one identified area where



exceeding the minimum was widely used was for insulation. The report outlines some recommendations for targeted initiatives and future research to encourage exceeding the minimum within the residential housing refurbishment/retrofit market.

Keywords

High-performance housing, building and construction industry, builders, architects, designers, New Zealand Building Code, NZBC, exceeding the minimum, sustainable buildings, retrofit, refurbishment.



Contents

| | |
|--|-----------|
| EXECUTIVE SUMMARY | 1 |
| 1. INTRODUCTION..... | 4 |
| 1.1 Defining 'exceeding the minimum' | 5 |
| 1.2 Structure of report | 5 |
| 2. BACKGROUND | 7 |
| 2.1 Information provision and research..... | 7 |
| 2.2 Leveraging change points..... | 8 |
| 2.3 Financing..... | 9 |
| 3. METHODOLOGY | 11 |
| 4. CONSUMER PERSPECTIVES ON REFURBISHMENT/RETROFIT THAT SEEKS TO GO BEYOND THE REQUIREMENTS OF THE NZBC | 12 |
| 4.1 Summary of survey results | 12 |
| 4.2 Current stage of building | 12 |
| 4.3 Information sought by consumers | 12 |
| 4.4 Factors and motivations influencing the decision to undertake a refurbishment/retrofit..... | 13 |
| 4.5 Costs involved in undertaking a refurbishment/retrofit..... | 15 |
| 4.6 Percentage spent or planned on higher-performing features that are beyond the requirements of the NZBC | 16 |
| 4.7 Who undertook the refurbishment/retrofit..... | 17 |
| 4.8 Duration of the refurbishment/retrofit and delays..... | 17 |
| 4.9 Focus of the refurbishment/retrofit | 19 |
| 4.10 Building features that exceed the minimum..... | 20 |
| 4.11 Benefits and barriers of exceeding the minimum | 21 |
| 4.12 Overall performance of the house..... | 22 |
| 4.13 Summary of results..... | 23 |
| 5. CONCLUSION AND RECOMMENDATIONS | 24 |
| REFERENCES..... | 27 |

Figures

| | |
|---|----|
| Figure 1. Current status of refurbishment/retrofit..... | 12 |
| Figure 2. Where information was sought for the refurbishment/retrofit..... | 13 |
| Figure 3. Respondents' reasons for refurbishment/retrofit. | 14 |
| Figure 4. Most important motivation to undertake refurbishment/retrofit. | 15 |
| Figure 5. How much respondents plan or planned to spend to complete the refurbishment/retrofit..... | 15 |
| Figure 6. How the refurbishment/retrofit will be funded. | 16 |
| Figure 7. Percentage of budget spent on higher-performing features beyond the requirements of the NZBC. | 17 |
| Figure 8. Who undertook the refurbishment/retrofit. | 17 |
| Figure 9. Duration of the refurbishment/retrofit. | 18 |
| Figure 10. Reasons for delays in refurbishment/retrofit. | 19 |



| | |
|---|----|
| Figure 11. Focus of the refurbishment/retrofit. | 20 |
| Figure 12. Building features used that exceed the minimum..... | 21 |
| Figure 13. Benefits of exceeding the minimum..... | 21 |
| Figure 14. Barriers to exceeding the minimum..... | 22 |
| Figure 15. Overall performance of house after refurbishment/retrofit..... | 23 |



Executive summary

This report outlines a survey of consumer attitudes to and experiences of refurbishments and retrofits and the planning and use of features and products that exceed the requirements of the New Zealand Building Code (NZBC). The report focuses on existing residential buildings that had recently been or were in the process of undergoing a refurbishment/retrofit.

This research report has sought to examine the following questions:

- What information/advice are consumers using in the refurbishment/retrofit?
- What issues are consumers facing when considering a refurbishment/retrofit of their house with features that go beyond the requirements of the NZBC?
- What are the costs and time commitment for refurbishment/retrofit projects?
- For consumers who have undertaken a refurbishment/retrofit of their house with features that go beyond the requirements of the NZBC, does it meet their expectations and why/why not?
- Was the consumer's refurbishment/retrofit that went beyond the requirements of the NZBC justified in terms of cost and benefit?
- What features that go beyond the requirements of the NZBC are consumers interested in?
- What value do consumers place on features that seek to go beyond the requirements of the NZBC?

A social survey was undertaken to collect the attitudes and experiences of consumers who had undertaken a refurbishment/retrofit. The social survey sought to learn more about consumer choices and decisions of exceeding the minimum for features and products within the design and construction. A nationwide online survey was distributed to 2,952 randomly selected individuals who had applied for an additions or alterations building consent (excluding garages) from their building consent authority. The selected sample was intended to capture those who had either completed or were still in the process of undergoing a refurbishment/retrofit. A total of 245 completed surveys from around New Zealand were returned – these represent the results presented in this report. In addition to questions about the refurbishment/retrofit, participants were asked a series of demographic questions including age, gender, geographical region, household income and housing tenure type.

The main findings of the results are as follows:

- Aucklanders were more concerned with increasing the square metre size of their dwelling than Wellington and Canterbury.
- Respondents who were within the 31–50 age bracket were more concerned with increasing the size of their dwelling than those 51+ years of age.
- The average duration of refurbishment/retrofit was 3–6 months. However, in the major regions (Auckland, Wellington and Canterbury), the average duration was 7–11 months. Auckland recorded the highest number of jobs that took more than 2 years to complete.
- Delays were experienced by 75% of respondents. Areas of concern tended to focus on issues with contractors – both a lack of availability and a general perception of slackness. Councils received a significant share of remarks around delays, especially in Auckland, where there were a far higher proportion of respondents who reported delays with council than the rest of the country.



- Costs of retrofits were high – 57% spent over \$100,000, and the median cost was \$110,000.
- 85% of retrofits were carried out by industry professionals.
- Nearly all (97%) of respondents installed higher-than-Code features when undertaking the refurbishment/retrofit.
- Health benefits were of overwhelming importance for survey respondents.
- 49% of respondents believed their house went beyond the requirements of the NZBC.
- The medium household income bracket (\$60,000–130,000) had a higher proportion of respondents who believed their house went beyond the requirements of the NZBC compared to other household income brackets.

The survey highlighted a number of issues for the New Zealand housing market and for the building and construction industry:

- Housing preferences are aligned with changing life stages such as the creation and expansion of families.
- The building and construction industry is in high demand, which creates pressure within the market in terms of workflow for industry and frustrations for consumers.
- Within the New Zealand housing market, the choice to go beyond the requirements of the NZBC is predominantly the concern of individuals and families on higher incomes.
- Consumer perception that performance of their house was beyond the requirements of the NZBC needs to be verified with actual building performance.
- More information is required for consumers about what going beyond the requirements of the NZBC means as well as outlining options and benefits.

Recommendations

1. More research is needed to determine how changing demographics are going to impact house design and the composition of existing housing stock. This information would help to determine the types of houses New Zealand may need as the population dynamics change. It would also provide insight into the market impact of expanding houses sizes when we have an ageing population. Such information would help industry planning and workflow.
2. More research is needed to understand the workflows and pressure points of building professionals and local councils in relation to refurbishments/retrofits that go beyond the requirements of the NZBC. Such information could shed light on industry and market-wide pressure points that will need to be addressed in order to help create greater industry and market efficiency.
3. More research is needed into the financial implications of refurbishment/retrofit, such as determining whether overcapitalisation is taking place within the New Zealand market.
4. Initiatives are needed by banks to create financial packages (such as lending packages) that may incorporate building features and products that seek to go beyond the requirements of the NZBC. Such lending packages would allow and support a greater number of homeowners (who currently may not be able to do so) to build beyond the requirements of the NZBC and accrue its benefits. Where possible, financial initiatives should support low carbon, sustainability, climate resilience and other options that will help create improvements in the health and wellbeing of consumers.
5. More targeted evidence-based information on a range of features and products that go beyond the requirements of the NZBC is needed for industry and



- consumers. Of relevance is the provision of a range of options aligned with what benefits can be gained from using the feature or product. The quantifiable evidence of going beyond the requirements of the NZBC is needed alongside this initiative to highlight and communicate the evidence to industry and consumers.
6. A social marketing campaign directed at industry and consumers is needed to help communicate what building beyond the requirements of the NZBC is and why it is important. Such a campaign would share information and advice so that high-performing buildings can become more normalised and encouraged within industry and among consumers groups.
 7. BRANZ and other relevant industry organisations should work with local councils to help provide more accessible information and create greater awareness for existing services that are currently available to help consumers explore options for higher-performing building features that go beyond the requirements of the NZBC. For example, it may be worth promoting the Eco Design Advisor service more widely and frequently, as consumers are seeking advice from building professionals but underutilising this free service.
 8. A seminar or e-training module is required for industry on higher-performing building features and products that seek to go beyond the requirements of the NZBC.
 9. Research that undertakes post-occupancy review of refurbishment/retrofit of houses before and after adoption of features and products that seek to go beyond the requirements of the NZBC would be useful to understand the efficacy of exceeding the minimum.
 10. More research is needed to understand what information on higher-performing buildings and features and products that go beyond the requirements of the NZBC consumers would like. For example, it would be useful to know if technical information or design information is more sought after, and how consumers would like to receive this information.



1. Introduction

This report outlines a survey of consumer attitudes to and experiences of refurbishments and retrofits and the planning and use of building features and products that seek to go beyond the requirements of the New Zealand Building Code (NZBC). The report focuses on existing residential buildings that had recently been or were in the process of undergoing a refurbishment/retrofit that required a building consent.

Retrofitting is the adding of a building component or feature that was not part of the original construction. Some building components or features that are commonly retrofitted include installation of new heating and ventilation systems, façades, insulation and double glazing (Designing Buildings, 2018a). Retrofitting is often done in an effort to improve thermal comfort, repurpose space and enhance sustainability. An often-aligned term with retrofitting is refurbishment, which is a term used to describe a process of improvement by numerous methods such as decorating, cleaning and re-equipping. Refurbishment can be cosmetic, such as painting and decorating, or involve major upgrading and repairs, alterations, conversions, extensions and modernisation (Designing Buildings, 2018a).

Recent research on consumer experiences of seeking to go beyond the requirements of the NZBC has highlighted that many consumers see the NZBC as a quality assurance mechanism rather than the legally allowed minimum building standard (MacGregor & Donovan, 2018). There is currently a gap in existing research that documents consumer perspectives of seeking to go beyond the requirements of the NZBC in relation to refurbishment/retrofit. This report aims to fill this gap in order to provide some evidence of consumer attitudes and experiences.

The issue of refurbishment/retrofit is of ever-growing importance for the New Zealand housing market. Existing residential housing makes up the majority of dwellings within the New Zealand market, and at present, it is a growing market for the building and construction industry. For example, Wynn (2015) notes that "Statistics New Zealand figures reveal we spent \$1.5b on renovating [consented alterations and additions] houses last year [2014], up from \$940 million in 2012". However, the full extent of the refurbishment/retrofit market is unclear as minor work (such as painting, many internal alterations and so on) is often unconsented.

The purpose of this study is to contribute to the available research to gain an understanding of consumer perspectives and experiences of refurbishment/retrofit and the decision to go beyond the requirements of the NZBC or not.

This research report has sought to examine the following questions:

- What information/advice are consumers using in the refurbishment/retrofit?
- What issues are consumers facing when considering a refurbishment/retrofit of their house with features that go beyond the requirements of the NZBC?
- What are the costs and time commitment for refurbishment/retrofit projects?
- For consumers who have undertaken a refurbishment/retrofit of their house with features that go beyond the requirements of the NZBC does it meet their expectations and why/why not?
- Was the consumer's refurbishment/retrofit that went beyond the requirements of the NZBC justified in terms of cost and benefit?



- What features that go beyond the requirements of the NZBC are consumers interested in?
- What value do consumers place on features that seek to go beyond the requirements if the NZBC?

1.1 Defining 'exceeding the minimum'

The NZBC sets out the minimum standards (the lowest legally permissible standard) that a new building must meet. Within our current housing market, new houses tend to just meet the minimum standards outlined in the NZBC rather than striving to exceed the minimum standards.

For this reason, BRANZ established an 'Exceeding the minimum' research programme, which seeks to help and encourage consumers and the building industry to understand that the NZBC is a minimum only and that there are real benefits to exceeding these standards (BRANZ, 2017). The research programme hopes that, with the availability of accurate information and choices around design features and the benefits of these features, the opportunity to consider higher-performing buildings will be created for industry and consumers alike (BRANZ, 2017). Over time, it is expected that the 'Exceeding the minimum' research programme will help to create a more responsive housing market, with industry better able to meet consumer expectations, aspirations and needs and create higher-performing housing (BRANZ, 2017; James et al., 2018).

The 'Exceeding the minimum' research programme seeks to ensure that:

- consumers and industry understand that the NZBC and standards are a minimum that must be met but can and should be exceeded
- the benefits of exceeding the minimum can be clearly articulated based on meaningful terms
- the barriers to exceeding the minimum have been addressed
- consumers expect and demand buildings and communities that perform to a higher standard
- the industry delivers buildings and communities that perform to a higher requirement in a cost-effective way
- existing buildings are brought up closer to current NZBC minimum performance levels.

Within this report, the terms 'exceeding the minimum' and 'higher-performing housing' will be used interchangeably to refer to buildings, features and products that seek to go beyond the requirements of the NZBC

1.2 Structure of report

- Section 1 sets the scene for the research and outlines key concepts relevant to this report, such as defining what 'retrofit', 'refurbishment' and 'exceeding the minimum' mean, and outlines the research aims.
- Section 2 outlines some background context to issues relating to refurbishment/retrofit that seeks to exceed the minimum, such as exploring recent research, as well as identifying leverage change points for industry and a review of financing for industry and consumers for refurbishment/retrofit that exceeds Building Code minimums.
- Section 3 outlines the methodology of our consumer survey, such as the process used and how it was undertaken, as well as the ethics process used.



- Section 4 outlines the results of a New Zealand-wide consumer survey about attitudes, experiences, design choices and costs of refurbishment/retrofit that exceeds NZBC minimums in residential houses.
- Section 5 discusses the overall findings from the study and outlines some recommendations for future research.



2. Background

Encouraging housing that seeks to go beyond the requirements of minimum performance standards as outlined in building codes through retrofitting has long been a challenge. Many countries, especially in Europe, have committed to the construction of buildings with enhanced building performance and sustainability that seek to go beyond building code standards (Torregrossa, 2015). Sitting alongside the regulation of buildings standards are more market-based and industry-run initiatives that seek to encourage buildings with higher performance and sustainability requirements. One such example is the so called Green Deal in the United Kingdom – a government and industry-led policy that sought to produce energy-efficient retrofitting at scale in residential dwellings (Gooding & Gul, 2016).

In examining research about buildings that go beyond building code requirements within residential housing through refurbishment/retrofit, we seek to outline a number of challenges that emerged from this process: information provision and research, leveraging change points and financing.

2.1 Information provision and research

Homeowners' perceptions of retrofitting, especially those that include beyond code features such as increased insulation, are often inaccurate and present the issue as one that is more complicated and expensive than reality (Novikova, Vieider, Neuhoﬀ & Amecke, 2011; Mallaband, Haines & Mitchell, 2013; New Zealand Business Council for Sustainable Development, 2008). This finding is underscored by other research that highlights the need for more research and information for consumers and industry alike (Blumstein, Krieg, Schipper & York, 1980; Bardhan, Jaffee, Kroll & Wallace, 2014; Novikova et al., 2011).

General resistance to behavioural change can be a strong barrier to not adopting higher-performing design and features within refurbishment/retrofit, even when no cost is involved (Long, Young, Webber, Gouldson & Harawatt, 2015; Dowson, Poole, Harrison, & Susman, 2012). For example, the Kirklees Warm Zone scheme in the UK was a "local government led city scale domestic retrofit programme that installed energy efficiency measures at no charge in over 50,000 houses" (Long et al., 2015, p. 1853). The study found that socio-economic and behavioural factors affected the take-up of the energy efficiency measures. However, the research did not touch on the reasons why people did not take up the offer. This research helps to highlight that cost was not the sole barrier to going beyond the requirements of building codes. Further, the research also highlights the importance of the provision of relevant and digestible information for consumers and industry from a trusted source so that those undertaking or contemplating a refurbishment/retrofit can overcome resistance from market uncertainty and misinformation (Sustainable Energy Authority of Ireland, 2017).

Within New Zealand, there is a wide body of generic information around some aspects of sustainable building, such as the Eco Design Advisor service and BRANZ websites Level (www.level.org.nz) and Up-Spec (www.branz.co.nz/up-spec). However, a lot of information sources, especially in New Zealand, are more oriented at aligning sustainable solutions to concerns around cold, dampness and mould (Saville-Smith, 2008). As MacGregor and Donovan (2018) have outlined in relation to exceeding the minimum, there is a serious inability for consumers to access relevant information on



exceeding the minimum especially in relation to range and costs of options. A range of higher-performing building options is critically important as there is wide variation between houses and the behaviours of households that occupy them. Tailored advice based on cost-benefit analysis is necessary to achieve a technically and economically efficient market solution that encourages building beyond Code (Bardhan et al., 2014; Hindley & Pringle, 2009; Page & Fung, 2009).

Demonstration projects could also be used to tangibly inform owners, occupiers and building practitioners of the benefits and operational and installation considerations associated with refurbishment/retrofit that seeks to be higher performing and go beyond Code (MacGregor & Donovan, 2018; Hindley & Pringle, 2009). Further, the supply of features that exceed the minimum could be supported through the provision of specific information and Building Act compliance pathways for higher-performing refurbishments/retrofits and fast-track or exemption processes for building consents that comply with these solutions (Hindley & Pringle, 2009; New Zealand Business Council for Sustainable Development, 2008). Despite the need for greater information, the challenge to normalise exceeding the minimum will continue, especially as cost is a prohibitive factor in consumer decision making within the current housing market (MacGregor & Donovan, 2018).

2.2 Leveraging change points

Change points are often cited as an opportunity to encourage higher-performing and sustainable retrofits, as retrofitting is rarely a stand-alone event (Sustainable Energy Authority of Ireland, 2017; Saville-Smith, 2008, Bardhan et al., 2014). Fawcett and Killip (2015) suggest certain change points can be utilised to influence motivation to undertake a retrofit. For example, there are “particular times in people’s lives at which they are more likely to undertake renovation work, examples include moving into a new home, changing family size, retirement” (Fawcett & Killip, 2015, p. 436).

In contrast, Novikova et al. (2011) found that building appearance is the main trigger for undertaking building retrofits, and awareness of the benefits of sustainable retrofits increased throughout the planning process. By focusing on certain change points within the refurbishment/retrofit process such as motivations to undertake a retrofit (changing family size, retirement etc.), this provides an opportunity to influence consumers and industry to facilitate change. However, it should be noted that strong motivations for change such as an expanding family or retirement may be associated with time and financial constraints that could make the decision to exceed the minimum less clear cut than a standard new build.

Jones, Lannon and Patterson (2013) examined three large-scale housing retrofit programmes in Wales. Each of the housing retrofit schemes in the study was analysed for energy savings, CO₂ reduction and costs. The study compared data on a range of retrofit options through the use of different strategies (elemental, multiple and whole-house measures) and examined these strategies in relation to costs, actual CO₂ reductions and associated benefits. The study found that, as the cost of measures rose in relation to the predicted savings, reasonable paybacks were difficult to achieve. Jones et al. (2013) suggest there are funding opportunities for installing ‘shallow’ elemental measures (small measures up to the cost of £6,000 or NZ\$12,000) to reduce CO₂ emissions by 10–30%. However, the large-scale financing of ‘deep’ measures (whole-house measures costing up to £70,000 or NZ\$140,000 achieving approximately 60–80% reductions) were not currently available in the UK and therefore did not offer payback.



Similarly, within the New Zealand context, Page (2010) identified that a number of common retrofit solutions were deemed not to be cost-effective in warmer, northern parts of New Zealand. This also highlights the need to be clear on objectives and motivations for refurbishment/retrofit to exceed the minimum, as a purely financial cost-benefit analysis may not consider other motivations such as reduced carbon emissions.

2.3 Financing

The ability to finance retrofits that are higher performing and go beyond building code is often cited as a key barrier, for example, 70% of Irish households cited the lack of funding as a barrier to energy efficiency action (Sustainable Energy Authority of Ireland, 2017), while the US Governments Council on Environmental Quality's study cited a major barrier was that "the costs of home retrofit projects are beyond the average homeowner's budget" (Middle Class Task Force, 2009, p. 7). Both actual costs and perceptions of cost can discourage uptake of higher-performing retrofits. As Mallaband et al. (2013) outline, the financing of energy-saving investments is considered higher risk than buying a new house, therefore borrowing costs are higher.

Subsidies, grants and similar measures have been widely used within the wider New Zealand housing market. Such measures do not necessarily need to incur a direct expense to the government. For example, the UK Green Building Council (2013) identified a range of revenue-neutral incentive schemes that were implemented, compelling local energy companies to facilitate and subsidise sustainable and higher-performing retrofits.

A successful example of a large-scale higher-performing retrofit scheme is the Community Energy Saving Programme (CESP), which worked on a street-by-street and whole-of-house approach, with benefits of comprehensive improvements, an element of social compulsion and economies of scale (Gooding & Gul, 2016). The most comprehensive UK scheme was known as the Green Deal, which enabled homeowners to repay the initial cost of retrofit over time as the benefits accrue. The UK's Green Deal came into effect in 2012. The premise of the scheme was that consumers could improve the energy efficiency of their homes by using Green Deal providers (Torregrossa, 2015). There were no upfront costs associated with installing energy-saving measures such as roof and wall insulation, energy-efficient window glazing, innovative hot water systems and micro-generation systems (Torregrossa, 2015). Costs from the Green Deal scheme were covered by energy savings from the homeowner's energy bill – termed the Pay-As-You-Save principle (Torregrossa, 2015) – but were underpinned by a so called 'golden rule' that determined the amount of money that consumers could borrow. The limits were balanced between the amount the Green Deal provider could attach to the electricity bill in relation to the estimated energy bill savings that were likely to result from the retrofit (Torregrossa, 2015, p. 126). The Green Deal scheme experienced low uptake and was often criticised for its performance. It was subsequently dismantled (Gooding & Gul, 2016).

A number of similar schemes have been implemented across Europe, including interest-free loans for building insulation in Slovakia, subsidies for renewable heating installation in Romania (with the secondary aim of creating employment), sustainable retrofit loans in Germany and subsidised retrofit of insulation, doors, windows and environmentally friendly heating and construction of new passive energy standard houses in the Czech Republic (Torregrossa, 2015). In New Zealand, government subsidies for the retrofit of insulation and clean heating sources has been provided to a



significant number of houses, with the value of the subsidy increasing for houses with low-income residents (Chapman et al., 2009; Grimes et al., 2012; Howden-Chapman et al., 2012). Despite schemes like Warm Up New Zealand, a significant number of landlords are resistant to regulatory prompts to improve performance, so subsidies and regulation are important for this subsector (Saville-Smith, 2008).

A key constraint to the perceived value for money of higher-performing retrofits, both in New Zealand and overseas, has been the lack of recognition of high-performing and sustainable features in subsequent house sale prices (Christie, 2010). This prevents owners from recouping the value of their investment when they subsequently sell, affecting both owner-occupiers and investors especially, as they do not reap the benefits of reduced operating costs (Torregrossa, 2015). Developing an understanding of the economic benefit of higher-performing and sustainable retrofits across owners and the broader real estate and finance sectors may also overcome barriers to obtaining finance for such retrofits.

3. Methodology

A social survey was undertaken so we could collect the attitudes and experiences of consumers who had undertaken a refurbishment/retrofit and to learn more of their choices and decisions to exceed the minimum or not. A nationwide online survey was administered through Qualtrics by Global Research on behalf of BRANZ. The survey was distributed to 2,952 randomly selected individuals who had applied for an additions or alterations building consent (excluding garages) from their building consent authority. The selected sample was intended to capture those who had either completed or were still in the process of undergoing a refurbishment/retrofit. In early December 2017, a letter inviting participants to complete the survey was sent to the address listed in the building consent application, and a follow-up reminder postcard was sent 1 month after the initial invitation. A total of 245 completed surveys from around New Zealand were returned – these represent the results presented in this report. Completed entries were put into a draw to win one of three \$200 Prezzy cards.

The survey design was centred around gaining insights into the experiences of owners throughout the entire refurbishment/retrofit process. We were particularly interested where the owner looked to exceeding the minimum standards of the NZBC.

The survey began by asking respondents a series of questions about how and where they received their information during the planning stages. These questions aimed to highlight whether any services that promote exceeding the minimum such as Homestar or Smarter Homes were consulted or used. It then asked questions detailing the mechanics of a retrofit such as the duration, costs and who carried out the work. The third part of the survey asked which high-performance features that exceed the minimum building standards were planned and/or used. Further, those who indicated that their refurbishment/retrofit had been completed at the time they received the survey were asked to describe the performance of the house in terms of meeting minimum NZBC requirements, exceeding the current minimum standards or exemplifying best-practice building. All participants were asked to determine the benefits of exceeding the minimum and rank environmental, economic, social and health factors from 1–4. This was followed by a question on each respondent's top three barriers to exceeding the minimum. Finally, the survey asked a series of demographic questions including age, gender, geographical region, household income and housing tenure type.

The data received by each respondent was analysed using Microsoft Excel. Analysis was carried out on each question and is reported on in the section 4. Selected questions were further analysed, particularly those that carried high overall importance. Factors that were considered in this further analysis were age, region and household income. These questions included those who included higher-performing features that exceeded the minimum in their retrofit and the benefits of exceeding the minimum.

A BRANZ Human Research Ethics Application (ER0887) was undertaken for this research project. It received ethical approval from BRANZ's external Human Ethics Advisor on 14 December 2017 in accordance with BRANZ's Human Ethics Policy.



4. Consumer perspectives on refurbishment/retrofit that seeks to go beyond the requirements of the NZBC

This section of the report outlines the results of a survey undertaken with consumers who had applied for a building consent for a refurbishment/retrofit in order to gain their views on exceeding the minimum.

4.1 Summary of survey results

The survey was sent out to participants on 13 December 2017. An initial 2,952 postcard inviting participants to complete the survey were sent (151 postcards were returned to the sender). A total of 245 survey were completed, and 24 were partially completed. The response rate was 9.6%. The responses were predominantly from the Wellington (32%), Auckland (26%) and Canterbury (11%) regions.

4.2 Current stage of building

Figure 1 shows that a significant majority of our survey respondents had completed their refurbishment/retrofit within the last 12 months (51%), while 29% completed it over 12 months ago. Thus, 80% of our sample had completed their refurbishment/retrofit while 18% were in the middle of the process. Only a very small number were still planning their refurbishment/retrofit (1%) or had cancelled their refurbishment/retrofit or placed it on hold (1%).

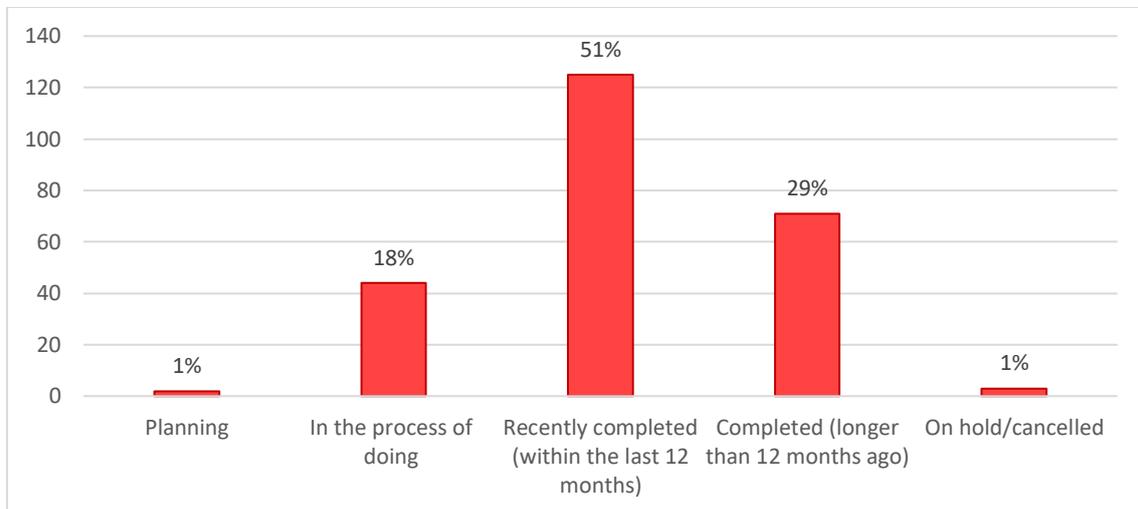


Figure 1. Current status of refurbishment/retrofit.

4.3 Information sought by consumers

Consumers were asked where they sought and accessed information about their refurbishment/retrofit (Figure 2). The most popular information source was the local council (28%), and information was also often sought from architects and builders or building firms (26%). More-specialist information sources, especially the ones most likely to advocate exceeding the minimum such as BRANZ Up-Spec (1%) and the Eco Design Advisor service (one respondent), were rarely used. Up to 15% or 61 participants did not seek any information.

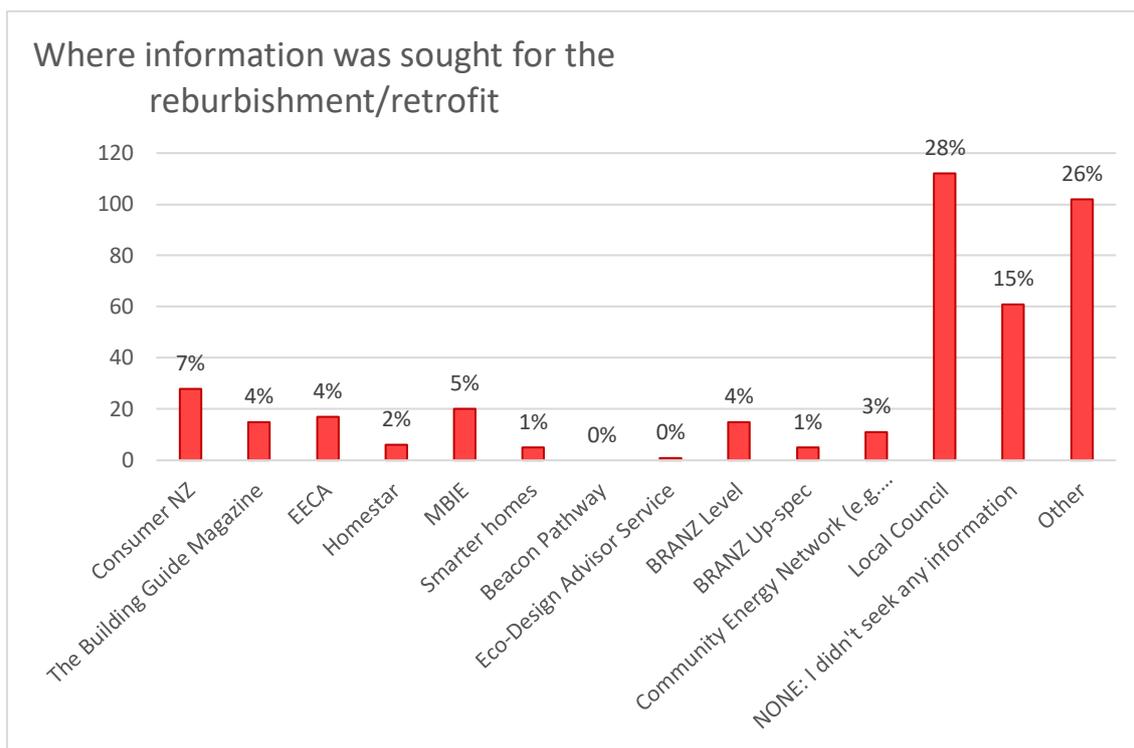


Figure 2. Where information was sought for the refurbishment/retrofit.

The kinds of information sought by consumers was mainly concerned with regulations, such as information on the NZBC, council regulations, consent and compliance. This information was sought by over one-third of respondents. Product information and other building examples, designs or ideas were sought by over one-third of respondents. Information on whether a project was feasible, how to build something or how much a project would cost was sought by under one-quarter of respondents. Searching for contractors or information about contractors was conducted by a small proportion of respondents. The only comment received on the Eco Design Advisor service stated that it was "OK, did not add to our understanding but did arrange under floor insulation although only where it was easy to access". Discussion about beyond Code features did not feature in respondents' comments in relation to this question.

4.4 Factors and motivations influencing the decision to undertake a refurbishment/retrofit

A question was asked identifying the factors that influence the decision to undertake a refurbishment/retrofit (allowing respondents to select multiple options) (Figure 3). The factor that received the highest count (27%) was the reuse/repurpose of existing space. Other options that gained a significant count of responses were for maintenance purposes (22%) and increasing the size of the house (19%). The least common factors included a desire to improve/add value prior to selling the house (4%) and due to it being a hobby for the respondent (2%).

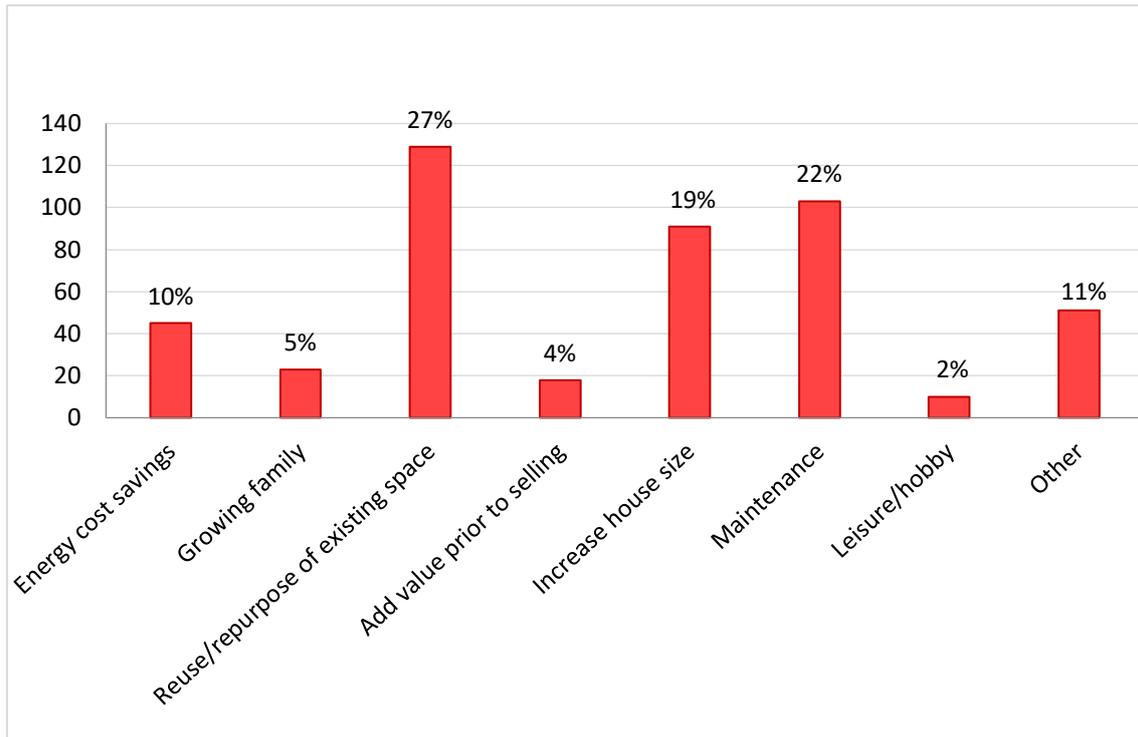


Figure 3. Respondents' reasons for refurbishment/retrofit.

Under 'other' comments (11%), just over one-third of the responses fell under a theme of improving living quality, with one respondents stating "upgrade kitchen to today's standards", and another was "sick of being cold – no insulation".

Different preferences were uncovered when analysing factors by respondents' age bracket and region type. For those carrying out the refurbishment/retrofit to increase the size of the household, the 31–50 age bracket held a proportion 10 percentage points higher (25%) than the 51+ age bracket (15%).

Regionally, 32% of Aucklanders selected increasing the size of the household as at least one factor of the refurbishment/retrofit, whereas those from Wellington and Canterbury recorded much lower figures (13% and 16% respectively). This reinforces the idea that land is more scarce in Auckland whereby residents tend to increase their dwelling size given a fixed section size.

A question on the motivation behind refurbishments/retrofits elicited a total of 242 responses (Figure 4). Of those, the most significant reason was to create more space (95 responses or 39%). The motivation selected may be interpreted as the most important factor when choosing to refurbish/retrofit. It is therefore worth noting that only three respondents (1%) listed an increase in energy efficiency or implementing other sustainability features as their main motivation. Although section 4.10 addresses the idea that there is a high prevalence of respondents who carry out retrofits using energy-efficient products/systems, responses to this question tell us that they are not the main motivation behind the refurbishment/retrofit.

Again, 'other' received a significant proportion of responses, with two-thirds of respondents' answers falling under a theme of improving living quality. Comments



were similar to the previous question – one respondent’s desire was to attain a “modern open plan living space”.

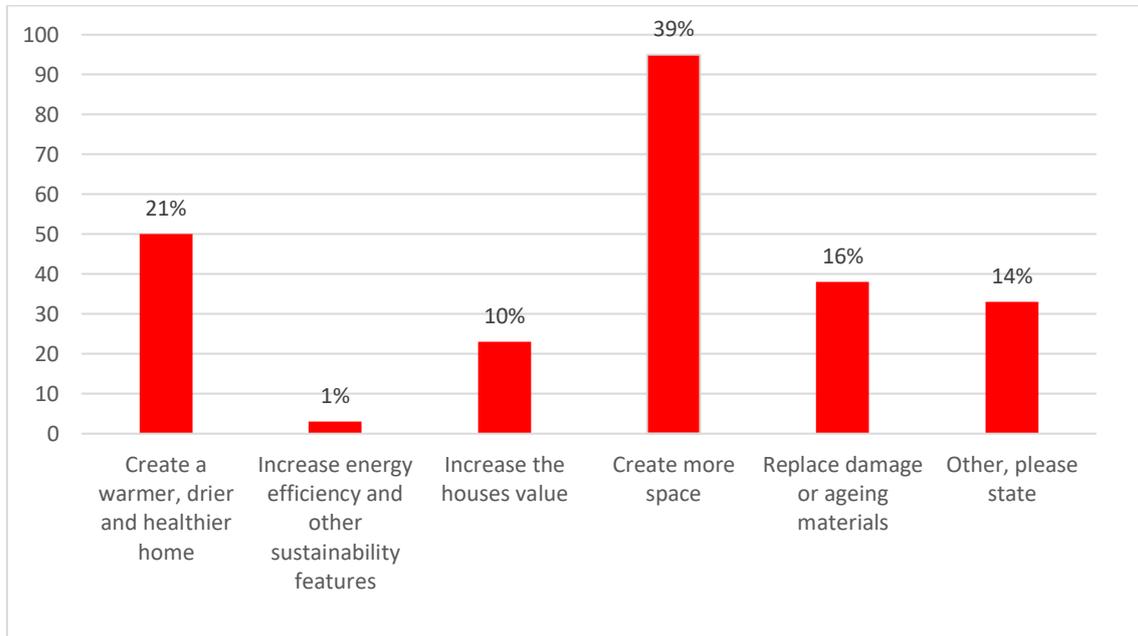


Figure 4. Most important motivation to undertake refurbishment/retrofit.

4.5 Costs involved in undertaking a refurbishment/retrofit

A large proportion (46%) of survey respondents had planned or were planning on spending more than \$100,000 on their refurbishment/retrofit (Figure 5). However, the actual spend outlined a large range from the least at \$1,200 to \$1 million at the most, with the average being \$177,888 and the median \$110,000. Of these, 60% of respondents went over budget, 33% went under budget and 7% were unsure.

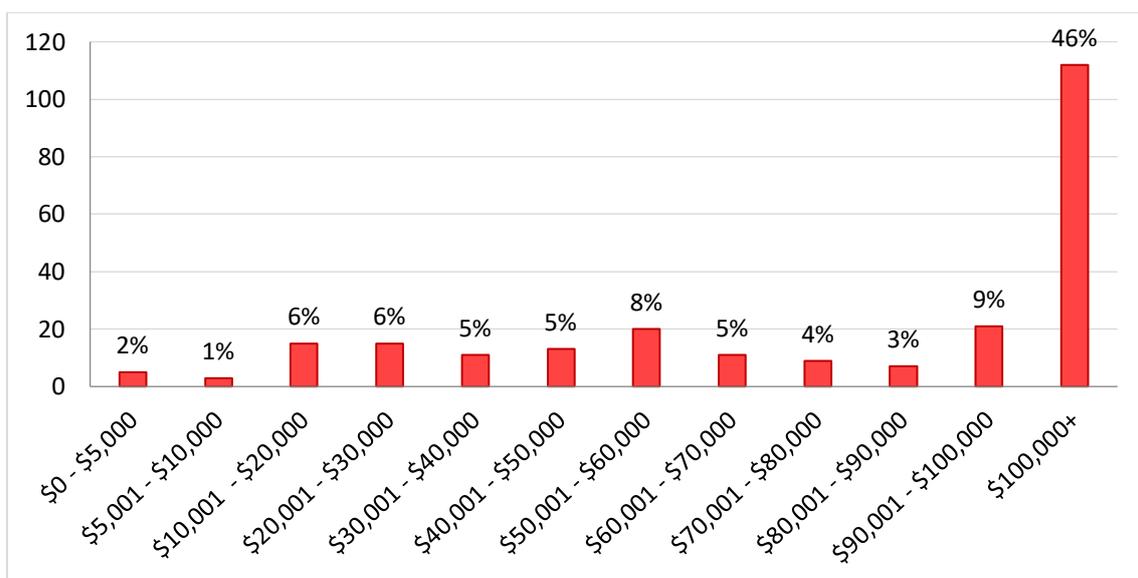


Figure 5. How much respondents plan or planned to spend to complete the refurbishment/retrofit.

Respondents were also asked how they intended to fund the refurbishment/retrofit (Figure 6) – 50% listed savings, 9% listed remortgage, 8% funded or intended to fund through a loan from the bank and 6% listed a loan through family/friends. This indicates that, although savings is the dominant form, a significant number of New Zealanders are willing to take on debt to carry out refurbishment/retrofit of their home.

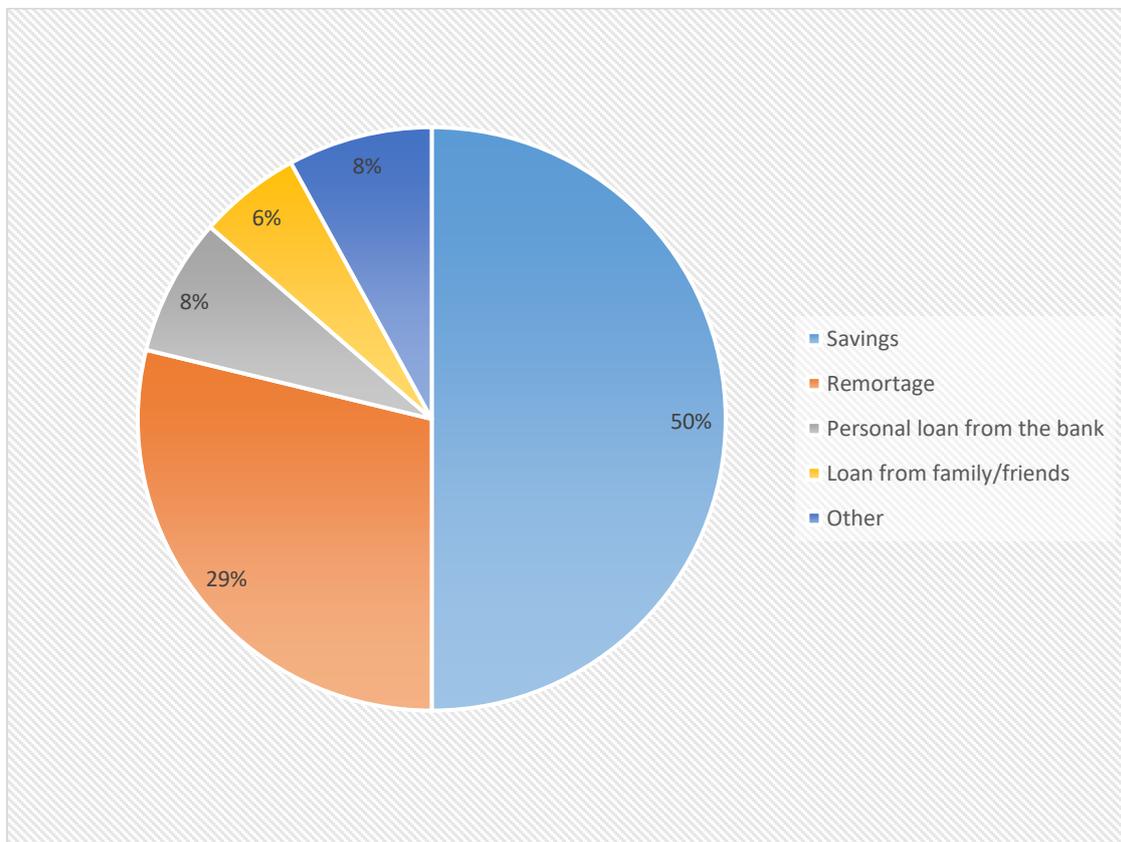


Figure 6. How the refurbishment/retrofit will be funded.

4.6 Percentage spent or planned on higher-performing features that are beyond the requirements of the NZBC

Respondents were asked how much of their total budget was spent on higher-performing features and/or products that sought to go beyond the requirements of the NZBC (Figure 7). Respondents were asked to select which percentage band they fell into. After those who did not reply (35%) and those who spent none (21%), the largest was the 6–10% band with 12%. Given that this is a technical question involving knowledge of products that meet the NZBC and products that go beyond the requirements of the NZBC, this may explain why there is high number of respondents not answering this question. The accuracy of each band selection may also be questionable.

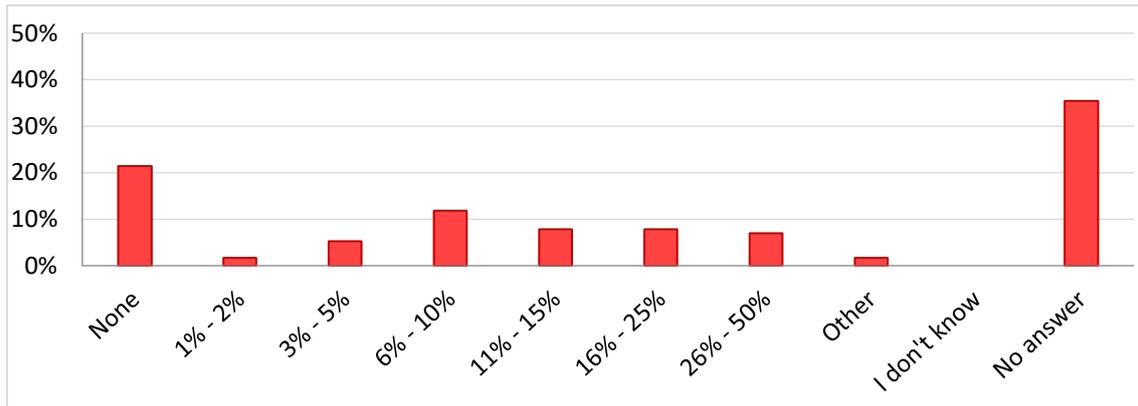


Figure 7. Percentage of budget spent on higher-performing features beyond the requirements of the NZBC.

4.7 Who undertook the refurbishment/retrofit

There were only 81 responses to this question. Figure 8 shows 81% had their work done by a professional licensed building practitioner. DIY responses totalled 9%.

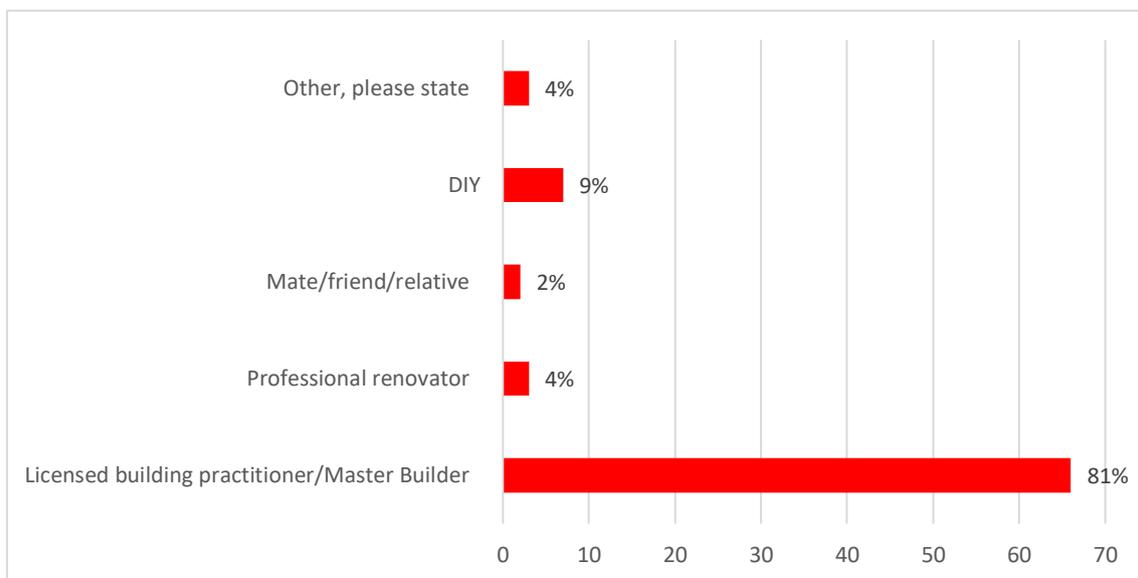


Figure 8. Who undertook the refurbishment/retrofit.

4.8 Duration of the refurbishment/retrofit and delays

Respondents were asked how long the refurbishment/retrofit took from planning until completion (Figure 9). Responses were generally evenly spread, with the top response of 3 to 6 months (22%) followed by 7 to 11 months (18%).

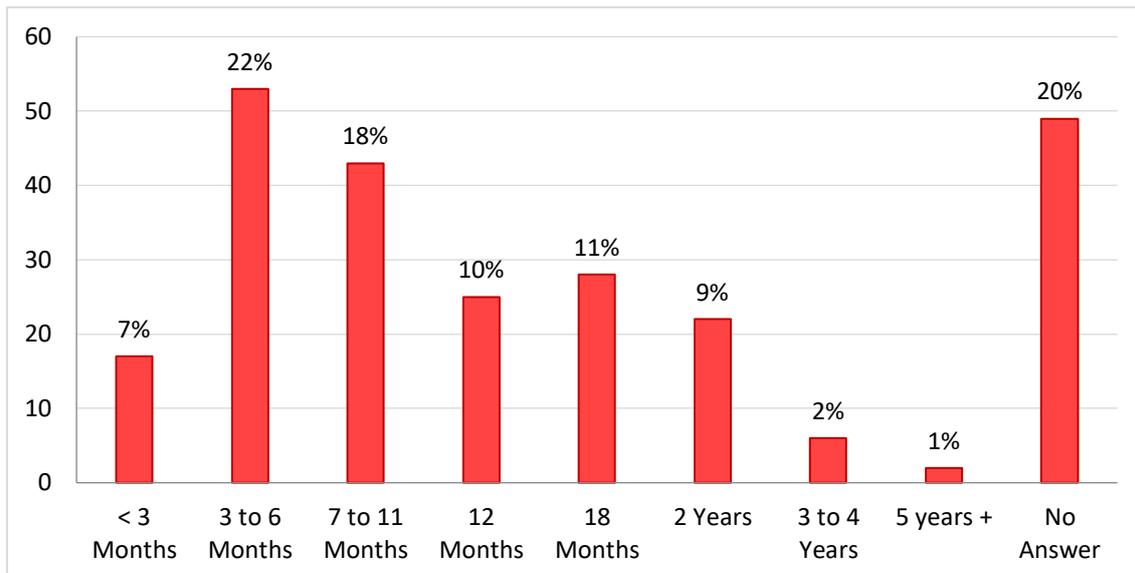


Figure 9. Duration of the refurbishment/retrofit.

Across the three major regions – Auckland Wellington and Christchurch – the bracket that the highest number of respondents selected for time taken was 7 to 11 months. This is one bracket higher than the overall sample (respondents across the whole country including Auckland, Wellington, and Christchurch), which indicates there may be a supply shortage in these major regions contributing to a longer job duration.

Respondents from Auckland reported the highest number of jobs that took 2 years to complete. This time window registered 13% of all responses in Auckland whereas Canterbury and Wellington registered 8% and 7% respectively. This is indicative of an even greater strain on the building industry in Auckland – whether this is in the consenting stage or the execution of a job.

Delays seemed to be a significant factor to those who underwent a refurbishment/retrofit (Figure 10). Almost 75% experienced a delay, which is concerning for the industry. The greatest single cause of a delay was attributed to local councils – registering 15%. Consents are often cited as being a lengthy process and different councils adhere to a different set of rules, which makes it even more difficult for those applying for consent to get across the line. However, given we have elicited consumer views, this is likely based on what they have been told by their builder.

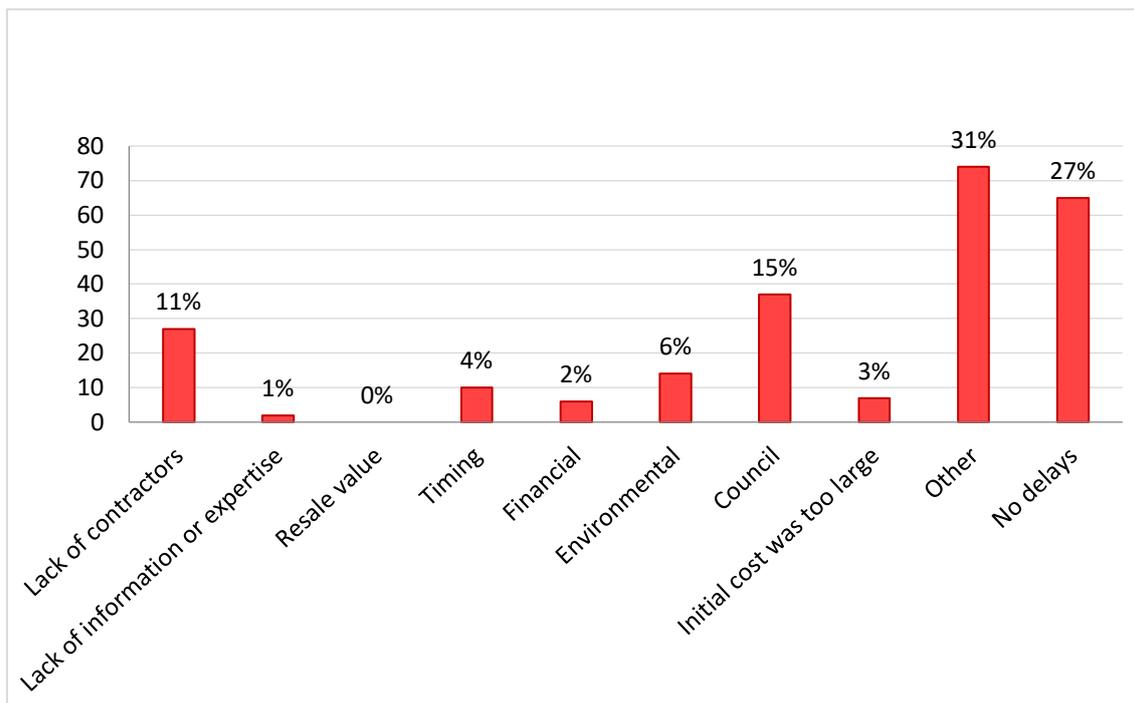


Figure 10. Reasons for delays in refurbishment/retrofit.

Among the 'other' category (31%), respondents took issue with builders and contractors working together. Various comments were recorded on slackness and an inability for builders and subcontractors to work cohesively, stating there was "poor co-ordination between builders and subcontractors, builders had other jobs on the go at the same time, they were overcommitted". There was also a sense there were insufficient numbers of contractors readily available to carry out a job. It is well documented that the industry is inhibited by a lack of skilled workers and that small firms often enter and exit the market largely in line with the economic cycle, which may in part explain trends in delays.

When the delays were analysed by region, Auckland respondents reported an inability to find contractors at a rate double that of Wellington and quadruple that of Canterbury.

There was much higher reporting of issues with Auckland Council – the cause of 29% of all delays versus 12% in Wellington and none in Canterbury. Also, respondents found that there were far fewer delays in both Canterbury (32% experienced no delay) and Wellington (24%). This contrasts to Auckland where only 16% of all respondents experienced no delays.

4.9 Focus of the refurbishment/retrofit

Participants were asked about the focus of their refurbishment/retrofit, allowing multiple selections (Figure 11). Between the kitchen, bathroom, living/lounge/dining and bedroom, the proportions were evenly spread – registering 18%, 18%, 17% and 15% respectively.

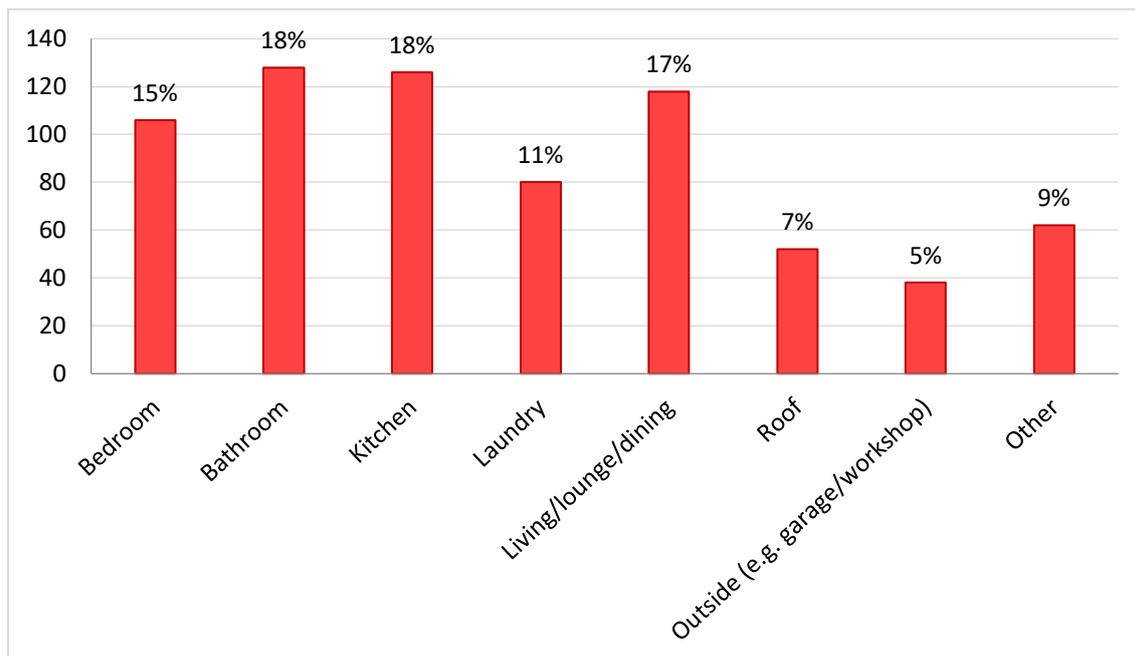


Figure 11. Focus of the refurbishment/retrofit.

4.10 Building features that exceed the minimum

Respondents were asked which building features that exceed the minimum were incorporated into the refurbishment/retrofit (Figure 12). It was encouraging to see nearly all respondents (97%) indicated that they installed features that exceed minimum standards, with options including insulation, moisture management and energy efficiency among others.

The most common avenue taken by respondents was to install higher than Code insulation (22%), followed by the selection of energy-efficient products (20%). Areas where there was a low uptake included water efficiency processes such as rainwater collection and greywater recycling (2%), renewable power generation such as solar panels (1%) and external solar shading (1%).

Overall, the high proportion of respondents selecting building features that exceed the minimum indicates there a strong willingness for New Zealanders to invest in housing quality as well as features that can help enhance personal health.

The use of building features that exceed the minimum were further analysed by three different demographic factors – age, region and income. Proportional use was largely in line with the overall sample, but there are a few areas of note. By age, the use of insulation (underfloor, wall and ceiling) was 5 percentage points higher by those in the 31–50 age bracket (24%) than the 51+ age bracket (19%).

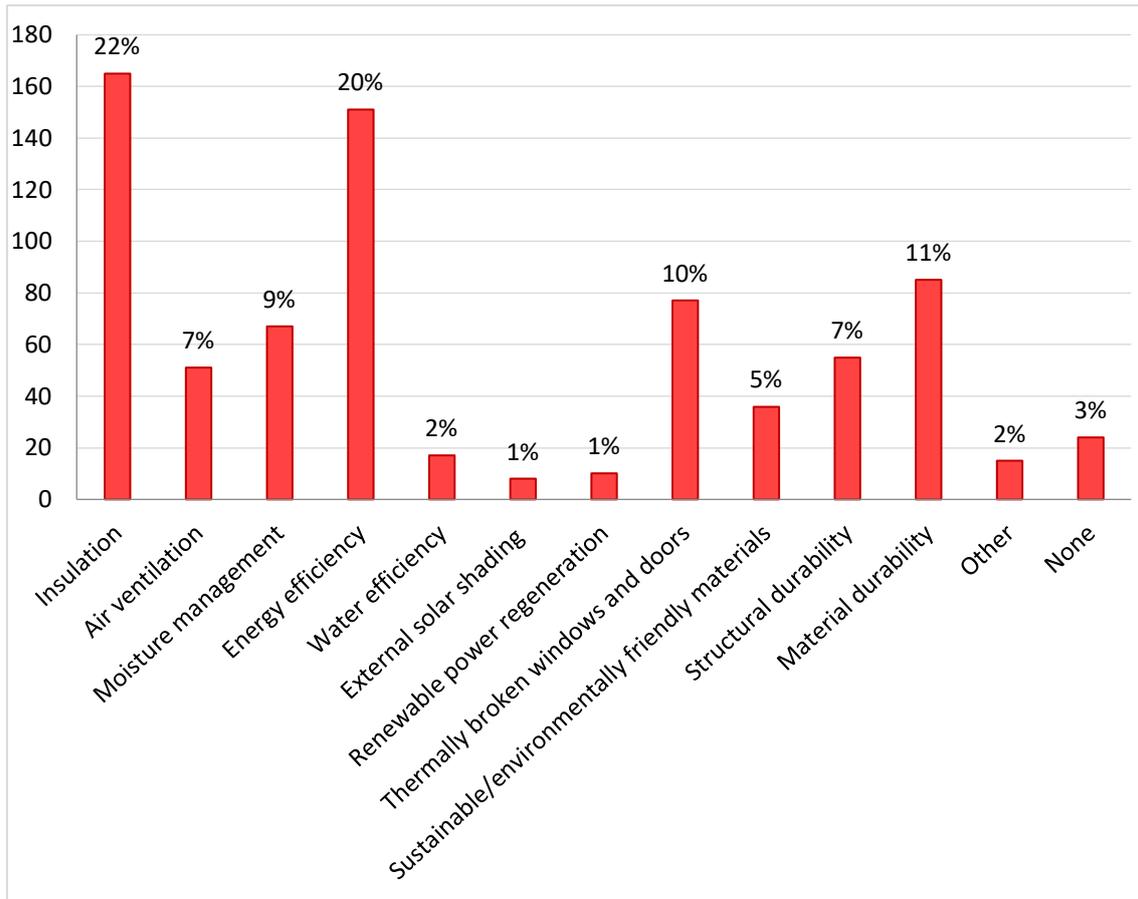


Figure 12. Building features used that exceed the minimum.

4.11 Benefits and barriers of exceeding the minimum

Respondents were asked to rank the perceived benefits when choosing to install features that exceed minimum standards (Figure 13). The options – economic, social, health and environmental – were ranked from 1–4 by each respondent and weighted accordingly. Health received the highest score by far, with 152 respondents claiming this as the greatest benefit.

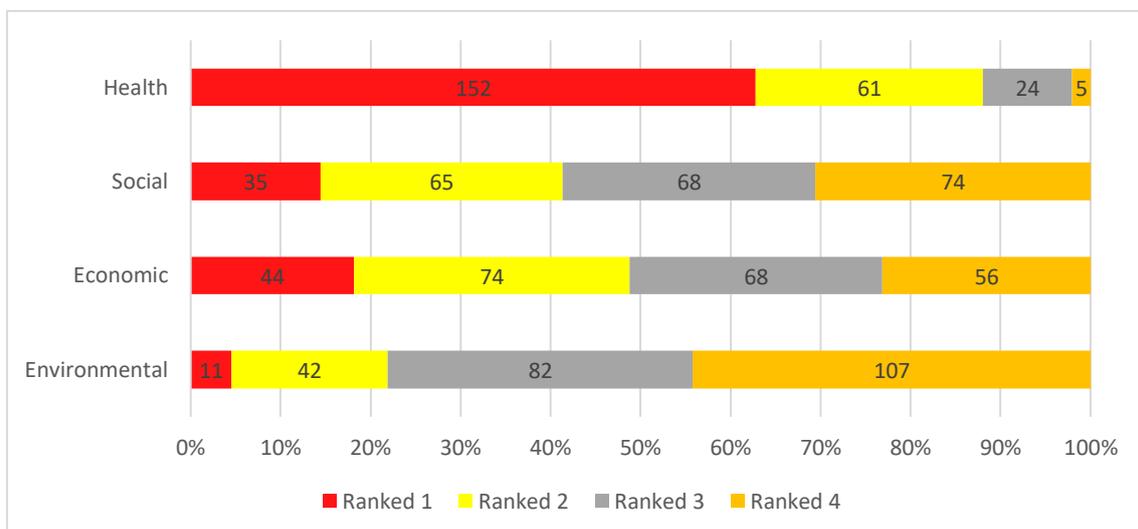


Figure 13. Benefits of exceeding the minimum.



Age groups were looked at when identifying the perceived benefits of exceeding the minimum. It was found that the older cohort (51+) rated the social benefits higher than the 31–50 age bracket. This meant that social benefits ranked second for the 51+ cohort whereas social benefits were ranked third for the 31–50 age bracket and the overall sample.

To elicit the most important barriers to exceeding the minimum, respondents were asked to rank certain barriers (Figure 14). The biggest barrier was build cost. This was ranked as the number one barrier, with 102 participants ranking it first, followed by no barriers (48 participants) and then lack of knowledge of owner (29 participants).

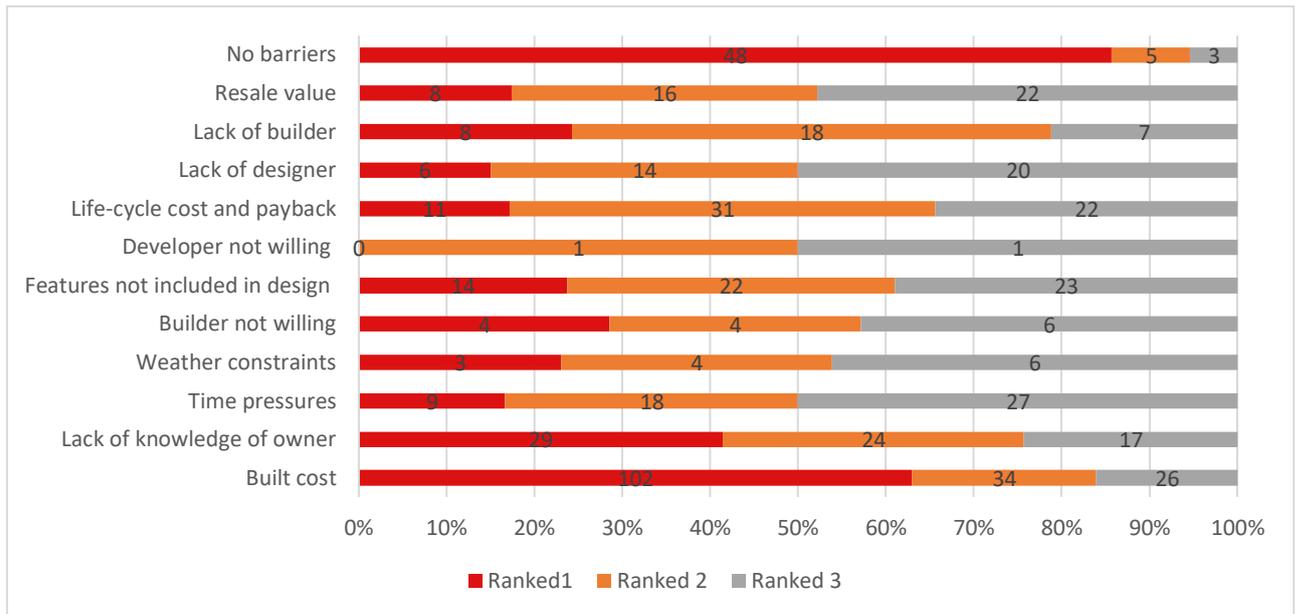


Figure 14. Barriers to exceeding the minimum.

4.12 Overall performance of the house

When asked how to best describe the house after refurbishment/retrofit from an overall point of view, the results for exceeding the minimum standard and meeting the minimum standard were closely placed (Figure 15). However, those who believed their house to exceed the minimum standard recorded a score 6 percentage points higher – 49% perceived that their house exceeded the NZBC versus 43% who perceived that their house only met the minimum standard. Only a fraction of respondents (2%) had a home that they perceived as exemplifying best practice.

Analysis was carried out for house performance relative to the NZBC. Interestingly, a higher percentage of those who were classified in the medium household income bracket (\$60,000–130,000) reported they had a house that exceeds the current minimum standard versus those on a high household income bracket (\$130,000+). The medium household income bracket registered a score 4 percentage points higher than the high-income bracket – 54% versus 50%.

Wellington had the highest proportion of those who believed their house exceeded the minimum standard – 55%. This contrasts with Auckland (42%) and Canterbury (33%).

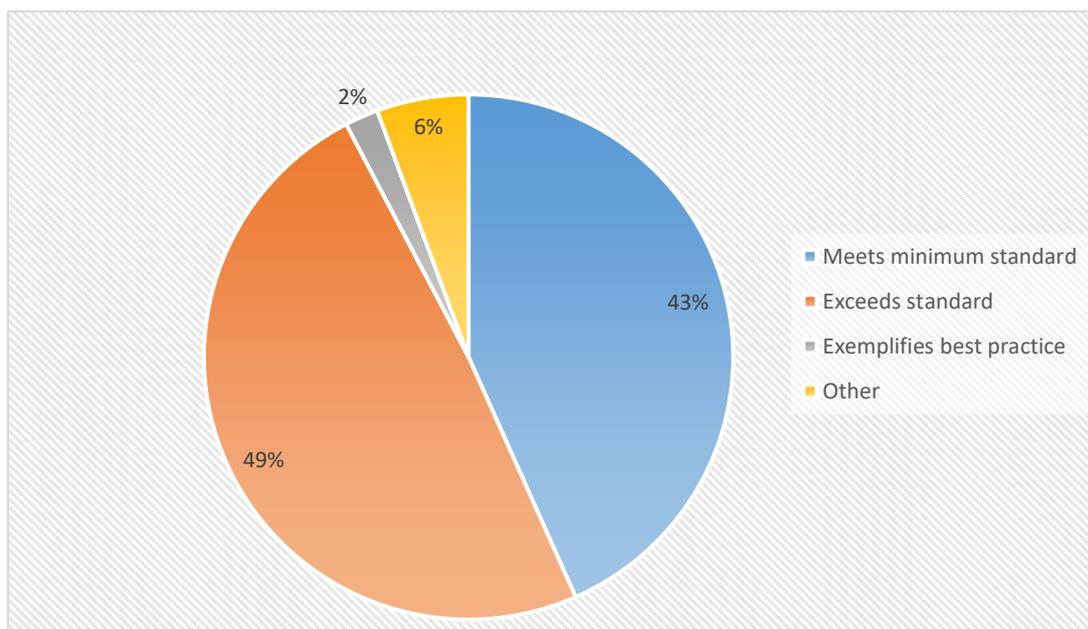


Figure 15. Overall performance of house after refurbishment/retrofit.

4.13 Summary of results

The main findings of the results are as follows:

- Aucklanders were more concerned with increasing the square metre size of their dwelling than Wellington and Canterbury. Respondents within the 31–50 age bracket were more concerned with increasing the size of their dwelling than those aged 51+.
- The average duration of refurbishment/retrofit was 3–6 months. However, in the major regions (Auckland Wellington and Canterbury), the average duration was 7–11 months. Auckland recorded the highest amount of jobs that took at least 2 years to complete.
- Delays were experienced by 75% of respondents. Areas of concern tended to focus on issues with contractors – both a lack of availability and a general perception of slackness. Councils received a significant share of remarks around delays, especially in Auckland where there were a far higher proportion of respondents who experienced delays with council than the rest of the country.
- Costs of retrofits were high – 57% spent over \$100,000, and the median cost was \$110,000.
- 85% of retrofits were carried out by industry professionals.
- Nearly all (97%) of respondents installed higher-than-Code features when undertaking the refurbishment/retrofit.
- Health benefits were of overwhelming importance for survey respondents.
- 49% of respondents believed their house went beyond the requirements of the NZBC.
- The medium household income bracket (\$60,000–130,000) had a higher proportion of respondents who believed their house went beyond the requirements of the NZBC compared to the high household income bracket.

5. Conclusion and recommendations

This report has outlined a survey of consumer attitudes to and experiences of refurbishments and retrofits and the planning and use of features and products that exceed the requirements of the New Zealand Building Code (NZBC). The survey highlights a number of issues for the New Zealand housing market and for the building and construction industry.

Housing preferences are aligned with changing life stages such as the creation and expansion of families. For example, within our survey, Aucklanders especially were more concerned with increasing the square metre size of their dwelling than Wellington and Canterbury respondents. Respondents who were within the 31–50 age bracket were more concerned with increasing the size of their dwelling than those aged 51+. Given New Zealand’s population growth, it is likely that refurbishment/retrofit of houses to increase size will likely continue, especially in high-demand real estate markets such as Auckland.

The building and construction industry is in high demand, which creates pressure within the market in terms of workflow for industry and frustrations for consumers. High demand for builders could have a number of flow-on effects such as poorer housing quality, pressure on building companies to retain staff and greater risk of dissatisfaction from consumers who have to wait longer for jobs to be completed. This is a critical issue especially for New Zealand’s largest urban area, Auckland. For example, our survey found that Auckland recorded the highest amount of jobs that took at least 2 years to complete. Further, delays were experienced by 75% of respondents. Areas of concern tended to focus on issues with contractors, especially their lack of availability. Local councils also received a significant share of remarks around delays. Again, this was especially in Auckland where there were a far higher proportion of respondents who experienced delays with council than the rest of the country. However, this could have been in part due to the formation of the amalgamated Auckland Council.

Within the New Zealand housing market, the choice to go beyond the requirements of the NZBC is predominantly the concern of individuals and families on higher incomes. For example, within our survey, the median cost of a refurbishment/retrofit was \$110,000, with over half of respondents (57%) spending over \$100,000. The majority of survey respondents stated that their refurbishment/retrofit was funded through personal savings. However, 23% of respondents were willing to take on debt to fund the refurbishment/retrofit through remortgaging or loans from the bank or family. Within a changing housing market, the taking on of debt or risk of overcapitalisation from refurbishment/retrofit may not translate to enhanced value or a higher resale price. This is because the changes made through refurbishment/retrofit may suit the consumer’s present need, such as an extra room for a new child, but in terms of resale within the context of an ageing population, the increased house size may present a financial risk within the housing market that may not see a return on investment (Barrett & Kelly, 2016).

Consumer perception that performance of their house was beyond the requirements of the NZBC needs to be verified with actual building performance. A significant number of consumers in the survey perceived that their house went beyond the requirements of the NZBC – 49% versus 43% who perceived that their house was only the minimum standard. Only a fraction of respondents (2%)

had a home that they perceived as exemplifying best practice. This insight suggests there is a great need to learn more about the perceived and actual building performance of New Zealand buildings. Within the literature, this is often referred to as the performance gap – evidence that buildings do not perform as well when they are completed as was anticipated when they were being designed (Designing Buildings, 2018b). An evidence review undertaken by the Zero Carbon Hub (2014) suggests that the performance gap is mainly due to a lack of knowledge and skills, particularly at the testing and verification stages, as well as issues relating to communication problems across the various delivery stages of the construction. The Chartered Institution of Building Services Engineers (CIBSE) undertook a series of post-occupancy practical evaluation studies on a number of buildings over different time periods (www.cibse.org/knowledge/probe-post-occupancy-studies). A post-occupancy review of refurbishment/retrofit of houses before and after adoption of features and products that seek to go beyond the requirements of the NZBC would be useful to understand the efficacy of exceeding the minimum.

More information is required for consumers about what going beyond the requirements of the NZBC means as well as outlining options and benefits.

Our survey has highlighted that consumers undertaking refurbishment/retrofit are likely to seek no information (15%) or seek information only from building consent authorities. The prominence of this over using more technical advice websites suggests consumers are more concerned about regulatory compliance rather than technical and product information on exceeding the minimum. Of interest from the survey was the underutilisation of the Eco Design Advisor service and BRANZ Up-spec and other industry sources of information. Such an omission or underutilisation by consumers suggests either a lack of awareness on the part of consumers about this information or that the mode of communicating this information is not fit for purpose. More research needs to be done on this issue to determine what information is needed and how consumers would like to receive it. This was a similar finding to other research on consumer experiences of exceeding the minimum for new builds (MacGregor & Donovan, 2018).

Recommendations

1. More research is needed to determine how changing demographics are going to impact house design and the composition of existing housing stock. This information would help to determine the types of houses New Zealand may need as the population dynamics change. It would also provide insight into the market impact of expanding houses sizes when we have an ageing population. Such information would help industry planning and workflow.
2. More research is needed to understand the workflows and pressure points of building professionals and local councils in relation to refurbishment/retrofit that go beyond the requirements of the NZBC. Such information could shed light on industry and market-wide pressure points that will need to be addressed in order to help create greater industry and market efficiency.
3. More research is needed into the financial implications of refurbishment/retrofit, such as determining whether overcapitalisation is taking place within the New Zealand market.
4. Initiatives are needed by banks to create financial packages (such as lending packages) that may incorporate building features and products that seek to go beyond the requirements of the NZBC. Such lending packages would allow and support a greater number of homeowners (who currently may not be able to do so)



to build beyond the requirements of the NZBC and accrue its benefits. Where possible, financial initiatives should support low carbon, sustainability, climate resilience and other options that will help create improvements in the health and wellbeing of consumers.

5. More targeted evidence-based information on a range of features and products that go beyond the requirements of the NZBC is needed for industry and consumers. Of relevance is the provision of a range of options aligned with what benefits can be gained from using the feature or product. The quantifiable evidence of going beyond the requirements of the NZBC is needed alongside this initiative to highlight and communicate the evidence to industry and consumers.
6. A social marketing campaign directed at industry and consumers is needed to help communicate what building beyond the requirements of the NZBC is and why it is important. Such a campaign would share information and advice so that high-performing buildings can become more normalised and encouraged within industry and among consumers groups.
7. BRANZ and other relevant industry organisations should work with local councils to help provide more accessible information and create greater awareness for existing services that are currently available to help consumers explore options for higher-performing building features that go beyond the requirements of the NZBC. For example, it may be worth promoting the Eco Design Advisor service more widely and frequently, as consumers are seeking advice from building professionals but underutilising this free service.
8. A seminar or e-training module is required for industry on higher-performing building features and products that seek to go beyond the requirements of the NZBC.
9. Research that undertakes post-occupancy review of refurbishment/retrofit of houses before and after adoption of features and products that seek to go beyond the requirements of the NZBC would be useful to understand the efficacy of exceeding the minimum.
10. More research is needed to understand what information on higher-performing buildings and features and products that go beyond the requirements of the NZBC consumers would like. For example, it would be useful to know if technical information or design information is more sought after, and how consumers would like to receive this information.



References

- Bardhan, A., Jaffee, D., Kroll, C., & Wallace, N. (2014). Energy efficiency retrofits for US housing: Removing the bottlenecks. *Regional Science and Urban Economics*, 47, 45–60.
- Barrett, A. & Kelly, E. (2016). *Housing and Ireland's older population*. Dublin, Ireland: Economic and Social Research Institute. Available at www.esri.ie/pubs/QEC2016SPR_SA_Barrett.pdf (Accessed: 04/07/2018).
- Blumstein, C., Krieg, B., Schipper, L. & York, C. (1980). Overcoming social and institutional barriers to energy conservation. *Energy*, 5(4), 355–371.
- BRANZ. (2017). *Exceeding the minimum*. Retrieved from <https://www.branz.co.nz/etm>
- Chapman, R., Howden-Chapman, P., Viggers, H., O'Dea, D. & Kennedy, M. (2009). Retrofitting houses with insulation: A cost-benefit analysis of a randomised community trial. *Journal of Epidemiology & Community Health*, 63(4), 271–277.
- Christie, L. (2010). *Understanding New Zealand homeowners apparent reluctance to adopt housing-sustainability innovations* (PhD thesis). School of Architecture and Design, Victoria University of Wellington, Wellington, New Zealand.
- Designing Buildings. (2018a). *Retrofit*. Retrieved from www.designingbuildings.co.uk/wiki/Retrofit (Accessed 04/07/2018).
- Designing Buildings. (2018b). *Performance gap between building design and operation*. Retrieved from www.designingbuildings.co.uk/wiki/Performance_gap_between_building_design_and_operation (Accessed: 04/07/2018).
- Dowson, M., Poole, A., Harrison, D. & Susman, G. (2012). Domestic UK retrofit challenge: Barriers, incentives and current performance leading into the Green Deal. *Energy Policy*, 50, 294–305.
- Fawcett, T. & Killip, G. (2014). Anatomy of low carbon retrofits: Evidence from owner-occupied Superhomes. *Building Research & Information*, 42(4), 434–445.
- Gooding, L. & Gul, M. S. (2016). Energy efficiency retrofitting services supply chains: A review of evolving demands from housing policy. *Energy Strategy Reviews*, 11–12, 29–40.
- Grimes, A., Denne, T., Howden-Chapman, P., Arnold, R., Telfar-Barnard, L., Preval, N. & Young, C. (2012). *Cost benefit analysis of the Warm Up New Zealand: Heat Smart Programme*. Wellington, New Zealand: Motu.
- Hindley, D. & Pringle, T. (2009). *Determining the industry need for a retrofit and renovation information resource*. BRANZ Study Report SR203. Judgeford, New Zealand: BRANZ Ltd.
- Howden-Chapman, P., Viggers, H., Chapman, R., O'Sullivan, K., Barnard, L. T. & Lloyd, B. (2012). Tackling cold housing and fuel poverty in New Zealand: A review of policies, research, and health impacts. *Energy Policy*, 49, 134–142.



- James, B., Saville-Smith, N., Saville-Smith, K. & Isaacs, N. (2018). *Doing better in residential dwellings: Going beyond the Code in energy and accessibility performance*. BRANZ External Research Report ER27. Judgeford, New Zealand: BRANZ Ltd.
- Jones, P., Lannon, S. & Patterson, J. (2013). Retrofitting existing housing: How far, how much? *Building Research & Information*, 41(5), 532–550.
- Long, T. B., Young, W., Webber, P., Gouldson, A. & Harwatt, H. (2015). The impact of domestic energy efficiency retrofit schemes on householder attitudes and behaviours. *Journal of Environmental Planning and Management*, 58(10), 1853–1876.
- MacGregor, C. & Donovan, E. (2018). *The choice to exceed: Consumer perspectives on building beyond Code in New Zealand*. BRANZ Study Report SR402. Judgeford, New Zealand: BRANZ Ltd.
- Mallaband, B., Haines, V. & Mitchell, V. (2013). Barriers to domestic retrofit: Learning from past home improvement experiences. In W. Swan & P. Brown (Eds.), *Retrofitting the built environment* (pp. 184–199). Chichester, West Sussex: Wiley-Blackwell.
- Middle Class Task Force. (2009). *Recovery through retrofit*. Washington, DC: Council on Environmental Quality.
- New Zealand Business Council for Sustainable Development. (2008). *Better performing homes for New Zealanders: Making it happen*. Wellington, New Zealand: Author. Available at www.sbc.org.nz/__data/assets/pdf_file/0008/99422/Better-Performing-homes-for-New-Zealanders.pdf (Accessed: 04/07/2018).
- Novikova, A., Vieider, F., Neuhoff, K. & Amecke, H. (2011). *Drivers of thermal retrofit decisions: A survey of German single- and two-family houses*. Berlin, Germany: Climate Policy Initiative. Available at climatepolicyinitiative.org/wp-content/uploads/2011/12/Drivers-of-Thermal-Retrofit-Decisions-A-Survey.pdf (Accessed: 04/07/2018).
- Page, I. (2010). *Cost benefits of housing retrofits*. Paper presented at New Zealand Sustainable Building Conference SB10 Innovation and Transformation, Wellington, New Zealand, 26–28 May.
- Page, I. & Fung, J. (2009). *Housing life cycle and sustainability*. BRANZ Study Report SR214. Judgeford, New Zealand: BRANZ Ltd.
- Saville-Smith, K. (2008). *House owners and energy – retrofit, renovation and getting house performance*. Report EN-6570. Auckland, New Zealand: Beacon Pathway.
- Sustainable Energy Authority of Ireland. (2017). *Behavioural insights on energy efficiency in the residential sector*. Dublin, Ireland: Author. Available at www.seai.ie/resources/publications/Behavioural-insights-on-energy-efficiency-in-the-residential-sector.pdf (Accessed: 04/07/218).
- Torregrossa, M. (2015). Energy-efficiency investment with special regard to the retrofitting of buildings in Europe. In B. Galgóczi (Ed.), *Europe's energy transformation in the austerity trap* (pp. 115–139). Brussels, Belgium: European Trade Union Institute.



UK Green Building Council. (2013). *Retrofit incentives: Boosting take-up of energy efficiency measures in domestic properties*. London, UK: Author. Available at www.ukgbc.org/sites/default/files/130705%2520Retrofit%2520Incentives%2520Task%2520Group%2520-%2520Report%2520FINAL_1.pdf (Accessed: 04/07/2018).

Wynn, K. (2015, 8 March). More Kiwis opting to renovate than sell. *New Zealand Herald*. Retrieved from www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=11413675 (Accessed 3/11/2018).

Zero Carbon Hub. (2014). *Closing the gap between design and as-built performance*. London, UK: Author.