IN THE CANTERBURY EARTHQUAKES
INSURANCE TRIBUNAL CEIT-XXXX

IN THE MATTER OF	CANTERBURY EARTHQUAKES INSURANCE TRIBUNAL ACT 2019
BETWEEN	BRL Applicant
AND	EQC First Respondent
AND	IAG Second Respondent

Date: 23, 24 January, 10, 11, 12 March, 3, 4, 5, 19 June 2020

Appearances: A and K Cowie for the Applicant
No appearance for the First respondent
R Raymond QC, C Jamieson and M Gall for the Second Respondent

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RESERVED DECISION OF C P SOMERVILLE
13 July 2020

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Background

[1] When Canterbury was struck by a 7.1 earthquake centred near Darfield, east of Christchurch on 4 September 2010, the Cowies were asleep in their new home, between

Prebbleton and Lincoln. The strong motion seismograph closest to them recorded ground acceleration forces of 0.914g.[1] Another, slightly further away in the opposite direction, recorded ground acceleration forces of 0.878g. These forces are amongst the highest recorded in Canterbury and compare with 0.36g at Kaiapoi, 0.297g at Christchurch airport, and between 0.17g – 0.38g recorded in Christchurch city.[2]

[2] The Cowies say that this earthquake caused damage to their home, owned by their company BRL and insured with IAG. Specifically, they say that it caused structural damage to the foundations, floor, and superstructure of the building and damage to the effluent disposal system. It also caused aesthetic damage to the concrete floor. They maintain that this damage can only be addressed by a total rebuild of the home, estimated to cost $876,422 including GST.

[3] EQC, the statutory insurer, responsible for covering the initial $100,000 plus GST, has taken no part in the hearing and simply abides the decision of the Tribunal.

[4] IAG is bemused that so much time and energy is being devoted to a claim about a building they say is virtually undamaged.

[5] The Cowies explain the "all or nothing" nature of this dispute, by claiming that Mr Cowie is the victim of retaliation by IAG for his outspoken public criticism of the insurance response to the Canterbury earthquakes. In their view, a ruling from this Tribunal on the important principles at stake in this claim, such as how to repair aesthetic damage and whether proportionality is an appropriate consideration when determining contractual responsibilities, will benefit many homeowners besides themselves.

[6] IAG denies acting in bad faith and wonders whether the Cowies are seeking a large cash pay-out with which to build their dream house. The Cowies deny that, saying they are only interested in having their present home repaired.

[7] Although all parties have responsibly attempted settlement on several occasions, the homeowners and their insurer are too far apart philosophically. This case has all the hallmarks

[1] The Lincoln Food and Crop strong-motion sensor.
[2] Undated GNS map. Although the accuracy of this data is open to challenge, it is sufficiently accurate for comparative purposes.

of a claim being driven beyond reasonable lengths by matters of principle. To break the deadlock, I went to the trouble of advising the parties at the conclusion of the hearing of the likely outcome but am pessimistic about them using the opportunity to resolve their dispute when they can await the release of the decision and challenge it on appeal if necessary.

What BRL seeks

[8] BRL seeks the following declarations:

(a) that the claim is over the EQC statutory cap and that EQC pay BRL $115,000 including GST, less any excess;

(b) that the insured building has suffered earthquake damage such that it is beyond economic repair and requires replacement;

(c) that the driveway is damaged and that EQC are to pay BRL $9,990 excluding GST to settle the land claim, plus interest from 23 June 2017 (the date of the quotation to undertake this work);

(d) that the Oasis Clearwater system has been damaged beyond economic repair and requires replacement;

(e) that the external sewer and stormwater systems are damaged beyond economic repair and require replacement;

(f) that IAG reimburse BRL for the cost of rebuilding the home on the site, and pay:

(i) architects', engineers', surveyors', building consultants', legal and Council fees;

(ii) the cost of demolition and of removing debris and contents;

(iii) $2,500 including GST to restore or reconstruct any part of the garden or lawn that has been damaged or destroyed while the home is being rebuilt;

(iv) a stress payment of $1,000 including GST; and

(v) the cost of alternative accommodation during the rebuild up to a maximum of $20,000 including GST.

Approach

[9] I intend to start my analysis by taking an overview similar to the desktop study an engineer undertakes before carrying out a site inspection. I will then examine the credibility of the various witnesses before investigating the alleged damage, looking at the policy standard, and reviewing the respective repair strategies.

Overview

[10] Although this claim is being considered by the Tribunal in proceedings that are inquisitorial in nature, that does not relieve the Cowies of the responsibility for establishing their claim. IAG is under no obligation to have its own hypothesis and may, if it wishes, restrict itself to challenging the claimant's hypothesis.

[11] It is traditional to speak of a "chain of evidence", but that evidence is less like a chain and more like a rope, where each strand, no matter how weak, can bind together to form a strong enough conclusion to satisfy the appropriate standard of proof.

[12] It is the civil standard of proof that applies to this claim: the Cowies must prove that it is more likely than not that:

(a) their home has been damaged;

(b) the cause of that damage was the earthquake; and

(c) the method of repair proposed by EQC/IAG to restore their home to a condition as similar as possible to when it was new is unreasonable.[3]

[3] *M v IAG New Zealand Ltd* [2019] CEIT 0047 and *H Trust v Southern Response Earthquake Services Ltd* [2019] CEIT 0011.

[13] The next part of this overview involves examining the nature of the earthquake, the ground, the foundations, and the superstructure before deciding what damage might be expected under those conditions.

4 September 2010 Earthquake

[14] The rupture of the Greendale Fault near Darfield resulted in ground movements likely to have serious consequences for man-made structures. Although it is not possible to be precise about those forces on the Cowies's property, Mr Thompson, BRL's geotechnical engineer, estimates that the ground under their home experienced a near ULS event, defined as being a 1 in 500 year earthquake.[4] Structural engineers use a slightly different method to calculate the forces applied by the earthquake to structures. The Cowies structural engineer, Mr Weber, says that those forces were in the vicinity of 0.82g and exceeded those for a ULS event which, on this site, he estimates would have been 0.7g.

[15] IAG's engineer, Mr Lewis, agreed with the 0.82g calculation, but volunteered out that a study of all the recording stations around the Canterbury region would demonstrate that earthquake shaking was subject to a whole range of variables and differed from point to point. He also attempted to reassure Mrs Cowie that he appreciated the severity of the shaking at her house by comparing it to the shaking he experienced on 4 September 2010 at his house in West Melton, noting that his house was significantly closer than the BRL property to the Greendale Fault epicentre. When he made this comparison, he must have believed that the shaking was worse at his property, but the GNS map of the results from the measuring stations in the region demonstrates that the forces at his property were likely to be less than half of those likely to be experienced on the BRL property even if his property was closer to the epicentre, which is questionable.

Ground

[16] The Cowies's home is in an area identified by MBIE as Green Zone, Technical Category two (TC2), yellow, meaning that minor to moderate land damage from liquefaction is possible in future significant earthquakes.

[4] Standards New Zealand AS/NZS 1170.0.

[17] The Selwyn District Council has classified the site as having potentially liquefiable ground. A plan prepared by the Council shows that, immediately after the 2010 earthquake, it observed liquefaction on a neighbouring property to the south.

[18] Aerial photographs, supported by a plan drawn by Mr Cowie, establish that liquefaction ejecta appeared at the same time on BRL's property but not around the house site, the nearest sand boil being about 50 m away.

[19] A geotechnical investigation involving shallow tests using dynamic cone penetrometer and hand augers at each corner of the house was conducted in June 2012. Mr Thomson, the only geotechnical engineer who provided evidence to the Tribunal, reviewed these test results and looked at hand auger logs taken when the effluent treatment system was being installed, before commissioning further tests to obtain more accurate results. He concluded from this data that silty clay extended below organic topsoil to about 0.8 m depth below ground level where it was underlain by various clay and silty sand layers extending to 2.0 to 2.7 m generally. Below these depths, gravel material was encountered in nearly all the test locations.

[20] Mr Thomson analysed this data to determine whether the land performed as TC1 or TC2, concluding that it had been properly classified as TC2. Although he admitted in cross-examination that there was an error in his calculations for one of the sites, he maintained that his conclusion was still justified. Certainly, as Mr Cowie pointed out, testing is normally undertaken to 20 m before MBIE makes its classification decision whereas, in this case, no testing was undertaken below 2.8 m. Despite there being no evidence to the contrary, I am rather cautious about this evidence, and base my decision on a finding that the site performs at the low end of TC2.

Foundations

[21] The design of the building and its foundations, built in late 2009 and early 2010, has more in common with farm or light commercial buildings than it does with residential buildings of the period.

[22] Although there was much debate as to whether this building was a domestic dwelling, a temporary dwelling, or a farm utility shed, I do not consider that this discussion served any useful purpose:

(a) the building was designed as an Importance Level 2 structure, meaning that the design parameters were the same as for a conventional domestic house;[5]

(b) the Selwyn District Council, which issued a building consent for the building and subsequently issued a Code Compliance Certificate at the completion of the building works, described the building as a "detached dwelling";

(c) at the time of the earthquake it was being occupied by the Cowies as their home; and

(d) although a greater part of the building was being used for storage purposes than would be normal for a conventional domestic house, very little, if any, of the equipment being stored was agricultural.

[23] The Joint Expert Report (JER) provided to the High Court by the parties' three engineers, described the foundations as follows:

> The foundation system consists of the foundation ground, subbase which consisted of well compacted gravels of around 350 to 400mm thickness, damp proof membrane, polystyrene under the living room, bathroom and kitchen area, cast in elements such as plumbing, reinforcing steel in the pad foundation and perimeter beam areas and reinforcing mesh throughout the slab and concrete.
>
> The top of slab was machine floated to a high standard of finish.
>
> Foundations consist of pad foundations under portal frame legs and other steel posts. These pad foundations vary in size depending on loading. The larger pads shown on the structural drawings are 700 x 700 x 700mm deep and the smaller pads are 500 x 500 x 700mm deep. The arrangement of pads to the slab and slab thickening means that the perimeter pads are 700mm deep into the ground (i.e. 900mm below top of slab or 700mm below external ground level). Pad foundations are reinforced with 4012 and 4 x D10 stirrups. It appears that the pads were poured to ground and as such are likely to be oversized. In the Topografo report they are referred to as having dimensions of 1000mm and 800mm to 900mm deep.
>
> The slab is 100mm with D147 Double Edge Mesh. There is 40mm thick polystyrene under 12m x 8m area of slab in the Lounge/Bathroom/Kitchen area. The record drawings note the polystyrene used was second grade.

[5] Building Regulations 1992, sch 1 cl A3 [Building Code].

[24] Both engineers agreed that photographs taken by Mr Cowie showed that the base course material was well-graded and would have been well-compacted to a hard surface by the 3.5 tonne roller used to compact it.

[25] I regard this 350 – 400 mm deep base course layer as a significant improvement to the strength and stability of the ground under the building.

Superstructure

[26] The JER contains the following agreed description of the superstructure:

> The structure is formed from steel portal frames founded over reinforced concrete pad footings. These portal frames are braced in the orthogonal direction using diagonal braces to the roof and walls providing lateral restraint, along with sheet bracing elements.[6]
>
> Externally the building is clad with profiled metal sheeting to both walls and roof, which is fully serviced by guttering.
>
> All windows and doors are double glazed and aluminium frames except the toilet and bathroom windows which are double glazing in NK PVC and metal frames.
>
> The internal walls and ceiling are lined with plasterboard in the living room, kitchen, bathroom, bedrooms, stair walls, one wall of the mezzanine floor and office. The walls through the garage section are unlined or lined with exposed plywood sheets.
>
> A mezzanine floor is supported on timber framed walls with timber joists forming the floor.
>
> There are three large sectional garage doors. These are cedar clad and are insulated.
>
> The garage space contains several rows of high-level racking providing storage which is formed from timber built directly off the concrete slab.

[27] From the outside, the building resembles a barn with a pitched gable roof and a lean-to on the western side. The original plans, prepared by Mr Cowie and submitted in August 2009, described the building as "proposed barn". The Cowies admit that the family referred to it as "the barn".

[28] The building consent issued by the Selwyn District Council on 8 October 2009 described the property as "Garage/office/domestic dwelling". The intended use was said to be "non-habitable" but this is probably an error copied out of an earlier PIM, as the application

[6] "Orthogonal" means "at right angles".

for the building consent had described it as habitable and the plans accompanying it showed a kitchen and a double bed in the lean-to area. There is no doubt that it was designed as a habitable Importance Level 2 building.

[29] Although none of the documentation held by the Council specify the New Zealand Standards used in its design, both engineers agree that the appropriate standard is NZS 1170, rather than NZS 3604 commonly used for the design of timber framed domestic dwellings. There was much debate during the hearing about whether this was a "lean" structure, but I did not find the discussion helpful. I find that the building was designed and built to satisfy the New Zealand Building Code for an IL2 building.

[30] I regard the concrete slab as being properly designed for its purpose and consider that the superstructure was designed to be light but strong and stiff.

Analysis

[31] The New Zealand Building Code sets earthquake performance standards for building design:

(a) Buildings are to be designed to protect the occupants from a loss of amenity through deformation, vibratory response, degradation, or other physical characteristics caused by a 1 in 25-year earthquake (called an "SLS event").[7] If this design standard is met, then no repair will be required to the structure or non-structural components after such an event.[8]

(b) By contrast, the design standards for a 1 in 500-year earthquake (a ULS event) are to protect the physical safety of the occupants from building rupture, instability, loss of equilibrium or collapse.

[32] These design standards, therefore, tolerate loss of amenity and/or the failure of structural or non-structural components caused by earthquakes falling between these two design parameters so long as they do not result in building rupture, instability, loss of equilibrium, or collapse.

[7] Building Code, cl B1.3.2.
[8] AS/NZS 1170.0 at [3.4.2].

[33] Bearing in mind that Mr Thompson, using the conservative calculations adopted by geotechnical engineers for calculating ULS, estimated that BRL's property experienced a "near ULS" event, seismic damage to the building was predictable.

[34] The parties' structural engineers, who use a different formula for calculating ULS, accepted that the building survived a beyond ULS event in the September 2010 earthquake and were largely in agreement about the damage that could be expected, taking into account the size of the earthquake, the soil structure, the well-prepared base course and the nature of the building.

[35] Mr Weber, the engineer called by the Cowies, said he would expect to see:

(a) dislevelment and excessive floor slopes in the floor slab;

(b) cracks in the floor slopes;

(c) voids under the floor slab;

(d) possible damage to the damp proof membrane between the compacted base and the floor slab;

(e) damage (buckling) of the tension bracing;

(f) random leans in the portal frame;

(g) wall lining damage,

(h) leans and racking in the joinery;

(i) damage to the heavy garage doors;

(j) some damage to the Oasis Clearwater effluent treatment system; and

(k) some differential settlement in the driveway.

[36] Although IAG's engineer, Mr Lewis, would not have expected to see voids or damage to the damp proof membrane, he largely agreed with Mr Weber, saying that after an earthquake event of this nature he would expect to see:

(a) cracking;

(b) some dislevelment if the slab had been perfectly level before the earthquake;

(c) damage to the tension bracing;

(d) damage to internal linings; and

(e) some racking in the joinery, door frames, and window frames.

Credibility

The applicants

[37] Mr Cowie is an intelligent and articulate person whose professional work is well respected. He has passionately held views about the way insurers and the authorities have handled the earthquake claims process and is quite outspoken about them. He is not afraid to speak his mind in public or confront authorities if he believes they are wrong. I hold none of that against him.

[38] But I was troubled by his dealings with the Selwyn District Council at the time he was designing this building as a home for his family. The Cowies had sold their former family home and were living in temporary accommodation at the time. The consent process needed to be as speedy as possible as they were under pressure to leave. To short-cut the process, Mr Cowie was less than frank with the Council about his intentions. Although he says he intended, from the outset, that this building would house his family, he concealed this from the Council for many months. Over the seven-month planning process the building morphed from a "barn" to a non-habitable "domestic garage with office/workshop, sanitary facilities and solid fuel heater" to a "workshop/office/studio". At no stage has the Council been told that his office is

now in the south-eastern corner of the house, that the room alongside it is a bedroom, or that the family's children slept on the un-lined and uninsulated mezzanine floor for some time.

[39] Although I appreciate that Mr Cowie's desperate housing situation possibly overcame his scruples, it demonstrates to me that there are occasions when he believes that the end justifies the means. I am therefore cautious about accepting any self-serving evidence from him that is not corroborated by other sources.

[40] I have no such reservations, however, about Mrs Cowie's evidence. She is more than capable of holding Mr Cowie to account and clearly felt able, during the hearing, to remonstrate with him in public. She has left her husband to carry the burden of the technical side of the claim but has a good grasp of the legal issues involved.

The engineers

[41] All three engineers, Messrs Thompson, Weber and Lewis, were criticised as being less than impartial.

[42] Mr Thomson's geotechnical report was not impressive. Not only did it contain a mathematical error that undermined his conclusion that the foundations had suffered differential settlement resulting from liquefaction, but he himself down-played his initial report on which his evidence was based as being prepared simply to support the design for new foundations that would be required if the building were to be demolished and re-built. I note, however, that his report is dated 23 June 2017, only a week before Mr Cowie's own report and about a month before Mr Weber's. In any event, his disavowal of it as a report into the causes of the alleged earthquake damage indicates that he himself does not consider that he undertook enough research/investigation to warrant his conclusion.

[43] Mr Weber was challenged about his limited earthquake engineering experience, at least half of which involved working alongside Mr Cowie. I do not accept, however, that his association with Mr Cowie led to him giving unreliable evidence. I consider that he is a careful and intelligent engineer who put a good deal of thought into his report.

[44] I can see, however, that Mr Cowie is not an easy person to have as a client and my impression is that there were occasions, in relation to the roof replacement as one example and

the voiding issue as another, where Mr Weber allowed himself to be pressured by Mr Cowie into maintaining a position that was not professionally sustainable.

[45] Mr Lewis was challenged about his association with a private company offering professional indemnity insurance to engineers. Although he may be neither a shareholder nor an officer in that company, he attends its board meetings and has intimate knowledge of its insurance arrangements, including a long-standing association with IAG. Although I do not consider that this disqualifies him from giving evidence, it alerts me to the possibility that he might have a greater understanding of insurance practices than would the average engineer.

[46] Mr Lewis is a very experienced and competent engineer. He holds a senior position in a large firm and has long experience with earthquake related engineering issues. He is also intelligent and articulate. However, I felt that he was too alert to burden of proof issues and I noted the lack of supporting calculations in his initial report. Moreover, the 35 pages of diagrams and calculations he made in respect of the 2013 wind event were misguided. Although he made some other calculations during his evidence, they were made "on the fly" and were not always correct. I also felt that his comments about the strength of the earthquake, the strength of the superstructure, the September 2013 wind event, and the design of the saw cuts were argumentative and not particularly relevant.

[47] I appreciate that it cannot have been easy for Mr Lewis to be cross-examined by Mr Cowie who has been very personal in his criticism of him, but he should bear in mind the following comments made by Fisher J in *Wrightson Ltd v Fletcher Challenge Nominees Ltd*:[9]

> Nothing destroys an expert's credibility quicker than the spontaneous volunteering of evidence sought to score points for their "side"; a uniformity of arguments all pointing in the same direction; an unwillingness to consider anything which might point the other way; a readiness to advance matters which fall outside the expert's strict area of expertise; the volunteering of arguments which are not directly responsive to questions; and a tendentious style of delivery.

[9] *Wrightson Ltd v Fletcher Challenge Nominees Ltd* HC Auckland CP129/1996, 21 August 1998 at 21–22.

Damage

Dislevelment

[48] "Damage" in the context of an insurance claim is "a physical alteration or change, not necessarily permanent or irreparable, which impairs the value or usefulness of the thing said to be damaged."[10]

[49] This damage assessment begins with Mr Cowie's "heat map" in Figure 1 showing the dislevelment in the floor slab.

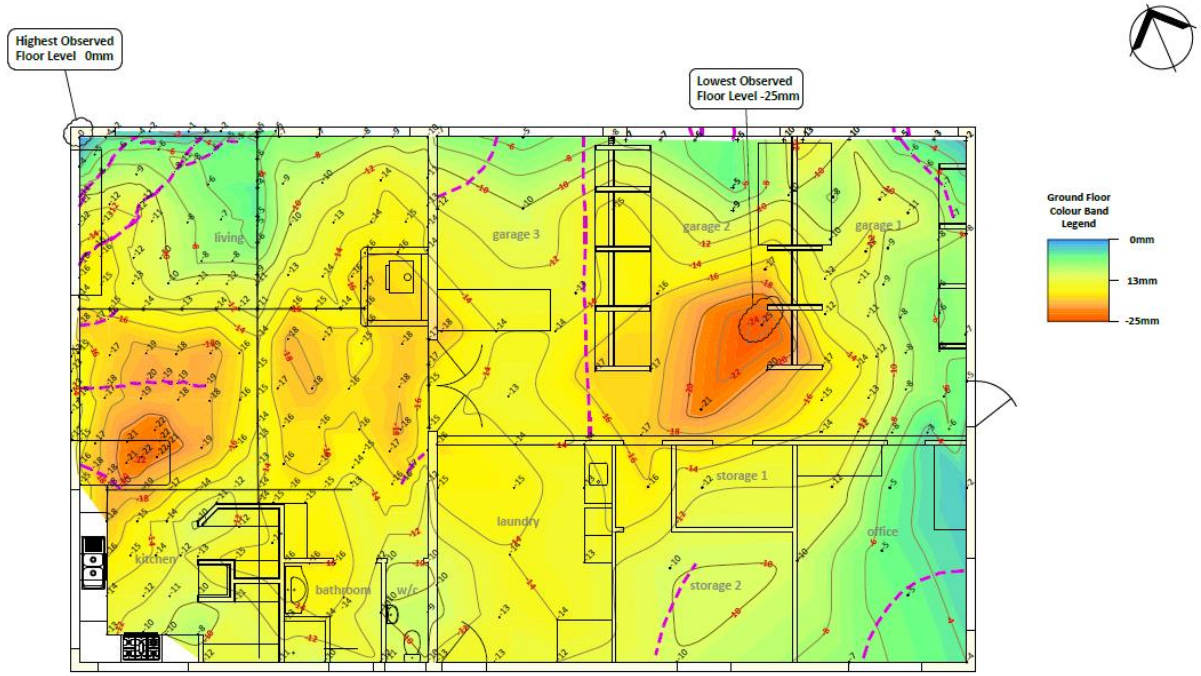

Figure 1: Floor levels, Contours, Coloured Height Bands, and visible cracks. 13 December 2016

[50] As can be seen, this plan was first issued in December 2016, more than six years after the September 2010 earthquake. The date on the plan, however, is the date upon which the plan was compiled and not the date (or dates) on which the measurements were made. Although much was made of the delay in preparing this plan, I do not believe that its credibility or accuracy is affected. It remains what it purports to be: a survey of the floor profile in late 2016.

[10] *Parkin v Vero Insurance New Zealand Ltd* [2015] NZHC 1675 at [36].

[51] What is not obvious at first sight, is that the scale used in the preparation of this plan is far smaller than Mr Cowie has used to prepare similar plans. For example, this plan has contour lines at 2 mm intervals and uses 25 different coloured height bands between 0 and 25 mm, whereas the plan he prepared for the *H Trust v Southern Response Earthquake Services Ltd*, another Tribunal case, had contours at 5 mm intervals and used a similar number of coloured height bands to span 76 mm.[11] Had the present plan been prepared using the H Trust scale, there would have been only five contour lines and five coloured height bands, all in shades of green.

[52] IAG contends that the total dislevelment of 25 mm is within construction tolerances, despite that being generally accepted as at the upper level for older, timber framed, houses built on piles and perimeter footings.

[53] Mr Cowie denies that the total dislevelment is within construction tolerances, and cross-examined Mr Lewis on this point at length. He makes the point that this is a modern building constructed using accurate measurements, and says that construction tolerance is always spoken of as a plus or minus figure. Mr Weber, for example, says that it is ± 6mm. All that means, though, is that the difference between the highest point and the lowest point is 12mm. Naturally, it all depends on how the datum point is selected. Mr Cowie finds the highest point and scales down from that; he could just have easily scaled up from the lowest point or scaled either side of the median measurement.

[54] Mr Cowie's argument assumes that concrete placers work off the height of the boxing, these days using a laser level. I am satisfied that there was a laser level set up on-site on 21 October 2009 when the concrete slab was poured. I also accept that Mr Goodwin, the construction manager of the company that built the building, was present that morning for an hour or so while the concrete was being poured and saw the laser level being used by the concrete placers, Precision Concrete Placers of Ashburton. I also accept that the laser level was likely to have been used every 3 meters across the floor to confirm that the height of the concrete in the slab matched the height of the boxing. Finally, I accept that this is a very accurate way to level a concrete slab and will, as Mr Goodwin said, generally result in a level of accuracy of ± 6 mm over 3 metres.

[11] *H Trust v Southern Response Earthquake Services Ltd* [2019] CEIT 0011 at [121]–[122] and Figure 2.

[55] This rectangular slab, however, was 12 m wide and 20 m long, requiring three laser height checks across the width and five down the length. I am aware that these construction tolerances are not cumulative, but this highlights that there were 15 opportunities for errors to creep in.

[56] In addition, the height of the boxing varied around the slab which, would have created some issues for the concrete placers if those variations had been present at the time the slab was poured.

[57] Thus, the levelness of the slab, even assuming the use of the laser level, would depend on the skill of those using the level and the degree of precision used by the builders when constructing the perimeter boxing.

[58] Mr Cowie has set out and surveyed of hundreds of concrete slab-on-grade during his career. As he said in his evidence: concrete slabs, concrete finishes, levelness, flatness and the aesthetic finish of slabs have been part of his work for 25 years. Over that time, he would have had the opportunity to evaluate the skills of many builders and concrete placers, and he is likely to have carefully chosen workmen of high-calibre to lay the concrete slab and erect the building. Moreover, those he chose to carry out this work would have been aware that their workmanship would be under close scrutiny. It is likely, therefore, that this work was undertaken to a high standard.

[59] Having said that, however, there is an issue with the floor height in the kitchen corner. I accept that when the perimeter boxing was being installed, levels would have been established at each corner using a laser level, and that the levels in-between probably would have been set using a string line. Three of the corners (south-eastern, north-eastern, and north-western) are within 4 mm of each other, but the kitchen corner is significantly lower. Although it is not possible to be completely precise, it appears that this corner is 13 mm lower than the north-western corner and 9 mm lower than the north-eastern corner. If these were the original levels, then the boxing along the western end of the slab would have declined 13 mm over 12 metres, well within building tolerances and no reflection on the skill of the builder.

[60] There are three reasons why I believe that this slope was present when the concrete was poured:

(a) there is evidence from the measurements taken near window 9 in the north-western end of the living area of a slope on the floor that was present before the earthquakes;

(b) similarly, the measurements of the guttering on the western face of the building would have had inadequate fall had the floor been completely level at that point; and

(c) because Mr Cowie has provided no evidence of any slope in the kitchen bench under the window or the window sill above it. I draw the adverse inference that measurements taken at this point would have demonstrated a pre-existing slope on the floor.

[61] Mr Cowie has assumed in his rebuttal of Mr Lewis' argument about building tolerances, that the concrete placer using the laser level would have used one of the higher portions of perimeter boxing as a datum point. However, if that person had taken the height at the kitchen corner as the datum point, then the floor would be largely at the same height as that corner, with some areas being higher and some lower within quite tight tolerances except on the higher edges where the slab would have been screeded back to the height of the boxing. While we do not know the actual datum point chosen, the above hypothesis is a reasonable match for Mr Cowie's contour map.

[62] Another problem is that no similar contour map was drawn to show the levelment of the floor slab prior to the September 2010 earthquake. However, there are some reasonable inferences that can be drawn from the available data.

[63] In the first place, we have photographs showing the construction of the base course from which it is apparent that it was laid out and rolled to one level before the floor profile was marked out on it. The consented plans show that the concrete slab, away from the perimeter walls and internal wall footings, was to have a universal depth of 100 mm. However, 40 mm of second-grade polystyrene was to be laid under the slab in the living area, requiring the builder to lower the western end of the base course by 40 mm. We also know that the plumbing services were to be located in the base course. We have no evidence of how the base course was lowered to accommodate the polystyrene or excavated to accommodate the plumbing, but

it is likely that it was not as level at the western end of the house as it was under the remainder of the house.

[64] This is confirmed by the six core samples taken of the floor slab, cores 1 – 3 taken at the eastern end and cores 4 – 6 at the western. As can be seen from Figure 2, there is a greater variability of the base course levels in the western end than in the eastern.

1	2	3	4	5	6
-112	-116	-114	-105	-125	-100
0	0	0	-40	-40	-40
-112	-116	-114	-145	-165	-140

Figure 2: Core samples

[65] Secondly, both engineers agreed that the concrete placers would be striving to produce a level surface on the top of the slab; they would not be slavishly following the contours of the base course. Changes in the depth of the concrete, therefore, are more likely to be determined by changes in the levelment of the base course than changes in the surface of the concrete.

[66] Thirdly, although the length of the three core samples taken at the eastern end of the slab show a remarkable similarity, with only a 4 mm range, the current height of the sites from which those samples were taken ranges from over 8 mm. Either the concrete placers were following the profile of the base course when laying the concrete, which is unlikely, or there is some other factor present. I accept, however, that the number of samples taken over this 144 m² area is not enough from which to draw reliable conclusions.

[67] Fortunately, as Figure 3 shows, Southern Geophysical Ltd, which undertook a Ground Penetrating Radar (GPR) survey of the floor in the eastern end of the building, was able to calculate the depth of the concrete floor slab. The accuracy of these results can be gauged from the fact that core sample 1 measuring 112 mm was taken close to a GPR reading at the left-hand edge of the diagram of 115 mm.

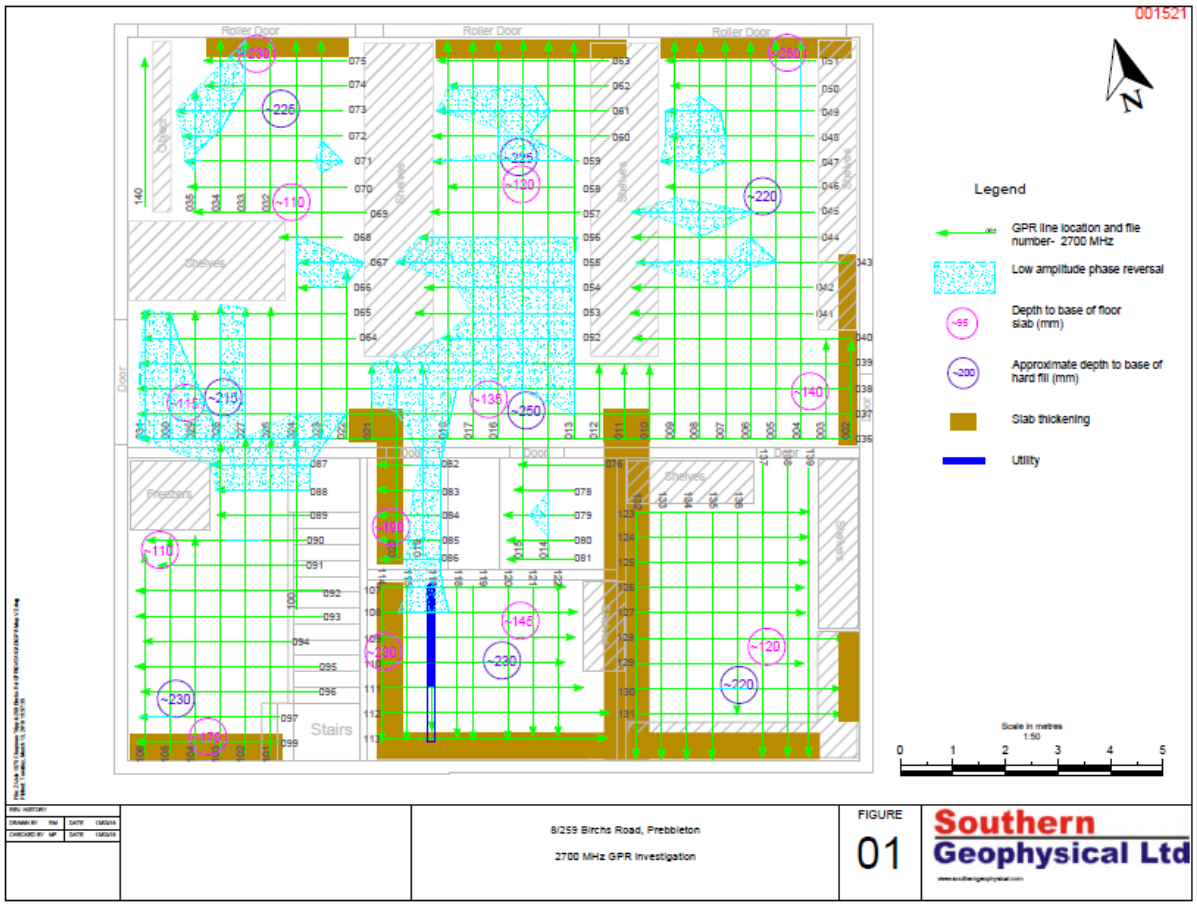

Figure 3: Depth to base of floor slab (red circles) from GPR survey

[68] If we ignore the readings taken alongside the perimeter or internal walls, which have deeper concrete footings, there are eight readings that range between 110 and 145 mm. This is a 35 mm range which can be expressed as ± 17.5. This range is likely to contain tolerances for measurement, construction of a level surface on the base course, and construction of a level surface on the concrete slab. If we ignore the measurement tolerance and accept Mr Goodwin's evidence that he would expect a construction tolerance of ± 6 mm in levelment of a modern concrete slab, then that leaves a ± 12 mm tolerance for laying the base course. That ratio of 1:2 seems reasonable having regard to the more accurate method used to place the concrete than to lay the base course.

[69] I consider that this establishes that Mr Goodwin's hypothesis of a ± 6 mm construction tolerance was an accurate assumption to make and that the slab was level to that standard prior to the September 2010 earthquake.

[70] There is no reason to suspect that the western end of the slab was any less level.

[71] It is also worth noting that EQC's engineer, Mr Finn, conceded in the JER that, bearing in mind that the slab was constructed in 2009, the floor level variations in the garage and living area exceeded the likely construction tolerances.

[72] My finding that the slab was level to a construction tolerance of ±6 prior to the September 2010 earthquake contrasts with total dislevelment across the slab of 25 mm (± 12.5 mm) shown in Mr Cowie's contour map of December 2016.[12]

[73] Clearly, some factor other than construction tolerance is present.

[74] Mr Lewis has suggested that the foundations may have settled under loading, but he is referring to those parts of the foundation that are load bearing, namely the pads under the portal feet. The effect would be minimal, and, as he conceded during cross-examination, studies have shown that there is a reasonable possibility of the foundations rising as well as settling.

[75] The evidence relating to the levelment of the free-standing bench in the kitchen and the window in the north-eastern corner of the living room also indicates that some factor has altered these levels between the date of construction and today.

[76] It is reasonable to assume that the surfaces of the benchtop and of the window sill would have been constructed as close to level as humanly possible, bearing in mind that the window sill formed the top of a working surface, as did the bench. Moreover, there is a photograph of Mr Cowie in the process of installing the bench, looking along it to gauge its level. Beside him on the floor are two spirit levels. I am quite satisfied that it was level immediately prior to the earthquake, knowing that Mr Cowie would not have finished this task until he was satisfied that it was level. His recent measurements show that the eastern end of this bench is 9 mm below level, indicating that the level of the floor on which one end rests has altered since the date of construction.

[77] Similarly, the window sill is out of level, sloping to the south. It is not possible to be precise about the degree of this dislevelment as there are different measurements taken at

[12] See Figure 1 at [49].

various places on the windows, but all consistently show a lean to the south. Once again, I am satisfied that this windowsill was level immediately prior to the earthquake but has become out of level at some stage during the last 10 years through an unknown cause.

[78] Mr Cowie also believes that the spouting on the western wall demonstrates that there has been some slumping in the floor and perimeter beam since construction, but I am dubious about that for several reasons:

(a) it assumes that the spouting was made with proper fall;

(b) there is no comparison with the spouting on the eastern end of the house;

(c) the match between the spouting level and the floor level is not particularly close;

(d) the measurements are minuscule; and

(e) there is no evidence of the likely construction tolerance for this type of work.

[79] Nor am I convinced by the under-slab waste pipes. Mr Cowie is asking me to assume that these pipes were constructed with a grade of 1:40, that the grade is now much less than that, that the change in grade is caused by changes in the ground, and this in turn was caused by the earthquake.

[80] I am cautious about this evidence because:

(a) the pipes have been constructed in the base course, not in the slab;

(b) a change in fall of the magnitude suggested by Mr Cowie would have required a change in relativity between the point where the pipes enter the base course under the slab and where they exit through the base course, something that would not be possible without a similar change to the slab; and

(c) the slab above the pipes is virtually level with no evidence of the sort of grade change that would result in a major change in fall in the pipes.

Slope

[81] The three engineers who signed the JER recorded that "approximately 20% of the ground floor has floor slopes steeper than a grade of one in 200 (0.5%)." It is widely recognised that any floor slope that exceeds 1:200 is perceptible and breaches the provisions in the New Zealand Building Code relating to amenity. Mr Cowie's diagram of those areas is shown at Figure 4.

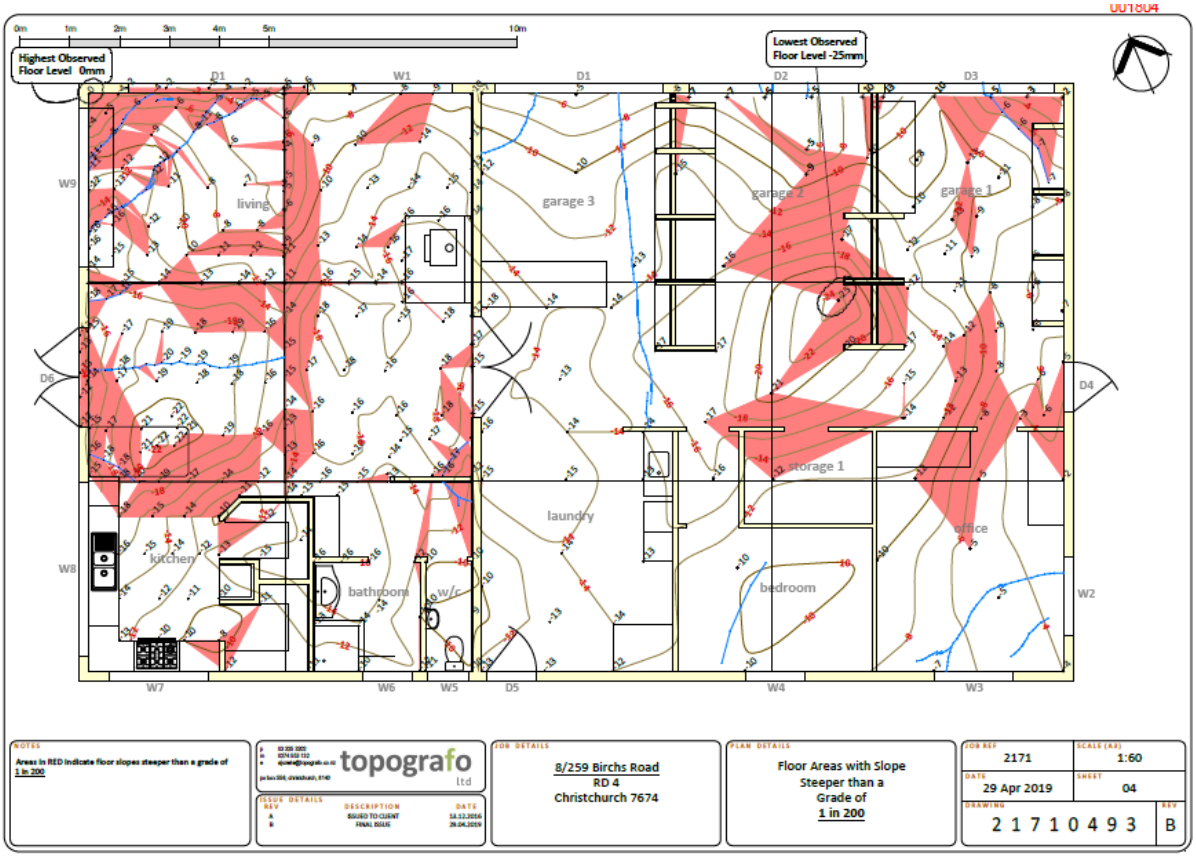

Figure 4: Floor slopes steeper than 1:200

[82] The offending slopes are predominantly in the north-eastern and north-western corners of the building, often immediately adjacent to the perimeter boxing. Bearing in mind that these are perceptible slopes which would have been obvious to the concrete placers, those adjacent to the perimeter boxing are unlikely to be due to construction tolerances. Some other factor is responsible.

Cracking

[83] It was recognised in the JER that there was "cracking to the slab at three corner locations and along the width of the garage slab and elsewhere." The engineers were unable to agree, however, about the extent of this cracking or the initial cause:

(a) BRL's engineer, Mr Weber, said:

> The slab is cracked. These cracks are throughout the dwelling and when compared to when new the cracking is significant. The cracking adversely affects functionality, usefulness, aesthetic quality and amenity.
>
> The slab cracking adversely affects the reinforced concrete strength capacity. Cracking has an adverse effect on the reinforcement capacity. The cracking has an adverse effect on the concrete capacity. It also negatively impacts the aesthetic value for the occupants and visitors to the dwelling. The cracks are clearly apparent to the eye.[13]

(b) EQC's engineer, Mr Finn, said:

> The dwelling foundations are considered to have performed well during these events with only minor damage observed in the form of slab cracking at the corners where foundation depths change. The cracks present in these locations are found within the 100 mm reinforced slab section and show no evidence of a level change across the crack faces to suggest that the portal pads have settled differentially to the slab. The diagonal cracking observed to the three visible corners of the dwelling appears to show a difference in performance between the deeper pad footing supporting the steel portal frames and the internal reinforced slab which bears over a compacted fill platform. The level variation in these locations however does not show any notable change or transition with some cracked locations running in a different direction to any localised slab level variations. On this basis, the cracks do not appear to be an indicator for settlement occurrence or causation of any loss of utility of the structure.[14]
>
> The only structural issue present to the foundations is the slab cracking and based on the lack of transition across these cracks as well as maximum crack widths of 1.5 mm there is insufficient evidence to suggest that the reinforcement has been compromised.[15]
>
> In terms of the saw cut joints, there appears to be possible signs of minor separation in some locations, generally where they have been spaced at larger centres. Should concerns be raised regarding this then the saw cuts (which have now served their purpose in controlling drying shrinkage) can be filled with a flexible sealant.

(c) IAG's engineer, Mr Lewis said:

> I believe the slab cracks visible have been caused by a combination of normal concrete drying, shrinkage over time coupled with a definite potential exacerbation component caused by the CES.

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[13] See the JER (5 October 2018) at [16.5.b]–[16.5.c].
[14] JER at [18.1.b].
[15] JER at [18.1.d].

> The slab cracks present are in locations I would expect given the slab and foundation geometry and the natural restraint this foundation system places on the floor slab as it normally undergoes drying shrinkage and contraction.
>
> Apart from the reference on the drawings to 25 MPa concrete for the slab, I have been unable to find any reference on the building file documents, specifications and site reports to specific low shrinkage mix designs or extra curing provisions to limit the slab shrinkage effects.
>
> Conversely, I note that the concrete was pumped into position, necessitating a higher slump mix and a maximum sawcut spacing of 6 m is greater than I would normally expect for a 100 mm thick slab. I believe this explains the longer crack between saw cuts in garage 3.
>
> The cracks visible within saw cuts are as would be expected with a good majority of the slab shrinkage occurring at these predetermined locations.[16]

(d) Mr Weber responded by saying:

> I do not agree with Mr Lewis' assessment that the slab cracking was pre-existing. Apart from one pre-existing hairline crack reported by the dwelling owner and the expected shrinkage cracking at the saw cuts, I have not found any evidence of pre-existing cracking. The slab has saw cuts, which are placed to induce shrinkage cracking at those locations. The slab was construction [sic] in line with standard practice and there was no need for a low shrinkage mix design and concrete pumping is typical for most slabs so I am unsure why Mr Lewis has raised this as a concern. My assessment is that the slab cracking is earthquake damage and that it is consistent with, and interrelated to, the other observed earthquake damage including differential settlement, under-slab voids, excessive floor slopes and observed ground settlements around the dwelling.

[84] Figure 4 shows, in blue, the location of the cracks in the floor slab. Mr Cowie acknowledges that the crack running through the garage was present prior to the earthquake but exacerbated during it. He says that the other cracks appeared afterwards. Mrs Cowie corroborates this evidence.

[85] The most significant crack is the one running across the living room from the middle of window W9. Mr Cowie demonstrated in a video that a straight-edge placed across that crack at right angles shows that the surfaces on either side slope down from the crack, leaving the straight-edge flush with the ground on one side and suspended above it on the other. This is clearly not a shrinkage crack because:

[16] JER at [20.2.p]–[20.2.t].

(a) shrinkage cracks in a 4m x 4m panel would more likely occur in the saw cuts; and

(b) there are grade changes on either side of it, which could indicate that the steel reinforcing below it might be broken or bent.

[86] Figure 4 indicates that there are other less noticeable grade changes coinciding with cracks, particularly the crack in the north-eastern corner.

[87] Both engineers recognised that shrinkage cracks occur in concrete slabs as they dry without affecting the structural integrity of the slab. Indeed, saw cuts are deliberately placed into the slab early in the curing process to accommodate this cracking. Mr Lewis considered that the slab was likely to have experienced between 16 – 22 mm in the first 80 days, but I accept Mr Weber's evidence that the true figure is likely to be between 7 – 8 mm when the restraint provided by the base course, reinforcing mesh and foundation thickening/pads is considered.

[88] Shrinkage cracks appearing in the slab away from the saw cuts can be unsightly, especially if the floor is to be left uncovered, as is the case here. The risk of this happening can be reduced in a variety of ways, such as the placement of reinforcing steel in the slab, the creation of saw cuts to contain the cracks, and the use of additives in the concrete to extend the curing time. Conversely, that risk can be increased by having the saw cuts at too big an interval and by failing to properly manage the curing process which, in Canterbury, should take 4-5 days in the winter and 6-7 days in the summer.

[89] Most, if not all, of the saw cuts in the slab contain cracks, but they are accepted to be wider than normal shrinkage cracks. Mr Lewis is of the view that all the cracks in the floor began as shrinkage cracks. Although he accepts that they may have been exacerbated by the earthquake, he says that none of them has any more structural significance than the saw cuts. He explains that the level differential on either side of the major crack in the living room is simply slab curl.

[90] His view that these cracks are merely shrinkage cracks results from his view that the saw cuts were made in the wrong place and too little time was spent curing the slab.

[91] In the JER, Mr Lewis made no reference to the saw cuts being incorrectly positioned. He now says that the saw cuts should have been evenly positioned around the internal portal pads and has produced his own design which places the saw cuts closer to the perimeter footings and has the internal portal pads in the centre of a panel rather than at an intersection between four panels. Certainly, his suggested saw cuts are likely to have captured some of the cracks occurring near the portal pads and maybe the large crack in the middle of the living room floor, but that does not make them shrinkage cracks. Nor does it make the original, consented, plan for the saw cuts inappropriate or non-compliant.

[92] On the other hand, I consider that any impact these cracks would have had on the structural function of the floor slab is de minimis, except for the large crack in the living area which I do not consider is simply slab curl. I accept Mr Weber's evidence that this is an unusual place for slab curl which usually occurs at the end of a free joint.

[93] The photographs produced by Mr Cowie, show that the concrete was poured early on 21 October 2009, the Wednesday before Labour Weekend. There is some indication from the photographs produced that there was a plan to manage the curing process with a sprinkler.[17] The weather may also have been kind, in that it appears that it rained heavily sometime before 27 October 2009.

[94] By late in the day on 27 October 2009, the steel portal frame had been erected and the purlins required to hold it in place had been attached. It is not possible to say when the portal frame was erected, but this could have occurred as early as Friday, 23 October 2009. Bearing in mind that the equipment used to erect the portal frame appears to have been working in mud, I consider that it is likely that most of this work was carried out on 27 October. Although, if this work was likely to take two days as Mr Lewis has stated, it may have started on Monday 26 October, despite it being a public holiday.[18] This would have given the slab 4 or 5 days to cure, which at that time of the year and in those conditions would have been sufficient.

[95] Whatever the date, the saw cuts must have been made prior to the erection of the portal frame, providing ample opportunity for shrinkage cracks to form in them and reducing the chance that they might occur elsewhere.

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[17] See the Common Bundle at 1023.
[18] Common Bundle at 1035.

Voids

[96] Mr Cowie has been convinced from the beginning that there are voids under the floor slab. He reported hollow sounds from tapping with a hammer and vibrations in the slab caused by walking on it. Because these tests are generally considered to be unreliable, two tests for voids were carried out using ground penetrating radar but these were interpreted differently by the engineers: Mr Cowie and Mr Weber believed that they showed areas of significant voids; Mr Finn and Mr Lewis believed that they did not. Although it was recognised that this issue could only be resolved by taking core samples through the floor, the Cowies resisted this because of the aesthetic impact, especially in the living area. Eventually, however, they agreed midway through the hearing to have samples taken. They believed that only one core sample would be needed, but when that did not demonstrate the presence of a void, they agreed to a second sample being taken with a similar result. Eventually, six samples were taken, none of them revealing the void they had been expecting.

[97] Surprisingly, they have not abandoned their belief that there might be voids elsewhere under the slab. I consider that there are none.

[98] They also suggested that the 1-3 mm consolidation discovered in the base course under the core sample had adversely affected the structural performance of the slab by reducing the friction between the bottom of the floor slab and the top of the base course. Mr Weber should not have advanced this argument which I consider has little, if any, merit.

[99] The evidence from the core samples, however, merely establishes that there were no voids under the floor when the core samples were taken in March 2020. Because the living area had 40 mm of polystyrene under the slab, it is not possible to tell from the ground penetrating radar tests whether there were any voids under the polystyrene when those GPR tests were undertaken. It is possible, therefore, that there were voids present after the earthquake under the floor in the living area, caused by shaking down and further minor consolidation of the base course or underlying soils, that are no longer present because the floor has since subsided. This could be an explanation for the excessive slopes and large crack in the living area.

Racking of the superstructure

[100] Although the JER recorded agreement that the doors and windows did not properly open after the earthquakes, that emergency repairs were required to the living room area doors which had become jammed shut, and that the door on the eastern side of the garage was rubbing on the frame and was difficult to close, there was no general agreement that the superstructure of the building had become racked.

[101] Mr Cowie surveyed all window and door openings around the building and produced the diagram shown as Figure 5.

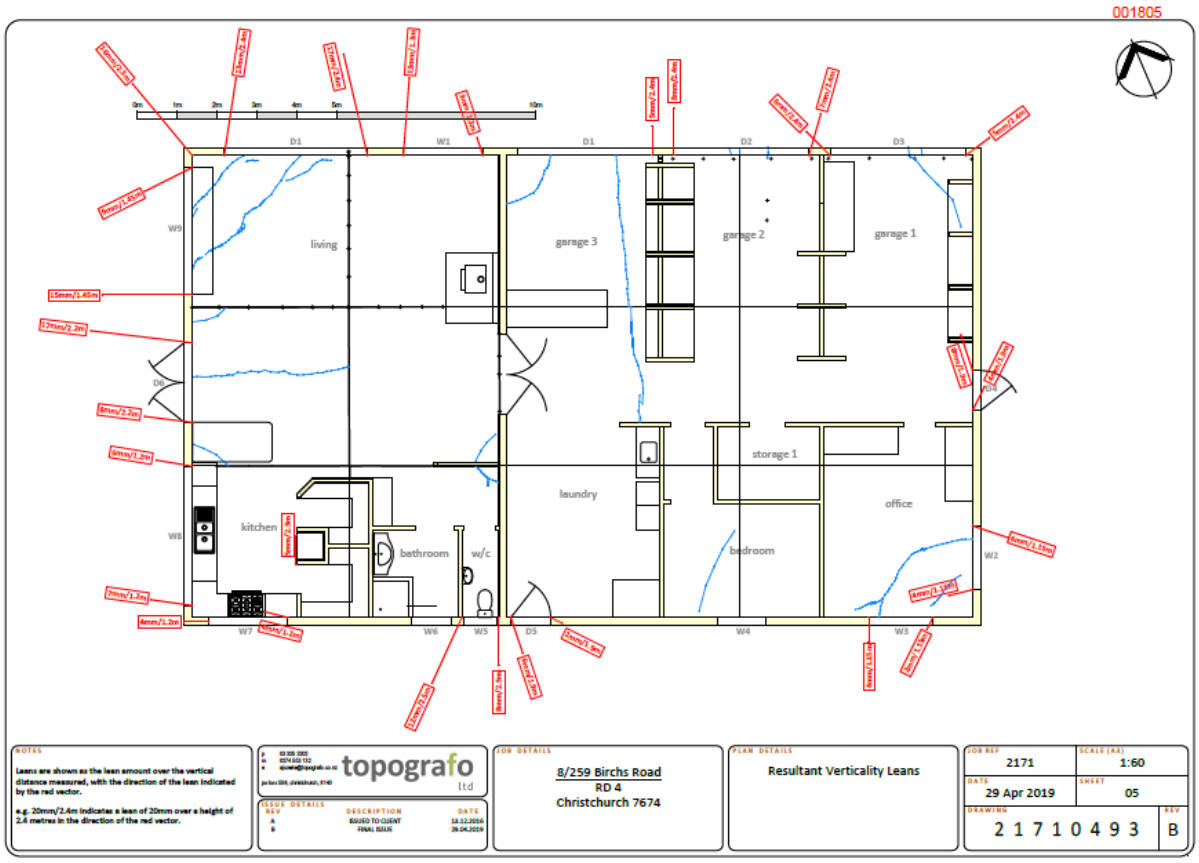

Figure 5: Verticality Leans

[102] Although some sections of the portal frame are exposed (in parts of the garage area and on the mezzanine floor) no attempt has been made to measure their verticality. Conversely, some measurements were taken at my request of the wall adjacent to sections of the portal

frame (between W9 and D6 and also behind the fireplace) but those measurements were taken over wallboard and only in one plane.

[103] In general, the openings surveyed by Mr Cowie are leaning outwards and are within building tolerances, but there are some exceptions:

(a) window W9 is significantly out of plumb, and shows signs of racking;

(b) door D1 is significantly out of plumb, and shows signs of racking;

(c) door D6 is significantly out of plumb, and shows signs of racking;

(d) door D4 shows signs of racking although it is only slightly out of plumb;

(e) door D5 shows signs of racking although it is only slightly out of plumb;

(f) the wall between window W9 and door D6 is significantly out of plumb; and

(g) part of the wall behind the fireplace is significantly out of plumb.

[104] Window W9 and doors D1 and D4 have been, or still are, sticking. Although it has been suggested that this may be the result of the doors and windows being constructed without sill bars, despite this being required in the plans, this is unlikely to be a cause of the sticking as there are sill-bars present under the doors that stick.

[105] Mr Frunt, a director of a company that supplies and installs windows and doors, questions whether this joinery has been racked by the earthquake as he did not observe split mitres, sashes racked in their frames, or open joints normally seen in joinery that has been compromised by earthquakes. However, it is likely that he is referring to more extreme damage than is present here.

[106] I do not accept IAG's suggestion that the sticking could be due to the windows resting on the cladding or being poorly maintained;

(a) the photographs clearly demonstrate that the window frames rest on the building framework and not the cladding; and

(b) the photographs also demonstrate that the sections of the windows that might cause sticking if they were not properly maintained, have actually been properly maintained.

[107] I conclude, therefore, that there is evidence of minor racking in the joinery mentioned above.

[108] Mr Bonniface, a structural engineer instructed on behalf of EQC, inspected the structural steel work in July 2019 and noticed some loose nuts on the purlin and girt bolts which he then tightened. In his opinion, this was likely to have occurred throughout the roof and where the wall girts were secured to the steel columns. He also accepted that there would be loose nuts behind the Gib board in the living areas. In his opinion, the loosening of these nuts could have been caused by an earthquake, but it was not structural and could be easily remedied. He acknowledged, however, that the calculations made by engineers to test the performance of the building assumed that the nuts were done up tightly, and that loose nuts would reduce that performance. On this basis, I find that the loosening of these nuts has had a detrimental effect on the structural integrity of the building and therefore qualifies as damage covered by the policy.

[109] Mr Weber's suggestion that the portal frame has been seriously compromised by racking is not supported by the evidence other than by the verticality of the two walls where the portal frame straddles the living area near the fireplace. These walls are both significantly out of plumb, and are well beyond construction tolerances, probably due to the two legs of the portal frame being out of plumb. It is also significant that the third portal leg to which these two legs are connected by the frame, is adjacent to door D4 which is noticeably racked and cannot be opened at present.

[110] Although it is quite possible that part of this loss of verticality is the result of construction tolerances, I consider that it is no coincidence that the two western portal legs on this frame are grounded in areas where the slab and perimeter beam show signs of dislevelment.

I consider that it is significant that the racking of the doors and windows has occurred near these out of plumb sections of the wall.

[111] I also accept Mr Bonniface's evidence that a change in the height of the portal feet of this magnitude could result in a 5 to 10% increase in stress in this section of the portal frame, affecting its structural integrity to a similar extent.

[112] Bearing in mind that the stiffness of the cladding in those areas without internal linings is provided by the steel frame and the metal bracing straps. However, it is significant that:

(a) none of the bracing straps has broken and only one is stretched; and

(b) the building paper lining the roof does not appear to be disturbed or torn.

[113] It is also significant that there is very little damage to the exterior cladding.

[114] For those reasons, I do not accept Mr Weber's assessment that the structure of the building has suffered major distortion and a 40% reduction in capacity.

Garage doors

[115] The garage doors are heavy with a relatively light support system. They are electrically operated and would have been in the vertical shut position at the time of the earthquake.

[116] Although the verticality measurements for the doors are within construction tolerances and there is no evidence that the doors are racked, nevertheless they have required adjustment four times since the earthquake and now require further adjustment, which, according to Mr Read who was asked by EQC to examine the doors, is outside the realms of normal servicing. As far as he can see, all three doors appear to have the same problems caused by movement in the head.

Exterior cladding and interior lining

[117] The lightweight cladding makes only a limited contribution to the stiffness of the building in areas without internal linings. Instead, this comes from the steel frame and the metal bracing straps. Any distortion in the building during the earthquake would certainly be

noticed in the external cladding. It is significant, therefore that the damage to the cladding is minimal.

[118] However, there are some popped nails on the roof and some slotting around a few wall fixings. I consider that the damage around two of the wall fixings is more likely to be earthquake damage then the result of construction issues as the holes in the cladding appear to be more like slotting caused by earthquake damage than burring caused during construction.

[119] There is a lifting flash guard on one corner of the building, an unexplained bulge on the north-western corner of the building, and a detached drainpipe on the south-eastern end of the house.

[120] There are also slight scratch marks on the roofing iron and wall cladding that could be earthquake damage but fall into the de minimis category.

[121] Some cracking along sheet joints is evident to the Gib board linings in the living area.

[122] The Gib board sheet between window W9 and door D6 has pulled out of the door jamb and appears to have tilted.

[123] Mr Turner claimed there was no damage to the wooden kitchen floor beyond fair wear and tear, but the Cowies say that the wooden floor boards were dented by items falling out of the pantry. This is confirmed by EQC offering to replace the wooden flooring following its inspection in April 2012. As Mr Turner's inspection was not until August 2019, he would not have been able to distinguish between earthquake damage and fair wear and tear. I accept, therefore, that the wooden flooring was damaged in the earthquake.

[124] Mr McDougall from EQC said that he observed cosmetic damage to interior linings and his scope of works includes cosmetic repairs to the bathroom and toilet.

Leak above the chimney flue

[125] The Cowies have reported that a leak developed above the chimney flue immediately after the earthquake, requiring emergency repairs made by EQC. Because this leak appeared before the repairs were carried out, they may have contributed to it but did not cause it. The

cowling around the flue detached from the ceiling, probably because the Gib board had become saturated and was unable to support the weight of the cowling.

[126] Because the flue penetrates the roof at a point where there is a slope transition, it is possible that this leak might not have developed had a transition slope flashing been installed during construction, but no other leaks were reported anywhere else along this roof transition.

Oasis Clearwater sewer tank

[127] Mr Cowie says that after the earthquake his Oasis Clearwater S2000 sewer system became so dysfunctional that he had to clean the filter at least once a day. He says that a new system should only require six monthly cleaning of this filter.

[128] His evidence is confirmed by Oasis Clearwater (Oasis) who supplied and installed the equipment. Within days of the earthquake, Oasis was recommending that all its customers should contact their insurers as damage to the system might not be immediately visible but would become apparent later through events such as a drain blockage, flooded tank, or failure of electrical components, all of which occurred to the Cowie's tank.

[129] Mr Cowie has supplied field service reports he received from Oasis showing that the system was commissioned in December 2009 and was properly serviced only days before the earthquake.

[130] After the earthquake, Oasis was called out on 8 December 2010, 29 December 2010, 28 February 2011, 5 October 2011, and 5 June 2012. During that period, the tank was also serviced on 9 August 2011, 15 March 2012, and 25 September 2012.

[131] The tank was found to be flooded on 8 and 29 December 2010. On the second occasion, the service person recorded that "this tank could be leaking". It was found to be flooded again on 28 February 2011. On this occasion the pump had stopped working, the service person recording that "internal filters cause of blocking appears to have been recent earthquakes [sic]".

[132] Oasis reported on 5 October 2011 that the system had flooded because the pump had blown, which the service person attributed to "earthquake damage". A new pump was installed

but it burnt out within eight months and left the system flooded again. That second pump burnt out in October 2018.

[133] Mr Brewer, a drain layer called by IAG, said that the flooding issue and pump failure was most likely caused by ground water entering cracks in the tank, especially during the winter when groundwater levels were higher. He conceded that there was differential height of 40 or 50 mm between the tank and the connecting sewer line, caused either by the tank rising, the ground sinking, or a combination of both.

Sewer line

[134] The sewer and stormwater lines were installed by a registered plumber and drain layer under an approved building consent. They were inspected and approved by the Council and eventually given a code compliance certificate. In particular, the sewer line had compliant falls as demonstrated in a plan Mr Cowie made at the time of construction.

[135] The sewer line is no longer compliant, with evidence of ponding adjacent to the Oasis tank and smaller areas where laterals that connect to the main sewer line appear to be mis-aligned. There is also evidence of a silty build-up just upstream of the ponding near the tank.

[136] There is also ponding in the stormwater line just upstream of the tank area, with a large area of silty build-up out from the north-eastern corner of the building, indicating that it, too, no longer has compliant falls.

Disposal field

[137] Mr Cowie claims that the disposal field for the Oasis system is blocked but there is no evidence to corroborate that. Indeed, the field service reports from Oasis confirmed that the disposal field was fully functional when tested on 9 August 2011, 15 March 2012, 25 September 2012, 24 June 2013, 11 January 2014, 7 July 2014, and 18 August 2018.

Driveway

[138] Mr Cowie says that there are areas of the driveway that have slumped, particularly near the north-eastern corner of the building. This is confirmed by Mr Weber who said that there is a significant substance near the house. There was no evidence to contradict this.

Causation

[139] As I said in *H Trust v Southern Response Earthquake Services Ltd*:[19]

> [39] Determining causation in the law of contract is a common-sense exercise rather than one involving formal tests for causation. It is sufficient if the breach was an effective cause.[20] If there are two causes, the court need not choose which is the more effective cause.[21] If, however, a loss has two effective and interdependent causes, one within the policy and one excluded by it, the exclusion prevails.[22]
>
> [40] Pre-existing damage is not a barrier to a claim for earthquake damage, but the additional damage must make a material difference to the utility or value of the property. An insurer cannot be expected to repair or reinstate something that has not been discernibly changed in value, amenity or utility.[23]

[140] The high-level overview I conducted at [10] to [36] concluded that the September 2010 earthquake was likely to cause dislevelment, slopes of more than 1:200, and cracking to the slab. It was also likely to cause: racking to some doors and windows, some areas to be out of plumb, some damage to the iron roofing and cladding, the internal linings, and the sewer system. Mr Weber also thought that it could cause: voids under the floor, damage to the damp proof membrane, buckling of tension bracing, damage to the garage doors, and subsidence in the driveway.

[141] An examination of the evidence discloses that damage of that sort was found to be on the property after the earthquake. Even allowing for measurement error, construction tolerances, concrete shrinkage and foundation settlement there are still obvious signs, especially in the floor slab, of some other causative factor.

[142] The earthquake forces experienced by this building during the September 2010 earthquake exceeded those for which the building had been designed. It was tested by a ULS event and was likely to suffer damage. The fact that it suffered damage of the sort expected makes it more likely than not that the earthquake, at the very least, was an effective cause of the damage even if it was not the sole cause.

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[19] *H Trust*, above n 11 [citations reproduced].
[20] Hugh Beale *Chitty on* Contracts (33rd ed, Sweet and Maxwell, 2019) at 26–76.
[21] *County Ltd and Anor v Girazentrale Securities* [1996] 3 All ER 834 (CA).
[22] Known as the Wayne Tank principle. See *AMI Insurance Ltd v Legg* [2017] NZCA 321, [2017] 3 NZLR 629 at [46].
[23] *He v The Earthquake Commission* [[2017] NZHC 2136] at [67].

[143] I am supported in this conclusion by Mr Weber's evidence that his calculations using a Finite Element Analysis show that the residual bending moments in the slab during the earthquake exceeded the slab capacity by more than nine times. Although these calculations assume that the floor slab was level, I have found that it was virtually level, making this a reasonable assumption. If Mr Turner is right that the cracks are where he would expect to see shrinkage cracks as they form where the slab is weakest, then that is also where you would expect to find seismic cracks caused by excessive bending moments.

[144] Mr Raymond QC highlighted the inadequacy of Mr Thomson's geotechnical evidence and Mr Weber's inability to identify a plausible theory for the differential land settlement observed in the floor slab. In his view, Mr Weber arrived at his engineering conclusions without sensible, logical, reasonable or compelling geotechnical support.

[145] I accept that the onus of proof lies on the applicant to establish causation and that the failure to conduct a deep ground investigation or to have a plausible theory of causation can often result in applicants failing to cross the evidentiary threshold, but earthquakes of this severity are chaotic, with effects that are not always able to be predicted or understood.

[146] There was no onus on BRL to prove that the site was subject to liquefaction consolidation; its onus was to prove that the slab had been damaged by the earthquake.

[147] Mr Lewis highlighted a major wind event in September 2013 that he considered was likely to have contributed to the variations in the wall verticalities and potentially exacerbated minor lining damage and the serviceability of the windows and doors. His 35 pages of calculations and diagrams, although appropriate for design purposes in calculating the wind load on a building over its 50-year life, were not appropriate for calculating the wind load in a specific event because they failed to consider the shelter provided by a nearby belt of trees. I accept Mr Weber's evidence that this wind event would have had a negligible impact on the building.

[148] I find that the shaking during the September 2010 earthquake and some subsidence of up to 13mm in some parts of the slab and under some of the portal frame legs has resulted in the following damage to BRL's building has been caused by the September 2010 earthquake:

(a) the noticeable dislevelment in the floor slab which affects its utility;

(b) the visible cracks in the floor slab, all of which have affected its aesthetic function and one of which may have affected its structural function;

(c) racking of doors D1, D4, D5 and D6 that has affected their utility;

(d) racking of windows W2 and W9 that has affected their utility,

(e) racking of the wall between W9 and D6 that has affected its aesthetic function and may demonstrate a reduction in the structural performance of the portal leg behind the wall;

(f) racking of part of the wall behind the fireplace that affects its aesthetic function and may demonstrate a reduction in the structural performance of the portal leg behind the wall;

(g) dislevelment of the kitchen bench that affects its utility;

(h) damage to the garage doors that affect their utility;

(i) popped nails in the roofing iron;

(j) slotted fixings on the wall cladding;

(k) a visible lifting flash guard on one corner of the building;

(l) a visible and unexplained bulge on the north-western corner of the building;

(m) a detached drainpipe on the south-eastern end of the house;

(n) a noticeable leak in the roof beside the chimney flue;

(o) minor damage to the linings in the kitchen, living area, toilet and bathroom that affects their aesthetic function;

(p) visible dents in the wooden flooring in the kitchen that affect its aesthetic function;

(q) cracks in the Oasis Clearwater tank that affect its utility;

(r) dislevelment between the Oasis Clearwater tank and the connecting sewer line that affects its utility;

(s) dislevelment in the sewer line that affects its utility; and

(t) an obvious subsidence in the driveway near the north-eastern corner of the building that affects its utility.

The policy standard

[149] BRL's insurance policy with IAG provided:

> You're not covered for a loss that is already covered by the Earthquake Commission Act or that would have been covered if:
>
> 1. An excess hadn't been deducted (for example, if the excess is greater than the value of the loss), or
>
> 2. The Earthquake Commission hadn't exercised its power to decline the claim for the loss.
>
> If the Earthquake Commission agrees to cover your loss, but the value of your loss is higher than the Commission's payment, we'll pay the difference between what the Earthquake Commission pays, or would have covered, and your maximum entitlement under this policy.
>
> If you have a loss that is covered by this policy and you repair or rebuild the home, we'll pay:
>
> 1. the cost of repairing or rebuilding the home to a condition as similar as possible to when it was new, using current materials and methods, and
>
> 2. the cost of compliance with Government or local authority bylaws or regulations, as long as:
>
>   a. we pay the cost of compliance for only that part of the home that has suffered loss covered by this policy, and
>
>   b. the home complied with all requirements that existed at the time it was originally built and at the time of any alteration.

[150] Because the building was brand-new at the time of the earthquake (IAG had been insuring it for only two days), there is no argument about what materials or methods should be used. It is agreed that BRL's building must be restored "to a condition as similar as possible to when it was new."

[151] That is an objective standard which is constant and ensures that all buildings, whether basic or award winning in design, are restored to their original condition. It is immaterial whether this building looks more like a barn or a house; whether it is designed to NZS 3604 or NZS 1170. The policy requires it to be restored "to a condition as similar as possible to when it was new."

[152] Where an item has only a functional purpose, the policy requires the repair or replacement to restore that functional purpose sufficient to render the fact of the earthquake damage immaterial.[24]

[153] Where there is also an aesthetic purpose, the remedial strategy should restore the former aesthetic to a "when new" quality, replacing the damaged item if that is the only realistic option.[25]

[154] This does not mean, however, that every damaged item must be replaced just because it was new at the time of the earthquake. Instead, it must have its function restored if that was the purpose of the damaged item, or its appearance restored if its purpose was aesthetic.

[155] The primary issue in this case is whether it is possible to repair the building to that policy standard; IAG says that it is possible; the Cowies say that it is not.

Repair or replacement?

[156] The Cowies consider that the building is beyond economic repair and should be replaced. They submit that:

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[24] *Parkin v Vero Insurance New Zealand Ltd*, above n 10 at [120]; *Fitzgerald v IAG* [2018] NZHC 3447 at [29].
[25] *Parkin* at [121].

(a) the floor dislevelment and steeper floor slopes have resulted in a loss of amenity because they can feel themselves walking uphill and downhill, particularly in the kitchen and living area;

(b) crack repairs using epoxy resin will be very visible and will therefore affect the aesthetics;

(c) the dislevelment has caused distortion, racking and damage to the superstructure and thereby affects its strength, stiffness and functionality;

(d) the dislevelment, if left unrepaired, will worsen in subsequent earthquakes;

(e) the foundation and slab cannot be re-levelled, meaning that they are damaged beyond repair;

(f) the slab has lost stiffness and been weakened by the cracking; and

(g) placing epoxy in the cracks does not restore the same strength that the slab had before the earthquake.

[157] Mr Raymond QC is concerned that an extreme remedy is being proposed to repair what he considers is a largely undamaged building and has highlighted this disproportionality. Moreover, this disproportionality is thrown into sharp relief if this building was originally designed as a barn intended to be temporarily occupied as living quarters for the Cowies while they built their "dream home".

[158] Although this building was subjected to a ULS earthquake in September 2010, it survived remarkably well probably due, as Mr Lewis said, to the combined design of the base course and building. It was clearly a very strong and stiff design. My decision has focused so far on the damage that was caused by that earthquake, but it is fair to record that the structure and fabric of the building showed very little sign of overt damage.

[159] It is natural for IAG to be concerned about proportionality (that BRL seeks a complete rebuild when much of the insured building is undamaged), but I do not consider that issues of proportionality are relevant.

[160] Proportionality is generally discussed in claims based on negligence or breach of contract. It involves a comparison between fault and consequences: are the financial consequences out of proportion to the degree of fault?[26] However, there is no allegation of culpability in the present case. Instead, BRL is simply claiming the benefit of an insurance policy which promises to repair any damage suffered by its house in an earthquake. The cost of repair might be disproportionate to the level of damage suffered, but this is a risk that the insurer can address when fixing the premium and can spread across many policyholders. It can also limit its exposure to this risk through a specific exclusion or, at the extreme, by declining to provide cover.

[161] Whereas, the doctrine of proportionality might be used by courts to balance the rights of litigants, there is no need for intervention in cases such as the present, where the insurer has control of that balance through the terms of its policy and the amount of its premiums. In this case IAG chose to offer a policy which promised to restore damage without reference to, or limitation on the cost of the restoration. To consider the proportionality of costs would be to introduce a contractual term which was not part of the objective intentions of the parties when the contract was joined. There was correctly no argument that such a term is implied by usage or necessity.

[162] Instead, I am required to examine each item of damage and determine whether the insurer's approach to that repair is unreasonable having regard to the nature of the damage, the nature of the repair, the risk to BRL, and the cost to IAG.

[163] Whether any repair proposed by IAG is unreasonable will also involve considering how various parts of the building are used (differing aesthetic standards might apply) and the different purposes consented (different repair standards might apply).

The foundations

[164] As already indicated, the building is less like a house and more like a commercial or farm structure with a steel portal frame anchored to pad foundations under the portal frame legs and other steel posts. The pad foundations and the perimeter beam foundation contain

[26] Karan Venter "A Moment's Inadvertence Should Not Bring Down the Heavens: Rethinking Proportionality in Negligence Law in New Zealand" (2020) 51 VUWLR 127.

reinforcing steel and were poured first before they were encapsulated in the 100 mm concrete slab.

[165] There is no evidence of damage to the perimeter beam or pad foundations, other than the possibility that the pad foundations under the portal frame legs that straddle the living area by the fireplace and the perimeter beam in that vicinity may have sunk in the earthquake, but I will deal with that when discussing the superstructure.

[166] As far as the slab is concerned, IAG considers that any damage suffered by the slab is not structural and can be adequately repaired by grinding out the cracks and injecting them with a suitable epoxy resin.

[167] Such a repair to the slab surface, however, will inevitably be visible to the Cowies who chose to machine float it to a high standard of finish rather than use floor coverings. Both parties recognise that the floor in the living area has an aesthetic function that should be restored to its condition prior to the earthquakes but it is the restoration of this aesthetic function that has divided the parties.

[168] The Cowies say that it is impossible for IAG to provide an unblemished concrete floor in the living area without rebuilding the slab, and to do that without rebuilding the house would be uneconomic.

[169] IAG disagrees. It proposes to re-surface the floor with a product that combines cement with powdered resins that can be coloured to suit the customer's requirements. It contends that the final product is a decorative floor that is stronger than typical concrete and is a well-established product that has been used to repair dozens of floors since the earthquakes.

[170] The Cowies consider that this proposal is unreasonable because:

(a) it is different from what they had before;

(b) they do not like it;

(c) they would no longer be able to have a polished concrete floor, as they had intended;

(d) it has not been manufactured by a recognised supplier of such products;

(e) there is no acceptable evidence of the product's composition;

(f) there is no evidence that the product has ever been independently tested;

(g) the product does not have the durability of a concrete floor and requires regular maintenance;

(h) the manufacturer/installer refuses to supply verifiable references; and

(i) the manufacturer/installer will not provide a warranty for its product or service.

[171] Quite apart from whether this product could ever have restored the aesthetics of the exposed concrete floor, the last six points are enough on their own to render this proposal unreasonable as it would expose BRL to risks concerning durability and reliability that it did not have before the earthquake.

[172] On the other hand, I do not consider that the only option open to IAG is to offer BRL a complete replacement of the slab, for the following reasons:

(a) I infer from the plans that the only area considered by the Council as "habitable" at the time the consent was issued was the living area described on the consented plans as "office/studio";

(b) the use of one of the rooms under the mezzanine floor as an office and the other is a bedroom that does not appear to have consent from the Council and should, therefore, be ignored;

(c) different aesthetic considerations apply to the areas outside the living area;

(d) a garage floor, for example, could be said to have only a functional purpose and no aesthetic purpose;

(e) the same can be said of the floor in a storeroom;

(f) whatever aesthetic purpose the garage floor had before the earthquake has been significantly reduced since by fair wear and tear, including two large stains from battery acid;

(g) much of the garage floor is covered by wooden shelving; and

(h) when all the above is considered, the overall effects of the dislevelment, slab slopes, and cracking in these areas is de minimis.

[173] The same cannot be said, however, of the floor in the living area. I note that Mr Finn, the engineer for EQC, suggested that it might be possible to carry out a localised slab replacement, although he qualified this by saying that this would depend upon advice from an experienced concrete repair specialist. If this repair is possible, then it might not be unreasonable for IAG to propose such a repair solution. Although it might be visible, I do not consider that this would make the repair method unreasonable as:

(a) it may be possible to place at least one of the joins between the old and new slabs under a wall;

(b) the join along the outer wall would be underneath the rimu desk, behind a piece of furniture, and under the kitchen bench;

(c) any visible joins would form a straight line; and

(d) the impact of the joins on the aesthetics of the floor would be offset against the likely benefit from having tidier saw cuts.

[174] Moreover, replacing this section of the floor slab would address dislevelment, excessive floor slopes, the major crack through the middle of the room, the possibility that the reinforcement has broken, and allow inspection and repair if necessary of the DPM.

[175] I recognise, however, that it is not for the Tribunal to determine the appropriate repair. All I have done is suggest a possible repair method for the parties to consider.

[176] As far as the other areas of the house are concerned, I consider that the repair method proposed by IAG for repairing the cracks are not unreasonable.

Racking of the superstructure

[177] IAG did not consider that the superstructure had been racked and did not, therefore, propose a repair method.

[178] A more invasive investigation needs to be undertaken of the portal frame straddling the living area before consideration is given to the appropriate method for repairing this damage. At the very least, however, the nuts securing the purlins and the girts to the steel frame throughout the building need to be checked and tightened. This will require removing sections of Gib board in various areas of the building to expose the steel frame.

Racking of doors and windows

[179] The repair of the racked doors and windows needs to be considered in conjunction with the repairs to the racked superstructure. If no repairs are required to the portal frame that straddles the living area, then simply adjusting the windows may suffice.

[180] IAG's proposal to realign door D5 is not unreasonable. I do not know enough about the proposed repairs to the other racked doors to be able to comment.

Garage doors

[181] I am not satisfied that the garage doors require replacement. IAG's proposal that the hinges and wheels be replaced, and the doors then be serviced is not unreasonable as far as it goes. But it appears from Mr Read's evidence that rather more is required to repair damaged brackets and generally adjust the doors. The shelving will also need to be removed to provide proper access.

Exterior cladding and internal lining

[182] No repairs are proposed by IAG to the roof or the exterior cladding.

[183] Considering the small amount of damage to the roof, I do not accept that the entire roof should be replaced as Mr Weber suggested. I am satisfied, however, that the loose nails on the roof should be replaced with screw fixings. Repairs are also required to a lifting flash guard on one corner of the building, an unexplained bulge on the north-western corner of the building, and a detached drainpipe on the south-eastern end of the building.

[184] IAG's proposal for the repair of damage to the internal linings in the living area and the kitchen is not unreasonable but should include similar repairs in the bathroom and toilet to repair the damage observed by Mr McDougall. It should also include the replacement, plastering and painting of the wall cladding removed to inspect the steel frame. This does not include replacing the cladding in Mr Cowie's office, as this has been added since the earthquake.

[185] The scope should also include the replacement of the wooden flooring in the kitchen.

Leak above the fireplace

[186] I consider that IAG's proposal for a roofer to assess the rubber boot flashings around the chimney flue and replace/reseal them as necessary is unreasonable as it is based on an assessment that the leak is due to the absence of a change of pitch flashing and is likely to leave the earthquake damage unrepaired. IAG should be able to develop a more reasonable repair strategy. At the very least, the soaker flashing should be replaced with a dry pan flashing as Mr McPhail suggested.

Oasis Clearwater system

[187] IAG's repair strategy involves identifying and repairing the cracks in the Oasis tank and then reconnecting the sewer line lower down the tank to accommodate the required fall. Mr Cowie considers that the tank should be lifted and returned to its original relativity with the sewer line. He says that the cost of doing this and repairing the cracks are not significantly different from the cost of replacing the tank. Mr Cuff, one of the contractors approved to maintain Oasis systems, says that the installed cost of a new system is about $15,000 plus GST compared with the proposed repairs that could cost anywhere between $3,500 and $11,500 plus GST.

[188] I consider that IAG's proposed repair is unreasonable because:

(a) the cracks will not be easy to identify and there is a risk, therefore, that some of the damage may not be repaired;

(b) this leaves BRL with the risk of future problems with the system;

(c) this is not a risk that BRL had before the earthquake;

(d) lowering the sewer line connection on the tank will reduce its capacity; and

(e) the only way of properly restoring the Oasis system to its pre-earthquake condition is to remove the tank and reinstall it at a level that provides the required fall in the sewer line.

[189] I consider, therefore, that the Oasis tank should be removed from the ground and replaced with a new tank in conjunction with repairs to the sewer line.

Sewer and stormwater lines

[190] IAG proposes to repair the sewer line by replacing a five-metre section of the line immediately upstream of the Oasis tank. It also proposes to replace a three-metre section of the storm water drain.

[191] Mr Cowie considers that the entire sewer line and stormwater drain should be replaced to provide Code compliant falls.

[192] I consider that IAG's proposed repair is unreasonable because it will not necessarily restore Code compliant falls. The scope of work should be re-drafted to ensure this, and the work should be undertaken in conjunction with the replacement of the Oasis tank.

Driveway

[193] EQC is responsible for repairing the earthquake damage to the driveway but has not provided any details of how this is to be repaired. Mr Cowie has scoped repairs costing $9,990 plus GST.

Declarations

[194] I am not able to make many of the declarations sought by BRL.

[195] For example, it will not be possible to specify the extent of EQC's liability for the repair of the building, let alone whether that liability exceeds the cap, until the repairs are scoped and costed.

[196] For the same reason, it is not possible to determine IAG's liability at this stage.

[197] I now make a declaration, however, that the driveway has suffered earthquake damage and that EQC is to pay BRL $9,990 excluding GST to settle the land claim, plus interest from 23 June 2017 (the date of the quotation to undertake this work).

[198] None of the other declarations are appropriate at this stage as further investigations are required. It is disappointing that a more collaborative approach from the parties over the last 10 years could have avoided this unsatisfactory outcome.

Suppression

[199] At the end of the hearing I asked whether either party wanted to have the names of their witnesses suppressed under section 51 of the Canterbury Earthquakes Insurance Tribunal Act 2019. Mr Raymond QC sought no such order, but Mrs Cowie asked for her name and the name of her husband to be suppressed. Although I understand her reason for wanting her name suppressed and sympathise with her; to grant her suppression without also suppressing her husband's name would be pointless. There are no grounds, however, for suppressing his name. As I indicated at the beginning of this decision, he has been an outspoken critic of the earthquake claims process and has never attempted to hide his involvement. I believe that it is important that the many people with whose claims he has been involved are aware of the fate of his own claim.

[200] For those reasons, there will be no suppression of the names of any of the witnesses who provided evidence to the Tribunal.

C P Somerville
Chair
Canterbury Earthquakes Insurance Tribunal