New house construction quality survey

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Introduction

This project was undertaken by the Building Research Association of New Zealand (BRANZ) in 2014 and involved the inspection of New Zealand houses under construction. The reason for the project was to investigate media reports of widespread quality defects in new housing. The work included an estimate of the size of the apparent problem and the type of defects that were most common. Builders were surveyed in a different survey by post on their challenges in producing quality work.

Main results

The analysis was for two main categories of defect, building code compliance defects, and aesthetic or quality of workmanship defects. The former mainly relate to structural and weather-tightness issues and the latter to finishes on surfaces and fittings. The main findings were:

- An estimated 9% of all new housing had a level of compliance defects classified as serious.
- These compliance defects related to improper flashings at openings, lack of timber connectors, inadequate holding down anchors, poor fixing of window frames, loose underlay and structural framing cut-outs and deformation. The average number of these per house was 2.2.
- There was also a large number of defects related to poor surface finishes, poor fittings installation and inadequate insulation. The average number of these per house was 4.3.
- In the builder's postal survey lack of adequate details on drawings, and lack of skilled labour were than main impediments in producing quality work.

Method

A total of 225 houses were inspected on site during construction. Inspections were done by a firm of experienced building surveyors. Houses were inspected at 3 stages, namely, after fixing of the wall underlay, pre-lining, and at final completion. The first enabled the openings to be inspected for flashing tapes, flashings and cavity battens. The second inspection checked for framing quality (straightness, cut-outs), insulation, timber connectors and holding down anchors. The final inspection was of the surface finishes and the fittings (e.g. doors, showers, benches, electrical and plumbing fittings, cupboards and other joinery.) It also inspected the wall and roof flashings, and claddings.

The method was to contact the council on what inspections were due that week for council inspection. This project inspectors would then visit the site, explain the project, ensure confidentiality, and obtain approval to inspect. Almost always approval was granted.

The inspections occurred in 5 cities, Auckland, Tauranga, Hamilton, Wellington and Christchurch. It was initially intended to do the three staged inspections on each house but this proved difficult to

arrange in practice. The result was that very few houses were inspected more than once and the 225 inspections were almost all on different houses.

It was somewhat arbitrarily decided that 4 or more building code compliance defects in one house was a cause for concern and these houses were classed as "serious". About half of the inspections were at completion (and before the owner had moved-in) and after the council code compliance inspection had been done. The other half were during construction and usually on the day of the council visit. It was assumed that 50% of the compliance defects detected and recorded by our project inspectors were subsequently picked up and remedied.

To get another viewpoint, namely the builders, the project also undertook a postal survey of builders to ascertain the problems they have experienced in building quality houses. This was additional to and separate from the sample of houses inspected on-site. A total of 108 responses were received for this survey.

Main results

The proportion of houses with number of defects is shown in Figures 1 and 2. For the compliance defects, in Figure 1, only 18% of houses had zero defects, and 19% had 4 or more compliance defects. The average number was 2.2 defects per house. As described above we have allowed for half of compliance defects to be remedied. That leaves about 9% of houses with 4 or more defects, which we have classed as "serious".

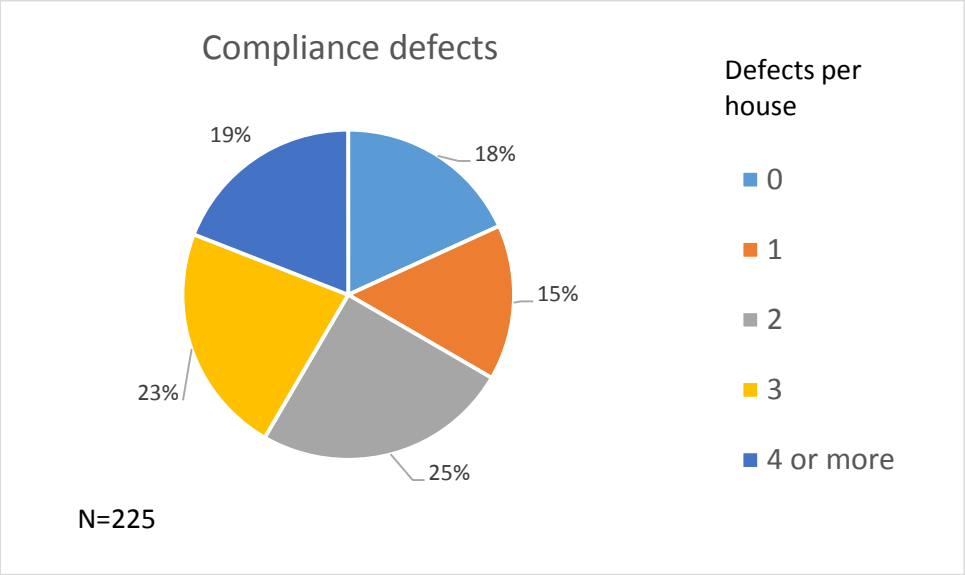

FIGURE 1 Incidence of compliance defects

The frequency of aesthetic defects are shown in Figure 2. Only 8% of houses had none of these defects. The average number was 4.2 per house. Most of these aesthetic or quality of finish defects were picked-up in the final inspection and after the issue of the code compliance certificate and builder completion. So they have not been initially remedied by the builder and would require the owner to call back the builder to fix them, assuming he/she is aware of what a reasonable standard of finish should be expected. It is quite disappointing that there are a significant number of these. For example, 20% of houses had 6 or more aesthetic defects.

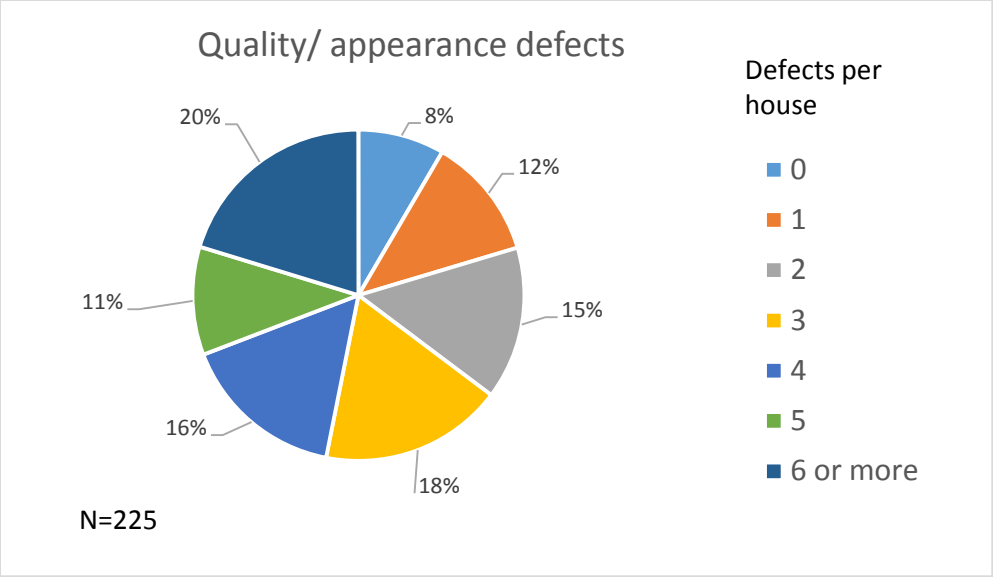

FIGURE 2 Incidence of aesthetic defects.

What type of defects were found?

Figure 3 shows the incidence of defects by type. The most common defect was the wall insulation was not correctly fitted in parts of the house. Two other aesthetic defects, protruding nogs and straps and bowed wall frames affects the evenness of the wall finish and were quite common. The quality of interior paint finish was also a frequent area of concern. Fixings to the wall cladding, such as drainpipes and lights were often without sealing washers.

The most common compliance defects were inadequate fixing of windows to the building frame, loose wall underlay, and poor head flashings to windows. Structural compliance defects include large cut-outs in the timber frame and inadequate holding-down (HD) anchors which secure the frame to the floor slab. Window seal and scribers defects were also common. Penetrations through the wall underlay and cladding are sometimes not adequately sealed with tape. Window scriber defects were gaps between the window frame and cladding, usually associated with weatherboard profiles. Path to cladding clearance refers to concrete poured too close to the wall cladding. In the case of brick veneer this defect sometimes blocked the drainage holes of the veneer cavity. There were several other compliance defects, not further described, but included on the chart.

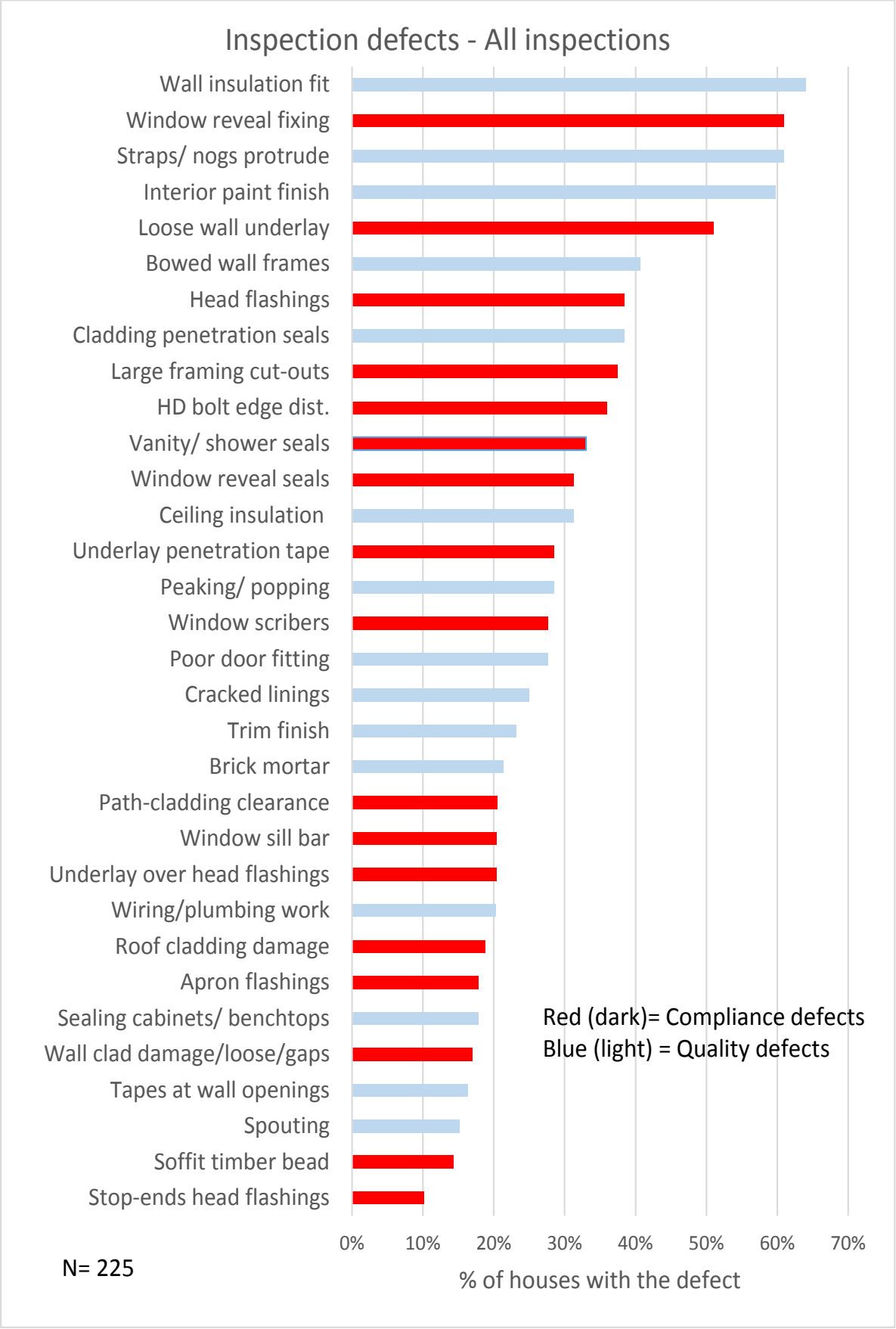

FIGURE 3 Type of defects

Postal survey to builders

This survey asked for builders to indicate what issue affected them in producing quality work over the previous 12 months. The areas canvased included drawings, skills, sub-contractors and materials. The results are summarised in Figure 4 and show that inadequate details on the drawings, and shortage of skills were the main inhibiting factors.

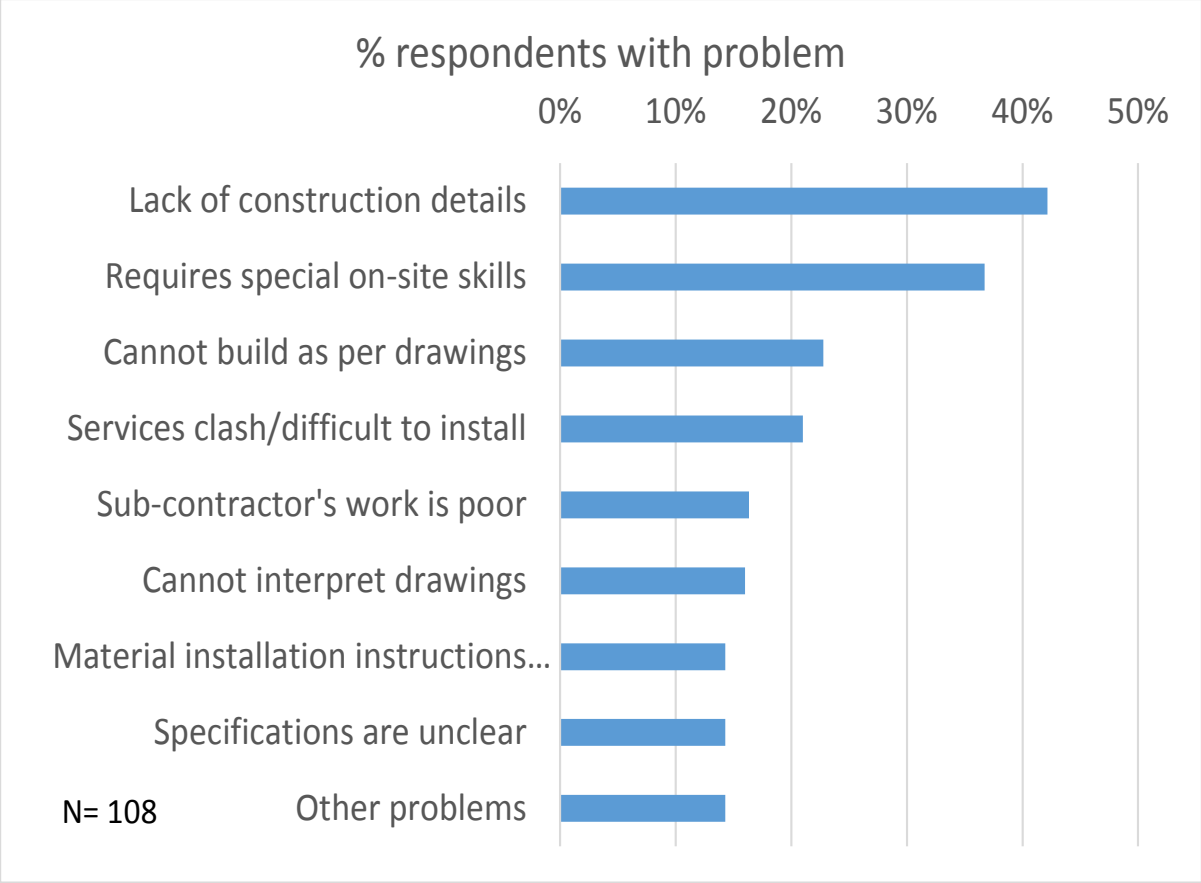

FIGURE 4 Postal survey to builders

Discussion

The inspectors recorded all defects that they saw and in many cases this was only one instance, confined to a small area of the component. For example, a single flashing that was wrongly installed, or an isolated paint run, or one HD anchor not located correctly. So the expected standard of compliance and quality was high, and owners rightly expect this.

The most common defect was the wall insulation was not correctly fitted in parts of the house. These were minor gaps or undue compression of the insulation piece, usually confined to a small area. It was decided to classify this as a quality defect rather than a compliance defect, though it does not conform exactly to Clause H1 of the building code. Similarly, fixings to wall claddings without flexible washers were quite common, potentially allowing moisture entry. This is a possible compliance issue but since it was an isolated occurrence on any one house, and on a drained wall cavity, it was classified as a quality issue.

For compliance issues the most common defect was inadequate fixing of windows to the building frame. Eighteen months or so before the inspections the fixing requirements for windows were increased and many builders were unaware of these changes.

Loose wall underlay relates to concerns about bridging between the wall insulation and the cladding which could allow moisture transfer across the wall drainage cavity. Window flashing defects included inadequate length or overhang, nil slopes on the profile allowing water ponding, inadequate clearance to the cladding and missing flashings near the eaves. These are vital elements in ensuring a control of moisture and builders should be installing these correctly 100% of the time. Structural compliance defects include large frame cut-outs, and frame HD anchors located too close to the slab edge and liable to spall under load. There is some redundancy in framing but sub-contractors need to be less cavalier when doing their work.

There was a high incidence of aesthetic defects, most of these found after issue of the code compliance certificate and after the builder had left the site. They would require the owner to call back the builder to fix them. This assumes he/she is aware of what a reasonable standard of finish should be expected. It is concerning that there are a significant number of these. For example, 20% of houses had 6 or more aesthetic defects.

We asked builders about their challenges in doing quality work. They indicated they are often hindered by inadequate details provided on drawings. They also suffered from a shortfall in skills. A comments section was provided in their survey form, and as well as specific comments on skills and drawing details, the builders noted council requirements were often quite onerous. Seven respondents (i.e. 6%) said they had few or no problems and that management of, and partnership with, trusted designers and sub-contractors was the solution.

This project was undertaken at a time of rapidly increasing demand for new housing after a period of 5 years of low demand. The industry is struggling to adapt to this increase and while trainee numbers are increasing it will take some time to have an adequate number of skills.

The full report[1] is on the BRANZ web-site, www.branz.co.nz, click Study Report.

Conclusions.

Designers need to provide sufficient details, appropriate to the complexity of the work. They should explain to their clients the value of this for producing a quality house.

Building firm owners need to support their charge hands (i.e. their licenced building practioner) in obtaining adequate details from the designer.

The building control authorities (i.e. the councils) should consider the skill level of the builder at consent application time. They need to closely inspect the adequacy of the documents of inexperienced builders so that compliant houses are built.

Builders need to ensure they are up-to-date with the building code amendments, including the acceptable solutions.

The survey should be repeated at 5 year intervals to monitor progress in improving compliance and quality in new housing.

[1] Page I (2015) New housing construction quality survey 2014. Study Report 335, BRANZ, Wellington.