STUDY REPORT

SR 319 (2014)

Client and designer choices and their effect on new housing costs

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Preface

This is a report on common client and designer choices and what those choices mean for the final cost of new housing in New Zealand. It also introduces the BRANZ Index for New Housing Affordability and the BRANZ Building Envelope Characteristics Index for New Housing.

Acknowledgments

This work was funded by the Building Research Levy.

Note

This report is intended for designers and architects, new house builders, people considering building a house. It may also be of interest to those researching housing affordability and the effect of client choices on the final cost of new housing.

Client and designer choices and their effect on new housing costs

BRANZ Study Report SR 319

MD Curtis and DS Norman

Abstract

This report aims to improve our understanding of which factors affect housing affordability. It focuses on changes in quality and design, through first talking to builders and designers on common client and designer choices, and the additional cost of these changes. A datasheet is produced for use by builders and designers illustrating the additional costs.

The BRANZ Index for New Housing Affordability is then introduced. Existing housing affordability indices already exist. However, there is nothing measuring the affordability of **new-builds** over time. The index shows that affordability has declined since 2001. A standardised 200m^2 house now costs an extra year of the median New Zealand household income than it did in 2001. Once the fact that the average new house size has increased over this period is also taken into account, it costs an extra 1.7 years of the median household income to build a new house.

The BRANZ Building Envelope Characteristics Index for New Housing is the second index in this report. It uses the BRANZ materials survey to identify where changes in building envelope characteristics occur over time. The index shows that there has been little change in this over the last three years.

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1. EXECUTIVE SUMMARY

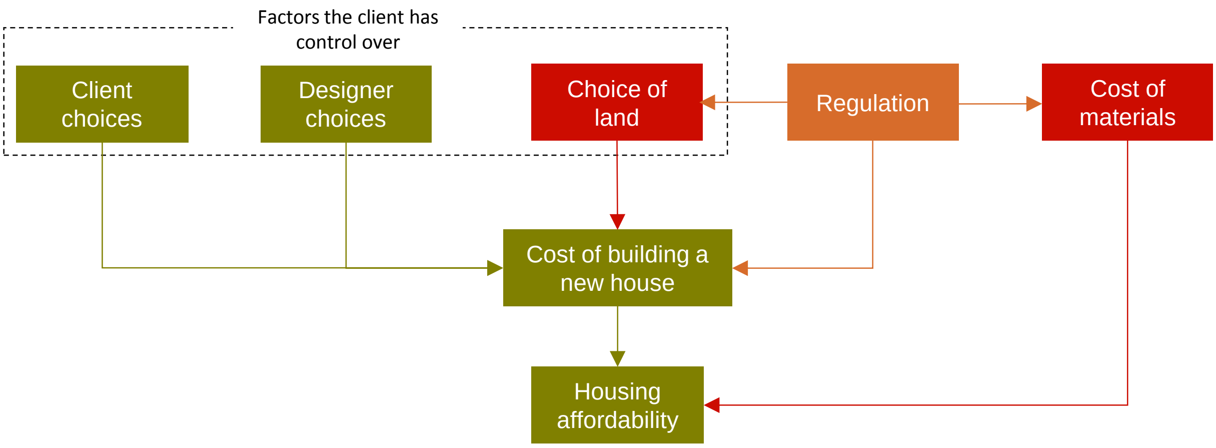
The BRANZ Research Levy funded project “Industry performance measures” has several outputs. One of which is this report on how designer and client choices affect the price of new housing.

This study adds to the body of work that has been done around housing affordability in New Zealand. We first look at the factors that the client has control over in the new-build process, namely client choices and designer choices during the planning and design stage. We then introduce the BRANZ Index for New Housing Affordability. This is an index developed by BRANZ to illustrate the affordability of new-build housing. Finally, we introduce the BRANZ Building Envelope Characteristics Index for New Housing. This is an index that can be used to track improvements in the characteristics of the building envelope in new housing over time.

What are client and designer choices?

Client and designer choices are those choices that clients and designers make at the planning and design stage. These are choices where, given better information, the client may opt for alternatives, or understand the trade-offs that will need to be made.

We understand that these factors are not necessarily the most important aspect for housing affordability. However, little work has been done in this area and is an area where better education can lead to better outcomes as it is an area where the client has most control. The cost of land has not been included. However, this is also a factor that the client has control over, as they can choose to buy a cheaper section, or a section that may require less earthworks.



Common client and designer choices include unique shapes that add significantly to the external wall area, upgraded kitchen benchtops, and other upgrades to both the kitchen and bathroom.

The additional cost of any one client or designer choice may be small. It is when the client or designer is making multiple design decisions (over and above what is considered the standard offering), each with an additional cost, that the total cost can start to add up. The attached data sheet (in the appendix) provides the means for designers and clients to make informed decisions on the 'additional cost' items.

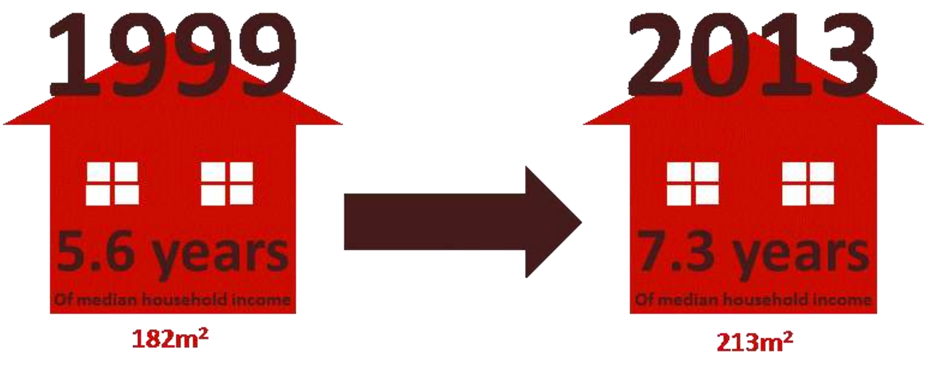
What is the Index for New Housing Affordability?

The BRANZ Index for New Housing Affordability is a new index showing changes in the affordability of **new-build** housing over time. It shows both the affordability of building a standard 200m^2 house and the average sized house across 15 years.

Both measures show that new-build houses have become more unaffordable over the last 15 years. The index shows that it would take **7.2 years** of the median household's income for a new 200m^2 house in 2013. This is up from **5.8 years** of the median household's income in 2001.

The average new-build house size in 2013 (213m^2) would take **7.4 years** of the median household's income to service the mortgage. The average sized new-build house in 1999 (182m^2) would have taken **5.7 years** of the median household's income for the new house.

This captures the changes in the costs of materials, labour, land and other costs in the new-build process.



When mortgage rates are added into the new housing affordability index, an improved picture of new housing affordability can be given. A new house has been 'unaffordable' for the median household since 1999 (at least). This means that given a median household with a 20% deposit, they would have to spend well over a third of their income to service a mortgage on a new house. The median household income increased by 71.7% (in nominal terms) over this period. This has meant that increases in the cost of a new-build have been tempered by increases in household incomes. Nevertheless, the average new-build remains unaffordable to a household on the median income.

However, the costs of land and building are higher some areas such as Auckland and Christchurch. This means new house affordability will be even more of a challenge in these areas. In other parts of the country houses may be more affordable, meaning fewer years' income will be needed to service a mortgage.

What is the Building Envelope Characteristics Index for New Housing?

The BRANZ Building Envelope Characteristics Index for New Housing is a new index that assesses a number of characteristics that may be perceived as being "quality" improvements for a new-build house. It allows for the tracking of changes in the characteristics of the building envelope over time.

The factors looked at are:

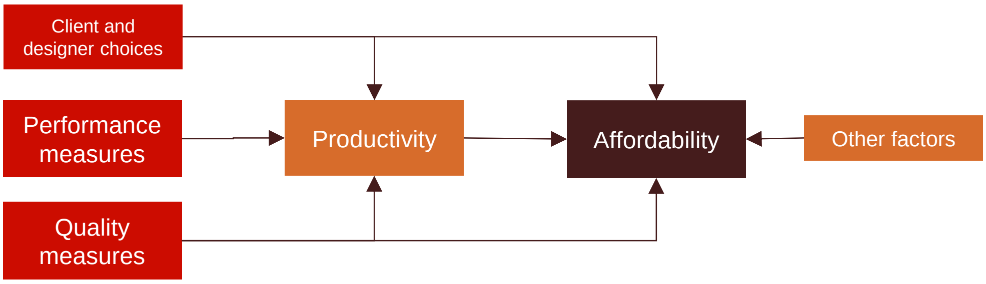
- Wall cladding type
- Roof cladding type
- Wall insulation and ceiling insulation R-Value
- Glazing and framing type
- Ceiling height
- E2/AS1 risk score.

At this stage, three years of data is available on these characteristics. In 2013, **the index value was 0.52**, where a value of 1 is the maximum achievable for each house. A value of 1 assumes:

- a low maintenance wall and roof cladding
- wall and ceiling insulation are double the code
- low-e or argon gas filled double glazed windows
- the ceiling height is 3.6m
- the E2/AS1 risk score is 28.

2. INTRODUCTION

Performance and quality measures together provide an indication of changes in the productivity of the industry. Productivity is, in turn, a major factor influencing housing affordability. Understanding how performance and quality are changing (including design and client choice factors) will help better understand productivity changes and affordability.



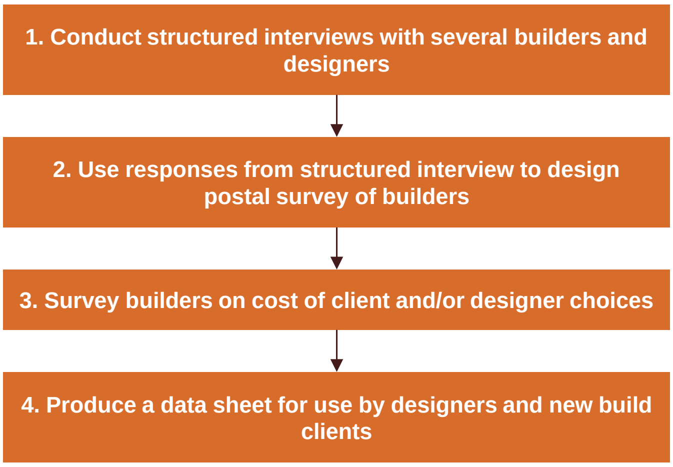
This study began with builders who were surveyed on client and/or design factors. Factors that BRANZ looked at included form, storeys, fittings, and client changes, that impact the quality of the dwelling, but also have **major impacts on housing costs**. These results are being fed back to designers and builders to assist in their advice to clients with the aim of **improving affordability**.

The second step was the creation of an affordability index. Work has been done elsewhere on existing housing affordability indices. But nothing had been done for **new** housing. The **BRANZ Index for New Housing Affordability** aims to enable the monitoring of trends in new housing affordability over time.

It is difficult for standard productivity measures to accurately account for **improvements in quality of the build**, meaning they likely **underestimate productivity improvements**. The BRANZ Building Envelope Characteristics Index for New Housing is introduced which will track **changes in characteristics of new housing** over time, aiming to help better understand the productivity question.

3. CLIENT AND DESIGNER CHOICES

This section looks at common client and designer choices, and **their impact on the final cost of a new-build house**. We first look at our structured interviews with several builders and designers. These interviews gave us a long list of common client and designer choices. With this long list, we designed a short postal survey for builders so we could identify approximate costs of each of the items. Finally, a data sheet was produced for use by designers, new-build clients, and builders to show indicative costs of the more common client and designer choices.



3.1 Structured Interviews

The first step was to conduct interviews with several builders and designers. The majority of these interviews were conducted face-to-face in the Wellington region. One interview was conducted with a Construction Supervisor in Auckland via email. It was hoped that if it was successful we could conduct a greater number of interviews at this initial stage and have a better idea of which factors to include in our survey. This interview does not appear in this report as the interview largely confirmed what we had been hearing from our other interviews.

It was apparent very early in the interview process that the factors we are looking at are not all encompassing. Many builders and designers stated that client choices are not the biggest issue affecting new housing affordability. They believe factors such as land prices, regulation/over-regulation and provision of utilities have a much greater impact. Although these factors are beyond the scope of this study, these factors are commented on briefly in Appendix A of this report.

These interviews proved helpful in developing a long list of items that affect the build cost. The long list was reduced to the 24 items that we believed to be common client choices from our interviews and that had a significant effect on cost. These 24 items were included in a short survey to builders asking about the **additional cost** each of the items added to a new-build.

3.1.1 Interview Questions

The following questions were sent out to our interviewees prior to our meetings:

1. Which common client design choices do you believe add the most to build cost?
2. Which items do designers commonly include in the design of new houses without understanding cost implications?
3. What is the cost implication of these choices in questions one and two?
4. What role do you have in informing the client of cheaper/better design options?
5. Do you feel that one-off designs are overdesigned and/or over-engineered?
6. Do you offer multiple spec levels for clients to choose from and what is the (cost and quality) difference between them?

The interviews that follow are a summary of what the interviewees have told us and are not necessarily the views of BRANZ.

3.1.2 Interview One

Having sent through a list of questions we intended to cover prior to the meeting, our discussion with Builder A took on more of a conversational tone than intended. Builder A had prepared for the interview by listing several client/designer choices that they believe add the most to build cost. We decided that it was best for them to run through their lists and we would address each item separately. Rather than asking what the cost implication of these choices is, we focussed instead on getting a better understanding of the best way to ask builders about the cost implications

Builder A noted that often a potential client will bring them a design and ask how much it will cost to build. They then take this design and price it up, but also price up some potential ways to decrease the final build cost. They viewed this approach of "offering solutions" as an important part of their business.

The first design factor Builder A listed as impacting price related largely to **non-standard detailing** – adopting approaches to design that were not standard in terms of the Building Code. Of particular concern were **cladding** and **non-standardised windows** and anything that required additional input from building specialists such as engineers, such as **floor to ceiling glazing**.

A second factor was the **number of corners / external walls in a design**; the fewer external walls, the more affordable the house area is good. This means that it is often better to design largely square houses rather than rectangular or odd shapes with many corners.

Multi-storey construction (over and above a typical two-floor design) was deemed to significantly affect the build cost as it requires additional engineering as lower storeys have to bear greater loads. Often designs that aim to maximise views or sun include multiple floors that lead to higher costs.

Sustainability or environmental design factors are often expensive. Components such as double glazing and above code insulation are common choices for clients. However, additional measures such as solar energy systems or alternative insulation systems can be pricey and are often where clients draw the line when looking to reduce build cost. These sustainable building systems will "need to come down in price before clients will choose to use them".

Building height and roof design can add thousands of dollars onto a build. Higher than standard (8 foot) studs mean more cladding and framing, and higher costs. Moving from the standard hip roof to a gabled roof or mono-pitch roof similarly means more cladding and higher costs.

The **choice of claddings** was also mentioned. As inferred above, the cladding is a relatively expensive item in the overall build cost. Therefore, choosing a cladding that is non-standard can have a significant effect on the final build cost.

With the change in preference towards open plan living, wider spans need to be covered. This means that there are **additional engineering requirements** to support the greater spans. This is something that is often not considered at the design stage, but adds significant cost.

Glass balustrades were mentioned as a specific item that imposes substantial additional cost that is based purely on client preference.

The time cost of client changes during the build process can add additional cost

The **time cost of client changes** during the build process can add additional cost. A common client change noted by Builder A was **window placement or size**. Once the framing goes up and the view out of windows becomes apparent, it is not uncommon for the client to want to change the location and/or size of windows. These changes could also incur additional costs with respect to submitting amendments to council due to structural changes. Other common changes were often cosmetic. While the actual cost may not escalate substantially, these changes could lead to delays in ordering, which did impose costs on clients who were servicing two mortgages or were also paying rent.

Finally, we discussed the difference between the two standard levels of specifications that Builder A offers. Examples of differences between the two levels of specification included an upgrade to tiles from vinyl, electric to gas water heating, heat pumps to gas fireplaces, and more expensive bathroomware. On a typical 200 square metre house, moving to the higher specifications was estimated to add $15,000 to the build cost.

3.1.3 Interview Two

The second interview was with an architectural designer (Designer A). The interview included the identification of a number of factors that are beyond the scope of this study but have a significant impact on the final cost of a new-build.

Designer A stated that his clients typically wanted a 3 bedroom plus office, open plan kitchen/dining/living, separate media room and an ensuite for the master bedroom. He noted that the kitchen was often the emphasis with a walk-in pantry and scullery (so that dirty dishes could be hidden away whilst entertaining).

This led to a discussion of the size of new houses. Designer A suggested that clients, having had to spend a large amount on a section, need to build a big house (200+ square metres) on the land so as not to under-capitalise. He noted that he had clients that were a middle-aged couple, with no children living at home, who were wanting a four bedroom house. When questioned about their reasoning for needing four bedrooms, they stated that they need spare bedrooms for when relatives come to visit, and for resale value. He felt that there was a huge opportunity with the Christchurch rebuild and constraints around Auckland to introduce smaller (more affordable) houses. His belief was that many houses are larger than necessary, but that fears about inability to resell under-capitalised houses, and people's expectations and pre-occupation with space led a single-minded focus on size.

> Clients, having had to spend a large amount on a section, need to build a big house on the land for value

We then moved on to the cost implications of the regulatory environment. Some territorial authorities require large **water storage tanks**, and lifestyle blocks require a mix of storage tanks and home sprinkler systems (due to New Zealand Fire Service requirements). He had further concerns around possible future airtightness system regulations and the resultant need for mechanical ventilation. He also saw **slab-edge insulation** and **under-slab insulation** as being "overkill".

Amongst Designer A's specialities (as listed on the Architectural Designers New Zealand website) is energy efficient housing. As Builder A stated that sustainability features have a significant impact on the overall cost, we asked Designer A about these features. He stated that **solar water heating** typically costs $6,000 but did not make economic sense. He believed that 3 kW solar photovoltaic (PV) panel systems would meet about 70% of the energy needs of the household, and cost under $10,000. This would be paid-back in approximately 7 years. He noted that many systems such as these do not make economic sense due to low energy prices in New Zealand.

Designer A's preferred **Eco-Housing system** included a solar PV panel and water heat pump which provides both potable water and an in-slab radiant heating system which costs about $30,000.

We then looked at the house plans for a house that Designer A had just designed. It was used as a case study to help identify which factors in this particular house had a significant effect on the final cost. He picked out the following:

- Additional external wall space due to the unusual shape of the house (i.e. it was not a simple rectangular/"box" shape)
- Blockwork features/feature walls using concrete blocks which add to thermal mass but have an additional cost
- An LPG bottle system requested by the client, only used for cooking, at a cost of $3,000-$4,000
- The inclusion of both a woodburner (estimated cost of $4,000, servicing the open plan living areas) and heat pump (servicing the separate media room)
- Extensive landscaping including several patios, a boardwalk to the front entrance, privacy and shade screens and a long driveway to the garage
- Sliding glazed doors separating sections of the house
- In-slab heating at a cost of about $20,000
- A walk in stainless steel shower with timber slats for drying off rather than a standard acrylic shower
- Ceilings raking from 2.55m to 3.20m.
- Above code insulation (using 6" x 2" rather than 4" x 2", and more expensive insulation products)
- Doors that were both wider and higher (typically 2400mm x 860 to 900 mm)
- Thermally broken aluminium windows which can cost up to $100,000 but were about $38,000 on this particular property. This is unlikely to be additional, but the full cost of windows on the propery.

Every client wants a bespoke craftsman built house

Finally, we talked about Designer A's role in informing the client of cheaper/better design options. He stated that he tries to steer the clients towards his preferred items (such as a particular brand of insulation). He designs for passive solar gains by having north facing glass, above code insulation and thermal mass. He stated that every client wants a bespoke craftsman built house and he relies on referrals from previous clients for new work.

3.1.4 Interview Three

Our third interview was with the director of a local franchise-holder (Builder B). Builder B was sent the questions beforehand, but did not have time to go through them before our meeting.

We started off talking about which particular items affect the final cost of the build the most. Builder B stated that choice of **land** had a large impact. He said that there was a big difference between buying a flat section and one on a hill. It was common for sites to require a further $50,000 in earthworks and retaining walls. He also added that even a section that looked relatively flat could require $3,000 of work to prepare it for the foundation. It was also important to understand the wind zone for any

The choice of land has a large impact. There is a difference between buying a flat section and one on a hill particular site as a specific engineering design (SED) can add about $400 per square metre to the build cost.

He believed that the standard specs his group building network offered were at the affordable end of the price spectrum, but were a good product. He finds that the majority of clients that come to him are happy with the standard product although they may choose to upgrade a few particular aspects. However, almost everyone makes changes to plans. This is due to standard plans not often lending themselves directly to local sections.

Some of the most common areas that clients looked to upgrade were:

- the **kitchen** (typically $3,000 extra)
- the **benchtop** (another $7,000)
- changing vinyl/carpet to **tiles** ($2,500) and/or **solid timber flooring**
- upgrading the bathroom walls to **tiles** ($2,500)
- the shower from acrylic to **walk-in tiles** ($1,000)
- **tinted windows** (another $500).

Builder B does not usually upgrade insulation, as since the last change in insulation requirements, most clients feel that they do not need any additional insulation. They also don't upgrade the aluminium windows that they currently use to thermally-broken aluminium windows.

The vast bulk of customers (this builder does around 100 homes a year) installed one or two heat pumps. Around 10% installed wood burners and only 2-3% installed gas heating or fireplaces, which tended to be more expensive.

The cost of outdoor living and landscaping is largely dependent on the site-coverage of the house. Builder B also provides landscaping and says that **landscaping** is typically the first thing to go once money starts to get tight, but could cost $13,000 to $25,000.

Factors prospective new home owners often forgot about included:

- **drapes**, costing up to $5,000
- **services**, which could cost up to $30,000 if the section was not in a new development, was for example a sub-division of an existing property, or a lifestyle block
- **Soft ground** could cost $3,000 to $7,000 to remedy on a flat section
- The current risk-averse Council operating environment also meant that **surveyor** ($1,500) and **engineer** input ($800) were standard on new-builds.

Most of these are not client choices.

Builder B stated that he felt that the working at heights regulations for a one-storey building were overkill (typically $4,000). The need for scaffolding and safety fencing the full site (not yet required) potentially add an additional $15,000 to the build cost.

Suppliers' advertising has a big effect on customer preferences

He found that suppliers' advertising had a big effect on customer preferences. He tried to explain that there was no real difference between what the client wants and the product that they offer as standard. However, he is ultimately happy to make the changes as it is most important to ensure that they give the client what they want. They rely largely on recommendations for new clients. Builder B noted that there was often little difference in prices, particularly for some of the more common cladding choices.

Builder B felt that there was no need for provisional cost (PC) sums in new dwelling construction. Everything is able to be priced, and he was particularly concerned about the practices of some of his competitors in using PC sums to win contracts. His firm prices a project with as much certainty as possible, meaning they sometimes come out more expensive than competitors. He also stated that he often had potential clients return to him after going through part of the building process with another firm. They would complain about PC sums often coming out much more expensive than originally indicated to them. He also stated that despite some people saying that PC sums are often off by about 15%, in reality, they were often much more.

> There is no need for PC sums in new dwelling construction. Everything is able to be priced

We then talked about other factors that push up the price. He mentioned that things like **development contributions** and **GST** had a significant effect on the final cost. Other fees associated with sub-division and development including **land contributions**, **engineering fees** and **LINZ fees** also cost a lot.

Finally, Builder B mentioned that some firms based outside of the area would see the price being paid for building in Wellington as being higher than where they typically build. They would set-up in Wellington to compete with those firms already established here under the impression that profit margins are higher in Wellington. However, they did not last long as they soon found that due to climate differences and Council requirements, it is more expensive to build in Wellington than somewhere like Tauranga.

3.1.5 Interview Four

Our third builder (Builder C) specialises in building spec-houses. This gave quite a different perspective on questions compared to the views of designers and design-build builders.

Most of the interview was focussed around common variations that a client may ask for after building has commenced. Due to time delays around re-submitting documents for consenting purposes, these were largely cosmetic changes.

Builder C first stated that often they had to look at items in terms of how much it cost versus what additional value it added to the house.
In particular, changes that were not immediately visible were most likely to be sacrificed due to budget constraints. For instance, he referenced items such as **solar heating** (costing up to

> Changes that were not immediately visible were the first to be sacrificed due to budget constraints

$18,000), where clients when faced with the trade-off between a granite benchtop or solar heating would choose a **granite benchtop**. Another choice he mentioned was between having to use a **plywood wall underlay** in very high wind zones verses a standard underlay in other wind zones.

Then we discussed specific variations. Common examples included **extra electrical work** and/or lighting. This included mirrors with demisters, double powerpoints, feature lighting in stairways, LEDs (at an extra cost of $5,000) and/or halogen lighting. Another item is house alarms, which are becoming the norm and are now standard in this builder's houses.

The next item raised was **landscaping**. Builder C stated that they typically include a driveway and path to the front door, a small brushed concrete area outside the ranch slider and a clothesline. However, clients often ask for additional paving/concreting/footpaths at a cost of about $80 per square metre.

Other common items included were:

- security latches to upstairs windows
- extra glass splashbacks
- wall paper
- timber overlay laminate flooring (instead of carpet and/or tiles)
- upgraded appliances such as a gas hob or an additional oven ($2,000)
- bathroom/kitchen wall tiling
- a walk-in shower (typically an additional $2,000)
- improved carpet underlay
- a granite benchtop (additional $2,500)
- replacing timber skirting with tiles
- upgrading tapware ($1,000)
- schist and stone cladding
- chrome switch plates and underfloor heating to the bathrooms and kitchen ($900 per room).

Gas central heating, at a cost of $7,500 to $10,000, has become standard in most of Builder C's builds. HRV systems were commonly added at a cost of $3,000 to $5,000, or air-conditioning systems with six outlets at a cost of around $4,000.

In terms of design features that affect price, Builder C stated that "pre-thinking" engineering at the design phase, such that the number of **reinforcing beams are minimised** can reduce costs considerably. His firm has worked closely with engineers to ensure designs require limited engineering. Squarer designs also cut costs but are not always attractive to potential buyers.

One of the biggest issues is ensuring build times are not overly long

Builder C stated that one of their biggest issues is ensuring **build times** were not overly long. Therefore, it was important to steer clients away from complicated variations that would delay completion significantly, especially if this required them to re-submit plans for consent.

Our final question of the interview was in regards to responding to advertising. Builder B stated that his clients were heavily influenced by advertising. We wanted to see whether or not Builder C kept up-to-date with what was being advertised and if his clients were influenced by advertised products. Builder C stated that he was aware of what was being advertised but it did not change what materials he used. He also said that the common item that clients were asking for due to advertising was LED lights, and that clients were largely influenced by home shows or media. His view was that his firm tended to adopt new specifications into their house builds as they came to be seen as the norm.

3.2 How Client Choices affect Build Cost Survey

A survey on the cost implications of client and/or designer choices identified from the interviews was posted to 200 randomly selected builders. A copy of the survey form is in the appendix. 23 Builders responded to our survey (a 12% response rate).

The lower-quartile value and upper-quartile value were calculated for each item. This takes away some of the outlying responses. Quartiles are also used as there will be differences between builders and different quality products may be used. For example, in the case of solar photovoltaic systems, some quoted a 2kW system and others a 3kW system.

The lower-quartile and upper-quartile values make up the cost range shown in Figure 1 and in the data-sheet at the end of the appendix. This provides data for a complete list of features studied.

Figure 1 illustrates the range of values that we received for several of the client and/or designer choices. It shows that there appears to be some variation between different builders. The level of variation could also show how common each of the client and/or designer choices are. They perhaps show how much research builders have had to do into the cost of the different features. The box contains 50% of the responses.

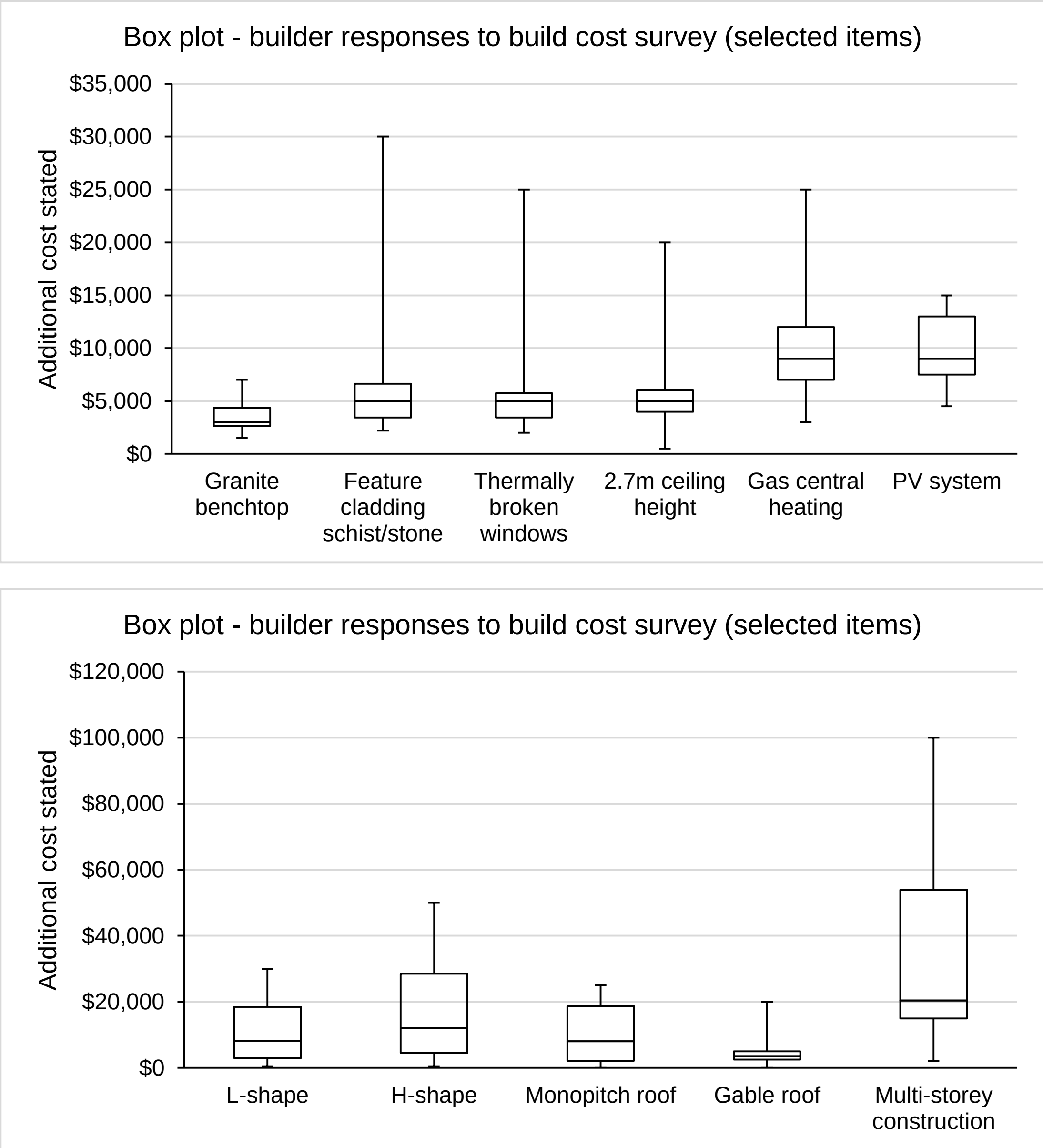


Figure 1. Builder responses to build cost survey

The tight boxes for granite benchtops shows that there is little variation between builders on the additional cost of a granite benchtop. The minimum and maximum values (as illustrated by the lines extending from the boxes) are also reasonably close to the box. However, for items such as a feature cladding or thermally broken windows, it appears that some builders are suggesting prices that are much higher than the majority of builders have told us. It is likely given the huge variation in prices that this is due to a misunderstanding of the survey question.

Table 1 shows the cost of the surveyed items as given by the builders. The lower and upper-quartile values are used. Perhaps the biggest stand-out is multi-storey construction. A check on survey data from the BRANZ Materials Survey suggests that moving 70m^2 upstairs would cost $15,000 to $17,500, which is at the bottom end of the range shown.

We asked builders to assume a **basic spec** 200m^2 house: single level, open plan living, 4 bedrooms, 2.5 bathrooms, simple rectangular design (20m x 10m), vinyl bathrooms and kitchen floors, and that no landscaping is included.

Table 1. Price ranges

Upgrade or addition	Price range
Kitchen and Bathrooms:	
Upgrading from a standard kitchen benchtop to a granite benchtop	\$2600 - \$4400
Upgrading from an acrylic shower to a tiled walk-in shower	\$1800 - \$3000
Upgrading from vinyl to tiles in the 2.5 bathrooms and kitchen	\$1200 - \$2700
Heating and Energy Efficiency:	
Installing an HRV/DVS system	\$3000 - \$4300
Adding an additional heat pump (back-to-back installation)	\$2900 - \$3500
Switch from a heat pump to a gas fireplace	\$2000 - \$4000
Switch from a heat pump to a woodburner	\$1000 - \$2400
Upgrade to underfloor heating in the 2.5 bathrooms and kitchen	\$1800 - \$3000
Upgrade insulation from R-2.3 in the walls and R-3.3 in the ceiling to R-2.6 in the walls and R-3.6 in the ceiling	\$800 - \$1500
Add gas central heating	\$7000 - \$12000
Add gas hot water	\$1500 - \$3100
Add grid-connected solar PV system	\$7500 - \$13000
House design:	
Change design from a rectangular shape to an L-shape	\$3000 - \$18500
Change design from a rectangular shape to an H-shape	\$4500 - \$28500
Change from a 2.4m high ceiling to a 2.7m high ceiling	\$4000 - \$6000
Switch from a hip roof to a monopitch roof	\$2100 - \$18800
Switch from a hip roof to a gable roof	\$2500 - \$5000
Multi-storey construction - moving 70m^2 upstairs	\$15000 - \$54000
Add a 10m^2 schist/stone external feature wall	\$3400 - \$6600
Add a 10m^2 paved patio	\$1000 - \$2000
Add a 10m long glass balustrade	\$3500 - \$5000
General:	
Upgrade to thermally broken aluminium windows	\$3400 - \$5800
Upgrade from carpet to timber overlay flooring in hallways and living areas	\$3200 - \$8600
Upgrade from standard downlights to LED downlights	\$1000 - \$2500

Other items such as changing from a rectangular shape to an L or H-shape had a wide range of prices. This could be due to some builders estimating for a simple L-shape or H-shape and others estimating for something more complicated which may be closer to the high end of the ranges.

BRANZ previously did some work on design factors affecting costs in new housing[2]. There was some similarity in the type of features looked at such as an upper storey, high stud and more than one type of wall cladding. Comparing the median from our survey with the average percentage increase in costs gives some similar results, particularly for an upper storey and high stud (i.e. 2.7m high ceiling).

[2] See Page, I. and Fung, J. (2011). *Cost Efficiencies of Standardised New Housing.*

4. BRANZ INDEX FOR NEW HOUSING AFFORDABILITY

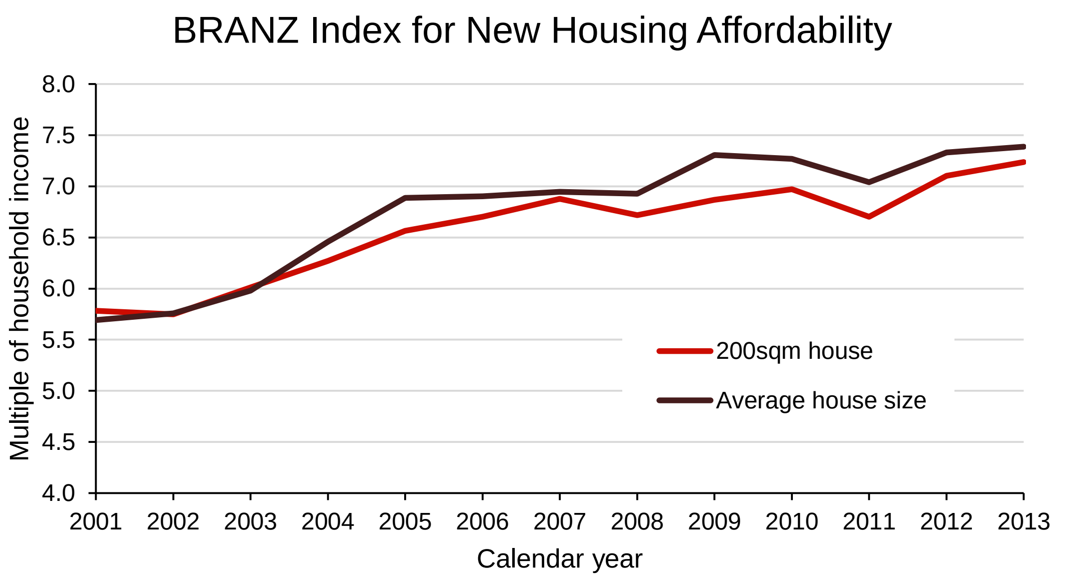
As part of this research, BRANZ have looked into a **new** housing affordability index. Before this, only affordability indices covering all existing housing stock were available. The BRANZ Index for New Housing Affordability will enable the monitoring of trends in new housing affordability over time.

Figure 2, illustrating the BRANZ Index for New Housing Affordability, shows both the affordability of building the average sized house across 13 years and a standardised 200m^2 house. Both of these measures are useful, as the 200m^2 house illustrates the changes in material, labour, land and other costs comparing like with like. The average house size measure shows the implication of the increasing size of houses on the affordability of new housing.

An estimation was made on the cost of building an average quality 200m^2 house in March 2014. This cost was then adjusted using the Statistics New Zealand consent dollar per square metre rate to determine the cost in previous years. These numbers were then weighted by the average house size for each year for the “average house size” index line. Both index lines use the Real Estate Institute of New Zealand (REINZ) median section size and median section price to establish the price that could be expected to be paid for a 500m^2 section.

Statistics New Zealand’s median household weekly income is then used to determine how many years of household income is needed for a new house. A value of 7 indicates that it would take 7 years of the median household’s annual income to pay the cost of a **new**-build.

The index is only for new detached housing. It does not include granny flats, other flats, apartments, or any other attached dwelling.



Source: BRANZ and Statistics NZ

Figure 2. BRANZ new housing affordability index

Both index measures have been going up (i.e. becoming less affordable) over the 13 year period shown. Both index measures rose sharply between 2002 and 2004. The increase in section prices accounted for 28% of the increase in new housing cost, and the other 72% was the increase in the building cost. It is likely that the large increases in section prices and building costs were in large part down to the huge demand for sections, materials and construction workers during this time.

Average house size by year	
Year	**Average house size**
2001	197
2002	205
2003	208
2004	213
2005	217
2006	215
2007	214
2008	216
2009	217
2010	216
2011	211
2012	215
2013	213

The index measures then largely flattened out after 2004 as both the cost of building[3] and land increased by a slightly higher percentage than the median household income. The average house size measure has slightly more variation than the 200m^2 house illustrating the impact of the changes in house size during this period.

Since 2011, the index measures have begun trending upwards again. This is largely due to low median household income growth as the cost of building and land have increased by 11% over this period.

The land proportion of the overall cost has remained relatively steady at about 25% of the total cost over the period. This was lowest (around 20%) between 1999 and 2004. However, between 2004 and 2007 this rose to just above 25%. Since 2007 it has been trending slowly downwards, sitting at around 24% in 2013.

Median household income has increased by 59% between 2001 and 2013 (an average of 3.7% per year).

[3] Building and construction consent values flattened out between 2004 and 2007/2008 before falling by 32% between 2007 and 2011.

What happens when we include mortgage rates?

Part of the housing affordability issue does involve mortgage rates, as when mortgage rates increase housing becomes less affordable.

Figure 3 shows what percentage of the median household's income would need to be spent in order to service a mortgage[4]. It assumes that the household has a 20% deposit, will have a 25 year mortgage, and uses the same median household income and house costs as the BRANZ Index for New Housing Affordability.

The percentage of household income necessary to service the mortgage over the period that we have looked at moves in line with the mortgage rates (from the Reserve Bank of New Zealand). The period where mortgage rates were highest coincided with the period where new housing was least affordable. Upwards of half of the median household's income needed to be spent to service the mortgage.

We note that rates tend to rise when the Reserve Bank is trying to curb inflation with a strong focus on house price inflation. It is therefore no real surprise that at times when house prices are rising fast, rates also rise, exacerbating the affordability decline.

During the analysis period, the median household's income needed to service a mortgage is in the unaffordable range (as it far exceeds the maximum of 33% of income). However, this new BRANZ Index for New Housing Affordability is a national figure and in many of the regions, such as Auckland, Canterbury and Wellington, land prices and building costs are higher. Therefore new houses in these regions will be even more unaffordable than some of the less developed regions.

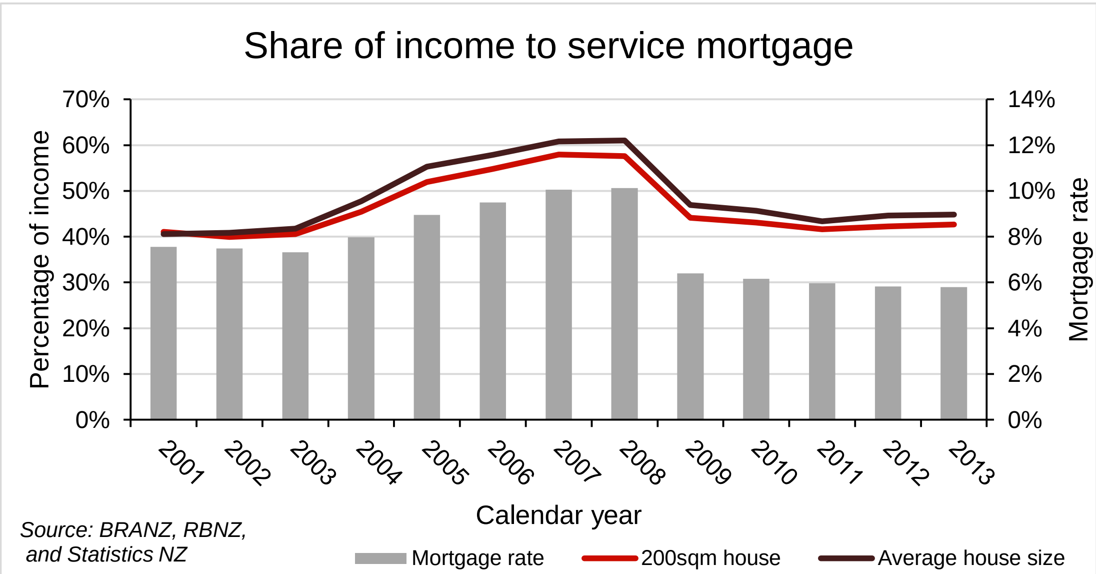


Figure 3. Share of income to service mortgage

[4] The average mortgage rate in each year is calculated to determine what repayments would be. It does not allow for changes in mortgage rates over time.

5. BRANZ BUILDING ENVELOPE CHARACTERISTICS INDEX FOR NEW HOUSING

There is often a trade-off between the initial cost of any particular feature and on-going benefits such as operating improvements. Because of this trade-off, clients may not make the decision to install quality features during the build process. The client may have a singular focus on the up-front cost (i.e. their budget is ‘x’ and they will not exceed it).

This means that housing features that could be considered as improvements in quality (such as additional insulation or improved glazing) are sometimes not being used in new housing. This is not captured in the housing affordability sections of this report.

This section looks at the building envelope of new housing. Using the BRANZ new dwellings survey[5], we can assess a number of measures related to the building envelope of a house to create an index for the “quality” of the building envelope.

This section considers some of the build features which we measure in our survey that a typical new-build housing client may perceive as being “quality” items. These are likely associated with a higher cost. We acknowledge that some items which we do not measure may have a bigger impact on the affordability of new housing and may also be considered quality items. However, we focus on the structure, claddings and insulation materials in our survey.

The maximum value achievable for the new housing index is 1.0, i.e. if all new houses in our survey adopted the highest possible characteristic value, the index would be 1.0. The index has barely moved between 2011 and 2013.

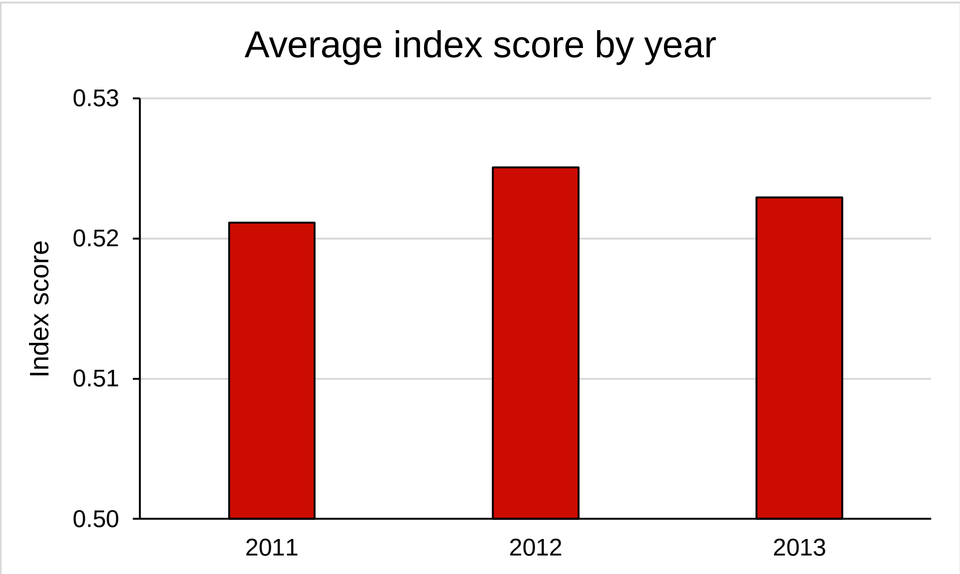


Figure 4. Average index score by year

[5] For more information on the BRANZ New Dwellings Survey, please see Curtis, M. (2013). *Physical characteristics of new houses 2013*.

Figure 5 shows the spread of houses for the latest year analysed. It shows that over a quarter of houses have an index score between 0.6 and 0.65, and 3% had an index score of over 0.7. The highest individual index score achieved was 0.82.

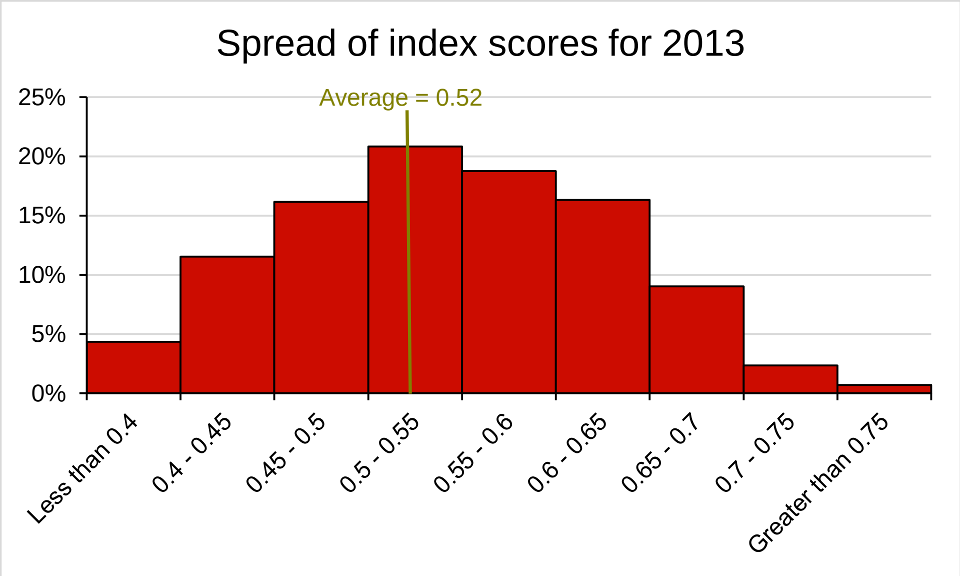


Figure 5. Breakdown of index scores for 2013

The following sections explain how we estimated the index scores for each house.

5.1 Methodology

The BRANZ new dwellings survey was assessed for which measures could indicate an improvement in new housing. The following factors have been used to create the index:

- Wall cladding type
- Roof cladding type
- Wall and ceiling insulation R-Values
- Glazing and framing type
- Ceiling height
- E2 risk score

The index works by assigning each of these factors a value between 0 and 1 inclusive. It then averages these values for an overall index value, i.e. we do not assign different weights to each factor. Only where five of these factors for any individual house have been provided has the house been included to work out the average index value and the distribution of index values. The maximum value achievable for any house is 1.

5.1.1 Wall Cladding

The benefit of different wall claddings is determined by the maintenance period of the chosen material(s) i.e. the assumption is that lower maintenance materials are more beneficial. The following table illustrates the maintenance period that BRANZ has assumed for each of the more common materials chosen. The maintenance period excludes washing/cleaning of materials, which should be done regularly. We understand that the maintenance period shown may vary by manufacturer, between different profiles of the material, or the specific site conditions. We have tried to take a mid-point for each of the materials shown.

Maintenance period of wall claddings		
	Maintenance period	**Index value**
Clay brick	30	1.0
Concrete brick	30	1.0
PVC weatherboard	30	1.0
Stone	30	1.0
Concrete block	30	1.0
Aluminium	30	1.0
Lockwood	30	1.0
Steel zincalume	15	0.5
Fibre cement sheet	10	0.3
EIFS	10	0.3
Linea weatherboard	10	0.3
Plaster on clay brick	8	0.3
Radiata Weatherboard	8	0.3
Stucco	8	0.3
Plywood sheet	8	0.3
Aerated concrete panel	8	0.3

Table 2. Maintenance period of wall claddings

The index value is based on the maintenance period. Where the maintenance period is highest, a value of 1 is used. For all materials where the maintenance period is less than every 30 years, the index value is based on how the maintenance period compares to the "best" maintenance period. Where multiple different types of wall claddings have been used, the index value is weighted by the percentage of wall coverage of each material.

5.1.2 Roof Cladding

The benefit of the roof cladding is determined in the same way as for wall claddings. The following table shows the maintenance period for the more common roof cladding choices.

Maintenance period of roof claddings		
	Maintenance period	Index value
Aluminium	30	1.0
Concrete tiles	30	1.0
Asphalt shingles	20	0.7
Metal tiles	15	0.5
Prepainted corrugate	10	0.3
Other steel profiles	10	0.3
Timber shingles	7	0.2

Table 3. Maintenance period of roof claddings

A value of 1 is assigned to the material with the "best" maintenance period, in this case Aluminium. Each subsequent index value relates to how the material compares to the "best" maintenance period.

5.1.3 Wall and Ceiling Insulation

Both the wall and ceiling insulation values depend on how the chosen material insulation R-Value compares to code for each climate zone. Where the material R-Value of the installed insulation is equal to code, a value of 0.5 is given. Otherwise, the value is given by the following formula:

$$= \frac{(\frac{Material\ R\ value\ wall\ insulation}{Code\ x\ 2}) + (\frac{Material\ R\ value\ ceiling\ insulation}{Code\ x\ 2})}{2}$$

In other words, a maximum value of 1.0 would be awarded for a house with insulation R-values double the code requirement.

5.1.4 Glazing and Framing

The glazing and framing are looked at together. The framing material, whether or not the window is double-glazed, and whether the window has low-e panes and/or argon gas fill, are all taken into account to determine the quality of windows. Using this information, we were able to determine the R-Value of the glazing and framing. Unfortunately, we did not record whether windows had both low-e panes and argon gas fill, so the maximum R-Value achievable was 0.48 (i.e. PVC or wooden framed double glazed with low-e panes). Windows of this type were given a value of 1. The most common type of glazing and framing is standard aluminium framing with double glazing. This has an R-Value of 0.26 and is therefore given a value of 0.54.

$$= \frac{0.26}{0.48} = 0.54$$

5.1.5 Ceiling Height

The average ceiling height is included in our index. Where the average ceiling height is 2.4 (i.e. the most common ceiling height), a value of 0.67 has been assigned. The formula for assigning the value for the index is as follows:

$$= \frac{Average\ ceiling\ height}{3.6}$$

Up to a maximum value of 1.

5.1.6 E2/AS1 Risk Score

The maximum risk score is looked at to determine the quality of the house in terms of complex constructions. The risk score looks at the wind zone, number of storeys, roof/wall junctions, eaves width, envelope complexity and decks to determine the risk level for each external face of the house. A higher risk score implies a more complex design. The formula for assigning the index value is as follows:

$$= \frac{Maximum\ risk\ score}{20}$$

Where a value of 0 indicates a maximum risk score of 0.

5.2 Average Index Scores

The following table illustrates why there has been little movement in average scores over the three years. Whilst the average score for wall cladding has increased slightly, there has been a reduction in the average score for roof cladding. However, overall there has been little change in any of the individual measures.

Average index score by measure			
	2011	**2012**	**2013**
Wall cladding	0.67	0.67	0.69
Roof cladding	0.47	0.47	0.45
Insulation	0.59	0.59	0.59
Glazing and framing	0.53	0.53	0.53
Ceiling height	0.71	0.71	0.71
Risk score	0.17	0.18	0.17
Average	**0.521**	**0.525**	**0.523**

Table 4. Average index score by measure

5.3 Discussion

This index was aimed at trying to better understand the changes in quality and their impact on affordability. However, there is insufficient information that we are able to draw on, and they mostly relate to the building envelope.

Figure 6 shows the relationship between the building envelope "quality" and the final contract value for a new house. There appears to be little relationship between the two factors. This suggests that there is greater variation in internal features such as fixtures and fittings which perhaps have a greater impact on final cost than variations in the building envelope may have. We also do not measure the shape of the house, nor the style of roof, which have an impact on the contract value.

Given that low maintenance cladding materials are not necessarily more expensive than their counterparts, it appears that the true **financial** benefit of these products in not being captured in its cost.

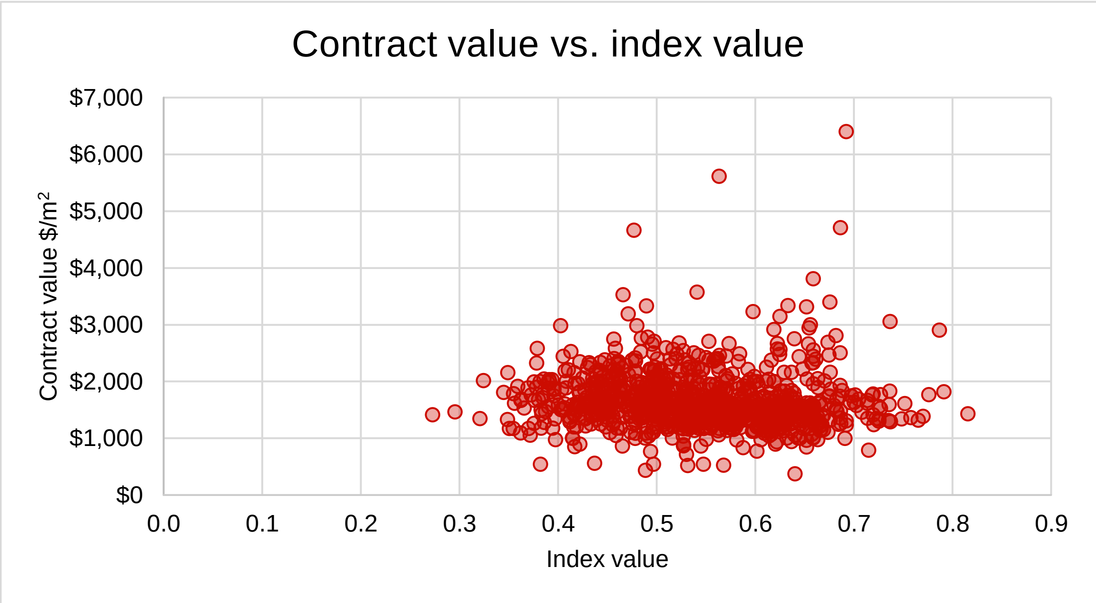


Figure 6. Contract value vs. Index value

6. APPENDIX A: OTHER FACTORS AFFECTING NEW-BUILD AFFORDABILITY

Designers and builders highlighted several additional costs associated with a new-build that clients often do not consider when budgeting the cost of their build. Many of these are costs that are beyond the control of the builder, as they are unanticipated.

The list below is not comprehensive, but does provide a starting point for further work on the impact of these costs on the new-build budget. Many of the builders we spoke to as part of this project saw the value of new-build clients better understanding these unanticipated costs. Accounting for all the potential costs of a build upfront has greater long-term benefits for the builder and the client.

A more comprehensive study of these and other factors that affect the overall price the new-build client pays would help the industry. It would ensure fewer surprises for the new-build client, fewer disagreements over final build cost, fewer time delays and fewer financial difficulties for clients in completing their build.

6.1 The true cost of a section

Most interviewees raised the cost of land (due to restrictions on supply) and the additional costs associated with a section as some of the biggest and least understood costs.

The true cost of a section should be seen as the sum of:

- **Section price**
- **Site clearing**: could easily be $5,000 for a smallish overgrown section
- **Slope and access**: earthworks and retaining walls could cost anything between $3,000 for a flat site and upwards of $100,000 for a steeper site
- **Wind zone**: a section in a very high, extra high or SED (Specially Engineered Design) wind zone will add thousands of dollars to the build price.

Therefore a section with a cheap price may not necessarily be the best option once these other factors have been considered.

6.1.1 The relative cost of the section and build

Land price was a common factor that interviewees mentioned as having a large impact on housing affordability, particularly in areas of low supply such as Auckland and Christchurch. Some interviewees believed purchasers felt the need to build bigger, higher-spec houses to ensure they did not under-capitalise their sections.

A question for further research is whether people think of their new-build project as a single pot of money, or one pot for buying a section and another for building with whatever money is left.

6.2 Common contract exclusions

- **Assumptions about services**: Many new-builds in established areas (such as in-fill housing) may not already have services to the boundary (unlike most large-scale new sub-divisions, which do). Council websites may also have inaccurate information about the existence or positioning of water tobies, wastewater and stormwater pipes. New-build contracts often having wording to the effect that they assume services are in place to the boundary or are easily accessible. New-build clients therefore need to physically confirm the status of as many utilities as they can to determine the actual cost of utilities, including:
  - Electricity connections (which can cost upwards of $10,000 if the road needs to be dug up and the lines company insists on using its contractors)
  - Water supply tobies (up to $5,000 to install)
  - Wastewater pipes (some Councils now insist on their own sub-contractors making these connections at a set price)
  - Stormwater
  - Gas (often piped for free, but should be checked)
  - Telecommunications (often cabled for free, but should be checked)
- **Soft ground and associated engineering**: Most contracts will specifically mention soft ground as an exclusion. However if they don't, the assumption is still that if the ground proves to be soft, the cost of remediation will be borne by the client. One way to mitigate this cost is through a full geo-technical report, but this itself could typically cost several thousand dollars.
- **Landscaping and additional paving**: Landscaping of the garden is usually excluded although specific allowance can be made for X square metres of concrete or paving in the contract
- **Floor coverings**: Contracts (or upfront non-binding estimates) can vary in how they deal with floor coverings. Some include carpets and not tiles, or carpets and vinyl but not tiles and so on.
- **Drapes and curtain rails**: These are the responsibility of the new-build client, but are often forgotten as a cost, and can run to several thousand dollars depending on preferences.

6.3 Regulatory fees

Another potentially large source of costs is regulation. These include:

- **Council fees** for building consents, resource consents, resource consent monitoring, and encroachment fees. These vary sharply from Council to Council, and by value of the project. Further, fees for things like resource consents are typically significantly more than the initial upfront application fee, and could run into hundreds or thousands of extra dollars.
- **Additional expert advice**: The leaky buildings problem left Councils facing huge financial liabilities. Partly in response to this, Councils now require significantly more

expert input into the building consent process. Requiring additional input (to the client's account) from engineers, surveyors and other experts is common, and may cost several thousand dollars.

6.4 Provisional sums and prime cost (PC) sums

Most building contracts include what are generically referred to as PC sums (but in fact also include provisional sums).

- **Provisional sums** are dollar amounts included in a contract for work where the extent and, hence, the price of the work can't be defined. A common example is earthworks. The problem is that provisional sums may dramatically under- or overestimate the actual cost of undertaking the work.
- **PC sums** are items of work, materials or fittings where the price will vary based on decisions and/or selections that may not have been made at the time of signing the contract. Examples may include a kitchen, where the contract includes a PC sum for $10,000. This means a kitchen will be delivered as per the specs in the contract for $10,000. However, it allows the client the flexibility to upscale or downscale on that kitchen, with a commensurate debit or credit. The problem for the new-build client is once again understanding how realistic the PC sum value is before signing the contract. For instance, will a PC sum of $10,000 deliver the kitchen the client expects, wants and can afford.

7. APPENDIX B: SURVEY FORM AND DATASHEET

Kitchen and Bathrooms:

Upgrade standard kitchen benchtop to granite	$________________
Upgrade acrylic shower to tiled walk-in (i.e. per bathroom)	$________________
Upgrade vinyl to tiles in 2.5 bathrooms and kitchen	$________________

Heating and energy efficiency:

Installing an HRV/DVS system	$________________
Add one heat pump (back to back installation)	$________________
Switch from one heat pump to one gas fireplace	$________________
Switch from one heat pump to one woodburner	$________________
Upgrade to underfloor heating in 2.5 bathrooms and kitchen	$________________
Upgrade insulation from R-2.3 in the walls and R-3.3 in the ceiling to R-2.6 in the walls and R-3.6 in the ceiling	$________________
Add gas central heating	$________________
Add gas how water	$________________
Add grid-connected solar PV system	$________________

House design:

Change design from a rectangular shape to an L-shape	$________________
Change design from a rectangular shape to an H-shape	$________________
Change from a 2.4m high ceiling to a 2.7m high ceiling	$________________
Switch from a hip roof to a monopitch roof	$________________
Switch from a hip roof to a gable roof	$________________
Multi-storey construction. Assume moving to 130sqm downstairs and 70sqm upstairs	$________________
A 10 square metre schist/stone external feature wall	$________________
A 10 square metre paved patio	$________________
A 10 metre long glass balustrade	$________________

General:

Upgrade to thermally broken aluminium windows from standard double glazed aluminium	$________________
Upgrade carpet to timber overlay flooring in hallways and living areas	$________________
Upgrade from standard downlights to LED downlights	$________________

Others: *If there is anything that you think should be included, please use this space*

....	$________________
....	$________________
....	$________________
....	$________________

ESTIMATED COST OF VARIOUS DESIGN CHOICES

Each builder was asked to assume a basic specification 200 m² new-build house that is single level with open-plan living, 4 bedrooms, 2.5 bathrooms, simple rectangular design (20 × 10 m), vinyl bathrooms and kitchen floors and no landscaping. They were then asked to price the following changes.

KITCHEN AND BATHROOM	
Upgrade from a standard kitchen benchtop to a granite benchtop	\$2,600–\$4,400
Upgrade from an acrylic shower to a tiled walk-in shower	\$1,800–\$3,000
Upgrade from vinyl to tiles in the 2.5 bathrooms and kitchen	\$1,200–\$2,700
HEATING AND ENERGY EFFICIENCY	
Install an HRV/DVS system	\$3,000–\$4,300
Add an additional heat pump (back-to-back installation)	\$2,900–\$3,500
Switch from a heat pump to a gas fireplace	\$2,000–\$4,000
Switch from a heat pump to a woodburner	\$1,000–\$2,400
Upgrade to underfloor heating in the 2.5 bathrooms and kitchen	\$1,800–\$3,000
Upgrade insulation from R2.3 in the walls and R3.3 in the ceiling to R2.6 in the walls and R3.6 in the ceiling	\$800–\$1,500
Add gas central heating	\$7,000–\$12,000
Add gas hot water	\$1,500–\$3,100
Add grid-connected solar PV system	\$7,500–\$13,000
HOUSE DESIGN	
Change design from a rectangular shape to an L-shape	\$3,000–\$18,500
Change design from a rectangular shape to an H-shape	\$4,500–\$28,500
Change from 2.4 m high ceiling to 2.7 m high ceiling	\$4,000–\$6,000
Switch from a hip roof to a monopitch roof	\$2,100–\$18,800
Switch from a hip roof to a gable roof	\$2,500–\$5,000
Multi-storey construction – moving 70 m² upstairs	\$15,000–\$54,000
Add a 10 m² schist/stone external feature wall	\$3,400–\$6,600
Add a 10 m² paved patio	\$1,000–\$2,000
Add a 10 m long glass balustrade	\$3,500–\$5,000
GENERAL	
Upgrade to thermally broken aluminium windows	\$3,400–\$5,800
Upgrade from carpet to timber overlay flooring in hallways and living areas	\$3,200–\$8,600
Upgrade from standard downlights to LED downlights	\$1,000–\$8,600