External Research Report

ER29 [2018]

Evidencing Quality Issues: What Can Industry Data Tell Us

Tyson Schmidt

Project LR0512

Third Bearing Limited, funded by the Building Research Levy

Funded from the
Building Research Levy

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

ISSN: 2423-0839

BRANZ

Evidencing Quality Issues – What Can Industry Data Tell Us?

LR0512

March 2018

third bearing

Published March 2018
This work was funded by the Building Research Levy

Third Bearing Ltd
Palmerston North

third bearing

Contents

Introduction

1. This report explores the link between type and nature of residential building practitioners and quality issues as expressed by information collected during the building consent process. It addresses Question 1 under Programme 3 of the BRANZ Research Levy Prospectus 2016 – informing options for encouraging and enabling change across the construction industry and related supply chain. Specifically it addresses "Gaining a clearer picture around the practitioners operating in the New Zealand building and construction industry."
2. The main intended outcome of this research is a framework for better understanding the relationship between industry players and quality issues as defined through the consenting process. This will give a better foundation from which to make decisions about what quality issues to address and how to address them, primarily through having more targeted information about what the issues are and where they are occurring.
3. Our report consists of three main parts:
   - First, we examine who is involved in residential building in New Zealand and segment these by scale of activity. This includes identifying financial and employment characteristics of the identified segments, as well as examining the nature of construction they are involved in.
   - Second, we examine quality information obtained from consenting systems used by four Building Consent Authorities (Selwyn District Council, Kapiti Coast District Council, Kaipara District Council, and Wellington City Council). We do this for both requests for information (RFIs) as part of consent processing, and inspection fail rates as part of the build process.
   - We then bring the first and second parts together to analyse quality information from the four BCAs by builder segments to determine whether RFIs and inspection fail rates vary by the scale of builder.
4. We would like to thank the teams from AlphaOne and GoGet for facilitating access to the consenting data, and to the BCAs for their agreement to access. As part of accessing the data we made the commitment not to identify any individual build or BCA as part of our reporting. We also purchased data from Statistics New Zealand relating to income and expenditure of firms in the residential construction industry, and from BCI New Zealand relating to standard consent data.

Introduction

Our methodology

5. Recent research has focused on labour productivity and therefore looked at the size of firms in terms of the number of employees. Given our focus on quality rather than labour productivity, we wanted to look at size in terms of volume of buildings consented.
6. The issue with focusing on volume of buildings is that it is not easy to connect datasets that cover volume of work (e.g. buildings consented) with information about the industry (such as number of employees, income, profitability etc), and then with data on quality as defined in the consenting process.
7. In an ideal world, primary and secondary data keys would exist that would allow connections to be drawn across the three main sets of data we needed. For example, each dataset would ideally use the same consistent and verified method of identifying building firms.
8. In reality these primary or secondary keys do not exist, making it impossible to accurately connect the datasets together. A lack of data standardisation around consenting data also means there is variation of practice across how BCAs define and capture information relating to the build process.
9. Our methodology therefore involved a 'data and design' approach through the development of 'persona' or segments of the residential building industry to act as the connecting mechanism between the datasets. Using national level consenting data we were able to create persona based on how many residential dwellings a builder constructed each year – for large, medium, and small scale builders. These persona were then able to be used to analyse consenting data held by our four selected BCAs, using information from their electronic consenting systems to look at quality indicators.
10. In lieu of direct connections between datasets, building this persona approach is one way we can determine if some types of builders (based on scale) are more likely to have quality issues. These persona also act as a way to understand who, and how, is best to start influencing quality during the build process. It also provides the basis for the development of more detailed persona if this initial methodology proves successful, including the use of other analytical devices such as journey maps.

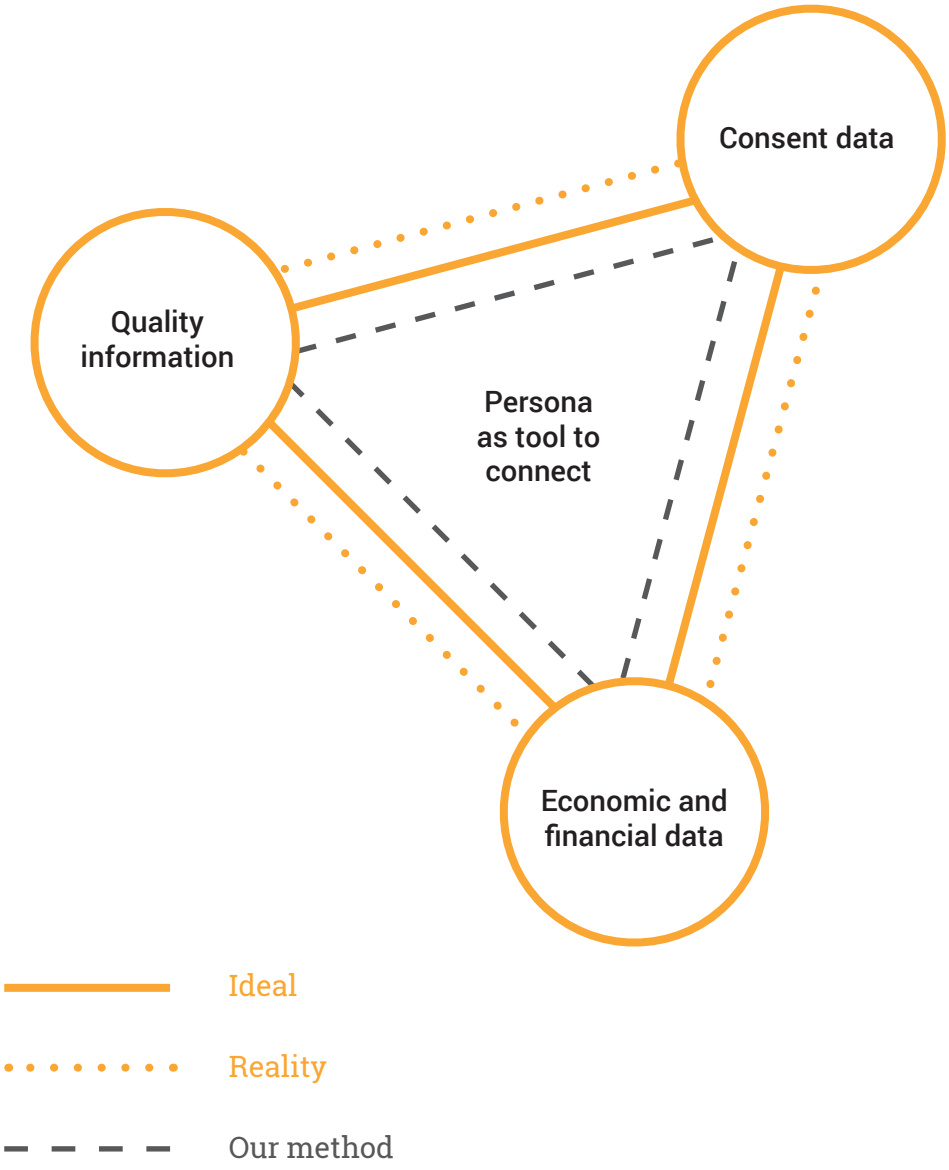
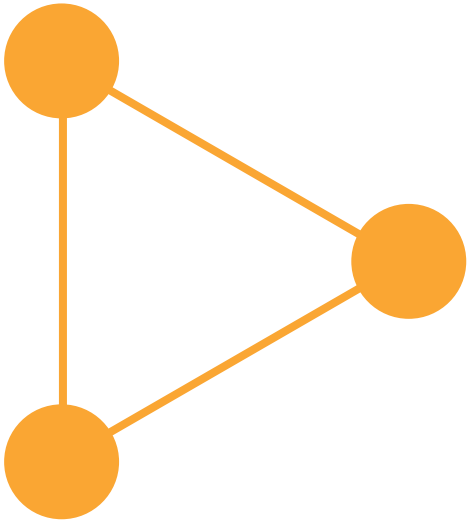


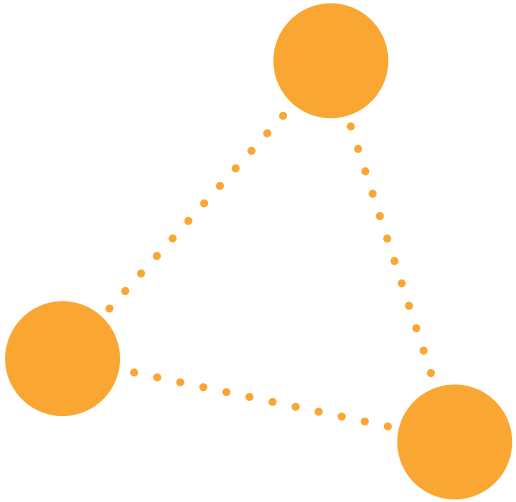
Plate One

Method



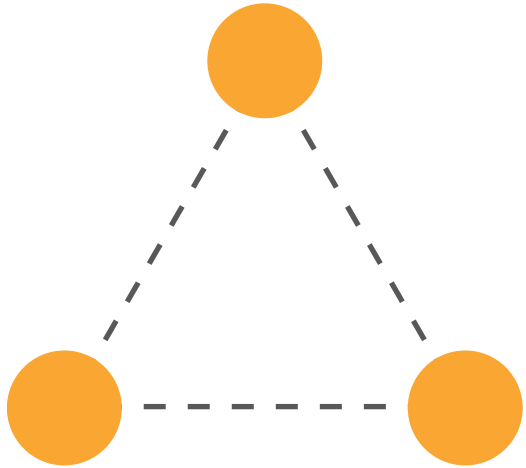
Ideal

In a perfect world, this is how the information would work. Consent data, economic and financial data, and quality information would be fully linked, making it easy to access and use.



Reality

There is no exact way to know who built what (including their financial and economic make-up) and what the quality of their design and build process was. The primary data keys needed to link these sets do not exist.



What we did

We built personas to act as the connecting points between data sets. It's not exact, but it provides enough of a connection to help build a picture out of all the parts - data on volume, financial and economic info, and understanding quality.

Summary

11. We have three overall findings:

- Persona can act as a tool to connect the various datasets and to understand who builds at volume and how they operate
- Electronic consenting systems hold a wealth of information about the building process, including quality, but there has been limited effort put into how to unlock this
- Large- and medium-scale builders have the better quality results based on the datasets we used, and together represent an avenue for influencing improvement across 50% of new residential builds.

Who is involved in residential construction?

12. Consenting data for 2015 shows us that 4% of builders account for nearly 50% of new residential dwelling consents, with the top 1% accounting for 37% of these consents. Focusing efforts to improve quality on this smaller group would impact a significant amount of New Zealand's building activity.
13. However, 50% of medium builders and 20% of large builders have less than six employees (i.e. they still match the definition often used elsewhere for 'small' when using the number of employees). This demonstrates a level of complexity in the industry – such as subcontracting and related-party activities – which is important to understand if trying to influence quality issues.
14. For example, the Annual Enterprise Survey 2015 records 17,787 enterprises involved in residential building construction. Building consent records for 2015 only record 8,517 builders. There is obviously a significant number of enterprises – approximately half – who do not have their names recorded against a consent and not directly responsible for new residential building work (but will likely be subcontracted). Further work is needed to understand this aspect of the persona.

Quality information – Requests for Information

15. Requests for Information (RFIs) occur during the processing of building consents when Building Consent Authorities (BCAs) ask questions to clarify whether a proposed dwelling meets Building Code standards. RFIs are therefore an indication of the quality of the design and consent documentation.
16. We examined RFIs relating to 2,035 consents issued in 2015. There was an average of 10.6 RFIs per consent across this group, although there were some significant outliers (the maximum being 123 RFIs).
17. More complex builds attract a higher average number of RFIs – R3 buildings had an average of 15.9 RFIs per consent (where complexity is measured by the national BCA competency assessment system levels).
18. We also looked at another proxy for complexity – value per bedroom. Above average value per bedroom dwellings had the highest level of RFIs, with 15.5 RFIs per consent.
19. Based on a textual analysis of RFI details, the most significant proportion of RFIs relate to missing information. RFI's are also commonly raised when information is unclear or incorrect. Over half of RFIs related to Building Code clauses B1 and E2 (although a large proportion were 'unspecified').

8,517
builders names on record

+9,270
other enterprises involved in residential building

17,787
enterprises in 2015

Summary

Quality information – Inspections data

20. Inspections occur during the build process, and are therefore an indication of the quality of the building work occurring. We looked at 3,195 inspections relating to 248 consents. 8.1% of the inspections we looked at had failed.

21. The BCAs in our dataset had different classifications for inspections. We therefore grouped these into five common areas – finishing, foundations, framing, other, and plumbing.

22. The 'Framing' group of inspection types recorded the highest fail rates – 11.9% overall. The next group was 'Finishing' with a fail rate of 9.4%.

23. More complex buildings did not attract higher rates of inspection fails. In fact, R3 buildings actually had a lower fail rate (7.7%) than the less complex R2 building (9.4%).

24. We also looked at inspections carried out in 2015 that related to consents from previous years. This showed that older consents have higher levels of failed inspections.

Connecting quality information to industry players

25. A relationship exists between the scale of builder and the quality of the work at consent processing and inspection stages.

26. Large-scale builders had the lowest level of average RFIs per consent – 7.2 compared to 10.3 RFIs per consent for medium-scale builders and 14.5 for small-scale builders.

27. This relationship held when analysed by complexity of dwelling. Large-scale builders had the lowest average of RFIs per consent for R1, R2, and R3 dwellings.

28. Median RFIs per consent were the same for each scale of builder (8 RFIs). Large-scale builders have a shorter 'tail' distribution with fewer high-count RFI consents, resulting in a lower average.

29. Large-scale builders also had a lower level of inspection fail rates, with only 6.9% compared to 10.6% for small scale builders.

Conclusion

30. Our work indicates that there are two main options for influencing quality during the consenting and build process:

> By focusing on the 4% of medium- and large-scale builders who record the highest levels of quality across 50% of new residential builds. This would require finding ways to influence a smaller group to lift their quality even further.

> By focusing on the 96% of small-scale builders who record the lowest levels of quality across 50% of new residential builds. This would require influencing a large number of players to, for example, reduce the long 'tail' of high-RFIs per consent.

31. Each of these options require different approaches in order to successfully influence groups of builders who structure their businesses in very different ways.

Who is involved in residential construction?

32. Previous study reports such as SR284 (2013) *Small firms' work types and resources* and SR315 (2014) *Small construction firms in New Zealand* (both by MD Curtis and IC Page) have used various datasets to segment firms by employee size and examine their characteristics. The focus on number of employees is an effective way of examining issues such as labour productivity. For example, SR 315 (2014) identified that firms with 0-5 employees as making up 91% of the construction industry, and SR 284 (2013) showed that small firms are largely involved in residential construction.

33. For our project we wanted to explore whether defining firm size by volume of build would better suit an examination of quality work. Online consenting systems do not record any details about the numbers of employees or other measures of firm size, but we are able to tell how many firms are associated with multiple consents (i.e. how many they are building). Our reasoning is that it would be more effective to work with large volume builders on quality matters if these complete a significant percentage of new residential buildings a year.

34. Diagram One shows the relationship between consents issued and the builder identified on the consent for all new residential building consents recorded in 2015 (excluding apartments). It shows that 4% of builders (259) account for 50% of consents issued for new residential dwellings that year (10,029). This is out of a total of 8,517 builders named across 20,058 new residential dwelling consents.

35. Table One shows the top ten builders by scale of new residential dwelling construction for all of New Zealand in 2015. At the national level, around 5% of consents do not specify a builder. The top ten named builders were associated with 20% of all consents, each building more than 200 new residential dwellings. Table Two shows the volume of new residential buildings put through by the top 3% of builders.

36. It is important to note that for Diagram One and Table One we have grouped common building entities. For example, we have combined the five Mike Greer Homes variations into one and the nine GJ Gardner variations into one. When we examined the use of builders names in the consenting records there was very little consistency in terms of using the local company variant for a specific geographic area. For example, consent records in Auckland could list Mike Greer Homes Auckland Limited or just Mike Greer Homes. While these are separate entities, it is not clear whether the recording on the consent form accurately matched which entity was doing the building work.

Who is involved in residential construction?

37. Combining these builder variants recognises that the group of building companies often have common ownership or brand connections. The Mike Greer Homes group of companies tend to have common ownership and director interests (in this case Michael David Greer as a director and owner)[1]. Other examples in the top ten list operate under a franchise model (such as GJ Gardner) where the common link is a franchise agreement rather than ownership interest.

38. While the structures are quite different, for our purposes the similarity is that multiple enterprises for the purposes of official statistics are listed under a single trading or brand name on consent forms. Even online consenting systems do not currently require Business Information Codes or other unique identifiers to be used when listing who the builder is on a consent form. For quality purposes, a group of common companies leveraging off a common brand implies an incentive to maintain a degree of quality consistency across the variants.

Diagram One. Who builds what - proportion of new dwelling consents by proportion of buildings, (All NZ 2015) (BCI consents data)

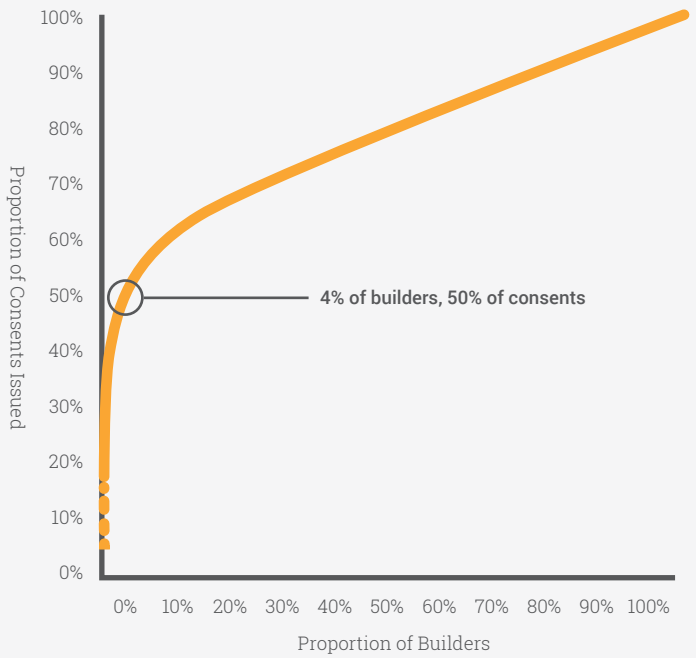


Table One – Top 10 builders by scale (All NZ)

Builder	Number of Consents	Proportion of total consents
G J Gardner Homes	1120	6%
Unknown	980	5%
Mike Greer Homes	675	3%
Stonewood Homes	422	2%
Classic Builders Ltd	376	2%
Generation Homes Ltd	302	2%
Fletcher Living	263	1%
Horncastle Homes Ltd	245	1%
Signature Homes	236	1%
Universal Homes Ltd	233	1%
Peak Construction	204	1%
Total	**5056**	**25%**
Total excluding unknown	**4076**	**20%**

Table Two – Number of builders with more than seven consents for new residential buildings (All NZ for 2015)

Number of Consents	Number of Builders
200 or more	10
100 to 200	4
50 to 100	13
30 to 50	20
7 to 30	218

1 This was confirmed through checking Companies Office records for the five different Mike Greer Homes variants listed in the consents.

Who is involved in residential construction?

Linking volume to income and employment

39. In trying to understand quality we have focused on identifying characteristics of firms that build significant numbers of dwellings. This allows us to draw connections to building consent data as we can identify volume builders easily in those datasets, and then explore linkages to quality indicators such as the number of RFIs and the number of failed inspections.

40. To construct basic persona for these volume builders we chose to use income and employment information as our key connections. When dealing with new residential dwelling consents we can use income as a proxy for volume – those who build more tend to earn more. We then looked to the Annual Enterprise Survey from Statistics New Zealand to identify the employment characteristics of these volume builders.

41. From the consenting data, the average value for high volume new residential builders is approximately $350,000. Table Three sets out the income bands using this average. Note that the consenting data also shows that there are a small number of builders who undertake low-volume but high-value work (for example, one build will be $2 million). None of these low-volume but high-value work builders were associated with more than seven consents.

42. We obtained information from the 2015 Annual Enterprise Survey that grouped residential building construction industry enterprises by income bands and rolling mean employee bands (see Tables Four and Five). If we take the $2m income band as our starting point for high volume builders (i.e. those doing more than seven new residential consents a year), we can see that there are 963 enterprises out of 17,787 (5.4%) who earned more than $2m in 2015. This is slightly more than the 4% of builders from consenting data who accounted for 50% of new residential dwelling consents in 2015.

Table Three – Number of builders with more than seven consents for new residential buildings (All NZ for 2015)

Number of Consents	Number of Builders	Estimated income band per year
200 or more	10	$70m+
100 to 200	4	$35m to $70m
50 to 100	13	$17.5m to $35m
30 to 50	20	$10.5m to $17.5m
7 to 30	218	$2.45m to $10.5m

Who is involved in residential construction?

43. While this is not an apples to apples comparison, it does indicate a degree of alignment with the difference potentially due to:

- grouping methodology we have used (as discussed above)
- variances in average value of build, with the estimates in Table Three being higher than the $2m income band used in the AES
- some low-volume but high-value builders encroaching into the above-$2m income bands.

44. Table Five shows that there are different employee characteristics across the income band groupings we have created. Similar to other research into small firms, Table Five shows that the vast majority of enterprises earning less than $2m a year have either no employees (i.e. sole operator) or have between 1 and 5 employees.

45. For the medium and large enterprises that have income over $2m a year (approximated to seven new residential dwellings or more), more than half (495 or 51%) are 'small' when using a measure of less than six employees and just under half (468 or 49%) have more than 6 employees. This sliding scale continues if we look just at those earning income above $10m a year, with just under 20% having less than six employees.

46. We can now start to build a basic persona of residential building firms based on their volume of dwellings per year (see Plates Two to Five).

Table Four – Level of income for residential building enterprises (AES 2015)

	Income band	Enterprises
Small	$0 to $2m	16,824
Medium	$2m to $10m	855
Large	$10m+	108

Table Five – Number of residential building enterprises by level of income and rolling mean employee band (AES 2015)

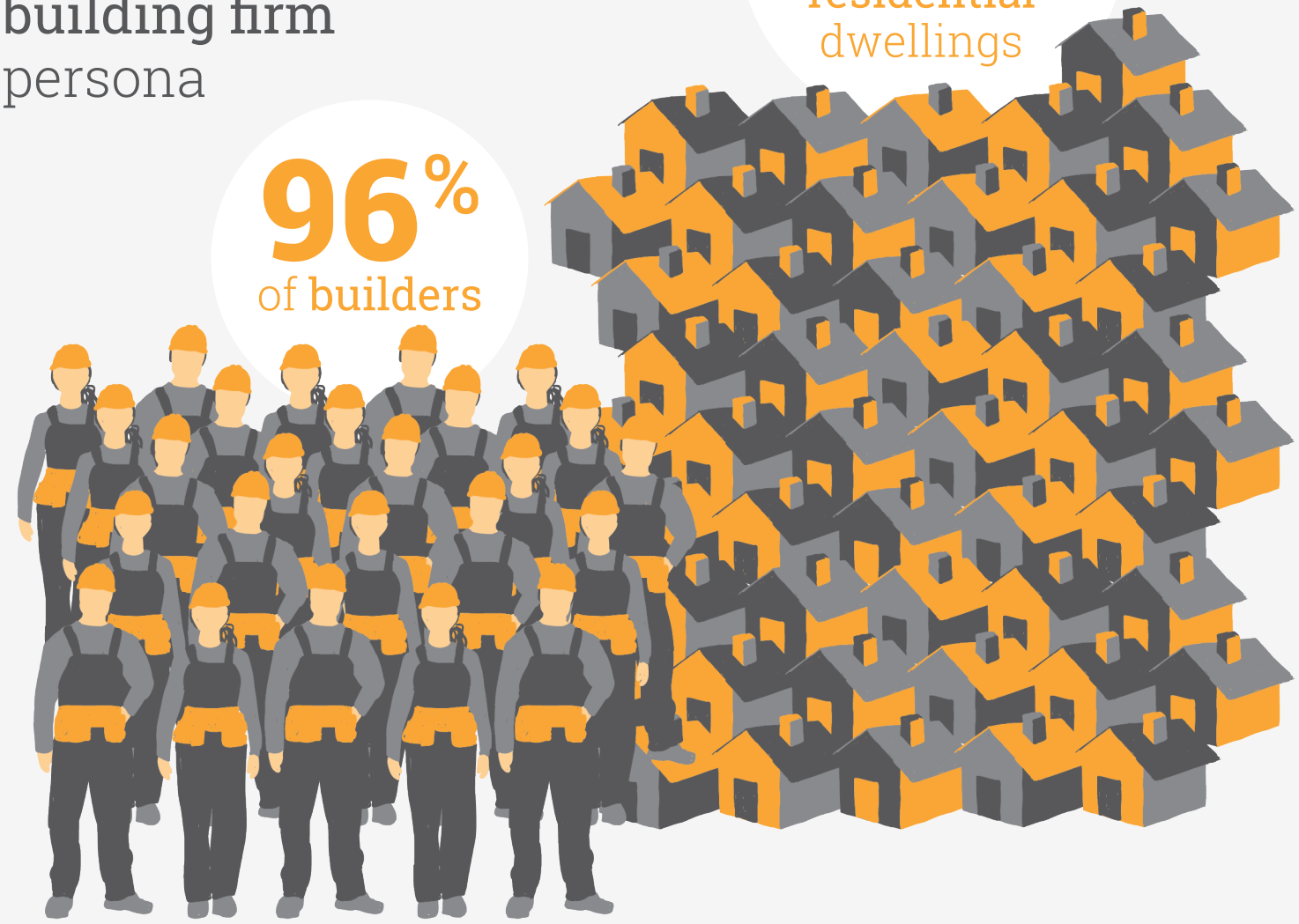
	Rolling Mean Employee bands				
Total income bands	0	1 - 5	6 - 19	20 - 49	50 and over
$0 to $2m	11,316	5,061	435	12	0
$2m to $10m	171	303	327	51	3
$10m+	12	9	45	30	12

Plate Two

Small residential building firm persona

51% of new residential dwellings

96% of builders



1-3 new residential dwellings a year — **Low** volume, **high** value per dwelling

OR

Up to 6 new residential dwellings a year — **Medium** volume, **low to medium** value per dwelling

Income of **$0-$2m** a year

95% of enterprises

97% have less than 6 employees

67% have no employees

8.5% spend 50%+ of expenses on subcontracting

42% have related party remuneration expenses

Plate Three

Medium residential building firm persona

7-30
new residential dwellings a year

Income of
$2m-$10m
a year

4%
of enterprises

49% have 6 or more employees

20% have no employees

49.5%
spend 50%+ of expenses on subcontracting

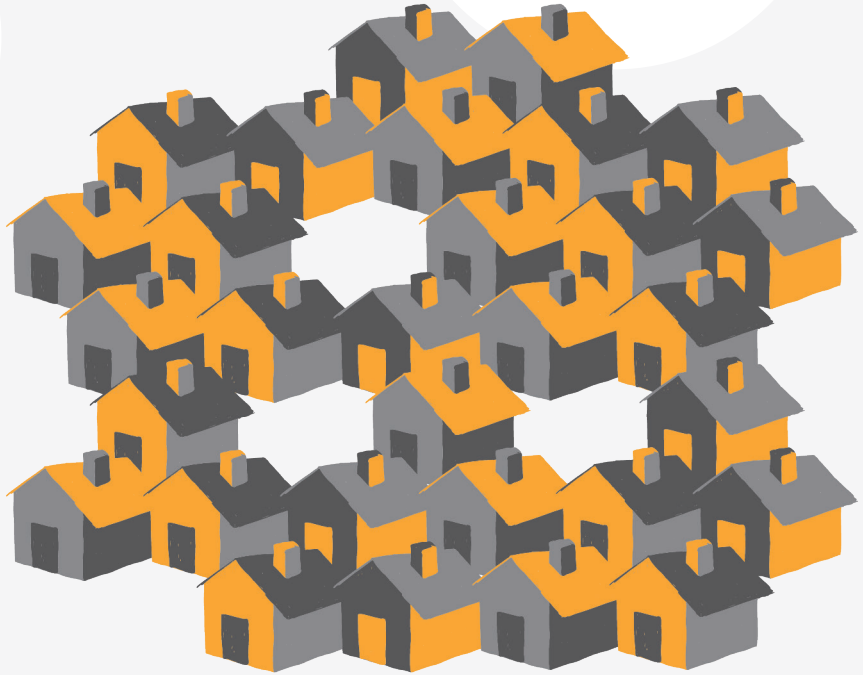
69% have related party remuneration expenses

Plate Four

Large residential building firm persona

1% of builders

37% of new residential dwellings



30 or more new residential dwellings a year

Income of **$10m** plus a year

Less than 1% of enterprises

80% have 6 or more employees

11% have no employees

83.3% spend 50%+ of expenses on subcontracting

50% have related party remuneration expenses

Plate Five

Residential building firm comparison

	Small		Medium	Large
	96% of builders		**3% of builders**	**1% of builders**
	51% of new residential dwellings		**12% of new residential dwellings**	**37% of new residential dwellings**
	Low volume High value per dwelling	Medium volume Low to medium value per dwelling		
	1 to 3 residential dwellings a year	Up to 6 residential dwellings a year	Between 7 and 30 dwellings a year	30 or more new residential dwellings a year
	Up to $2m a year	Up to $2m a year	Income of between $2m and $10m	Income of $10m plus
	95% of enterprises		4% of enterprises	Less than 1% of enterprises
	97% have less than 6 employees		49% have 6 or more employees	80% have 6 or more employees
	67% have no employees		20% have no employees	11% have no employees
	8.5% spend 50%+ of expenses on subcontracting		49.5% spend 50%+ of expenses on subcontracting	83.3% spend 50%+ of expenses on subcontracting
	42% have related party remuneration expenses		69% have related party remuneration expenses	50% have related party remuneration expenses

Who is involved in residential construction?

Extending persona with additional financial data

47. These basic personas can be built on with additional financial data. The fact that the AES information covers 17,787 enterprises involved in residential construction but only 8,517 builders are listed on consent records indicates that there is a significant amount of subcontracting or other association occurring in the industry (i.e. some 9,270 are involved in residential construction work but not directly responsible for a consent).

48. We looked at using IR10 data to help us understand the structure of these firms in more detail, in particular the level of subcontracting that occurs versus direct employment or related party payments. This will help us understand the operating structure of medium and large enterprises in particular, given a large percentage of these have no employees but significant income (indicating work done via subcontracting or by related-parties). Understanding the different ways relationships between the 17,787 enterprises are structured would help us understand how to influence quality issues.

49. The information we accessed from Statistics New Zealand covered economically significant IR10 units that have been selected in the AES population. It covered 17,526 units compared to the 17,787 enterprises in the AES. We obtained data relating to the percentage of total expenses that these 17,526 units spent on salaries & wages, subcontractors, and on related party remuneration (i.e. payments to associated firms or directors). This was detailed by income level to match our previously constructed personas.

50. The IR10 data showed that over 50% of the enterprises surveyed have an indistinguishable activity base (see Table Six). These enterprises feature strongly in the income bands between $0 and $2m and demonstrate no activity in the variables measured i.e. have no employees, do not make subcontractor payments, do not pay salaries and wages, and/or do not pay related party remuneration. These firms are likely to have either little or no income, or are very small operations with income distributed via drawings.

51. We are able to identify that larger firms spend significantly more on subcontractors than small scale builders (83.3% in the $10m+ income bracket have 50% or more of their expenses on subcontractors) and that a considerably higher percentage of medium and large scale builders have between 10% and 50% of their expenses allocated to salaries and wages.

Table Six – Selected payments as percentage of total expenses by builder groups

Salaries and wages as a % of total expenses

	Zero	>0 to <50%	≥50%
Small scale builder	57.6%	32.1%	10.2%
Medium scale builder	11.2%	71.0%	17.8%
Large scale builder	0.0%	83.3%	16.7%

Subcontractor payments as a % of total expenses

	Zero	>0 to <50%	≥50%
Small scale builder	62.6%	28.9%	8.5%
Medium scale builder	27.9%	22.6%	49.5%
Large scale builder	16.7%	0.0%	83.3%

Related party remuneration as a % of total expenses

	Zero	>0 to <50%	≥50%
Small scale builder	57.7%	26.2%	16.1%
Medium scale builder	31.1%	67.6%	1.4%
Large scale builder	50.0%	50.0%	0.0%

Who is involved in residential construction?

52. However, the dominance of firms in the 'zero' category in all three expense areas we looked at suggested that the IR10 data was not telling as clear cut a story as we were hoping for in these areas. This could be because:

> These categories were not mutually exclusive and we could not track individual firms across all three. For example, we had no way of knowing if a small scale builder with 0% of its expenses in salaries and wages also appeared in the 0% category for the other two expenses types (or if not, where they did appear).

> The differences in how income is recorded by the AES and IR10 data makes it difficult to cross match between the equivalent sections of each data set (see Table Seven). The IR10 definition of income already takes into account a number of expenses (including labour) which the AES does not, so the IR10 value for income is likely to be less than the AES data because the value has had expenses deducted above the line versus AES below. This means the income bands are not directly comparable and expense categories may be underrepresented.

Table Seven – Differences in income definition between AES and IR10 data

AES – "Income"	IR10 – "Total Income"
• Sales of goods and services	• Sales of goods and services
• Interest	• Opening stock – partly finished goods or incomplete contracts
• Dividends and donations	• Purchases
• Government funding	◦ Material
• Grants and subsidies	◦ Labour
• Non-operating profit	◦ Other direct costs
	• Closing stock
	• Gross profit
	• Interest
	• Dividends
	• Rent, lease and licence income
	• Other income

53. Further research is needed to align these definitions and better track the residential construction firms across the category of expenses, which would then unlock a better understanding of the structure of these enterprises and how they operate. With the development and refinement of primary keys, the two surveys present a significant opportunity to bring the respective data sets together to provide meaningful information. This will provide insight and better understanding of how building enterprises/businesses are structured and operate.

54. In addition, this research into persona could be extended by:

> Further AES analysis to look into aspects such as profitability

> Understanding the variations in company ownership structures for the largest builders, both through Companies Offices records but also AES information around organisation form.

Plate Six

Residential building process

Requests for Information (RFIs)

RFIs occur during the processing of building consents when Building Consent Authorities (BCAs) ask questions to clarify whether a proposed dwelling meets Building Code standards. RFIs are therefore an indication of the quality of the design and consent documentation. Consenting systems record each RFI and which Code clause they relate to.

Inspections data

Inspections occur during the build process, and are therefore an indication of the quality of the building work occurring. Consenting systems record pass or fail status of each inspections throughout the build process.

Quality Information – Requests for Information

55. Requests for Information (RFIs) are issued when a BCA requires additional information in order to make a judgment about whether a submitted consent meets requirements (primarily focused on Building Code requirements). If the information presented in the consent is unclear or incomplete, a BCA will issue a RFI to ask for clarification or additional information in order to determine whether the consent meets Building Code requirements.

56. Several RFIs can be issued if there are a number of clarifications required, and if additional information is not sufficient a BCA can issue extra RFIs until it is satisfied with the information provided.

57. RFIs are often used to judge whether a design and its related design documentation is of sufficient quality, with quality being defined as meeting the Building Code. A design may be deficient because it does not achieve the performance standards set in the Building Code – for example, materials specified by the designer may not be durable enough and therefore not meet the performance standards of Clause B2 of the Building Code.

58. A RFI may also be issued because design documentation is deficient – for example, the submitted consent may not contain enough detail for the BCA to make a judgement about whether the design meets the Building Code.

59. The following section is based on an examination of data for 2,035 new residential consents from 2015. These consents resulted in 21,621 RFIs at an average of 10.6 RFIs per consent and a median of 7 RFIs per consent. This sample comes from a total count of 20,058 new residential consents for 2015, giving a confidence interval of approximately 98%.

Quality Information – Requests for Information

Requests for Information by Building Code Clause

60. Understanding the number of RFIs and what Code clauses they relate to can help us understand where quality issues exist at the design stage of a building. The Building Code is organised into 8 main clauses (see Table Eight).

61. Online consenting systems assign most RFIs to a particular Code clause. When a Building Officer assesses a consent and issues a RFI, they will generally be prompted to tag the RFI to a particular clause and sub-clause of the Building Code. We were able to analyse the consenting data to determine which Building Code clauses were the subject of the most RFIs, indicating where the most difficult issues for designers are.

62. Of the RFIs that did specify a Code clause, the most common are described in Table Nine. The most common Code clauses are B and E, which together make up over 60% of all RFIs that specified Code clauses.

63. The Stability clause is wide ranging – covering a number of structural and durability issues – and this breadth of coverage is one likely reason why it accounts for nearly 37% of all RFIs. Significant focus has also been placed on weathertightness and ensuring healthy homes (particularly through the control of moisture inside a house), which also helps explain why nearly 24% of RFIs cover these matters.

Table Eight – Building Code clauses and coverage

Code clause	Coverage
A	General provisions
B	Stability, including structure and durability
C	Protection from fire
D	Access, including safety of entry/exist to the building and any stairs
E	Moisture, including managing water on site, stopping it getting into buildings, and managing moisture within buildings
F	Safety of users, including safety from falling and restricting access to pools
G	Services and facilities, including natural light, ventilation, and waste water
H	Energy efficiency

Quality Information – Requests for Information

Table Nine – Proportion of RFIs by Code Clause

Clause	Title	Proportion of RFIs	Example
B	Stability	36.6%	*Stringer fixed to concrete block foundation wall below entry area doesn't comply with Table 6.5 NZS 3604. Please revise. In addition, the Entry Framing Plan does not specify a stringer size for the deck off living and dining room.*
E	Moisture	23.7%	*Proposed BRANZ weathertightness detail for EIFS junctions 1.2.12.2 shows EIFS over timber frame. Whereas, detail 5 Plan Detail at NW Corner shows EIFS over concrete masonry. Please submit appropriate BRANZ detail, which is Concrete masonry 4.2.16.2 External corner.*
G	Services & facilities	17.9%	*Please show the complete stormwater layout on one drawing showing field drains passing through silt traps before connecting to the existing stormwater*
Not specified	Not specified	9.2%	*Please provide a revised Certificate of Design Work addressing the following sections:* *a) Page 1 to be completed for owner\'s details.* *b) Page 2 to include the LBP\'S name.* *c) Page 5 to be completed for waivers & modifications.* *d) Page 6 to specify the practitioner type.*
F	Safety of users	4.8%	*Please amend the balustrade height specified to a min 1m.*
C	Protection from fire	3.5%	*Provide confirmation on wall linings surrounding the gas cooker area*
D	Access	2.8%	*The external entry area will need to comply with the slip resistance requirements of D1 and this will need to be noted.*
H	Energy efficiency	1.5%	*As the hot water cylinder for the flat is in the garage and outside the thermal envelope, please show how the requirements of H1.3.4 will be met.*

64. Close to 18% of RFIs relate to Building Code clause G – another wide ranging clause which includes ventilation, natural & artificial light, supply and disposal of water and solid waste, and electricity and gas supply.

65. Just over 9% of RFIs did not specify a Code clause. This tends to be for one of four reasons:

- The RFI was not related to a specific Code clause but relates to other administrative issues or inconsistency of entering information.
- The RFI was related to Building Act or Resource Management Act matters that are not covered by the Building Code – for example the RFI may ask for planning-related information or for details of Licensed Building Practitioners undertaking the design or building work.
- The RFI was related to a specific Code clause but was recorded in free-text RFI detail description fields but not identified in the field capturing Code clause data.
- The RFI was related to a specific Code clause but the clause was not listed.

Quality Information – Requests for Information

Requests for Information by Consent Complexity

66. Table Ten shows RFIs issued by consent complexity category. The majority of BCAs use the national BCA competency assessment system levels as a proxy for the complexity of the building covered by a consent. They were primarily designed to determine the skill level required of a building officer to process a consent, and describe three increasing levels of complexity for residential buildings – Residential 1 (R1), Residential 2 (R2), and Residential 3 (R3).

67. The average number of RFIs per consent is 10.6 and increases by half again as the complexity of the building increases (to 15.9 per consent for R3) and decreasing to a lesser extent to 6.5 RFIs per consent for R1 consents. A similar relationship occurs for the median number of RFIs per consent – for all consents the median number is 7 RFIs, reducing to 4 for R1 consents and increasing to 10 RFIs for R3 consents.

68. This indicates a strong relationship between complexity as measured by the national BCA competency assessment system levels and the number of RFIs issued. The more complex a residential building is, the more RFIs it tends to receive. In terms of quality, this indicates that designs for more complex buildings find it harder to meet Building Code requirements than more simpler designs do. This relationship held across the four BCAs our dataset covered.

69. There were some outlier consents that generated very high numbers of RFI's. Our sampling of these consents did not reveal a specific driver of the high RFIs. One possible explanation is that these high-RFI consents were designed by less qualified or experienced designers, but we found instances of both designer-produced and homeowner-produced consents that resulted in high numbers of RFIs. In our dataset, the consent with the highest number of RFIs was at complexity level R2. This consent had RFIs issued on 9 different dates over two and a half months, with a number of repeated requests for engineering advice, drainage and construction details.

70. Table Eleven shows RFIs generated by consent complexity and Code clause. The average RFIs per consent tend to be consistent across complexity classes with the exception of Code clause C (protection from fire) which increases from 2.5% of RFIs for R1 consents to 4.6% for R3 consents, and Code clause B which peaks at 38.3% of RFIs for R2 consents compared to 33% for R1 and R3 consents. Otherwise there did not seem to be any relationship between consent complexity and any particular Code clause that RFIs were issued against. More detailed analysis against Code subclauses may reveal a relationship.

Table Ten – RFIs issued by consent complexity

	R1	R2	R3	Total
Consents	486	1316	233	2035
RFI's	3160	14747	3714	21621
Average	6.5	11.2	15.9	10.6
Median	4	8	10	7
Max	84	123	106	123
Min	0	0	0	0

Table Eleven – RFI's by consent complexity and code clause

	R1	R2	R3
None Specified	11%	8.8%	9.2%
B	33.4%	38.2%	33.0%
C	2.5%	3.4%	4.6%
D	2.8%	2.8%	2.9%
E	24.2%	23.3%	24.7%
F	5.1%	4.5%	5.8%
G	19.7%	17.5%	18.1%
H	1.3%	1.5%	1.8%
Total	3,160	14,747	3,714

Quality Information – Requests for Information

What did the RFIs focus on?

71. RFIs in the datasets we obtained were almost always accompanied by a thorough explanation. These explanations were a mixture of user-defined free text responses and repeated standard responses. There was no overall consistency in the phrasing or terminology used by BCAs, with a seemingly large degree of flexibility afforded to the individual building officer to phrase or describe the RFI as they best thought. This flexibility is moderated by the need to refer to specifics in the design and the Building Act.

72. There was sufficient repetition of key words that suggested or made clear what the BCA was asking for in the RFI. Table Twelve provides a summary of our textual analysis of the types of RFIs that are most commonly raised. We have grouped these into three main areas:

- Text suggesting information is missing. This is where the RFI language emphasises insufficient information has been provided to make a judgement about whether the design meets the Building Code. We used the words 'provide', 'advise', and 'show' for this as each of these suggest that the design documentation was not complete enough.
- Text suggesting information is unclear. The design may include enough information for an assumption to be made about meeting a particular Building Code clause, but clarification is needed to be certain. We looked at instances of the word 'confirm' and 'clarify' to determine when a BCA was asking for such clarification in a RFI.
- Text suggesting information is incorrect. The RFI language asks for revision or amendments to the submitted design as it does not currently meet Building Code requirements. We used the words 'revise' and 'amend' as each of these point to the BCA requiring information be changed.

73. 'Provide' and 'show' were the most frequent RFI requests. Nearly half of all RFIs used the word 'provide' in the request, and a fifth of RFIs used the word 'show'. This indicates that a significant number of RFIs are driven by incomplete information being provided as part of the consent application. The terms 'confirm' and 'amend' were the next frequently used (11% and 10% respectively).

Table Twelve – Textual analysis of RFI data

RFI 'type'	Explanation	Frequency	Example
	RFI text suggesting missing information		
Provide	Request for additional or missing information before consent can be approved	45%	*Please provide the Truss manufacturer literature and PS1 as this is required at the consenting stage.*
Advise	Clarification of specific point or requirement that is unclear in documentation	1%	*Please advise how the following will be achieved: The delivered hot water temperature at any sanitary fixture used for personal hygiene shall not exceed 55°C and to meet Health requirements, the water temperature at the kitchen sinks must not be less 63°C and 83°C for the dishwashing unit.*
Show	Request to include or more clearly show a specific location or show compliance with a specific code clause	21%	*Please show the location of the existing water heater.*
	RFI text suggesting unclear information		
Confirm	Confirmation of an assumption that has been made in the processing of the consent	11%	*Please provide confirmation on slip resistance to the stairway access for the upper floor.*
Clarify	Request to clarify information that is present but not conclusive for consent processing	4%	*A gas califont is specified on sheet A21, whereas sheet A6 specifies a hot water cylinder. Please clarify & reconcile the design for the project specific selection.*
	RFI text suggesting consent information is incorrect		
Revise	Request to revise plans to meet Code	7%	Please revise the waste pipe sizes for the laundry / bathroom to show 65mm minimum pipe size under the floor as discussed with a 50mm vent from the pan
Amend	Request to amend plans to meet Code	10%	Please amend the proposed stud spacing as 90x45 at 600 centres is outside the scope of table 8.2 of NZS3604 for very high wind zones

Quality Information – Requests for Information

74. It should be noted that these RFI 'types' are not mutually exclusive – that is, a single RFI could include multiple terms. Deeper and more complex textual analysis could focus on groups of words and where they occur in an RFI, revealing a richer picture of the drivers behind requests.

75. We also looked at whether the frequency of these terms changed depending on the complexity of the proposed building. Most terms occurred at similar frequency across complexity types, except for 'provide' and 'confirm'. 'Provide' appeared in 48% of R1 consent RFIs compared to 41% of R3 consents. 'Confirm' appeared in only 9% of R1 consent RFIs but nearly doubled to 16% in R3 consents.

76. This indicates that R1 consents attract less RFIs on average but are more likely to have information missing in the consent documentation. R3 consents receive a higher number of RFIs on average, and an increased proportion of these relate to clarifying the information provided (potentially indicative of the complexity of the design).

Check on R1 etc as definer of complexity

77. A lot of our analysis in this section relied on the national BCA competency assessment system levels as the way to define complexity. This system assesses complexity according to the structure of the building and the weathertightness risks (via the E2/AS1 matrix).

78. We wanted to look at defining complexity in others ways in order to check whether the BCA competency system was a valid model for this type of analysis. The method we chose was to calculate 'value per bedroom' on the assumption that new residential dwellings with a high value per bedroom are likely to be more complex and detailed in construction and finish.

79. To do this we built a sample set of consents for which we held full consent, RFI, bedroom number, and value of work data. This subset covered 1,121 consents out of our total sample of 2,035. We were able to access value and bedroom information for these consents from Council consenting systems and also BCI datasets, and RFI information from Council consenting systems.

Table Thirteen – Largest differences in frequency for specified terms in RFI data by complexity

	R1	R2	R3	Total
Provide	48%	45%	41%	45%
Confirm	9%	10%	16%	11%

Table Fourteen – RFIs per consent by complexity category (sample set only)

	R1	R2	R3	Total
RFIs / consent	10.3	10.9	16.3	11.4

80. Our first step was to calculate the number of RFIs by level of complexity for our subset of consents. This showed that our subset had slightly higher levels of RFIs than our overall sample, but the same relationship existed in that the number of RFIs increased as complexity level did (see Table Fourteen).

81. We then calculated value per bedroom for each of the consents in the subset. We relied on the value of work entered as part of the consent application and checked the stated number of bedrooms against the general description of the build (correcting or filling in where this was needed). We excluded consents that did not have all of this information available. Value per bedroom was a simple calculation of value of work divided by the number of bedrooms.

Quality Information – Requests for Information

82. Rather than use quartiles, we chose to create a model of thirds for value per bedroom in order to match the 3 BCA residential competency categories. We did this only for the four BCAs in our dataset in order to match the rest of the analysis in this section. The average value per bedroom was $98,655, with a minimum value of $16,667 and maximum value of $500,000. The median was $91,500 and one standard deviation came to $42,154.

83. Analysing RFIs per consent against the three levels of value per bedroom showed the same pattern as for BCA competency levels – as the value per bedroom of the consent increased, so did the number of RFIs per consent (see Table Sixteen). Consents in the below average value per bedroom group had noticeably less RFIs per consent than when measured by the R1 category. Levels of RFIs per consent for the about average and above average groups were slightly lower than when measured by R2 and R3 categories.

84. We also looked at RFIs per consent when measured both by value per bedroom and complexity level (Table Seventeen). We expected R3 consents with above average value per bedroom to have the highest number of RFIs per consent – this relationship held with 21.8 RFIs per consent. The level of RFIs per consent increased with complexity and value per bedroom in the about average and above average groups.

85. However, the lowest complexity consents (R1 with below average value per bedroom) actually recorded more RFIs per consent than either R2 or R3 consents in the same complexity category. This may be explained by a relatively low sample set for R1 consents (a total of 78 across all value per bedroom categories).

86. Whilst caution must be taken in interpreting these results as they are based on a subset of our main dataset, they do suggest that the national BCA competency assessment system levels are a suitable proxy for complexity when considering quality issues during consent processing. Broadening the sample for value per bedroom would be a useful next step in order to have more confidence around this, as would exploring other proxies for complexity from consenting data (for example, value per square metre).

Table Fifteen – RFI and Inspection Fail rates by value per bedroom (sample set only)

	Below Average	About Average	Above Average
Value per bedroom range	$16,667 to $76,667	$76,726 to $105,750	$105,750 to $500,000
Spread of consents in sample	33%	34%	33%

Table Sixteen – RFIs per consent by value per bedroom (sample set only)

	Below Average	About Average	Above Average	Total
RFIs / consent	8.2	10.4	15.5	11.4

Table Seventeen – RFIs per consent by value per bedroom and complexity (sample set only)

	Below Average	About Average	Above Average	Total
R1	10.2	8.2	13.4	10.3
R2	7.9	10.4	14.3	10.9
R3	9.2	13.1	21.8	16.3

Quality Information – Requests for Information

Issues with RFI data

87. As RFIs are issued at consent processing stage they are an indication of design capability and quality rather than build quality. They are an important indicator of which clauses of the Building Code are causing the most difficulty for compliance at the design stage, and for understanding whether these difficulties occur in particular complexity types. Since RFIs are about ensuring compliance with the Building Code, they are indicators of meeting the minimum level of compliance, rather than an indicator of the absolute level of quality of any building design.

88. We found a range of variation issues across the BCAs in our dataset. Some of these were BCA operational decisions and style and others were to do with the structure of the data and systems being used. The most common variation was around the bundling of questions in an RFI – some BCAs would ask multiple questions Code clause in a single RFI while others would have one question per RFI. This variation also occurred within BCAs, and tended to vary according to the building officer undertaking the processing. This impacts on being able to accurately account for the number of RFIs. We did not make any adjustments for this variation in our analysis.

89. A number of RFIs would not relate to a Code clause but instead dealt with wider Building Act or planning issues. For example, a BCA may ask for details to be completed about a Licensed Building Practitioner or for a valid Certificate of Title to be completed. Both of these are required to meet Building Act requirements but do not relate to quality issues in terms of the Building Code. Where these non-Code related RFIs did not have a Code clauses associated with them (i.e. the field was blank or used a different identifier), we excluded them from our analysis in order to give a more accurate picture of RFIs relating to design quality issues.

Quality Information – Inspections Data

90. Building inspections occur during the build process, where the BCA undertakes checks at specified points in the building process. An inspection will fail if the building work does not meet the requirements set out in the consented design documentation, and is therefore a way of ensuring that building work is undertaken in a way that meets Building Code requirements (i.e. the minimum quality level).

91. The following section is based on 3,195 inspections for 248 new residential dwelling consents in 2015. This is a smaller sample set than we used for RFI analysis in the section above due to difficulties in accurately matching consents data from all our datasets.

92. While we had a higher number of consents available to us, there were a number of issues (and not consistent across the datasets) which meant we were only able to 'stitch' a smaller number together as a full processing picture. This is not a comment on the consenting systems themselves – which are able to produce this information – but instead an issue with structuring the data for the purposes of this research. We were able to resolve the structuring issues but not in time enough for us to re-run our analysis.

Inspections overall

93. Of the 3,195 inspections we examined, 8.1% were failed and 91.9% were passed.

94. Very few of the failed inspection records included detailed field notes, meaning we were not able to always identify reasons for the fails. We were able to analyse whether inspection fail rates changed depending on the complexity of the build, although the numbers of R1 consents was relatively low (202 out of the 3,195 inspections). This showed us that R3 consents actually had a lower inspections fail rate than R2 (7.7% versus 9.4%).

Table Eighteen – Total inspections by status

	Fail	Pass	Total
Inspections	235	1,485	2,907
	8.1%	91.9%	

Inspections by type

95. Each of the BCAs in our dataset had different inspection checklists. To ensure we could compare which part of the building process inspection fail rates were occurring in, we created a common set of inspection types – foundation inspections, framing, plumbing, other, and finishing. These roughly match the stages of construction, with foundation inspections occurring first, followed by framing, and finishing inspections being the last.

96. Table Twenty outlines inspection volumes by broad inspection type. This shows that the framing group of inspections have the highest fail rates, with 11.9% not passing. The second highest was the 'finishing' category, with 9.4% fail rate. While the finishing inspection fail rates are relatively high, the nature of the checks at that stage of the building process often means that a fail is not always a reflection on the quality of the building work. For example, a number of field notes reference that the builder's paperwork was not ready at the time of final inspection and that this caused them to fail.

Quality Information – Inspections Data

97. With the field notes available in the failed inspections relating to the 'framing' group, we identified a range of reasons for the fails. While incorrect or deficient work was noted at times, other common reasons commented on were (for example):

- Moisture content of framing being too high to allow construction to progress. Other parts of the inspection are passed but the overall inspection is failed until framing timber moisture levels are re-inspected and passed.
- One part of the construction work was not yet completed, and the inspection was 'failed' but work could be continued and the earlier work checked as part of a later inspections.
- Changes or substitutions were made to materials or building systems and consent variations or amendments needed to be processed before being able to pass the inspection.

Inspections by Time Elapsed since Consent Issue

98. Diagram Two shows the relationship between inspection failure and time elapsed since the Building Consent was issued. A number of inspections in our dataset related to consents that were issued a number of years ago. While not strictly part of the dataset for our study, as part of discussing early draft findings we were asked a question about what impact 'old' consents may have on inspection fail rates.

99. We therefore used a broader dataset (beyond our primary focus on 2015) to see if these older consents were associated with higher levels of inspection failures, potentially indicating that one of the reasons they have not been completed is because of quality issues.

100. 81% of inspections were performed either in the same year as the consent was issued or the year after consent was issued. The remaining 19% could have a very long 'life cycle', with some over 20 years old. Fail rates for these older consents tended to increase in relation to length of elapsed time. However, there are limited volumes of consents and inspections beyond year 5 which makes it difficult to draw firm conclusions.

Table Nineteen – BCA inspections grouped for comparison

Inspection group	Inspection example	
Foundations	> Block Wall Tanking > Drainage > Pre-Pour Floor > Pre-Pour Foundation/footings	> Site report > Siting > Sub Floor Drainage
Framing	> 1/2 High Brick > Post Clad/Weathertight > Post Line > Pre-Clad > Pre-Line Incl. Pbg	> Pre-Line-Bdg > Pre-Roof > Pre-Tile Tanking > Pre-Wrap
Other	> Accessibility > Block Work Construction > Concrete Construction > Major Project > Old Consents	> Solid fuel heater > Steel Construction > Strip Off > Swimming Pool
Plumbing	> Comm/Multi/Res Final - Pbg > Plumbing Only	> Pre-Line-Pbg > Residential Final - Pbg
Finishing	> Certificate of Acceptance > Certificate of Public Use	> Comm/Multi/Res - Final > Residential - Final

Table Twenty – Number of inspections and fail rates by inspection groups

	Total	Fail rate
Foundation	1533	7.2%
Framing	730	11.9%
Other	202	3.0%
Plumbing	410	7.1%
Finishing	320	9.4%
Total	3195	8.1%

Quality Information – Inspections Data

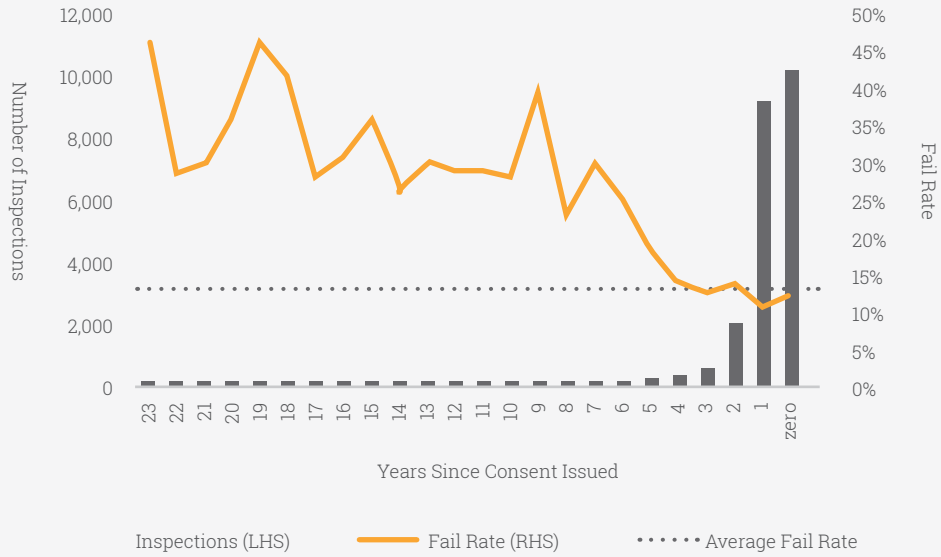
Issues with inspections data

101. The biggest issue we found with inspections data was the lack of common checklists across BCAs. This was more than a lack of naming conventions and extended into the substance of what was covered by each inspection. There were also indications that BCAs had different approaches to the number of inspections needed for relatively similar consents. These variances, while sometimes only small, make it difficult to undertake comparative analysis across BCAs or to look at issues such as quality from a systems perspective. We understand initiatives such as GoShift and work in BCA clusters are starting to address this by developing common approaches and checklists.

102. It was difficult to determine whether an inspection failed because of a substantive issue with the quality of construction or whether the inspection was failed due to a lack of paperwork or because the builder was not fully ready for the inspection. Sometimes the field notes would comment on the reason(s) for the fail, but there was no way of capturing the different types of fail. We note that some BCAs included a 'Pass N/C' or 'In progress' category did not always note the reason for the status.

103. Consent processing systems allow for the capturing and storage of images and videos as part of the evidencing of building inspections. These are a potentially powerful data source when looking at quality issues during the building process. We saw a number of examples where images were referred to in field notes in lieu of a detailed description – such practices can provide very rich information but need strong storage and archiving disciplines if they are to be useful for meta-analyses. There is, for example, currently no meta-data standards or consistency of approach across BCAs using image and video for evidencing purposes.

Diagram Two – Time elapsed since consent issued



Connecting Quality Information to Industry Players

104. Our work is focussed on the link between the type and nature of residential building practitioners and quality issues as expressed by information collected during the building consent process. This chapter brings together the elements covered in earlier parts of this report:

- grouping builders operating in the residential new build market by scale
- number of consents submitted by each group of builders
- number of RFIs per consent by each group of builders as an indicator of quality
- number of failed inspections per consent by each group as a second indicator of quality.

105. To achieve this we constructed a sample set of 1,236 new residential consents from our full set of 2,035. This sample set allowed us to cover builder information, and the number of RFIs. We also used a smaller sample set of 149 consents to test the relationship to inspection fail rates.

Scale of builders operating in sample set

106. In our earlier chapter we established from consents records for 2015 that in New Zealand:

- large builders (30 or more residential dwellings a year) accounted for 37% of dwellings even though they made up less than 1% of the industry
- medium builders (7-30 dwellings a year) accounted for 12% of residential dwellings and made up 3% of all builders
- small builders (less than 7 dwellings year) accounted for 51% of dwellings and 96% of builders.

107. Large builders were more prominent in our sample set, comprising 3.6% of builders compared to less than 1% nationally. Medium builders were also more prominent, though to a lesser degree (3.9% compared to 3%).

108. The difference between the national set and our sample set is likely indicative of the scale and nature of building undertaken in Selwyn District Council and Kapiti Coast District Council in 2015. A wider sample set that included areas with lower rates of growth would likely see this difference reduce.

Number of consents per builder

109. While large builders had stronger representation in our sample set in terms of numbers of builders, this only translated into a small increase in terms of share of consents across the four BCAs covered by our sample set.

110. Large builders accounted for 38.4% of consents in our sample set compared to 37% nationally. Medium builders accounted for 10% versus 12% nationally, and small builders were pretty much exactly the same in terms of consent volume (51.5% for the sample set, and 51% nationally).

Table Twenty One – Percentage of all builders by scale of builder

	National 2015	Sample set 2015
Large builders	1%	3.6%
Medium builders	3%	3.9%
Small builders	96%	92.5%

Table Twenty Two – Percentage of all builders by scale of builder

	National 2015	Sample set 2015
Large builders	37%	38.4%
Medium builders	12%	10.0%
Small builders	51%	51.5%

Connecting Quality Information to Industry Players

Number of RFIs per consent for builder groups

111. Our analysis of RFIs for the full dataset of 2,035 consents showed that on average there were 10.6 RFIs per consent, with a median of 7 RFIs per consent. The sample set delivered a slightly higher average, with 11.3 RFIs per consent and a median of 8 RFIs per consent overall.

112. Looking at builder groups, large builders in our sample set recorded the lowest average number of RFIs per consent with 7.2, and small builders had more than twice this level at 14.5 RFIs per consent. Medium scale builders (who complete between 7 and 30 dwellings a year) had an average of 10.3 RFIs per consent.

113. This analysis demonstrates that both large builders and medium builders, who accounted for 48.4% of new residential dwellings in our sample, have noticeably better quality levels than small builders when measured RFIs per consent. Small builders, who made up 51.5% of dwellings, have lower levels of quality when measured by RFIs per consent.

114. We also analysed the number of RFIs per consent for the different groups of builders by the level of complexity (see Table Twenty Five). Our full dataset showed an increase in RFIs per consent as the level of consent complexity increased – R1 consents had 6.5 RFIs per consent while R3 consents had an average of 15.9 RFIs. Our sample set showed a significant lift in RFIs per consent for R1 consents, increasing from 6.5 for the full dataset to 9.7 RFIs per consent for the sample set. The overall pattern remained the same – RFIs per consent increased with complexity for our sample set.

115. This same pattern appeared across consent complexity for each of the three groups of builders we looked at. Large scale builders had the lowest average RFIs per consent across all the complexity levels, followed by medium scale builders and then small scale builders. This reinforces the overall finding that large and medium scale builders operate with higher levels of quality.

116. While large scale builders had the lowest average RFIs per consent, it is interesting to note that they had the widest spread between R1 and R3 complexity levels – there is a 8.6 gap between the two. This compares to a gap of only 4.2 for medium scale builders and 4.9 for small scale builders. So while medium and small scale builders are associated with lower quality consent applications, they are more consistent across the complexity levels.

Table Twenty Three – RFI's per consent for groups of builders

	Large scale builders	Medium scale builders	Small scale builders	All builders
RFI's / consent	7.2	10.3	14.5	11.5

Table Twenty Four – Average RFIs per consent by consent complexity

	R1	R2	R3	Total
Full dataset	6.5	11.2	15.9	10.6
Sample set	9.7	10.8	15.3	11.3

Table Twenty Five – Average RFIs per consent by consent complexity

	R1	R2	R3	Total
Large scale builders	2.8	7.0	11.4	7.2
Medium scale builders	6.1	10.6	14.3	10.3
Small scale builders	11.9	14.5	16.8	14.5

Connecting Quality Information to Industry Players

117. The influence of spread is also shown when we compare the groups of builders by median RFIs per consent. This shows far more consistency across builder groups and complexity levels, with large scale builders recording the same median level of RFIs per consent as small scale builders across all complexity levels, and medium scale builders having lower median levels at R1 and R2 complexity levels. All three groups of builders have the same median RFIs per consent for their total number of consents.

118. The difference between median RFIs per consent and average RFIs per consent shows that the distribution of RFIs is not symmetrical. Perhaps more importantly, it shows that this distribution plays out differently for each builder group. For example, while all builder groups have the same total median RFIs per consent, the higher average for small scale builders shows that these builders have a distribution with a longer 'tail' of higher RFI consents. Large builders have a much smaller tail, with more consents tightly grouped around the median level of RFIs per consent. This results in large builders having lower average RFIs per consent.

Inspection fail rates per consent for builder groups

119. We also looked at whether inspection fail rates varied across the groups of builders. Our dataset was much smaller for this analysis (149 consents covering 1,268 inspections) due to difficulties in extracting and aligning consent information across the full 'life cycle' of all consents.

120. Table Twenty Eight shows a relationship exists between builder scale and inspection fail rates. Large scale builders have the lowest inspection fail rate at 6.9%, and small scale builders have the highest at 10.6%. This pattern is consistent with what we saw with average RFIs per consent across builder groups.

121. The inspections fail rate sample set was not large enough to reliably draw conclusions by level of complexity for builder groups, primarily due to low numbers of consents put through at R1 and R3 levels by medium scale builders. Analysis of R2 complexity consents showed the same relationship as overall inspection fail rates, with large scale builders recording a 3.9% fail rate for R2 complexity dwellings, medium scale builders a 6.5% rate, and small scale builders a 12.5% rate.

Table Twenty Six – Median RFIs per consent by consent complexity by builder group

	R1	R2	R3	Total
Large scale builders	7.5	8	10	8
Medium scale builders	7	7	12	8
Small scale builders	7.5	8	10.5	8

Table Twenty Seven – Maximum RFIs per consent by consent complexity by builder group

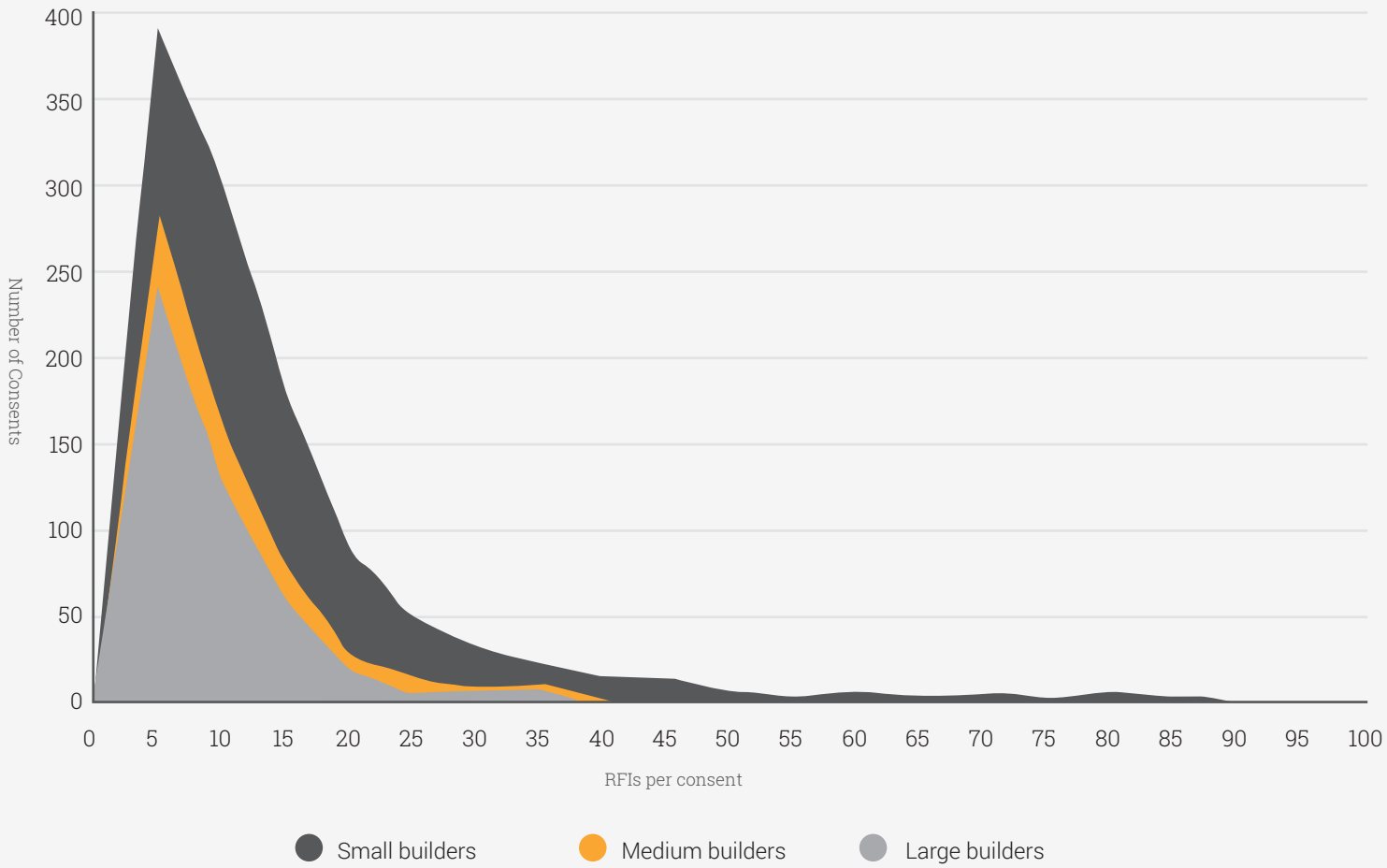
	R1	R2	R3	Total
Large scale builders	8	82	45	82
Medium scale builders	17	66	39	66
Small scale builders	79	99	76	99

Table Twenty Eight – Inspection fail rates by builder group

	Large scale builders	Medium scale builders	Small scale builders	Total
Inspection Fail Rate	6.9%	8.3%	10.6%	9.3%

Connecting Quality Information to Industry Players

Diagram Three – Frequency distribution of RFIs per consent by builder groups



Conclusion

122. Our work indicates that there are two main options for influencing quality during the consenting and build process:

- By focusing on the 4% of medium- and large-scale builders who record the highest levels of quality across 50% of new residential builds. This would require finding ways to influence a smaller group to lift their quality even further.
- By focusing on the 96% of small-scale builders who record the lowest levels of quality across 50% of new residential builds. This would require influencing a large number of players to, for example, reduce the long 'tail' of high-RFIs per consent.

123. Each of these options require different approaches in order to successfully influence groups of builders who structure their businesses in very different ways. For example, larger builders who have higher levels of subcontracting are likely to respond to different initiatives and incentives than smaller builders who tend to be the ones subcontracted.

124. Our work has shown the potential value of the information collected and held in BCA consenting systems. As more and more consents across New Zealand are being processed electronically, the information generated will become increasingly valuable.

125. However, its use to understand system-wide issues is hampered by a lack of data standardisation or connections across the datasets. This occurs at two levels:

- connections across BCAs so that data on quality (for example) is easily compared or aggregated to show a system-wide picture
- connections between consenting systems and other datasets that allow deeper understandings about who is building and how they operate in order to inform system initiatives.

126. We note that some initiatives, such as GoShift, are attempting to tackle some of these connections. These need to be supported by work at a national level to ensure, for example, that something like the New Zealand Business Number is used across the various systems which then provides a common identifier across datasets.

127. The addition of consenting data to the Integrated Data Infrastructure would allow more powerful analysis around residential and commercial construction activity. Improvements such as these would mean tools such as persona would not be needed as connecting devices, but instead could become richer analytical tools in themselves.