IN THE HIGH COURT OF NEW ZEALAND
CHRISTCHURCH REGISTRY

CIV-2014-409-000207
[2017] NZHC 1550

BETWEEN	SAYAD MOSTAFA SADAT and MASTOREH SADAT Plaintiffs
AND	TOWER INSURANCE LIMITED First Defendant
AND	EARTHQUAKE COMMISSION Second Defendant

Hearing: 22-29 March 2017 and 6-7 April 2017

Appearances: K T Dalziel & J R Pullar for the Plaintiffs
M C Harris & S F Alawi for the First Defendant
N S Wood & J W Upson for the Second Defendant

Judgment: 6 July 2017

JUDGMENT OF NATION J

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[1] The plaintiffs' (the Sadats) home may have had inadequate foundations for the site it was on from the time it was built. Subsidence of the foundations may have resulted in damage to those foundations and to the structure of the home before the Canterbury earthquakes. The Sadats had insured their home with the first defendant (Tower) and had Earthquake Commission (EQC) cover, but only at the time of the September 2010 earthquake. That earthquake may have resulted in further damage to the foundations and the structure of the home. The problems with the foundations cannot be fixed through repair. A rebuild of the home will cost some $762,000 including GST. The broad issue here is whether EQC and Tower are liable for rebuild costs.

Background

[2] The Sadats were refugees from Afghanistan. In 2006 they purchased what they regarded as their dream family home at 3 Victors Road, Hoon Hay, Christchurch for $235,000. They insured it with Tower.

[3] In September 2008, there was a potential sale of the property. The prospective purchaser arranged for a building inspection of the home. The report indicated there had been significant subsidence of the foundations, resulting in sloping floors and significant cracks in the exterior cladding of the home and through the foundations. The purchase went no further.

[4] In August 2010, the Sadats made a claim on their Tower house insurance policy for damage caused by water leaking from the kitchen waste under the house. An assessor, Mr Eric Dann, visited the property on 19 August 2010 to assess the situation. He noted and reported on extensive cracking to the foundation and the cladding and significant cracking on interior walls. He recommended the claim be declined on the basis the damage was excluded from the policy because it was gradual damage and damage from subsidence.

[5] On 4 September 2010, in the early hours of the morning, an earthquake (the September 2010 earthquake) occurred. The event was frightening for the Sadats and their family. There was significant shaking of their house and they subsequently resided away from the home for several days.

[6] The Sadats lodged claims with EQC and Tower. On 8 September 2010 an assessor for Tower, Mr Hargreaves, made a brief inspection of the property and took some photographs. He considered the property was habitable but noted the Sadats were nervous about residing in the home. Mr Hargreaves recommended the Sadats have a hot water cylinder repaired. EQC reimbursed them for the plumbing costs incurred of $200.39.

[7] On 9 December 2010, an assessor Mr Jones and a builder inspected the property for EQC. Without knowledge of the 2008 report and the August 2010 Tower report, Mr Jones produced a scope of works and estimate of costs for repairing the damage of $30,600.

[8] On 12 January 2011, Tower gave notice that it was cancelling its policy with effect from 26 January 2011. This was because, on the basis of the August 2010 Tower report, Tower considered the condition of the property made it a poor risk.

[9] This meant the Sadats did not have insurance cover for the February 2011 or later earthquake events. From January 2011 through to about May 2013, the Sadats, mainly through Mrs Sadat, complained of Tower's cancellation of the policy. The validity of Tower's cancellation is not, however, now challenged by the Sadats.

[10] On 22 February 2011, the second major Canterbury earthquake occurred at about 1.00 pm.

[11] On 20 August 2012, EQC wrote to the Sadats (through a letter to their daughter) advising that, allowing for their statutory excess and consistent with Mr Jones' costs estimate of $30,600, $30,290.50 had been paid to their bank mortgagee in settlement of their claim arising out of the September 2010 earthquake.

[12] On 30 January 2013, EQC costed a further scope of works for what they were treating as damage from the September 2010 earthquake. The total cost was $43,682.41. EQC paid $12,946.33 initially to the Sadats' bank but then to the Sadats directly in May 2013. That cheque was sent to Mr and Mrs Sadat with a letter of 14 May 2013 setting out how, with that payment, they had received a total of

$43,586.72. The letter advised the Sadats that they could bank the cheque but doing so would not affect their current or any future entitlements. EQC sent the Sadats a copy of the further scope of works on 3 July 2013.

[13] In 2013, 3 Victors Road was advertised for sale "as is, where is". The advertisement advised the vendors were prepared to transfer $43,000 to the new purchaser in EQC payout and that there were "no EQC claims, insurance has lapsed, no insurance will be transferred with this property". The advertisement advised the owners were committed to sell. At that time, they appeared to be proceeding on the basis they would have no further insurance entitlement.

[14] On 21 October 2013, the Sadats' solicitors in these proceedings wrote to Tower and EQC advising that they were acting for the Sadats in relation to their claim arising out of the September 2010 earthquake and that they had expert advice that the Sadats' claim would be for more than the $100,000 EQC cap and more than the $43,000 the Sadats had already been paid. They attached with their letter a report from Earthquake Services Limited (Earthquake Services).

[15] The report began by summarising the methods used by Earthquake Services to provide an opinion on the extent of damage caused to the relevant premises as a result of "the Canterbury earthquakes 2010 and 2012 [sic]". They said the purpose of the report was to assess the level of damage caused by "the series of earthquakes" that had occurred in the Canterbury region since 4 September 2010.

[16] Earthquake Services' estimate was for total repair costs of $864,214.15 including GST. Their repair strategy involved the lifting of the dwelling, the removal of the ring foundation and piles, and then replacement with a new ring foundation and piles. On that basis, they recommended rebuild as the more economical option.

[17] On 11 April 2014, the Sadats filed a claim in the High Court for damages for the full replacement value of the house estimated at $864,214.15 and general damages in the sum of $50,000 for anxiety and emotional distress. As against EQC, their claim was for $70,263 and general damages of $50,000.

[18] In July 2014, Tower and EQC both filed statements of defence.

Summary of defendants' positions

[19] EQC and Tower both deny liability on the basis the Sadats cannot prove that there was damage to their home which was materially different from damage which their home had already sustained before the September 2010 earthquake. EQC and Tower both say, if there was any damage resulting from the September 2010 earthquake, what was required to remedy that damage was not materially different from what would have been necessary to remedy pre-existing defects and damage.

[20] Tower's liability for earthquake damage is for damage exceeding EQC's cap of $100,000 plus GST. As against Tower, the Sadats need to prove that there was damage caused by the September 2010 earthquake for which they have cover under the Tower policy and which will cost more than $115,000 including GST to remedy.

[21] As against EQC, the Sadats have already been paid $43,586.72. EQC denied that, in all the circumstances they are now aware of, they were liable to pay that amount. EQC are, however, not seeking to recover that amount from the Sadats. To succeed against EQC, the Sadats had to prove that, as a result of the September 2010 earthquake, EQC have a liability for damage resulting from that earthquake and that the cost of remedying that damage is more than $43,586.72.

[22] My ultimate determination as to the Sadats' entitlement, and Tower and EQC's defences, essentially turns on what the Sadats have proved in relation to the damage suffered in the September 2010 earthquake as against pre-existing damage and defects in their home.

Evidence and the evidential burden

[23] The evidential onus of proof in these kinds of cases was discussed in *O'Loughlin v Tower Insurance Ltd*:[1]

> [146] The general principles as to onus of proof are clear. The onus is on the insured to prove the existence of the contract, and show that the event in

[1] *O'Loughlin v Tower Insurance Ltd* [2013] NZHC 670, [2013] 3 NZLR 275 (footnotes omitted).

> question was covered by the policy and claimable loss has been suffered. On the other hand, an insurer has to prove that a claim to which the risk insured against otherwise applies, falls with[in] an exception or exclusion.

[24] The evidence relevant to deciding the principal issue in this case, namely what, if any, damage has been caused to the Sadats' home as a result of the September 2010 earthquake, relates primarily to a series of reports commissioned by the parties for various purposes. These include: a 2008 building inspection report, when the property was for sale; an August 2010 report commissioned for Tower; an assessment by a Mr Hargreaves in September 2010 immediately following the earthquake; a Harrison Grierson report for the defendants of August 2015; a report from the plaintiffs by Dr Wu of 15 May 2015; a joint structural engineers' report to the Court of 10 March 2016; and a joint geotechnical experts' report of 16 December 2016. The witnesses involved in those reports also gave briefed evidence and, for the most part, were examined on it. The Sadats have also given evidence.

The 2008 Hayward report

[25] Mr Grant Hayward was called as a witness for EQC. In 2008, he had national certificates in carpentry and carpentry (advanced), and some 16 years building experience. In 2008, he had been working as a building inspector for some two and a half years. At the request of a real estate agent, he inspected the property on 2 September 2008 and subsequently produced a detailed inspection report for 3 Victors Road (the 2008 Hayward report).

[26] Mr Hayward recalled the house being relatively tidy inside and a family being there during the inspection. He remembered the exterior of the house was not in good condition and especially remembered a crack in the cladding below the kitchen window. He also recalled subsidence to "part of the floor". Mr Hayward said it was his normal practice to inspect the roof first, then the exterior of the house, the interior – room by room, the roof space and finally the sub-floor space. He said his inspection of the property would have lasted around two and a half hours but that his report was intended as a general outline of his significant findings and to "identify significant defects visible at the time of inspection". It was not intended to be a complete record of every crack or other defect in the house.

[27] In his summary, he referred to some positive aspects to the home such as a new roof, PVC spouting and other items. He then reported:

> There are two significant issues that need further investigations using our structural engineer. The south bedroom and kitchen show to have a significant fall, approximately 50mm over 3.5m. it is likely that there are two contributing factors to what has made the cracks to the concrete window sills and exterior plaster. We think that the bedroom subsidence is likely related to a few soft spots in the soil and that the kitchen exterior cracks are related to the glass blocks placed to a load bearing wall. The property file showed that Geotech Consultants Ltd stated that the ground was soft – firm grey clay silt in 1992 when surveying the ground for the new garage and subdivision. The other cracks to the home are likely related to a combination of natural settlement and subsidence from the south bedroom and kitchen. Viewing the subfloor showed no real problems, though it was difficult to evaluate if any movement was occurring as the bearers ran parallel to the south wall. Soil testing and survey levelling is recommended in this situation…

[28] He made certain recommendations as to work that should be carried out on the property. He noted that plain glass had been fitted lying flat on a porch over-hang. He considered this very dangerous and that it should be removed immediately as it had already cracked in two areas. It did not appear to have a safety glass sticker and "therefore could fall at any moment".

[29] There was a section in his report for what he considered were necessary urgent repairs. In that section, he referred to "the issues relating to the subsidence of the bedroom and kitchen" which he said required a structural engineer to better evaluate as to the cause and method of repair. He said the use of glass blocks through the kitchen exterior wall was not allowed as it had weakened the load-bearing wall. He said that no lintel appeared to be present because of the significant visible crack. He said the kitchen floor showed to be running downwards.

[30] Attached to the report were coloured photographs showing some of the defects referred to in the report and matters requiring attention. Two such photographs showed a major crack on the western exterior kitchen wall running through the sill of a window vertically down to a line of glass bricks. There is some apparent displacement of the windowsill consistent with there being some differential downward movement in the structure at the point of the crack. There was also a photograph of a crack on the southern wall of the home with an apparent

crack to the exterior sill below the bedroom window, running approximately vertically down to a vent and then through the foundation. It appears, from the photograph, that some attempt may have been made to fill part of that crack.

[31] Mr Hayward said it was not his practice to measure floor levels unless he saw or felt a slope. During cross-examination of various experts, and in submissions, it was suggested that Mr Hayward's evidence as to a 50mm fall should not be relied upon because of the manner in which he had taken the level. Under cross-examination he said he had used a laser from a point in the kitchen where it would have projected a level through to the bedroom in the south-west corner. That would have been over only a portion of the bedroom given the laser level had to go through a doorway. It was suggested the 50mm slope, as recorded, was inconsistent with levels taken at various times after the earthquake, including levels taken by Earthquake Services over 11 March 2013, 21 August 2014 and 18 November 2016.

[32] I do not consider that the evidence of Mr Hayward, as to the sloping floors, should be discounted on that basis. His evidence was that there was a slope of that magnitude in both the kitchen and south-west bedroom area. His report referred to there being such a slope over a length of 3.5m. That slope could have been from where the laser was situated towards the exterior kitchen wall as well as the exterior bedroom wall. He did not specify where the drop towards the perimeter in the bedroom area began so that it could have been from the doorway to the exterior wall.

[33] As was pointed out by several expert witnesses, Mr Hayward's measure was not intended to be absolutely precise. Mr Hayward himself described it in his report as "approximate". Consistent with the differing floor-slope measurements taken at different times, even by the same business, a number of factors can influence the precise measurement. Even with similar methods adopted in similar circumstances, there could reasonably be a variation in the results obtained of 10mm plus or minus.

[34] The measurement Mr Hayward made was consistent with what he had observed and felt. The slope was so significant that it would have been felt by anyone going to those areas. His measurement was consistent with the measurements of floor dislevelment included in Mr Jones' report for EQC of 9

December 2010 and also the measurements referred to in the Harrison Grierson report of June 2015.

[35] Mr Hayward's measurement and the slope in the floor to the kitchen and south-west bedroom area is also consistent with the significant cracking of the exterior wall which he observed outside those rooms.

[36] It is also of significance that Mr Hayward's report did not state that the cracks in the kitchen wall or the south-west bedroom wall were the only cracks observed. After referring to the crack outside on the kitchen wall, he said "the other cracks to the home are likely related to a combination of natural settlement and subsidence from the south bedroom and kitchen".

The August 2010 Tower report

[37] Following the Sadats' claim in August 2010 against Tower under their policy, an assessor, Mr Eric Dann, visited the property to assess the situation and to report on the claim. At the time, Mr Dann had been employed as an assessor by Tower for about four years. He ended that employment in 2011. He recorded observations from his visit on 19 August in a report dated 26 August 2010 (the August 2010 Tower Report) which he referred to in giving evidence as a witness for Tower.

[38] In Mr Dann's report, the orientation of the house was rather different to the orientation which other witnesses and I have used. In referring to his evidence, I have referred to the appropriate orientation as generally referred to by others.

[39] Mr Dann observed that the water level in the area was extremely high. There was water sitting on the surface of land across the road from the Sadats' house. He noted there was bad smelling, grey water under the floor of the house which appeared to have been released down the south side of the house under the floor, spreading some distance but no more than two piles under the house down the (eastern) side. He noted that on the (eastern) side of the house there was water inside the foundation but this was clear and resembled that of a high water table. His recorded observations as to the structure of the house included the following:

> To the exterior of the house there are extensive cracking [sic] to the foundation and also the cladding of the house which is solid plaster over brick or block work.
>
> …
>
> [East] side: Cracking to wall by front door. Insured said he repaired it 1 yr ago but it has opened up. Horizontal cracking to the right of the front door. This has been repaired. Cracking under window through cladding and foundation. This has been filled and painted over to cladding. Movement cracks to side of windows.
>
> [West] side: 3-4 big cracks to the wall plastering and substrate.
>
> [South] side: Wall appears to have sunk under window with Horizontal cracking to the wall under window. Multiple cracking around vents to the foundation. Multiple crack [sic] to the house cladding.
>
> Interior:
>
> Bedroom by Victors Road cracking to stippled ceiling.
>
> Back bedroom crack through ceiling, crack to wall above window.
>
> Hall: cracks to the lining, 5 cracks.
>
> Cracks to the bedroom on the [south-western] corner. Exterior wall has dropped, cracking to lining in the wardrobe.
>
> Living room: Cracks above door frame, Crack to end wall where join in lining.
>
> Cracking to the interior of the house is constant around the entire house and not limited to the kitchen area where the water has leaked from the kitchen waste. Under insured policy I believe this to be gradual damage as the cracking has happened over time. It appears that the house has subsided and this maybe because of the extremely high water table in the area…

[40] Associated with his report were photographs showing some of the defects he referred to, including:

(a) a photograph of a large crack in the lath and plaster lining of the wardrobe and a separation in the internal lining at the corner intersection of two walls in the south-western bedroom area;

(b) a photograph showing a crack on the eastern wall near the entrance to the home running from the windowsill down and through the foundation;

(c) photographs of a major crack running horizontally on an area of wall to the right of a window on the eastern side of the house (the hose reel crack). The photograph showed an attempt had been made to patch that crack but it had opened up;

(d) photographs of a crack running from the corner of a windowsill on the southern side of the house running down to a vent in the foundation and from a corner of that vented area of the foundation to the ground level of that foundation. A close up showed an attempt had been made to fill the crack but that it had opened up nearer the windowsill;

(e) photographs showing a horizontal crack from a windowsill on the eastern side of the house to the right of the hose reel;

(f) several photographs of the crack on the western exterior kitchen wall running from the windowsill down to a line of glass bricks, then from the bricks down to the foundation, horizontally along the top of the foundation to a vent and then down from the corner of the vent through the foundation. One of those photographs showed a hole had been dug next to the foundation. There was grey water in it to a level just below the ground.

[41] Under the heading "underwriting considerations", Mr Dann noted "subsiding cracking to interior and exterior cladding and foundation of the dwelling". Ultimately, his report recommended the claim be declined, on the basis the damage was excluded as being due to gradual damage and damage from subsidence.

[42] Mr Dann was not a structural engineer. His focus was on the claim for damage relating to a leaking pipe under the kitchen and possible other explanations for that damage. He had not been asked to provide a detailed report as to the structural state of the whole building. The state of the building was however such that it led him to make some general observations and to bring to Tower's notice particular matters which were of concern to him. His general observations were consistent with major subsidence to the foundations and significant structural damage before the earthquake.

[43] Mr Dann's report did not itemise or refer to all the cracks or defects which others identified in the building after the earthquake when responding to the claim arising out of the earthquake and in relation to these proceedings. However, I do not

consider that inconsistency detracts from the value of his observations or the weight that should be given to them.

Geotechnical evidence

Introduction

[44] Geotechnical evidence is potentially relevant because of the way ground conditions at 3 Victors Road might have contributed to pre-earthquake damage or have made it more likely significant damage would have resulted from the September 2010 earthquake.

[45] The geotechnical engineers were Giles Learman of Engineering Design Consultants Limited (EDC) for Tower, Barry McDowell of Tonkin and Taylor for EQC and Owen Thompson of Thompson Geotechnical Limited for the Sadats. They jointly inspected the property on 21 October 2016 and submitted a joint report to the Court of 16 December 2016. All three possessed the necessary expertise, independence and qualifications to give evidence as experts.

The experts' joint report – areas of agreement

[46] Matters they agreed on included:

(a) A summarised sub-ground profile based on the hand auger, scanner penetrometer and CPT investigations referred to in the report of EDC, Mr Learman, of 12 August 2016 as follows:

Depth range	**Description**
0 – 0.4m	Fill/Topsoil, soft, moist
0.4 – 0.8m	Silt, soft, wet
0.8 – 1.2m	Silt, soft, saturated
1.2 – 1.6 - 2.2m	Organic Silt, Silt some peat, soft, saturated
2.2 – 6.3	Interbedded firm to stiff Silt and loose Sand layers, saturated
6.3 – 7.0	Sand, loose to medium dense, saturated
7.0 - >7.6m	Gravel mixture, dense, saturated

Liquefaction assessments carried out by EDC indicated that liquefaction might occur in sand/silt layers between 2.0m to 3.5m depth and 5.0m to 7m depth.

(b) The bearing capacity of the soil supporting the footings of the dwelling was likely exceeded at the time of construction, leading to compression of the soil, movement of the footings and damage to the dwelling;

(c) Damage described in the 2008 Hayward report and August 2010 Tower report included several cracks in the internal cladding and ring foundation. These indicated pre-existing and gradual settlement of the building due to poor ground conditions and/or adverse ground water levels;

(d) Reference to damage, as described in the Jones/EQC site report of December 2010, the report of Earthquake Services dated 27 March 2013, the Harrison Grierson report of 14 August 2015 and a comparison between August 2010 photographs and 2015 photographs. The experts agreed "in general it appears that the cracking noted after the earthquakes has occurred at pre-existing cracks, either widening of existing cracks or reopening of sealed and painted cracks". Cracks are described as 0.5mm to 2mm wide, occurring across cladding and ring foundations, inclined, horizontal and stepped, in the south-west, north-west and north-east elevations. The cracking pattern suggested differential settlement of the ring and supporting floor levels;

(e) Reference to various floor levels surveys, which they agreed broadly showed the building was hogged due to settlement of the ring foundation and external walls;

(f) Pesometer monitoring records in the neighbourhood suggested a variation of about 0.5m to 1m in the depth of the water table on a seasonal basis, with low levels occurring from about February to April and high levels occurring from about July to October. In general, they considered the ground water on the property would vary between 0.5m and 1.5m depth below the ground surface. The likely depth of the water

table was 0.42m below the ground surface in September 2010 and 1.32m below the surface in February 2011.

(g) The peak ground accelerations, associated with the major earthquakes of 4 September 2010 and 22 February 2011, exceeded the serviceability limit state of liquefaction in susceptible layers (but those layers were agreed to be between 2.0m to 3.5m depth and 5.0m to 7.0m depth);

(h) It was likely that earthquake damage to the foundations of the house and possible non-liquefaction-related ground movements/changes were initiated in the September 2010 earthquake with further incremental damage possible in following earthquakes.

(i) Strutek (Dr Wu) had reported the concrete ring foundation might be supported by 0.6m square concrete pad footings at approximately 1.6m centres. Excavations by EDC had extended to 0.45m and 0.6m depths without finding the underside of concrete at the two locations where they had excavated holes close to the foundations. EDC had not found evidence of systematic concrete pad footings as indicated by Strutek. The experts assumed that the base of the pad footing was approximately 0.8m to 1.0m below ground level, approximately the level that ground water was encountered in the hand auger investigations made by EDC on 16 June 2016.

The joint report – areas of disagreement

[47] The report included a table setting out areas of disagreement. Mr Learman and Mr McDowell, for reasons given, considered the floor level surveys could not be relied upon to accurately quantify the movement of the dwelling post-earthquake. Mr Thompson said he shared the concern that caution must be exercised when interpreting floor level surveys where measurements were done by different companies at different times and on a deformed floor, but said he believed the data showed the house had been progressively settling post-earthquake.

[48] Mr Learman and Mr McDowell considered that, while it was possible for foundations to ratchet, ie rock, in an earthquake event, there was unlikely to be a

long-term increase in load on the soil. Mr Thompson considered degradation in soil stiffness could have triggered another cycle of consolidation settlement after the September 2010 earthquake.

[49] Mr Learman and Mr McDowell considered there was potential for some ongoing movement of the structure and possibly the ground once there were cracks in the cladding and footing, due to the seasonal variation in ground water levels. In this context, Mr Thompson said the opening of cracks around the house after they had been filled could be readily explained by settlement processes.

[50] Mr McDowell said it was not possible to estimate the amount of building settlement that may have occurred due to the earthquake and hence the proportion of earthquake damage caused by settlement against seismic shaking of the structure. Mr Thompson said "determining the magnitude of earthquake-induced settlements at the site is no easy task". He said that there are "various input parameters that are used to assist this that are either unknown or highly uncertain". He also said that it was difficult to estimate the amount of settlement that afflicted the structure following the September 2010 earthquake. However, based on his experience, he believed seismic induced compression of the soft foundation could have been large enough to deform floors and rack window and door frames as reported by the owners following the September 2010 earthquake.

Council records

[51] In 1992, 3 Victors Road was subdivided and a house was built on the subdivided section to the north of the Sadats' home. Council records associated with the building permit application for that house recorded that the ground conditions in the area were known to be of a low load-bearing capacity. As part of the application, the Council required penetrometer testing of soil-bearing capacity as a foundation check for the intended structure. Ground tests were carried out by Geotech Consulting Limited. Four holes at the four corners of the proposed building were investigated to a depth of 2.1m. The results obtained were broadly consistent with the profile adopted by the geotechnical experts in their joint report based on the investigations carried out by EDC. At all four sites, "roots and small wood

fragments" were found between 0.6m and 1.5m depth below ground level. Silty fine sand and sandy silt (the ground prone to liquefaction) was found at three sites between 1.6m and 2.1m depth and at one site between 1.5m and 2.1m depth.

Mr Thompson's initial brief of evidence

[52] Mr Thompson provided an initial brief of evidence for the plaintiffs dated 9 December 2016. In general, the views expressed in that evidence were consistent with his views as expressed in the joint experts' report. I note, in particular, he confirmed:

- when the home was built, the weight of the building was greater than the "carrying" or "bearing" capacity of the soil;
- the building subsequently settled into the foundation soils through consolidation settlement;
- the consolidation process had finished many years after the house was constructed; and
- the widening of cracks, as apparent from photographs, supported the view the foundation moved "as a result of the Canterbury Earthquake Sequence".

[53] He believed the September 2010 earthquake was likely to have triggered foundation movement due to cyclic loading and ratcheting of the house into the weak foundation soils, and that cyclic degradation/remoulding of the organic soils fabric would have led to a re-initiation of the consolidation process.

[54] In general, the magnitude of building movements that occurred via the processes he described was "not able to be determined based on the available data within a reasonable degree of accuracy". As such, quantifying the amount of settlement induced by ratcheting effects following the September 2010 earthquake was not possible.

[55] Generally, he considered that reconsolidation in liquefiable materials at various points between 1.7m and 7.0m below ground level would have resulted in

total settlement of the structure but was "not suspected of inducing significant differential settlement of the structure".

[56] He believed that, of the Canterbury Earthquake Sequence, the September 2010 earthquake would have had the most impact on the property. This was because the water table was within 1.0m of the ground surface and the foundation was therefore at its weakest during this event. He considered that, in dryer conditions, the ground in February 2011 would likely have been stronger and stiffer, so better able to resist the effects of cyclic loading and the triggering of ground movements occasioned by the earthquake.

[57] Of the foundations overall, Mr Thompson said that the house's foundation system "has failed to cope with the ground conditions in both static[2] and dynamic scenarios[3]".

[58] Mr Thompson said, to provide a code compliance foundation for the structure, reinstatement methodologies would need to mitigate the soft soil hazard within the upper 2.0m depths below ground level and the potentially liquefiable layers between 2m and 7m depths. He thus considered piling to dense gravel below 7m depths would be needed.

Mr Learman's initial brief of evidence

[59] In his evidence of 17 February 2017, Mr Learman referred to the investigations he had conducted when preparing his EDC report and what they showed of the soil profile on the site. He noted the seasonal variation in ground water depth. He referred to MBIE-endorsed methods for analysing the potential for liquefaction and said such analysis suggested that the soils between ground level and 2.0m were non-liquefiable. He said clay-like soils can soften and fail under cyclic loading but were considered non-liquefiable because they do not exhibit typical liquefaction features. He said, typically, cyclic softening[4] (deformation) was

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2 Non-earthquake with just the load of the building on underlying ground.

3 An earthquake is a dynamic scenario.

4 Mr McDowell explained that cyclic softening was the process equivalent to liquefaction for cohesive soils such as plastic silts and clays. Liquefaction occurs in soils that have little or no cohesion, such as sand and non-plastic silts. When cyclic softening occurs, repeated cycles of

possible only in normal to lightly consolidated clay-like soils. For reasons explained in his report, he did not consider significant cyclic softening of the soils was likely. However, he noted that his analysis of the soils through the use of hand augers indicated the soils were not entirely homogenous, and therefore the possibility of localised cyclic softening could not be discounted. He said, putting aside the observed damage, it was likely, from a theoretical perspective, that the dwelling had undergone static settlement prior to the earthquake. Quantifying that settlement was however difficult.

[60] In response to Mr Thompson's evidence, Mr Learman accepted that it was theoretically possible that ground movements could have stabilised well before the earthquake but said other factors, including construction of the adjacent garage and leaking water pipes, could have changed soil conditions. He considered the significant internal and external cracking observed in August 2010, along with the opening up of cracks which Mr Sadat had filled before August 2010, indicated the house was still settling only weeks before the September 2010 earthquake.

[61] Mr Learman did not accept Mr Thompson's view that, because the water table was higher, the September 2010 earthquake was likely to have been more damaging to the house than the February 2011 event. Rather, he considered more damage could have been caused by the February 2011 earthquake because of its higher peak ground acceleration.

[62] Although the water table was higher in September 2010, Mr Learman considered the residual strength of the ground was likely to have been less in the February 2011 event because the ground would have been weakened in the September 2010 event. While the ground water level, as recorded in September 2010, was higher, the depth between the base of the foundation and ground water in the February 2011 event was still likely to have been small.

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strong shaking reduces the contact and cohesion between soil particles. The ground softens for a short period during the cyclic (earthquake) event but does not turn to liquid. After a relatively short period of time, the ground returns to its previous strength.

Mr McDowell's initial brief of evidence

[63] Mr McDowell summarised his evidence in a brief of 29 March 2017 as follows:

(a) Pre-earthquake consolidation settlement was the main cause of the foundation settlement at the property. There was also likely to have been a small amount of non-earthquake-related post-earthquake consolidation settlement ongoing from 2010 to the present day.

(b) Given the ground and ground water conditions at the time of the Canterbury earthquakes, those events may have caused a comparatively minor amount of the overall foundation settlement.

(c) Given the ground conditions and the evidence of pre-earthquake settlement, he would have expected to see about the same extent of foundation settlement he observed in 2016, even if the earthquakes had not occurred. In the absence of reliable before and after measurements, he did not consider it possible to quantify precisely how much, if any, foundation settlement occurred as a result of the earthquakes.

[64] Mr McDowell referred to the most significant features of the ground conditions at 3 Victors Road in understanding the current condition of the house. They were consistent with the information in the joint experts report. He considered the soft silt and organic soils in the upper 2.2m had a limited bearing capacity to support shallow house footings. With the seasonal variation in the depth of the water table, there was a greater potential for ratcheting and settlement of the house foundation under earthquake shaking loads in a period of high ground water conditions. The thickness and composition of organic soil layers between 1.2m and 2.2m depth varied across the footprint of the house. This variation had the potential to complicate the pattern of settlement experienced by the house so that there could be a greater amount of settlement in some parts of the house than in others.

[65] Mr McDowell gave evidence of observations as to foundation settlement. Settlement of the house foundations had occurred, as apparent from site observation and the various floor level surveys. The floor levels showed the floors towards the

centre of the house were higher than those around the perimeter walls, resulting in the kind of deformation known as "hogging". The likely cause of hogging was settlement of the ring foundation. Based on visual observations, photographs and descriptions, he considered foundation settlement had occurred prior to the Canterbury Earthquake Sequence.

[66] Mr McDowell considered, having regard to the 2008 and August 2010 Tower reports, floor levels and the Harrison Grierson report from August 2015, that the location and scale of foundation and exterior wall cracking prior to the earthquake sequence was broadly similar to what he observed on site in October 2016. He considered the cracking he observed in the exterior of the house was typical of perimeter foundation settlement with foundation cracks at vent holes and cracking reflected up through the walls to windowsills. He noted that the rear, western side of the house had been unpainted since before 2008 and the cracks he saw in the walls appeared to be unchanged across photographs taken in 2008, August 2010 and 2015.

[67] Mr McDowell did not consider earthquake-related liquefaction would have caused any settlement of the foundations of the house. In his view, any liquefaction caused by the September 2010 and February 2011 earthquakes would have been at depths greater than 3.0m below the surface. There had been no ground surface evidence of liquefaction. There had been no evidence of cracks to the land on this property. If there had been sub-surface liquefaction, he considered it would have also occurred across neighbouring land. It would not have accounted for the differential settlement here. Mr McDowell rejected Mr Thompson's theory that there could be a re-initiation of static consolidation settlement of the foundations following remoulding or physical changes in the soil fabric after the earthquakes. As Mr Learman had also stated, Mr McDowell said there was no evidence or experience of such changes elsewhere as a result of the Canterbury earthquakes.

Mr Thompson's new evidence

[68] Mr Thompson provided a further brief of evidence dated 16 March 2017. The nature of that evidence and its delivery so close to the scheduled hearing date of 20 March 2017 caused EQC, Tower and their experts' considerable concern. It

resulted in two telephone case management conferences, was the subject of my comments in Minutes of 20 March 2017 and 21 March 2017, and resulted in the commencement of the hearing being delayed from 22 March 2017.

[69] It was appropriately titled as a "supplementary brief of evidence" when it was filed with the Court. The evidence purported to be in the nature of a reply but was largely not. In this brief, Mr Thompson said he was submitting "new evidence, descriptions, explanations and comments".

[70] Mr Thompson said he had arranged for a hand augered borehole analysis of ground conditions near the south-west corner of the house. He had also carried out a vein-shear test to measure the undrained shear strength of the ground in that location. He said this was key to determining the bearing capacity of silts and clays in the ground at that area and to determine the sensitivity of the soil. Sensitivity is a measure that reflects the ease with which soil can experience re-moulding and strength loss when ground is disturbed. He also arranged for holes to be dug at various points around the perimeter of the house. As a result, he identified that the bottom of the perimeter foundations were at shallow depths of 0.2m to 0.3m below ground level but there were two pad footings in the south-west and south-east corners. The bottom of these was at 0.6m. Although there was no excavation at the north-east corner of the house, he assumed there was no pad footing there. An excavation indicated there was no pad footing at the north-west corner of the house and there were no pad footings at regularly spaced intervals around the perimeter.

[71] The excavations and hand-augered borehole tests were carried out between 6 and 15 March 2017 without Mr Thompson advising the defendants' geotechnical experts of what he was doing. Borehole testing and ring foundation exposures were done by Geotechnics and were the subject of a report dated 17 March 2017 attached to Mr Thompson's further evidence.

[72] Mr Thompson said the ground analysis showed that, in the south-west corner, in dry conditions a surface crust had formed and there was "more than enough ground strength to support the static loading of the pad footings, without consolidation settlement being triggered". However, when ground water saturated

the sub-soil layers, softening could take place and the strength of the ground would be reduced such that consolidation settlement could occur. He said that, in dryer periods of the year (summer and autumn), the house would remain stable but, as the ground water rose during winter, softer conditions would prevail, consolidation could reactivate and this "would continue until the consolidation process has had sufficient time to fully consolidate the soils in their softened state".

[73] The particular ground analysis indicated to Mr Thompson that the silt/immediate soils within the immediate depths below the pad foundation in the south-west corner were sensitive. He relied on this to avoid allowing for a 40 per cent increase in the strength of the ground which would normally be appropriate when assessing the bearing strength of the ground during an earthquake.

[74] Mr McDowell said he did not agree with Mr Thompson's classification. He said it was based on soil conditions from an investigation when the ground was dry and very stiff. He said that, if the analysis was undertaken using the soil conditions likely to have been present during the September event, the soil would be classified as being "insensitive" or "medium sensitive". Using the measure of soil strengths, as observed on site, the results indicated to Mr McDowell that cyclic softening was unlikely to have occurred. Mr McDowell was not aware of any residential site where the mechanism of foundation settlement by cyclic softening has been recognised as resulting from the Canterbury Earthquake Sequence. Mr Learman acknowledged under cross-examination that there was a possibility of cyclic softening but said all the information he had looked at led him "to believe, in all probability, you are not going to get a huge amount of softening in the soil".

[75] Mr Thompson said the hand auger test had indicated that, because the ground was of "low plasticity" and was sensitive to disturbance, it was highly likely the fabric of the silty soils immediately below the footing degraded during the shaking of the September 2010 earthquake. Relying on that information, he calculated the bearing capacity of the ground beneath the foundations. Relying on his calculations, he then said "gross settlements" could have been expected as a result of the earthquake.

[76] Mr McDowell criticised Mr Thompson's conclusion in this regard, in particular, his exclusion of the 40 per cent allowance which was acknowledged to be normally appropriate. Mr McDowell considered it appropriate to apply the usual 40 per cent allowance when assessing the soil's bearing capacity under seismic/earthquake loading because he did not consider the soils to have a high likelihood of cyclic softening. Applying that allowance and Mr Thompson's other assumptions, Mr McDowell considered that it was unlikely the foundations would have failed to carry the loading on them during the September 2010 earthquake.

[77] Mr Thompson, relying on a particular paper published by the Department of Civil and Environmental Engineering at the University of California, considered that, with the ground water table at a 0.4m depth, the foundation pads would have been founded in or near to materials that liquefied and/or experienced substantial strength loss during the September 2010 earthquake. From that assessment, he considered it was "highly likely that the pad footings around the house settled into the liquefaction/weakened foundation" as a result of the September earthquake. He did however acknowledge that, with what may have been an appropriate adjustment to the inputs to his modelling, "essentially no liquefaction would have been triggered within the upper one metre depth profile". With that concession, he said the upper levels should be classed as "borderline materials that could behave as either cohesionless or cohesive materials".

[78] Mr McDowell pointed out that all geotechnical experts had agreed at the time of the joint report that any liquefaction that occurred beneath the property would have occurred at a depth that would be unlikely to have caused any differential settlement of the house. He therefore could not accept Mr Thompson's analysis in this later evidence. He said he had checked the analysis and the results that were obtained at the time of the joint report and had not found any justification for changing what had been agreed to at the time of that report. Mr McDowell said he did not consider liquefaction had contributed to any differential settlement of the foundations of the house as a result of the September earthquake.

[79] Mr McDowell said he had re-run a liquefaction analysis with Tonkin & Taylor's in-house software, using Mr Learman's ground analysis data and the input

parameters that Mr Thompson had used. That produced a different conclusion to Mr Thompson's analysis. Mr McDowell's analysis showed there would be no liquefaction triggered above a 2.0m depth with ground water at 0.4m below the ground level. He said his analysis produced similar results to the analysis performed by Mr Learman in 2016 which the experts had agreed, in their joint report, was correct.

[80] EDC, through Mr Learman, prepared a report for Tower dated 12 August 2016. It was checked by Gareth Williams, senior geotechnical engineer and a director of EDC. The report stated it was completed in accordance with the MBIE guidance documents "Repairs and Rebuilding Houses Affected by the Canterbury Earthquakes". The stated objective of the report was "to determine ground conditions and likely performance in an earthquake event". To do this, the geotechnical investigation included hand augers and Scala penetrometer tests. The Scala penetrometer/hand auger tests were carried out at two locations adjacent to the south-west corner of the home, the south-east corner and near the north-west and north-east corners of the home. Four cone penetration tests were made in similar situations with a further cone penetration test on the eastern side of the house. There was no evidence of a peaty layer in any of those investigations.

[81] In their joint report of 16 December 2016, Mr Learman, Mr McDowell and Mr Thompson considered it appropriate to express their opinions as to the significance of the sub-surface ground profile based on the hand auger, Scala penetrometer and CPT investigation reported by EDC. On that basis, all experts agreed to the generalised sub-surface profile referred to at [46] above.

[82] On the basis of that information, the experts agreed that liquefaction might occur in sand/silt layers between 2.0m and 3.5m in depth and 5.0m to 7m in depth. This was well below the 0.8m to 1.0m below ground level depth which they were willing to adopt for the bottom of the foundations in the absence of specific information as to this. It was also significantly below the depth of the bottom of the foundation beam at 0.4m below ground level or the bottom of the two pads at 0.65m, as identified through the March 2017 excavations carried out by Geotechnics (report of 10 March 2017) for Dr Wu and Mr Thompson.

[83] In his new evidence, Mr Thompson said the hand auger analysis had revealed there was a 50mm thick layer of peaty material directly below the footing at 0.9m. He referred to a paper which indicated peat was up to 20 times more compressible than regular clay and silty soils. Mr Thompson accepted that the peaty layer would have compressed over the 50 years the building had been sitting on top of it.

[84] Under cross-examination, Mr Thompson accepted that the EDC hand augers had not identified any peaty material at 50mm depth and therefore accepted that the layer of peaty material might possibly be discontinuous.

[85] Mr McDowell's opinion in that regard seems logical and appropriate, and consistent with Mr Thompson's opinion that a peaty layer would have been "highly compressible".

[86] Based on judgements he had made as to the nature of the soils and their load carrying capacity, Mr Thompson calculated the potential for them to fail during an earthquake. To do this, he used the calculations of Dr Wu, who also produced an evidential report for the plaintiffs as to the loading that would be carried by the pads. Those calculations were also made just prior to the hearing without the other experts involved with what Dr Wu was doing.

[87] Mr Finn, of Harrison Grierson, was critical of the assumptions which Dr Wu had made in making these calculations. He said that Dr Wu had assumed the two pads on the south-western and south-eastern corners of the house would be carrying the whole load of the southern end of the house. He said that assumption was not justified because the load of the house would be carried by the whole of the foundation beam along that end of the house and the pads. The pads would be supporting the beam that was directly above them. However, the beam between the pads was designed to be supported by the ground between the pads.

[88] Mr Finn also said Dr Wu's calculations assumed the load during an earthquake would be the earthquake loading for which buildings now have to be designed according to current design criteria, although he acknowledged that Dr Wu had made some adjustment to allow for what he was doing.

[89] Mr Finn explained that current code requirements are based on the load that would be on foundations as a result of an earthquake as if it was located close to the epicentre of a potential earthquake of a certain level. He said the loading in an earthquake that a new house has to be designed to withstand is thus assessed conservatively. He said that, even with the acknowledged adjustment, Dr Wu's calculations started with the assumption the house at 3 Victors Road was in the worst possible location at the time of the September earthquake, when this was simply not the case.

[90] Mr Polson, the structural engineer for Tower, essentially made the same criticism of the assumptions which Dr Wu had made in his calculations, namely that Dr Wu had assumed the foundation beam was being carried by the two pad foundations and that the perimeter beam spanned onto those pads. Like Mr Finn, Mr Polson said, in reality, the pads and the perimeter foundation would be supporting the house. He said that, in Dr Wu's calculations, the figures he had arrived at were for point loads on each pad. Mr Polson said he had used the concept of the load being shared more or less equally between the pad footings and the perimeter foundation and had come up with a pressure underneath the pads of approximately half of what Dr Wu arrived at.

[91] In his supplementary evidence, Dr Wu simply said he had made these calculations and produced details of his calculations as an annexure to his brief. Under cross-examination, he said he had calculated the force that would be applied to the bands by calculating upper and lower bands. He said the upper band assumed the loading of the house would be on the whole of the perimeter foundation. His lower band assumed the loading of the house was based on the pads taking all the weight.

[92] I have examined the way in which Dr Wu describes the calculations he made as referred to in the annexure to his evidence. I consider his ultimate conclusion was based on the pads carrying the weight of all the foundation and building on the south side without any allowance for the foundation also being supported, to some extent, by the ground between the pads.

[93] Mr Thompson also accepted that Dr Wu's calculations as to the loading on the pads assumed that each pad was a regular shape, 1100mm x 1100mm. Dr Wu accepted the size of the pads mattered in his calculations. In doing that, he was making an assumption because the excavations had exposed only the sides of each pad outside the foundation without any indication of how the pad was shaped on the inside. I infer from that, the pads could have been significantly less than assumed if, on the internal side of the pad, they were irregular in shape or if they were in the shape of a triangle under each corner of the foundation on the south-west and south-east side.

[94] Mr Thompson agreed that Dr Wu had assumed the size and shape of the pad by inference from the two measurements exposed on the outside of the footing. He also accepted that constructing pad footings in only the south-west and south-east corners was an unusual construction method. Mr Thompson did not rule out the possibility that the pads may have been placed under the foundation at some time after the house was built. No one had been able to obtain any council records as to this work or the design of the foundations when the house was originally built.

[95] Dr Wu also said that the pad and frame with this sort of construction was very unusual. He said, because of this, it was very hard to use a mathematical formula to define how that kind of construction would behave.

[96] In the Areas of Disagreement tabular attachment to the joint experts' report, Mr Thompson said:

> Determining the magnitude of earthquake-induced settlements at the site is no easy task. There are various input parameters that are used to assess this that are either unknown or highly uncertain. For instance, no laboratory testing of sampled subsurface materials has been carried out to properly characterise and vet the logging descriptions made by EDC, and provide a firm basis for deriving soil properties and consolidation parameters for the critical soil layers within the upper foundation zones. This makes back analysing and quantifying soil movements difficult.

[97] There has still been no laboratory testing of sample sub-surface materials. Mr Thompson has nevertheless relied on results from the recent limited geotechnic tests he arranged to analyse and quantify soil movement and to then argue that this

would have resulted in consequent building damage in the September 2010 earthquake.

[98] In the joint report, Mr Thompson said he shared the concern of all experts as to interpreting floor level surveys done by different companies at different times. Nevertheless, he considered the data showed the house had been progressively settling. Static settlement of the foundation would most likely have been completed well before the Canterbury Earthquake Sequence. He considered the opening up of cracks around the house could be readily explained by settlement processes.

[99] Under cross-examination, Mr Thompson resiled from the statement in his brief that, although the house bore the scars of previous ground movement, it was in a stable condition at the time of the September 2010 earthquake. He accepted there had been ongoing movement at the time of the September 2010 earthquake. He also withdrew his statement that the consolidation process would have finished many years after the house was constructed and ground movements had stabilised well before the onset of the Canterbury earthquakes. He accepted that there would have continued to be consolidation associated with the seasonal movements of the ground water table.

[100] Mr Thompson ended his new evidence by stating that his analysis of earthquake-induced liquefaction, cyclic softening and cyclic degradation of soil shear strength, all indicated that the bearing capacity of the foundations of the house would have been reduced during the September 2010 earthquake. It was consistent with what he described as "the abrupt, gross deformation of the floor in the south-west corner room and jammed doors experienced during the September 2010 ground shaking" and "the pervasive cracking of the foundation beams and reopening of wall cracking".

Concluding assessment of geotechnical expert witnesses

[101] Mr Thompson's evidence in his supplementary brief and the further evidence he gave during the hearing has not helped prove there was significant subsidence of foundations and associated damage as a result of the September 2010 earthquake. I consider the basis for his conclusions was highly theoretical and had to be based on

inputs where there was significant potential for error or reasonable differences of opinion. In significant respects, it is apparent he made unjustified assumptions. For example, he referred to there being a peaty layer and liquefiable ground at levels which would have impacted on the foundations. Such assumptions were not justified by the more extensive auger tests and CPT testing carried out by EDC. In some of his analysis he relied on Dr Wu's calculations as to the loading on the ground beneath the foundations. Dr Wu's calculations did not allow for the load on the foundation beam at the southern end of the house being shared between the concrete pads and the foundation beam and, in that sense, I consider they were unreliable.

[102] Mr Thompson concluded that his analysis was consistent with the gross deformation of the floor in the south-west corner room. In expressing that opinion, he appears not to have checked the conclusions he had reached on a theoretical basis against the evidence which existed from the 2008 and 2010 reports that there was significant gross deformation of the floor in the south-west bedroom before the September 2010 earthquake. He has also assumed there was pervasive cracking of the foundation beams and reopening of the wall cracking as a result of the September 2010 earthquake, without acknowledging that there was some real dispute as to whether such damage did result from the earthquake. Of further relevance, Mr Thompson said he had not seen the 2008 Hayward building inspection report at the time he prepared his initial brief of evidence or when he approved the joint experts' report.

[103] To the extent the experts arrived at a conclusion or expressed an opinion where they had to rely on their own experience or judgement, I attach greater weight to the conclusions arrived at by Mr Learman and Mr McDowell than to those of Mr Thompson. In their evidence and under cross-examination, Mr Learman and Mr McDowell demonstrated that, generally, they had considered possibilities inconsistent with their hypotheses and which were potentially of assistance to the Sadats. However, they were also able to logically explain why they discounted such possibilities, or considered them unlikely, by reference to evidence which was not significantly in dispute. Mr Learman demonstrated, through his role in carrying out the initial geotechnical investigation and preparing the EDC report of 12 August 2016, that he had approached his task objectively and with an open mind, to

investigate the site and provide information on which all experts were willing to rely in later considering what, if any, relevance ground conditions might have had to the issue in the proceedings.

[104] Against that is the way in which Mr Thompson carried out further investigations immediately prior to trial and then reformulated geotechnical evidence to align with views expressed by the Sadats as to earthquake damage. It is likely that, in doing so, he has made significant assumptions and judgments influenced by his wish to assist the Sadats with their claim, rather than to objectively and impartially assist the Court as an expert witness.

Conclusions as to geotechnical evidence

[105] The conclusions I reach generally as to the geotechnical evidence are as follows:

(a) The geotechnical evidence satisfies me that the sub-ground conditions at 3 Victors Road were such that they were not going to be strong enough to bear the load of the house, as carried by the foundations, particularly so in the wet conditions and the heightened water table conditions that occurred regularly on a seasonal basis. As a result, it is likely that there was significant subsidence of the foundations at various points and to differing degrees before the September 2010 earthquake.

(b) With the foundations inadequate for the load they had to carry and with the subsidence which occurred, it was likely there would have been significant structural damage to the foundations before the September 2010 earthquake.

(c) Sub-ground conditions were such that, given the peak ground acceleration associated with the September 2010 earthquake, there was potential for that earthquake to have exacerbated existing damage to the foundations and to have caused some further subsidence. Nevertheless, the geotechnical evidence does not assist the Sadats in proving just what damage was done to the home as a result of the September 2010 earthquake or to determine the extent of that damage as against:

- pre-existing damage;
- seasonal fluctuations in the water table;
- damage caused by the inadequate foundations;
- damage caused by ongoing subsidence due to the underlying ground conditions;
- damage that would have resulted from the February 2011 earthquake with its significantly greater peak ground acceleration; and
- later earthquakes.

The Sadats' evidence

[106] Mrs Sadat explained how she, her husband and family had come to New Zealand as refugees in 2001. They had visited 3 Victors Road regularly for a number of years before they bought it in 2006. She said it was a dream for them to buy what she described as "a beautiful house". She said they did not notice any evidence of sloping between the south bedroom and the kitchen, or of the floor in general, until after the earthquake. They did notice "small cracks" prior to the earthquake but they were "minor". She said they had the house "assessed" before they purchased it and everything was good.

[107] Under cross-examination, she said it was only the real estate agent who told them the house was good. She said that the agent had told her the house was essentially in perfect condition and all it needed was some painting done. They believed that "the cracks were small and only needed some plastering and painting".

[108] Both Mr and Mrs Sadat described how frightening the September 2010 earthquake was for the family, the sound calling to mind darker times back in Afghanistan. Mrs Sadat thought her children might be killed. There were a number of breakages: glasses, television and a laptop; a chandelier fell down and their aquarium fell over. Water leaked from the hot water cylinder. Both described the house shaking. Mrs Sadat said she could feel the floors going up and down and doors within the house became jammed. Although the earthquake occurred in the early hours of the morning, Mrs Sadat said they could see the roof moving with the nails coming out.

[109] Mrs Sadat said that, because they did not feel safe in the house, they sat in their car for five or six hours after the earthquake and then stayed at Burnside High School for three days.

[110] I do acknowledge how frightening the September 2010 earthquake must have been for the Sadats and their children. The amount of damage done by the earthquake cannot however be measured by the level of fear they felt.

[111] Mrs Sadat said in her evidence that, when they returned home after the earthquake, the house was badly damaged. They "saw cracks everywhere [and] [t]he cracks were significantly bigger than any that were there prior to the earthquake." She said the floors were noticeably uneven, and doors in the house and the cupboards would not open.

[112] There was some damage which Mr Sadat was able to fix. Mrs Sadat said her husband cut the bottom off one door so it could open and close, and tightened screws on others. She said her husband went onto the roof "and it was severely damaged". She said there were cracks and several nails had come loose but he hammered the nails back in to fix this.

[113] Mrs Sadat said in her evidence that she had no idea that there was any slope in the south bedroom and the kitchen before the earthquakes. She said she could not remember anything apart from cracks on the wall.

[114] Serious structural defects were identified with the home in 2008 and in August 2010. Geotechnical evidence discussed above demonstrates that the original foundations were probably never sufficient to carry the load of the home in the ground conditions that existed at this site. There would have been consolidation of the ground below the foundations in the period immediately after the home was built in the 1950s. The house was thus likely to have been affected by significant subsidence well before the Sadats purchased the home and probably continued to subside afterwards. Structural engineers for all parties noted there were significant cracks in external walls in August 2010, as recorded in photographs taken at that time. One of those cracks immediately on the external wall outside the kitchen

passed from a windowsill down to the foundation. The photographs indicate that it was a similar width after the September 2010 earthquake as it had been before, probably about 8.0mm wide. Mrs Sadat said this was the sort of crack she had described in her evidence as "small and minor".

[115] A photograph taken in 2010 recorded a major crack in the wall-lining within a wardrobe on an internal wall in the corner of the south-west bedroom. The wardrobe was next to the external wall of the house and thus adjacent to the perimeter foundations. Mrs Sadat said the crack had not been there before the earthquake. Under cross-examination, it was pointed out to her that there was a photograph of the crack taken in August 2010. When asked how she could explain this, she said the assessor had not taken a photograph of the wardrobe at the time he visited the property when investigating the August 2010 insurance claim.

[116] Mr Harris, counsel for Tower, objected to this evidence on the basis there had been no issue raised previously by way of reply evidence, and the photograph had been included in the common bundle as a photograph taken at the time of that assessor's inspection of the property in August 2010.

[117] After a break in the proceedings, Ms Dalziel, counsel for the Sadats, said she had discussed the matter with Mrs Sadat and she withdrew what she had said. Counsel passed on the explanation, not the subject of evidence, that Mrs Sadat said she had not understood the question. I reject that application given the context in which the question was put and the way in which Mrs Sadat had dealt with other questions with both the questions and her evidence being put in evidence through an interpreter.

[118] I am satisfied there was significant sloping of the floor of the house from the middle of the home towards the perimeter foundations, ie hogging, before the earthquake. That sloping had been observed, felt and expressly noted by Mr Dann in the August 2010 Tower report. It is likely there was significant sloping of the floor in other parts of the home towards the outer perimeter as a result of foundation subsidence. Mr and Mrs Sadat must have been aware of the sloping floors, at least in the kitchen and south-west bedroom, before the earthquake.

[119] In response to questions from the Court, Mrs Sadat said that she had not noticed any sinking of the house before the earthquake and it was only after the earthquakes that she looked carefully at every corner of the house for any point of weakness. She said she had not looked at the house like that before the earthquake because she "was enjoying" her house, was "very relaxed" and "very happy living in a good house". Either Mrs Sadat was being deliberately evasive in refusing to acknowledge the extent of patently observable dislevelment in the floor of the house or she had been oblivious to it because she was happy to live with the house as it was. The fact she said that in August 2010 she hoped the claim over a leaking pipe would lead to the insurer paying to fix the walls, makes this latter explanation doubtful.

[120] The Sadats say they noticed general unevenness and slopes in the floors of the house after the earthquake. It is surprising they have not been able to specifically identify marked slopes in particular areas if such slopes suddenly emerged as a result of just the September 2010 earthquake. It is also surprising that, if the sloping was new and as measured subsequently, they did not bring it to the attention of Mr Hargreaves when he visited the property on 8 September 2010.

[121] There was no evidence that the 2008 Hayward report had been disclosed to Mr and Mrs Sadat as vendors but I consider it likely they knew the potential purchaser had chosen not to continue with the purchase because the building inspector had reported on significant structural problems with the home.

[122] As Ms Dalziel suggested during cross-examination of Mr Hayward, Mrs Sadat's description of the property when they bought it and her feelings about it may well have reflected how fortunate they considered themselves to be at being able to buy a property rather than reflecting a realistic assessment of the structural soundness of the home at that time. On her own evidence, there were cracks which required filling. It is clear from the evidence of the structural and geotechnical engineers that there would have been significant subsidence of the foundations before 2006. The cost of the property when they bought it was $235,000. Given Mrs Sadat described the property when they bought it as being "perfect" and their dream home, it is surprising that it was available for sale in 2008.

[123] Mrs Sadat said they were living at their home when the February 2011 earthquake struck. The accelerated ground force of that earthquake was greater than the September 2010 earthquake. Mrs Sadat said in her brief of evidence that they did not feel safe during that earthquake due to the damage which they had observed from the first earthquake. She said the earthquake struck when she and her daughter were inside the house but the whole house shook and they had to run outside. She said, after the earthquake, everything in the kitchen had fallen to the floor but "the house looked much the same as it had since the first earthquake, there was no damage as far as I could tell".

[124] If there was significant new damage to their home as a result of the September 2010 earthquake, it is difficult to accept that this evidence would have been correct. The 2011 earthquake generally caused more damage to residential houses. Information produced as to claims to Tower for nearby properties indicated that greater damage resulted from the February 2011 earthquake.

[125] In her evidence as briefed, Mrs Sadat said that after the February 2011 earthquake her husband did some painting to the house to make it liveable but, because of how unsafe they felt due to the damage from the first earthquake as well as the stress of having no insurance, they moved out again before any other repairs were done. She said they had not lived in the house since. During cross-examination, Mrs Sadat was reminded of that statement and she responded that she was scared of the earthquakes and so still lived with her sons in another place. However, almost immediately after that, she was asked when she stopped living in the house. She said she had never stopped living in the house; sometimes she goes to her sons and sometimes stays in the house, but she had not lived there for six months after the event.

[126] Mrs Sadat was asked about the insurance claim made in August 2010. She said her daughter, who spoke English, dealt with Tower over the claim. Mrs Sadat was asked about a record of a communication to Tower of 24 August 2010, where the person calling for Mrs Sadat indicated the Sadats thought that Tower would respond to the claim by building a new house. Mrs Sadat's response was that she had not said that and she "only asked to fix our walls". She said they would have

been crazy to ask for a complete rebuild but said "we have only spoken about probably the cracks of the walls". She said she was unaware of her daughter communicating with Tower asking Tower not to decline the claim but rather to accept that the Sadats would be withdrawing the claim so there was not a formal decline. She said they had never received a letter dated 1 September 2010 addressed to their home where Tower advised that, as a result of there being no cover under the terms of the policy and as per that discussion with their daughter, the claim had been withdrawn.

[127] Mr Sadat said in his brief of evidence that he agreed generally with the evidence given by Mrs Sadat. He otherwise offered limited evidence as to the state of the building when they purchased the property in 2006 or immediately after the September 2010 earthquake. He did describe how he had attempted to fill at least some of the major cracks after the earthquakes with builders' bog.

[128] Mr Sadat said that after the earthquake the house was so damaged it was unsafe to live in. He and his wife had "lost the house that we love and had not been able to enjoy time at the house with our children, as we had intended". He said nobody wanted to stay in their daughter Ruby's room because there were so many large cracks and the floors had become very uneven and sloped.

[129] As to damage following the September 2010 earthquake, Mr Sadat said that:

> After the earthquake the damage to our house was obvious. Wide cracks had opened up in our house, in the pavers outside and throughout the garage. The roof had lifted up and the nails had come loose, allowing water to leak through into our property.

[130] I note that none of the structural engineers have identified permanent damage to the roof. At most, there were only two cracks of a minor nature to the garage floor.

[131] It is of some significance to me that Mr Sadat seemingly did not draw to the attention of Mr Hargreaves, the first assessor who visited the property on 8 September 2010, the claimed sudden extensive unevenness in the floors and new fracturing to the foundations or jamming of the doors. Mr Hargreaves spoke to Mr

Sadat during his inspection. Under cross-examination, Mr Hargreaves said he had no memory of being told that doors had jammed in the earthquake. He was clear that it would have made no difference if they had told him this because, when he was there, the doors were opening and closing. I accept his evidence as to this.

[132] I heard evidence from the Sadats' daughter. She gave her occupation as "interpreter". Much of the communication between Tower and the Sadats over the August 2010 insurance claim was through her on behalf of her parents. She had married in about 2009 and had moved to Auckland but said she was staying with her parents at the time of both the September 2010 and February 2011 earthquakes. She described how frightened she had been during the September 2010 earthquake, how her door had jammed and her father had to come and push very hard so she could get out of the room. She said there was a huge difference in the house after the earthquake. She said that, before the earthquake, it was their dream house, they had always thought it "so beautiful and perfect" and that was why she believed the damage was caused by the September 2010 earthquake.

[133] During cross-examination, she said she could not remember if there were significant cracks inside the house before the earthquake and said there had only been some "very small cracks" outside the house.

[134] A short brief of evidence was presented from a Mr Mohamed. He was not required to attend for cross-examination. He had been a tenant at 3 Victors Road for approximately five years until 2006. He said he had enjoyed living there with his family and had taken pride in the house. During that time, he had noticed "one small crack to the exterior of the property but this had been repaired by the owner". He said that, when they moved out of the property, "it was in good condition. It really was a lovely house." He said that, when he went back to the property after the September 2010 earthquake, he noticed cracks outside the house and in the garage, and the house had not been like this when he was there.

[135] Ms Dalziel suggested to Mr Hayward in cross-examination that his rejection of Mrs Sadat's evidence as to the building being perfect was unfair given Mr and Mrs Sadat were refugees from Afghanistan. I acknowledge that Mrs Sadat's

description of the home may well have reflected how the family felt about the property, a place which was their home and which they may have considered themselves fortunate to be able to buy in all the circumstances that they faced, having come to New Zealand as refugees. I cannot however, in terms of both their honesty and reliability, attach much weight to the evidence they gave as to the structural state of their property when they purchased it, in the period through to September 2010 or immediately after the September 2010 earthquake.

[136] The evidence of Mr Mohamed and the Sadats' daughter is also so at odds with the evidence from Mr Hayward and Mr Dann and the evidence of the expert engineers that it too has not helped the plaintiffs prove their case.

The initial post-earthquake assessments

The 8 September 2010 Hargreaves inspection for Tower

[137] Mr David Hargreaves is an experienced loss assessor and adjustor, having worked in that capacity since 1974. He visited the property on 8 September 2010 for Stream, the assessment group engaged by Tower to deal with earthquake-related claims. After visiting the property, he dictated a short note as to his observations. Included with that were photographs of at least some of the damage he had described.

[138] When Mr Hargreaves visited the property, he had none of the information which Mr Dann or Mr Hayward had provided as to the earlier condition of the property. In his report, he said the home had sustained earthquake damage:

> … primarily to the plastered exterior brick veneer. There is clear evidence of earlier fracturing and this is clearly evident by the fact the earlier fractures have been painted.
>
> Notwithstanding this fact, there have been significant fractures to the brick veneer plastered exterior. The fracturing appears to be the result of swaying, rather than any liquefaction … reinstatement may require epoxy gluing to fractures.

[139] He said there was no evidence of damage to existing artificial surfaces or to boundary fences. He noted the fractures were vertical. He said he could see no visual evidence of liquefaction or subsidence. A visual inspection did not disclose

any reason why the dwelling could not be occupied but he noted the insureds expressed nervousness as to residing in the home.

[140] I do not consider Mr Hargreaves' initial assessment much assists the Sadats. It was clearly an initial inspection, intended to provide the insurer with an initial and provisional assessment of their potential exposure arising out of the earthquake claim. The assessment was made without any awareness of relevant background information. It was superficial. Mr Hargreaves' observations indicated a preliminary view that the damage he observed would or might have been caused by the earthquake.

[141] Mr Hargreaves said in the report he could find no visual evidence of subsidence. All the structural engineers accept that the significant cracks on the exterior cladding, which were there before the earthquake but which Mr Hargreaves assumed resulted from the earthquake, were consistent with a failure of the foundations as a result of ground consolidation and subsidence.

[142] I also note that the photographs of cracking in the exterior cladding, which Mr Hargreaves included with his report, were of the same cracks that had been recorded in the photographs taken by Mr Dann. Mr Hargreaves' photographs are generally clearer than the photographs taken by Mr Dann. The crack on the exterior eastern wall of the house, near the hose reel hook, appears to be a little wider than as shown in the photograph taken by Mr Dann but was otherwise similar.

[143] Although Mr Hargreaves in his report said the fracturing appeared to be the result of swaying, Mr Finn, for EQC, explained in a way which was logical and convincing to me, why the horizontal fracturing was consistent with the brick veneer above the crack holding its position as a result of the holding strength of the bricks at that point being sufficient to resist the downward pull of the wall and bricks below as a result of the foundation at that point sinking. The vertical cracks in the plaster veneer were consistent with the displacement of the foundation because of subsidence.

[144] In Mr Hargreaves' report, he did not note any damage to the foundations which were of such a nature as to require repairs. He considered the damage to the brick veneer could be repaired by hacking out, re-plastering and a repaint. Consistent with that, he considered the cost of repairs to the damage, which he assumed was earthquake-related, would be less than the EQC cap of $100,000. Stream recorded a reserve in the amount of $80,878.83 against the claim on 9 September 2010.

[145] Under cross-examination, Mr Hargreaves said that, when he went to the property, the doors were opening and closing. He said it would have been normal, with a claim of this sort, if it had the potential to go over cap, to involve a structural engineer and for there to be a more in-depth investigation, especially so where there was obvious pre-existing damage. Where there was pre-existing damage, it would have been necessary to identify the cause of that in fully assessing the claim.

The Jones' assessment of 9 December 2010 for EQC

[146] Mr John Jones gave evidence for EQC. He inspected 3 Victors Road on 9 December 2010 and prepared a report for EQC. Mr Jones was a retired Police Officer. Between October 2010 and March 2011, he was employed by an Australian business and deployed to Christchurch as a loss adjustor, assessing earthquake damage. He said, in late October 2010, he received "several days" training by EQC on the requirements of property damage inspections. Mr Jones made his inspection on 9 December in the company of a New Zealand builder who was also working for EQC at the time. Neither of them had any of the information obtained by others as to the condition of the building before their inspection.

[147] The two men went through the building, noting damage and repairs required for a scope of works. They calculated it would cost some $30,600 to repair the damage which they observed, predominantly for foundation repairs. Of significance, they observed sloping in floor levels from 20mm to 40mm in five rooms, the fall being from the interior side of the room towards the perimeter of the house. In the kitchen they noted "windows jamming" but there was no such observation in relation to internal doors or cupboard doors. Significantly, they noted seven foundation

cracks on the northern side of the building and "major wall cracks" outside the bedroom which was on the southern side of the home. These cracks were in the same area as a crack that had been recorded in a photograph taken by Mr Dann associated with the 2010 Tower report. They recorded five cracks in the foundation on the south side, three foundation cracks on the east side and one crack on the western side. Those cracks must have included the crack on the western wall photographed by Mr Dann.

[148] A marked up rectangular scheme of the house also formed part of the report. On that, Mr Jones noted five foundation cracks on the southern side of the house, three foundation cracks on the western side of the house, seven foundation cracks on the northern side of the house and three foundation cracks on the eastern side of the house. They also noted nine stucco cracks on the northern side of the building, four stucco cracks on the southern side, five stucco wall cracks on the east side and two wall cracks on the west side.

[149] Mr Jones noted that the hot-water cylinder and toilet cistern were leaking. He advised the Sadats to have them repaired and to send the invoice to EQC. The Sadats did this, resulting in the reimbursement of $200.39 for those plumbing repairs.

[150] EQC sent Mr Sadat a copy of EQC's claim checklist and scope of works on 15 December 2010.

[151] The evidence of Mr Jones is important in that it suggests that, whatever damage there was to the foundations and to the external walls of the Sadats home before the earthquake, there was, at least potentially, increased cracking caused by the September 2010 earthquake.

Structural engineering evidence

Evidence of Samuel Polson, structural engineer for Tower

[152] Mr Polson is a professional chartered engineer. Since January 2012, he has been heavily involved in the assessment and repair of residential properties in Christchurch following the Canterbury earthquakes.

[153] Mr Polson said he first inspected the interior and exterior of the house and the sub-floor of the house on 24 June 2015. He said that, in his inspection, he observed a number of cracks in the perimeter foundation which he considered had "likely formed as a result of foundation settlement". He noted the floor levels taken by Harrison Grierson showed a total level variation across the dwelling of 70mm with the perimeter of the house typically lower than the interior and levels on the south-west elevation being typically the lowest. He observed some cracking of wall linings but said it appeared most wall lining cracks had been plastered and painted. He noted that some internal walls did not appear to be vertical with some doors sticking in their frames. He observed a number of cracks in the external cladding and said they typically aligned with foundation cracks.

[154] Mr Polson compared the 70mm floor differential in the Harrison Grierson report of 14 August 2015 to the 50mm slope referred to in the 2008 Hayward report. He concluded that "much of the floor level variation and settlement of the house pre-existed the September 2010 earthquake". Given the measurements in the two reports, Mr Polson said approximately 24 per cent of the floor dislevelment could be attributed to earthquake damage across the entire Canterbury Earthquake Sequence. Therefore, approximately 76 per cent of the overall settlement pre-existed the September 2010 earthquake.

[155] Mr Polson considered that his estimates of pre-earthquake settlement and damage due to the earthquake were consistent with information as to what had been observed with the home in 2008 and August 2010. He referred to information in the 2008 Hayward report and the 2010 Tower report as to cracking to the perimeter foundation as a result of foundation settlement and photographs from August 2010 showing cracks around the foundation perimeter, particularly at the sub-floor vent

openings. He also referred to the statement in the August 2010 Tower report that "cracking to the interior of the house is constant around the entire house". He noted that cladding cracks appearing in photographs attached to that report appeared to extend from perimeter foundation cracks. He was thus of the view that, based on the information available, it was evident external cracking damage pre-existed the September 2010 earthquake.

[156] Mr Polson then attempted to make an assessment of the likely settlement that could have resulted from the September 2010 earthquake, as distinct from the next major earthquake in February 2011. He looked at just these two events because they were the most significant in terms of shaking. He then referred to the level of shaking, as measured by the corrected peak ground acceleration of both earthquakes. The measure of those, as referred to in two different studies, was as follows:

Earthquake Event	**Magnitude**	**Magnitude Corrected PGA (M=7.5)**	
		Bradley	**O'Rourke et al.**
04 September 2010	7.1	0.23g	0.14g
22 February 2011	6.2	0.30g	0.23g
13 June 2011	6.0	0.12g	0.13g
23 December 2011	5.9	0.09g	0.08g

[157] Mr Polson said that, in terms of peak ground acceleration, these results showed the February 2011 earthquake was 30-65 per cent stronger than the September 2010 earthquake. Taking a conservative approach, he adopted the lower percentage. He then said that, assuming that the level of earthquake-related settlement was directly proportional to the level of shaking, the floor level settlement attributable to the September 2010 earthquake could be assessed as being 43 per cent of the total earthquake settlement. On the basis of an increased dislevelment in the floor of 20mm, using the measurements in the 2008 Hayward report and the 2015 Harrison Grierson report, Mr Polson attributed a maximum of 7mm of total settlement as being due to the September 2010 earthquake, with all other settlement being attributed to pre-existing damage or damage as a result of the February 2011 earthquake. He reiterated that, in making that assessment, he was again being conservative because he was ignoring possible damage as a result of significant earthquakes after February 2011.

[158] Again using the measure of floor dislevelment from the two reports, Mr Polson said sloping due to the September 2010 earthquake was 11 per cent of the total dislevelment in the floor. He then applied that percentage of damage to cracking in the external walls. He said that, taking the largest crack after the earthquake as being 10mm in width, this equated to cracks opening by a maximum of 1.1mm as a result of the September 2010 earthquake. Based on the information available, it was evident that there had been interior wall lining cracking damage before the September 2010 earthquake but he "expected that some new cracks would have formed as a result of the September 2010 earthquake, with the existing cracks likely to have been exacerbated".

[159] Mr Polson noted that the Harrison Grierson report had recorded that a number of internal walls were not vertical. However, he said that, because there was no clear trend consistent with racking, ie rocking, of the house to the extent walls were not vertical, this was directly related to foundation settlement. He considered that, as foundations had subsided, the walls above had been pulled over causing them to be no longer vertical.

[160] Mr Polson thus considered it "likely" there was some additional cracking to the foundations, some additional cracking to the exterior cladding and some widening of existing cracks which could all be attributed to the September 2010 earthquake. In that respect, his evidence differed from the opinion of Mr Finn. Mr Finn had considered further damage was merely "possible".

[161] Mr Polson observed that cracks in the foundations identified in August 2010 were still visible after that time but some "may have opened wider". He then said that no new cracks in the foundations appear to have formed after that time. It is difficult to see how he could have been sure of that, relying on either photographs or statements contained in the 2008 Hayward report or the August 2010 Tower report. In neither report was there any definitive statement as to the total number of cracks that had existed when those reports were prepared.

[162] The way in which Mr Polson arrived at the damage from the September 2010 earthquake as a proportion of all damage done to the building, before, during and

after the Canterbury earthquakes, seems arbitrary and theoretical given the potential for uncertainty as to the precise extent of sloping observed in 2008 and the way in which the extent of sloping varied throughout the home.

[163] Mr Polson went on in his evidence to say that settlement of the floors to the extent of 7mm as a result of the September earthquake was not a measure of movement that, by itself, would ever warrant repair work. He said many new build foundations are out of level by similar amounts.

[164] While Mr Polson considered that cracks could have widened as a result of the September 2010 earthquake but only by up to 1.1 mm, he acknowledged that, where a crack pre-existed the September 2010 earthquake, repair would have to deal with the whole crack and not just put it back to its pre-September 2010 width. In accordance with MBIE guidelines, cracks up to 10mm width could be repaired using epoxy injection techniques. He also said repairs to both the foundation cracks and cladding cracks should only be carried out once the foundation settlement had been remedied, even though he considered the damage to the external cladding was non-structural.

[165] Mr Polson said there was clear evidence that significant settlement of the house had occurred before the September 2010 earthquake. He said this was a major long-term problem that had to be remediated. The exacerbation of the pre-existing settlement and damage in the September 2010 earthquake was not substantial. Accordingly, it was Mr Polson's view that repairing the additional earthquake damage would have made no material difference to the work required to repair the pre-existing damage. Mr Polson's evidence was thus consistent with the evidence given by Mr Finn to the extent that both said the repairs required now to repair foundation settlement, through re-leveling of the property and cracks in the foundation, are essentially the same as were required to remedy pre-existing damage. He said this was also true of the repairs required to repair cracks in the internal lining.

[166] The opinion of both these experts, that additional earthquake damage would have made no material difference required to repair pre-existing damage, was not

challenged through cross-examination. Indeed, Mr Polson was asked to accept that it was his evidence that all repairs now required would have been necessary as a result of pre-existing damage. He confirmed this was his opinion.

Evidence of Simon Finn, structural engineer for EQC

[167] Mr Finn gave evidence as a structural engineer for EQC. His evidence in summary was as follows:

(a) He examined the home on 24 June 2015. The main defects he observed were cracking to the perimeter foundation, different floor levels and differential foundation settlement, cracking of internal linings and the external cladding, racking of the framing so walls were out of plumb, and cracks in the garage floor;

(b) The defects he observed were the result of vertical settlement of the foundations and were not earthquake-related damage.

(c) The settlement of the house was attributable to poor ground-bearing capacity, a high and variable ground-water level, and deficiencies in the original foundation design which were not appropriate for the ground conditions on site;

(d) Pre-earthquake information indicated the defects he observed were present before the earthquake and, while some earthquake damage was possible, any change as a result of the earthquake was minimal;

(e) He observed no earthquake-related damage to the timber framing of the roof;

(f) Cracking in the garage concrete slab was shrinking-cracking and not earthquake-related; and

(g) He was satisfied, on the evidence available, that the earthquake caused no physical change to the house or garage that would require any different or more extensive repairs than would have been necessary to fix pre-earthquake defects.

[168] Mr Finn's observations and opinions were initially set out in the Harrison Grierson report of 14 August 2015. The report included photographs of some of the damage he observed, photographs from the August 2010 Tower report and a floor plan showing floor levels that Harrison Grierson had measured.

[169] I have considered the whole of Mr Finn's evidence carefully. I have considered the evidence and opinions given by other experts, the evidence of Mr and Mrs Sadat and all the evidence that was presented as to the condition of this house before and after the earthquake, and the criticisms which have been made of Mr Finn's evidence by other experts and in counsels' submissions. I found the evidence of Mr Finn compelling.

[170] No challenge was made as to Mr Finn's expertise or experience which he relied on in the opinions he expressed.

[171] Although he had a clear view, which was strongly in support of EQC's position, and his opinions were challenged, in neither the evidence he presented nor in the way he gave that evidence was there any basis for me to find that he had ignored relevant information or considered matters that were irrelevant. When he was challenged as to opinions he had expressed regarding the likely cause of observed defects in the building, he was able to explain, in a way which was logical to me, why his opinions were correct and why the suggestions being put to him were not consistent with what he observed. He quite properly acknowledged that he could not exclude the possibility that the 2010 earthquake had caused some change to pre-existing defects.

[172] Mr Finn had, as was necessary, considered all the information that was available as to the pre-earthquake condition of the home and had not relied on just specific parts of the 2008 Hayward report and the August 2010 Tower report. His evidence was consistent with those reports and the evidence of Mr Hayward and Mr Dann arising out of them.

[173] Mr Finn acknowledged that the defects in the building were similar to earthquake-related damage he had seen in other houses where the soil had liquefied.

He responsibly advised the Court that his first impression was that the defects to the house were earthquake damage.

[174] Mr Finn inspected the property on two occasions. The first was on 24 June 2015, in response to a direction from the Court.[5] Mr Finn carried out the inspection as Harrison Grierson's team leader but was accompanied by others, including a representative from EQC and Mr Polson. As part of the expert conferral process directed by the Court, there was a second inspection on 19 October 2015, with which Dr Wu and Mr Polson were also involved.

[175] The first inspection was the subject of the detailed Harrison Grierson report of 14 August 2015. In that report, Mr Finn stated that the property owner and the then tenants had been present throughout the inspection. I consider his report, as confirmed in his evidence, objectively and carefully details the state of the home at the time of his initial inspection. I say that because the detail in the reports was largely unchallenged by Dr Wu. It was also consistent with the photographs which were produced as an appendix to the report and photographs which were produced with Mr Finn's brief of evidence.

[176] Mr Finn's observations included:

(a) Two hairline cracks in the surface of the garage slab;

(b) Hairline cracking in the foundation beam at a number of the vents. Most vent cracks showed some sign of reflective cracking in either the veneer and/or the external pathways;

(c) No signs of displacement between the veneer and the perimeter beam and no signs of lateral stretching or rotation of the perimeter beam;

(d) A number of cracks to the brick veneer, particularly above vent openings within the perimeter beam and below windows where the natural points of weakness occurred within this element of the building. He noted the cracks generally ran from the perimeter beam up to and through the windowsill but did not show any reflective damage in the window

[5] Minute of Wylie J, 12 May 2015 at [6](d).

framing. Where some attempt had been made to repair the cracks, the majority of the repairs showed further signs of separation after the repair was completed;

(e) Two locations between windows showed signs of horizontal cracking (likely along a bed joint in the bricks). With both cracks, there had been some attempt at repair but the cracks still showed signs of movement;

(f) External window frames were in average condition when considering the age of the dwelling but did not show any obvious signs of earthquake-related damage;

(g) Cracking to an exposed section of the original plaster wall lining in built-in wardrobes to the south-west bedroom;

(h) Internal fixtures within the kitchen did not show any signs of racking between doors and all internal doors and windows appeared to be operational;

(i) Wall verticality surveys were undertaken where appropriate and readings recorded. Wall measurements from east to west were generally within acceptable tolerances. Walls running north to south showed a general trend towards the west with out of plumb measurements up to 1.2 per cent recorded, generally matching the overall trend of floor levels towards the west; and

(j) Ceilings were generally in good condition with no signs of cracking or damage. There was one hairline crack in the stipple finish to the ceiling in the eastern bedroom next to the hallway.

[177] In his report, Mr Finn said his structural inspection indicated the building had been subjected to damage as a result of settlement of the foundations. He said the settlement and plumb verticality issues were typical of dwellings impacted by the Canterbury Earthquake Sequence but, in this instance, he believed this was not the cause.

[178] In the Harrison Grierson report of 14 August 2015, Mr Finn considered the pattern of settlement to be attributable to poor ground-bearing capacity of the bearing stratum and their inability to resist the loads imposed. He considered the settlement pattern was reflective of the entire dwelling settling as one unit but also in localised areas around the perimeter.

[179] Mr Finn noted in his report that in some instances the type of pre-existing defect or damage evident with this house could have been exacerbated by the impact of the Canterbury Earthquake Sequence. He considered the 2008 Hayward report and the August 2010 Tower report. He then considered whether any additional loss or damage had occurred as a result of the earthquakes. In doing that, he produced and compared 11 photographs of cracks to the cladding and foundations associated with the August 2010 Tower report and photographs taken during the Harrison Grierson inspection. The photographs included what Dr Wu had described as the 8mm crack outside the kitchen on the western wall. Consistent with what is shown in the photographs, there appeared to be no significant change in those cracks between August 2010 and the time the photographs were taken on 24 June 2016.

[180] In the joint report to the Court of 10 March 2016, Mr Finn said he had referred to the 2008 Hayward report and the August 2010 Tower report. He was of the opinion that the evidence gathered did not show any additional material change which could be attributable to the earthquake sequence.

[181] In his evidence, Mr Finn said his observations, as to a general trend of settlement towards the western elevation, were consistent with the observations made by Mr Hayward in the 2008 Hayward report, where he referred to a significant fall in the south-west bedroom and kitchen area. Mr Finn said he would have expected to have seen a significant difference between Mr Hayward's 2008 measurements and his 2015 measurements if the Sadats' evidence as to a sudden and marked changed in the slope of the daughter's bedroom was correct. He also said that, had there been a significant change in the foundation settlement and floor levels of the house as a result of an earthquake, he would have expected to observe a noticeable difference in the extent of cracking to the perimeter beam, interior linings

and the exterior cladding following the earthquake. He said that his comparison of before and after earthquake photographs suggested there was no significant change.

[182] Mr Finn considered the cracks at most vents occurred at relatively weak points in the super-structure and were consistent with vertical settlement. He said, in simple terms, the cracking resulted:

> … from the conflicting actions of the vertical settlement at ground level and the stability of the roof, which holds the super structure together and resists the downward pulling caused by the vertical settlement.

[183] He said that, if the dwelling had been permanently affected by horizontal earthquake forces, he would have expected to see signs of horizontal displacement and cracking in the corners, where different components of the building, which move with a degree of independence in an earthquake, intersect. He said he had not observed any signs of horizontal displacement of this nature, which might have manifested as displacement between the outer face of the veneer and perimeter beam. He had not observed signs of lateral stretch or rotation of the perimeter beam. In his opinion, all cracks in the foundation beam were due to vertical settlement.

[184] Referring to the 2008 Hayward report and the August 2010 Tower report, Mr Finn said he had not observed any evidence that the September 2010 earthquake "caused significant new cracks or significant change to the pre-existing cracks to the perimeter foundation".

[185] Mr Finn considered the cracking to the internal linings was consistent with the pre-earthquake vertical settlement that had occurred, with the north-south walls showing a general trend towards the west, also consistent with the pre-earthquake vertical settlement that had occurred.

[186] Mr Finn also considered that the lack of racking damage, and fixture and fittings not being out of plumb, further supported his opinion that the damage to the interior of the building was not earthquake-related. He said that, when a building suffers significant horizontal forces during an earthquake, which cause movement beyond the capacity of the building to withstand, there is usually diagonal cracking at corners and around openings such as windows and doors. In addition, there was

usually racking to door frames and fixtures such as the kitchen cupboards. Consistent with photographs attached to his evidence, he said he had not observed any damage of this type at the dwelling.

[187] Mr Finn noted that Dr Wu had attributed lining cracks to "severe shaking" during the September 2010 earthquake. Mr Finn said that dwellings that had suffered from severe shaking-related damage show signs of separation of the veneer from the timber framing, especially so in older brick-clad dwellings of the type here. Mr Finn said there were no veneer failures of this type and no evidence of cladding to perimeter beam separation or other evidence to suggest that severe shaking had resulted in any permanent change.

[188] Mr Finn referred to Dr Wu's statement in his brief of evidence that the shaking during the September 2010 earthquake exceeded the bracing capacity of the superstructure. Mr Finn explained that, when a dwelling exceeds its bracing capacity, this results in horizontal movement occurring at different magnitudes between the foundation and the roof. If the capacity of the wall or framing is exceeded then the wall or framing will be left in a deformed state, with doors, windows, fixtures and fittings left out of plumb.

[189] Mr Finn said that he did not see any evidence of earthquake-related deformations during his inspections of the house. Similarly, he did not see any separation at the mitre joints in the door frames in either the hallway or elsewhere, and the internal and external doors and windows appeared to be operable. He said he would have expected the door frames to be out of plumb if the superstructure's bracing capacity had been exceeded. He said he had taken into account the Sadats' evidence of at least one door jamming immediately following the earthquake. He did not discount that the level of shaking could have had that effect, for example, by loosening the door from its hinges (Mrs Sadat did refer to Mr Sadat having to tighten screws after the earthquake), but said he observed no evidence of any deformation of structural elements around the doors such as framing or architraves, which would have been consistent with a permanent change caused by earthquake shaking. This was also true of wardrobes in the south-west corner and the kitchen units, which he

noted were at the lowest points of settlement with the largest floor gradient changes. Again, this was consistent with the photographs he produced.

[190] There was a hairline crack in only one bedroom at a sheet-joint location. He said this was a hairline fracture that could have resulted from thermal shrinkage. Mr Finn said this was not a telltale sign of diaphragm failure, particularly so when there was no similar damage to other rooms throughout the dwelling.

[191] Mr Finn noted that Dr Wu's theory appeared to be that damage to the exterior cladding had been caused by lateral forces. Mr Finn explained that pre-existing cracks in the cladding would, in effect, have created isolated cladding sections. Had the earthquake impacted the dwelling as Dr Wu asserted, then Mr Finn would have expected exacerbation of these pre-existing defects to result in partial or total collapse of isolated cladding sections, or at least some evidence of horizontal dislodgement or movement of individual bricks or entire panels of cladding. He said he would have expected to see some separation between the framing and the brick veneer. He had seen no evidence of any such movement or separation, and reiterated the cracking was consistent with non-earthquake-related vertical settlement.

[192] Mr Finn noted that, in his evidence as briefed, Dr Wu did not explain the apparent similarity between pre- and post-earthquake photographs of cracking to the exterior cladding, nor address the lack of any apparent change to the structural components where it was possible to directly compare pre- and post-earthquake evidence of damage.

[193] Mr Finn concluded his evidence by stating that there were undoubted structural defects in the building which need to be addressed but, in his opinion, they were not earthquake-related. Based on pre-earthquake reports and photographs, and his inspections after the earthquake, he did not consider there had been any material change to the house or garage as a result of the earthquakes.

The experts' joint report

[194] The structural engineers, Messrs Polson, Finn and Dr Wu, provided a joint report to the Court dated 10 March 2016. In it they referred to various matters they agreed on. Relevantly, these included:

> a. The house has structural damage in its current condition. Differential floor level settlement is approximately 70mm, there are cracks in the concrete perimeter foundation and cladding, there are cracks to the internal linings and walls are not vertical.
>
> …
>
> c. There is recorded evidence of structural damage which existed prior to the 04 September 2010 earthquake.
>
> d. The property suffered some earthquake damage in the September 2010 earthquake (when it was insured). It was further damaged in earthquakes that struck after 26 January 2011 (when it was no longer insured).

Evidence of Dr Wu, structural engineer for the Sadats

[195] The Sadats' case relies heavily on the evidence of Dr Zheng Ping Wu.

[196] Dr Wu's qualifications include a Bachelor of Engineering with honours from China and a PhD in structural engineering from the United Kingdom. He said that, after graduating in 1986 with a Bachelor of Engineering, he had completed eight years of academic research on structural engineering, and has had 21 years of structural engineering design and construction experience in various parts of the world including Europe, Australia, China and New Zealand. He said he has published more than 20 academic research papers on structural engineering.

[197] Dr Wu prepared a report dated 15 May 2015 following a site inspection on 10 May 2015. This report was provided after Wylie J had issued a minute in these proceedings recording agreement that the key issue was what natural damage was suffered as a result of the September 2010 earthquake.

[198] In that report, Dr Wu said the perimeter footing "was severely cracked". He said the maximum crack width in footing and wall cladding which he observed was 6mm and 8mm respectively. The particular sites of this cracking and the photographs he produced of such cracking indicated that the cracks concerned were

the crack on the western wall outside the kitchen window, running through the glass bricks to the foundation, and a 6mm side crack on the southern side of the house. Both these cracks had been identified and referred to in the 2008 Hayward report and the August 2010 Tower report and in photographs taken at that time (the cracks, as photographed by Dr Wu, were little wider and no more extensive than when photographed in August 2010).

[199] In his report, Dr Wu identified the house as being badly damaged by "the major earthquak*es*" since September 2010.[6] In the ultimate conclusion to his initial report, Dr Wu said the purpose of his inspection was to establish the structural condition of the house and to record the damage to the house due to the major earthquak*es* since September 2010.

[200] I note that, consistent with the measurements of peak ground acceleration already referred to and the extent of damage to both residential housing and commercial buildings in Christchurch, the most major and most damaging earthquake in the Canterbury Earthquake Sequence was the earthquake of 22 February 2011.

[201] In his initial report, Dr Wu did not explain why he considered the damage associated with subsidence of the foundations had to have been caused by liquefaction of the sub-ground layers, rather than sub-ground consolidation because the foundations were inadequate in the soft and wet ground on which they were situated. Dr Wu did not seek to apportion, in any way, damage from the September 2010 earthquake as against pre-existing damage or damage caused by later earthquakes. The focus of his report seemed to be on explaining why a rebuild was necessary to deal with what he said was earthquake-related damage.

[202] In his initial report, Dr Wu noted that an aerial photograph taken on 24 February 2011 indicated there was no significant liquefaction-induced eject material in the vicinity of 3 Victors Road. Despite this, he said his initial assessment was that the house was badly damaged by the major earthquakes since September 2010 with excessive floor settlements being due to liquefaction. Under cross-examination, Dr

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[6] My emphasis.

Wu accepted that he needed a geotechnical engineer to identify whether there had been liquefaction of sub-layers of the ground, and at the time he made his report in 2015 he did not have any such information.

[203] In the experts' report to the Court of 10 March 2016, Dr Wu said it was likely that there was pre-existing damage "before the major earthquake". It was his view that the then current damage was the combined result of the exacerbation of existing damage and new damage caused by what he said was the "major" earthquake. He said there was no credible measurement for the floor differential settlements before "the major earthquakes". He also said the proportion of damage done by each earthquake should be assessment in accordance with the measurement of the earthquakes on the Richter scale: 7.1 for September 2010; 6.3 for 22 February 2011; 6.3 for 13 June 2011, and 5.8 for 23 December 2011. On that basis and because of the logarithmic nature of the Richter scale, 73 per cent of the damage should be assessed as having been due to the September earthquake.

[204] In the experts' report, Dr Wu said he considered the dominant damage to the structural integrity of the perimeter foundation was from the September 2010 earthquake, which he says exacerbated pre-existing cracks significantly and introduced new cracks. He considered that the majority of the cracks on the internal lining were the result of "the earthquak*es*". Damage to "wall verticality" related to the foundation damage and the damage to the house's superstructural bracing strength resulting from "the major earthquakes".

[205] It was Dr Wu's opinion, as expressed in the joint report, that the foundation needed to be replaced due to the extent of fracturing of the perimeter footing and the differential settlement of internal piles. He considered the bracing strength of the house was so severely compromised by the earthquake of September 2010 that the house required replacement to reinstate the bracing strength; external cladding would also have to be replaced and the garage concrete slab and superstructure should also be replaced.

[206] Under cross-examination, Dr Wu accepted he used the Richter scale analysis primarily because it supported his thesis that the predominant cause of damage to the structure was the September 2010 earthquake.

[207] Mr Harris, for Tower, asked Dr Wu if he could point to any material from anyone else that apportioned damage amongst four aftershocks, based on the Richter scale magnitude, in the manner that Dr Wu had done. Dr Wu could not point to any such material. He said his opinion was based on his own experience.

[208] I consider that the way in which Dr Wu sought to apportion damage, as described in the report of the joint experts, through the use of the Richter scale, was neither logical nor professionally justified. Dr Wu could not refer to any peer-reviewed paper justifying the way he had used the Richter scale. It is now common knowledge that, although the Richter scale may measure the severity of an earthquake, it is not a measure of the damage that will be caused by such an earthquake. That is because the extent of the damage will be influenced by the depth below the surface where the earthquake is centred and how far that centre is from buildings or structures that might be shaken by the earthquake. The fact the 22 February 2011 earthquake was measured as less severe on the Richter scale than the 4 September 2010 earthquake, clearly illustrates this point. The other engineers explained that the measure of ground force acceleration at an appropriate point was adopted as a better indication as to how damaging an earthquake might be at or near that point of measurement. I consider that explanation to be logically more attractive.

[209] Dr Wu's use of the Richter scale, to justify an apportionment of 73 per cent of the damage he observed as resulting from the September 2010 earthquake, significantly detracts from the weight I can attach to his opinion on other aspects of his evidence to the extent those opinions are not consistent with other evidence which I have heard or seen.

[210] Dr Wu provided an initial brief of evidence dated 9 December 2016. This was after the experts had provided their joint report to the Court, when there was clearly a major issue between engineers as to the extent to which damage to the

house resulted from the September 2010 earthquake. Despite that, in his initial brief of evidence, Dr Wu's only explanation for his conclusion was his crack number analysis.

[211] Dr Wu said that after the earthquake there were 18 cracks in the perimeter foundation. He said his reason for concluding that the majority of the footing cracks had been caused "by the earthquakes" was that it was apparent from the photographs attached to the August 2010 Tower report that "the maximum number of cracks on the perimeter foundation was four" and they were "four minor cracks". He said EQC, in its report of December 2010, had identified 16 perimeter cracks after the September 2010 earthquake.

[212] There was nothing in the August 2010 Tower report or in the earlier 2008 Hayward report or shown in photographs to suggest there were only four cracks in the foundation. Dr Wu made no reference to other general and specific statements in both reports which suggested there was wide-spread subsidence of the foundations to the home, and cracking to the foundations and external walls.

[213] In this regard, I consider the way Dr Wu used the information from the August 2010 report was both selective and arbitrary, and reflected a desire to justify the end conclusion to which he came, in favour of the Sadats' argument. His approach was not consistent with an independent objective assessment of just what damage had been done to the home before the September 2010 earthquake and what damage had resulted from that earthquake.

[214] In evidence during the hearing, Dr Wu accepted these cracks, as they existed before the September 2010 earthquake and were referred to in the August 2010 Tower report, were significant because they were consistent with the subsidence of the foundations and a failure of the foundations to carry the load of the house at those points. Dr Wu did acknowledge in a number of ways that subsidence of the foundations could be caused by ground consolidation under the load-bearing parts of the house, foundation subsidence could have occurred before September 2010.

[215] In a summary of key conclusions, Dr Wu said the ground conditions had been "damaged by movement in the sub-ground layers" which had reduced the compactness of the ground so as to remove what should have been a solid support to the foundations. He said the differential settlement and cracking to the footing thus represented movement in the sub-ground layers. At a similar point in his evidence, he said differential settlements of the floor area represented differences in sub-ground layers across the house footprint. He then said these demonstrated the loss of the compactness of the sub-soil layers, either due to liquefaction or consolidation, resulting in subsidence.

[216] In dealing with the foundation damage, he noted that the piles of the house were strong and could not be "shortened by the house loads". He then said that the differential settlements were the result of subsidence of the sub-soil layers underneath the pile bases.

[217] The three geotechnical engineers, together with Mr Finn and Mr Polson, all accepted that such consolidation, resulting in subsidence, could occur as a result of the foundations being built on ground which could become soft and wet at times when the water table was high. The floor level measurements taken by Harrison Grierson, under the oversight of Mr Finn, demonstrated that the most marked subsidence had been around the external walls and the perimeter of the home where the foundations had to carry the load of the walls and roof of the house.

[218] Dr Wu accepted that someone walking across a floor with a drop of 50mm would have felt that drop. Mr Hayward had felt the slope in that way in 2008. Dr Wu said that even a 30mm drop would be felt because that would be "really big". He accepted the difference in floor levels was indicative of a drop in the perimeter footing.

[219] Despite what he said in his brief of evidence, under cross-examination Dr Wu accepted that the cracks in the foundations and exterior walls, shown in photographs accompanied in the August 2010 Tower report, could not be described as minor. He accepted the cracks in the perimeter footing, evidenced in the August 2010 report, were severe cracks and consistent with a structural failure of the foundations. He

accepted the most significant cracks he found in the external walls were there before the earthquake. In giving evidence, Dr Wu accepted that pre-existing cracking on the exterior walls and foundations before the earthquake was significant.

[220] In neither his report of 15 May 2015 nor his initial brief of evidence did Dr Wu explain why he considered the subsidence of the foundations was more likely to have been caused by the earthquakes rather than the inadequacy of the foundations, given the underlying ground conditions.

[221] The focus of Dr Wu's evidence as initially briefed, as with his report of 15 May 2015, seemed to be to explain why a rebuild was necessary to deal with what he said was earthquake damage. What the Court required of him as an expert was the benefit of his expertise in identifying just what damage had been caused by the September 2010 earthquake, as distinct from pre-existing damage, and damage that may have been caused by later earthquakes.

[222] Given the significance of the information in the 2008 Hayward report and the August 2010 Tower report, I would have expected a more extensive and express consideration of the information contained in those reports than was apparent in Dr Wu's initial brief of evidence.

[223] Under cross-examination, Dr Wu said that, where there was a fracture through a perimeter footing, that footing is unable to perform its intended function. Dr Wu accepted that, with the width of the crack in the windowsill of the kitchen, it was reasonable to assume that crack would have carried down through the perimeter beam.

[224] In the course of giving evidence at the hearing, Dr Wu said it was difficult to make a comparison between the state of the interior cracks before the earthquake, as referred to in earlier reports, and the state of them when he came to inspect the property. He said the cracks on the interior walls before the earthquake were due to subsidence of the ground. He also indicated that an inconsistency in floor levels could be the result of subsidence rather than liquefaction.

[225] Near the end of cross-examination, Dr Wu was referred back to this cracking and had his attention drawn to the location of such damage at various points on all sides of the house. The obvious potential inference sought to be drawn was that the pre-earthquake cracking, evident in August 2010, was consistent with major and extensive damage to all the foundations of the home. In response to such questioning and again on re-examination, Dr Wu downplayed the seriousness of the cracking as apparent at that time, on the basis that in each instance it was localised. He also said that, if the cracking he observed had been caused by subsidence, he would have expected the extent of subsidence, as reflected in floor levels, to have been uniform throughout the perimeter of the house because the weakening of the ground, due to the softness and wetness as a result of the high water table, would have been uniform.

[226] Sub-ground conditions were such that a general trend in subsidence of the foundations after construction was to be expected, but there was also the potential for the level of subsidence to be influenced by localised ground conditions and also the load which was being carried by the foundation at a particular point.

[227] There was no evidence from geotechnical engineers that ground conditions were consistent across the site. There was evidence from the August 2010 Tower report that water had collected under the house but not in a uniform way, partly because it appeared the ground had been scalloped out below the floor between the piles, and partly because filthy water had collected in certain parts as a result of the deterioration of a pipe. It is apparent from the floor plan of the house that the rooms of the house are all of different shapes. The external walls are not uniform. The exterior walls are not aligned. The loads from the roof and walls on different parts of the foundation would thus have not been uniform.

[228] The August 2010 Tower report referred to the extent of pre-earthquake damage to the walls and foundations on the eastern, northern and western sides of the building and the significant sloping of the floor towards the southern wall in the bedroom in the south-west corner of the building. The evidence as to significant cracking of walls and foundations and sloping of the floor before the September 2010 earthquake was consistent with the general and significant subsidence of all the

foundations, resulting also in significant structural damage to the foundations, outside walls and interior walls before the September 2010 earthquake. I do not accept the damage could properly be considered less serious on the basis it must have been localised to particular parts of the house.

[229] The way in which Dr Wu ultimately sought to minimise the seriousness of the pre-earthquake cracking in the walls and foundation by describing it as localised and his explanation for that, does not withstand scrutiny when assessed against other evidence as to the state of the house or other expert evidence which I have accepted.

[230] In his initial brief of evidence, Dr Wu said that certain roof structural timber members were cracked in the form of splitting and fracturing. In his report of 15 May 2015, he said limited access to the roof had identified "the few fractures of the roof timber truss members".

[231] Mr Jones gave evidence as to the assessment he and a builder made of the property on 9 December 2010. He gave evidence as to how they had inspected every room of the house and that Mr Coley, the builder, had gone into the ceiling area but reported nothing had been damaged.

[232] Mr Finn had led the inspection of 3 Victors Road for the Harrison Grierson report accompanied by Peter Taylor from EQC, Mr Polson and two representatives from Stream. Harrison Grierson said in the report that they had observed the roof void from an access hatch near the rear entrance to the dwelling. They noted the framing within the roof was in good condition. They said there were some signs of shrinking cracking of the timbers along sap lines, as well as the imperfections or knots but nothing described as earthquake-related damage.

[233] The differences between the evidence of Dr Wu, Mr Jones and Mr Finn as to the issue of damage to roof structural timbers, was not the subject of cross-examination of any witnesses. On the information available to me, I am not able to find that the damage to the roof timbers, which Dr Wu said he observed, was caused by the September 2010 earthquake.

Damage to the garage

[234] Dr Wu said in evidence that a wall of the garage had, at some stage, fallen over. He considered the damage to the wall and a crack in the garage floor slab was caused by the September 2010 earthquake. He said this necessitated replacement of the whole garage floor which, in turn, effectively required a rebuild of the garage.

[235] In the Harrison Grierson report, Mr Finn said that two hairline cracks were observed in the surface of the slab. A low laser level survey had been completed during the inspection. It showed a maximum variation in levels of 0.11m from a high point at the back to a low point at the entrance. The report said a fall of this type was typical for garage slabs to maintain surface drainage and did not exhibit any pattern of earthquake-induced settlement. In evidence, Mr Finn said there was no indication of any uplift of the slab on either side of the crack and it was thus not consistent with earthquake damage. The crack was not noted at all by Mr Jones and Mr Coley in their December 2010 report for EQC.

[236] Dr Wu did not explain in his initial brief of evidence why he considered the garage slab crack to have been caused by the September 2010 earthquake. It was suggested to him that the crack he observed was nowhere substantial enough to justify a replacement of the entire slab. Dr Wu reported that the crack extended from the garage door back to almost the end of the garage. He had, however, depicted the extent of the crack in a drawing associated with his report which rather contradicted that. There, it was depicted as beginning at one end close to but not at the door and extending through just a little beyond a halfway point in the garage. There is nothing in the way the crack is depicted on the drawing to indicate it must have been caused by an earthquake and Dr Wu did not take any photographs of the crack which might corroborate his explanation. I was able to see only part of the crack when I made a site inspection during the hearing. I did not observe any displacement of the slab on either side of the crack.

[237] In his brief of evidence, Dr Wu said "based on the homeowner, the rear elevation of the garage wall fell over during the September earthquake, that he put it back but the work was non-professional and needed repair". There was however no

mention of any problem with the wall of the garage in Dr Wu's report of 15 May 2015. Neither Mr Finn nor Mr Polson identified any problem with the wall of the garage, either in connection with the Harrison Grierson report or in their evidence.

[238] In her evidence, Mrs Sadat said the panel next to the garage door became uneven (this was not the rear elevation of the garage). She said her husband fixed the panel as it had come loose during the earthquake and the wood had broken. She said nothing about the rear wall of the garage collapsing.

[239] In all these circumstances, I prefer the evidence of Mr Finn and Mr Polson. I do not accept that the crack in the concrete slab of the garage was caused by an earthquake. In any case, the evidence is not sufficient to prove that the crack was caused by the September 2010 earthquake. The Sadats have therefore not been able to prove that there was damage to a wall of the garage caused by the September 2010 earthquake or that, if there was such damage, it still has to be repaired.

Damage to concrete paths and driveway

[240] There was no cover under the Earthquake Commission Act 1993 (EQC Act) for damage to paths around the house. That could explain why Mr Jones made no mention of such damage following his inspection of 9 December 2010. In her evidence, Mrs Sadat said that, after the earthquake, the concrete outside the house was badly damaged. Mr Sadat said that, when he went back to the property after the September 2010 earthquake, he noticed cracks "outside the house".

[241] In the Harrison Grierson report of 14 August 2015, Mr Finn said he had observed:

(a) regular cracking to the external painted concrete path and patio slab leading to two dwelling entrances, cracking at 2-3m centres and some signs of uplift at these cracks;

(b) regular cracking up to 5mm in width to the concrete driveway leading to the detached garage; and

(c) the driveway appeared to be unreinforced and did not have any form of crack control which was likely to be a predominant cause of the cracking observed.

[242] There was however little, if any, specific evidence or cross-examination over whether cracking could have pre-existed the September 2010 earthquake, or whether it was likely to have resulted from subsidence of the ground underneath or had been caused by the more forceful February 2011 earthquake.

[243] As discussed above, Mr Hargreaves visited the property on 8 September 2010. His observations concerning the driveway and as recorded on the day were, "[a]t this stage there is no evidence of damage to the existing artisual[7] [sic] surfaces, any common area, property and boundary fences".

[244] In assessing whether or not all the defects in the Sadats' home had been caused by the September 2010 earthquake, Mr Polson had looked at damage suffered by nearby properties, as reported to Tower. There had been a claim for a property at 11 Victors Road, including damage to an unreinforced concrete access-way. Similarly, there had been claims for damage to unreinforced concrete access-ways for 14 Victors Road and 9 Victors Road. With all these properties, such damage was associated with the 22 February 2011 earthquake rather than the September 2010 earthquake. A claim was made for damage to an unreinforced concrete access-way for the nearby 175 Sparks Road but that was as a result of the 23 December 2011 earthquake.

[245] There had been a claim for damage to an unreinforced concrete path for 6 Victors Road arising out of the September 2010 earthquake. The estimated cost for repairing the damage was $741. A claim arising out of the 4 September 2010 earthquake was made for the property at 9 Victors Road. The claim included the costs of partial removal and replacement of a 100mm thick unreinforced concrete access-way to the property which had been compromised through excessive ground movement. The reserve placed on the claim for that damage was $8,500.

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[7] The typed reference should have been to "artificial" surfaces.

[246] For 3 Victors Road, the quantity surveyor's estimated costs for the demolition and removal of the concrete driveway and paths, and re-establishment and painting was $17,014 plus GST. The Sadats have not however proved that the damage to the path and concrete areas was as a result of the September 2010 earthquake. They thus cannot succeed on their claim to the extent it relates to damage to the driveway and paths.

Conclusions as to the damage caused by the September 2010 earthquake

[247] EQC pleaded that the Sadats' home had suffered no damage as a result of this earthquake. I am satisfied that it is likely some damage was done to internal wall linings and there may have been some slight increase in the level of floor dislevelment with the September 2010 earthquake. I say this because of the level of shaking that the Sadats experienced and the likely force of the earthquake, as measured by peak ground acceleration.

[248] My conclusion is also consistent with the agreement of the three structural engineers in their joint report to the Court that it was likely that "the property suffered some earthquake damage in the September 2010 earthquake".

[249] Damage to internal linings may constitute damage to the building although those linings served only a cosmetic purpose. Any obligation which EQC had to repair such damage may have required them to carry out or pay for targeted repairs or, where necessary, rather more extensive repairs, to avoid limited and unsightly patching.

[250] As far as the internal walls, linings, fixtures and external walls of the house are concerned, the Sadats have not proved that there was any structural damage to those elements of the building which have affected the ongoing structural integrity of the house.

[251] The Sadats have not proved that the cracking to the concrete slab of the garage was caused by the September 2010 earthquake or that there was any damage to a rear wall of the garage which requires remediation.

[252] The Sadats have not proved the September 2010 earthquake damaged concrete paths or the driveway so as to require their demolition, removal and replacement.

[253] EQC has paid the Sadats approximately $43,000 for repairs without differentiating between damage that pre-existed the September 2010 earthquake and damage which was done by the September 2010 earthquake. EQC's payments also allowed for repairs to the external cladding on the same basis. The Sadats have not proved that the September 2010 earthquake caused damage to the walls of the house and exterior cladding that would cost more than $43,000 to repair.

[254] While I am willing to accept there was probably some increase in the sloping of the floors as a result of the September 2010 earthquake, the Sadats have not been able to establish the extent to which that sloping was different from the pre-existing dislevelment or that such increase, as did occur, was of such an extent as to require significant relevelling of the floor by one means or another. In that sense, the Sadats have not been able to prove that the September 2010 earthquake resulted in a material difference to the extent of dislevelment that existed before that earthquake.

[255] I accept that it is likely there was some further cracking of the perimeter foundation as a result of the September 2010 earthquake and some further subsidence. That is consistent with the willingness of all the geotechnical engineers to accept that such further damage was likely. However, the Sadats have not proved that any such further damage made a material difference to the structural integrity of the foundations as a whole, or that the work required to remedy that damage was any different than what would have been required to remedy all the problems, highlighted by the geotechnical evidence, which patently affected these foundations before September 2010.

Payments made and sought

[256] On 9 December 2010, Mr Jones prepared an estimate of the cost of repairing what he had assumed was earthquake damage. It allowed $10,400 for internal repairs, $9,900 for external walls, $10,300 for foundations and relevelling and nothing for the garage, for a total of $30,600.

[257] On 30 January 2013, EQC prepared a further scope of work. It included $12,000 for lifting and reinstating the dwelling, $4,000 for lifting and reinstating the garage, $1,050 for repairs to the concrete slab in the garage, $3,156.60 for repairs to the cladding, $7,452 for exterior painting and costs for a number of the internal rooms, including estimated costs for packing and relevelling tiles in certain rooms. The total estimate was $43,682.41.

[258] On 29 April 2013, EQC paid $12,946.33 to the ANZ Bank lending services centre. On being told the ANZ no longer had a mortgage over the property, they paid that amount to the Sadats. The basis for that payment was explained in a letter from EQC to Mr and Mrs Sadat of 14 May 2013 as being on account of the Sadats' entitlement to a total of $43,586.72, reflecting this latest estimate, emergency repairs of $349.89 already paid, less excesses of $440.27.

[259] The only evidence as to the quantum of the Sadats' claim was from a quantity surveyor, Mr Stuart Harrison. His evidence was reached after discussion with a potential witness for Tower and was ultimately unchallenged. The costs he referred to were for an updated replacement of the home based on a ground floor area of 135m^2. The estimate was for a total of $762,445 including GST. This included $40,932 for a replacement garage, $21,124 for demolition and $31,889.70 for replacement of the driveway, paths and fences.

Claim against Tower

[260] The Sadats' policy with Tower insured their house for "sudden and unforeseen accidental physical loss or damage". "House", as defined in the policy, included the garage and driveways or paths other than concrete or sealed driveways or paths. The policy did not insure their land.

[261] The cover provided by the main insuring clause in the policy was supplemented by a number of automatic "special benefits", one of which was for cover for natural disaster damage:

> Natural disaster damage:
>
> If your house suffers natural disaster damage, we will pay the difference between the amount paid under EQ Cover and the sum insured shown in the certificate of insurance.

[262] The policy thus provided top-up cover for natural disaster damage which exceeds any EQC cover. The reference to EQC cover did not widen the scope of damage for which the Sadats had insurance. With a claim arising out of a natural disaster, the Sadats still had to prove that the damage for which they sought insurance resulted from a "sudden and unforeseen" event.

[263] Where there was cover, Tower had the option "whether to make payment, rebuild, replace or repair". The Sadats had a full replacement value policy which meant that, if liable under the policy, Tower had to pay:

> … the costs actually incurred to rebuild, replace or repair [the] house … with no limit to the sum insured to the same condition and extent as when new and up to the same area as shown in the certificate of insurance.

[264] The policy stated:

> If as a result of changes in government or local body bylaws you are not able to rebuild or repair the damaged part of your house to the same specifications as before the loss or damage occurred, we will pay any additional costs incurred to rebuild the damaged part.

[265] Section 17 Building Act 2004 states all building work must comply with the Building Code, that is the regulations that prescribe functional requirements for buildings and the performance criteria that buildings must comply with in their intended use.[8] Although this was not the subject of evidence or submissions before me, given the expert evidence I heard, I proceed on the basis that, if structural repairs to the foundations are required to deal with the cracking in them, the repairs would have to be sufficient for the foundations to then perform their intended function of supporting the load of the building, given the particular ground conditions on the site. Mr Thompson's evidence was that, for a residential building to be adequately supported by foundations at 3 Victors Road, it would be necessary to build on piles 7m deep. Mr Polson said, if pre-existing cracks were found to have widened as a

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[8] Building Act 2004, ss 8 & 400.

result of the earthquake, repairing that earthquake damage would necessitate dealing with the original crack.

[266] On that basis, it could be said that, to remedy exacerbated crack damage likely to have resulted from the September 2010 earthquake, Tower and EQC will have to remedy the inadequacy of the foundations for their function, an inadequacy which pre-existed the September 2010 earthquake and which had resulted in significant damage to the foundations before the September 2010 earthquake.

[267] The demolition and replacement of existing foundations, and hence the rebuild of this home was, as I have found, necessary as a result of the pre-existing inadequacy of, and damage to, the foundations. Mr Finn's and Mr Polson's evidence, that the steps required to remedy any earthquake damage were no different than what would have been required before the September 2010 earthquake, was not challenged.

[268] The essential defence for both Tower and EQC is that the earthquake damage was not material because it did not *materially add* to the pre-existing damage.

[269] The Sadats, through their counsel, first suggested that the new damage was material because it affected the value of the property. This can be dealt with in short order. I accept the submission for the defendants that any impact on the value of the property will not be relevant in determining whether there has been material damage, because a home insurance policy does not cover pure economic loss.[9]

[270] If value, in the economic sense, had been relevant, I would not have been satisfied that damage resulting from the September 2010 earthquake would have significantly affected the value of this property. There were significant obvious defects in the house before that earthquake. The measures required to remedy them and deal with the underlying problem were the same after the earthquake as before. In 2008 a prospective purchaser had pulled out of the purchase after obtaining a building inspection report. Both before and after the September 2010 earthquake the

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[9] *O'Loughlin v Tower Insurance Ltd*, above n 1, at [43], [52] and [65]; Robert Merkin and Chris Nicoll (eds) *Colinvaux's Law of Insurance in New Zealand*, (Thompson Reuters, Wellington, 2014) at [8.1.5(2)].

home would have added some value to the property because the home was and is still habitable, but the fundamental structural problems with the building, both before and after the earthquake, remained the same. They would have significantly affected the value of this property.

[271] Mr Pullar, for the Sadats, also suggested that the September 2010 earthquake was material because it rendered the home uninhabitable. I accept that often the sort of damage that will have to be covered in the event of a natural disaster may cause a home to be uninhabitable but whether or not the home is habitable is not the test as to whether there has been damage covered by the policy.[10] In any event, the evidence in this case established that 3 Victors Road has remained habitable and has been lived in by the Sadats, by members of their family and by tenants since the earthquake. It was occupied during the trial.

[272] The Tower policy has to be interpreted and applied having regard to the context in which the insurance contract was entered into. That purpose was to provide cover for damage as a result of sudden and unforeseen accidental physical loss, damage or such arising out of a natural disaster such as an earthquake. It would not be consistent with the intended meaning of this insurance policy for the Court to find that any damage suffered in the September 2010 earthquake was material where such damage required no more to be done than would have been necessary before the September 2010 earthquake.

[273] On that basis, the Sadats have been unable to prove that their home suffered material damage in the September 2010 earthquake which requires Tower to meet the costs of a rebuild.

[274] This conclusion accords with the general principle that an insured cannot recover twice for the same damage. In *EQC v Insurance Council of New Zealand*, the full High Court proceeded on this basis when considering EQC's liability for damage arising out of successive earthquake events.[11] In discussing potential liability arising out of successive earthquakes, the High Court accepted that, where

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10 *Kraal v EQC* [2015] NZCA 13, [2015] 2 NZLR 589.

11 *EQC v Insurance Council of New Zealand Inc* [2014] NZHC 3138, [2015] 2 NZLR 381.

there was damage in a first earthquake, that damage might be subsumed in the more extensive damage of a later earthquake.[12]

[275] My conclusion is also consistent with the reasoning of the High Court and Court of Appeal in *Arrow International Ltd v QBE Insurance (International) Ltd*.[13] In that case, there were claims arising out of leaky home issues with an apartment complex. Its problems first became apparent in 2003. The apartment owners issued proceedings in 2007 against a number of parties including the design and build contractor, Arrow International Ltd. The proceedings were settled in September 2008. Arrow sought indemnity from its insurer QBE. Arrow had a general liability policy with QBE for the period from 30 May 2002 to 30 May 2005. QBE was liable to indemnify Arrow in respect of all sums that Arrow might become legally liable to pay by way of compensation consequent upon "accidental physical loss of or damage to any tangible property".

[276] In the High Court, MacKenzie J had to determine whether the damage for which Arrow sought indemnity had occurred before QBE came on risk on 30 May 2002. He stated:[14]

> I consider that each case must be examined on its own facts to determine when an alteration to the physical state has occurred to an extent which is more than *de minimis* so that the point has been reached where physical damage has happened.

[277] MacKenzie J held the policy covered damage happening during the policy period and the question was "when has there occurred an alteration to the physical state of the timber which impairs its value or usefulness as a component in the building". That was the sense in which value was to be understood, not in economic terms.

[278] The relevant damage was of rotting and water damage to timber which was an ongoing process of microbiological decay. MacKenzie J said it was:[15]

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12 *Re Earthquake Commission* [2011] 3 NZLR 695 (HC) at [47].

13 *Arrow International Ltd v QBE Insurance (International) Ltd* [2010] NZCA 408, [2010] 3 NZLR 857.

14 *Arrow International Ltd v QBE Insurance (International) Ltd* [2009] 3 NZLR 650 (HC) at [82].

15 *Arrow International Ltd v QBE Insurance (International) Ltd*, above n 14, at [32].

> … common ground between the experts that the process of microbiological decay of the timber had commenced prior to 30 May 2002 and that it continued progressively over a period which extended before, during and after the relevant period of insurance.

MacKenzie J accepted that evidence. He found that the fungal or microbiological damage, such as to cause an alteration of the physical state of the building to an extent which impaired its value and usefulness, had occurred before 30 May 2002.

[279] On appeal, the Court of Appeal approved MacKenzie J's analysis, and relevantly recited:[16]

> The Judge recorded that the expert witnesses for each side agreed that this process of microbiological decay of the timber had commenced prior to 30 May 2002, that is, prior to the insurance policy being entered into with QBE. Further, both witnesses agreed that the scope of work required would have been substantially the same whenever the problem was addressed, unless the defects had been identified very early, before there was any manifestation of their existence. Accordingly, the Judge made a finding of fact that the damage giving rise to Arrow's liability had arisen before 30 May 2002.

That is directly parallel to the situation that has been established in this case.

[280] The Court of Appeal rejected the argument that QBE became liable to indemnify Arrow when it became liable to other parties with the settlement it reached after the policy was in place. The Court of Appeal accepted the argument for QBE that Arrow became liable to the other parties when the damage to the timbers of the building required the same remedial work for which Arrow acknowledged liability in the settlement it reached. In this regard, the Court of Appeal considered it important that the extent of the damage to the timber by 30 May 2002 was such that, had the damage been observed in any part of the building, the only practical means of repairing the damage would have entailed a scope of works broadly similar to that in fact held to be necessary when the value of the remedial work was later assessed.

[281] The Court of Appeal accepted counsel's submission that:[17]

> … the situation was analogous to a car that had been involved in an accident and damaged to the extent that it was a write-off. The insurer for the party at

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16 *Arrow International Ltd v QBE Insurance (International) Ltd*, above n 13, at [10].
17 At [22].

> fault for the first accident would be liable for the full value of the car. If, while the wreck was on the side of the road, another car smashed into it, making the damage even worse, the insurer for the driver of the second car would have no liability because the car was already a write-off before that second accident occurred.

[282] My conclusion is also consistent with the purpose and principles of insurance. In *AMP Fire & General Insurance Co (NZ) Ltd v Groves*, Hardie Boys J held:[18]

> It is a fundamental rule of insurance law that the insurer is liable only for losses proximately caused by the risk insured against…
>
> It need hardly be said that the proximate cause is the dominant or efficient cause and is to be contrasted on the one hand with a more remote cause which for example does no more than set the scene; and on the other with an event that is simply a usual or not unexpected attendant result of what has gone before…
>
> Causation in law is not a philosophical question but a question of fact, to be decided in accordance with common sense and the understanding of the man in the street: *Yorkshire Dale Steamship Co v Minister of War Transport*.
>
> (Citations omitted)

[283] In *CRS Kelly Properties Ltd v Earthquake Commission*, there was a dispute between the plaintiff homeowners and EQC and the insurer as to whether the earthquakes had caused more than de minimis floor dislevelment to the plaintiff's home.[19] Mander J considered that the issue before him was whether or not the earthquake had caused damage which affected the amenity value or utility of the house and thus had a practical consequence.

[284] Mander J referred to the observation of the Court in *EQC v Insurance Council of New Zealand Inc*, that natural disaster damage to residential land for the purposes of the EQC Act required physical change or loss which affects the use or amenity of the property. He referred to the High Court's discussion of "damage" and "physical damage" in the context of leaky home buildings in the *Arrow* case. Mander J proceeded on the basis the plaintiff had to establish there had been "material change to the floor as a result of the earthquakes".[20]

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18 *Groves v AMP Fire & General Insurance Co (NZ) Ltd* [1990] 2 NZLR 408 (CA) at 411-412.
19 *CRS Kelly Properties Ltd v Earthquake Commission* [2015] NZHC 1690.
20 At [303].

[285] The approach I have taken, in determining whether the plaintiffs have proved whether the September 2010 earthquake caused material damage, is thus the same as Mander J took in the *CRS Kelly Properties Ltd* case. Because of the evidence here, my conclusion is different.

[286] The Sadats have not been able to prove that the September 2010 earthquake caused damage to their home which requires the home to be rebuilt. On that basis, their claim must fail.

[287] If the Sadats had been able to prove the earthquake damage was more extensive than I have found, Tower would still have been entitled to rely on the exclusion clause in their policy. The policy stated:

> What you are not covered for
>
> General exclusions (applies to all sections)
>
> Loss, damage, liability or claims for or arising from:
>
> - Inherent fault, defective workmanship, materials or design …
> - Settling, or cracking or movement of land;
> - Subsidence, landslip, erosion or geothermal activity.

[288] I accept the submission from Mr Harris that "arising from" is wider than proximate cause. The matters within the excluded clause need only be a material contributing factor, not a proximate cause.[21]

[289] I am satisfied the damage to the foundations (which makes it necessary to rebuild the home), most of the damage to the cladding, the floor dislevelment and damage to interior walls was caused through a fault in the home's original foundations. Given their defective design in terms of the underlying ground conditions, they were never adequate to support the load of the house. As a result, the foundations dropped through subsidence. The evidence establishes that it is those problems which necessitate a rebuild, not any earthquake damage.

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[21] *Body Corporate 326421 v Auckland Council* [2015] NZHC 862 at [340].

[290] If, contrary to that finding, I had found the rebuild was necessary as a result of both earthquake damage and the pre-existing problems and associated damage, then Tower's liability could potentially still have been excluded on the basis that, where there are two or more causes of loss or damage, and at least one cause is expressly excluded by an exclusion clause, the exclusion will apply to exclude the entire claim. Tower would be relying on the basic principle that, where an insurer has stipulated for freedom from excluded loss or losses, the exemption cannot be taken away by the fact that there was another insured cause of loss. If there is a concurrent excluded loss, no part of it can fall on the policy (the *Wayne Tank* principle).[22]

[291] The principle has been applied by the High Court in New Zealand.[23] Application of the *Wayne Tank* principle would exclude Tower's liability for the cost of a rebuild because, at the very least, the pre-earthquake damage and problems with the foundations, through inherent fault, defective design and subsidence, would have been one of the proximate causes of the damage requiring a rebuild. It could be argued that application of the *Wayne Tank* principle should be more limited than has hitherto been recognised in the United Kingdom, Australia and New Zealand but, given my earlier findings as to the extent of pre-existing damage, it is not necessary for me to discuss that potential issue here.[24]

Rebuild costs and under-insurance

[292] This would have been an issue only if the Sadats had succeeded on their claim. The house was insured for an area of up to 120m^2. Tower, through the evidence of Ms Rose, contended that the actual floor area was 147m^2 and therefore the house was only insured for 81.6 per cent of its actual area. However, the area of the house, as accepted by the quantity surveyors and Mr Harrison for the Sadats in his evidence as to the costs of a rebuild, is 141m^2. That is the figure I adopt. The house was therefore insured for only 85 per cent of its actual area.

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22 *Wayne Tank & Pump Co Ltd v Employers Liability Assurance Corp Ltd* [1973] 3 ALL ER 825 per Lord Denning MR at 835.

23 *Body Corporate 326421 v Auckland Council*, above n 21.

24 See *New Zealand Fire Service Commission v Legg* [2016] NZHC 1492, [2016] 3 NZLR 685 at [108]-[132].

[293] When a house is under-insured by more than three per cent, Tower makes a pro rata deduction of the rebuild costs, which would cap the Sadats' entitlement at 85 per cent of the rebuild costs.

[294] This methodology was upheld recently by Dunningham J in *Myall v Tower Insurance Ltd*.[25] Her Honour made it clear however that her rationale for approving the adjustment in *Myall* (where the house was very large: 799m^2 in area with eight bedrooms and six bathrooms), would not necessarily be appropriate in a different situation. Her Honour said:[26]

> … I accept there will be many other situations where a pro rata adjustment for under-insurance would not be appropriate. For example, it would likely be inappropriate to pro rata the costs of building a 120 square metre house to reflect that the insurance policy provided for replacement of an 80 square metre house. In that situation significantly more of the costs would be for items that were not affected by floor area, such as provision of a bathroom and kitchen. More careful scrutiny of the costs would have to be made in adjusting for errors in insured floor area.

[295] No party presented evidence as to what the costs of a rebuild would be for a home with similar amenities to the Sadats' present home but of just 120m^2 rather than the 141m^2. If Tower's adjustment was appropriate, the Sadats' claim for 85 per cent of the rebuild costs would be for $595,949. Tower would normally make no adjustment for the actual square metre area where the differential in actual area was three per cent. If they were liable for rebuild costs, they would thus have been willing to accept a liability for $616,880.

[296] Had this been an issue, I would have held that Tower should have proceeded on the basis there would have been no change to the actual costs for:

Exterior windows and door	$42,380.60
Timber joinery and interior doors	$20,787.50
Plumbing	$12,415.00
Heating	$3,800.00
Electrical	$8,845.00
External works	$31,889.70
Demolition	$21,000.00

[25] *Myall v Tower Insurance Ltd* [2017] NZHC 251.
[26] At [101].

Replacement garage, excluding GST	$28,065.49
Consent Fees	$8,000.00
Drainage	$9,680.00
Contingency Sum	$40,000.00
Total:	**$226,863.29**

[297] I would have reduced the costs for the remaining categories of work by 15 per cent for the actual floored area, so that the remaining costs would have been:

Excavation	$29,173.70
Concrete work	$24,376.78
Brickwork	$18,462.00
Carpentry	$78,001.32
Roofing	$14,679.50
Floor covering	$2,448.00
Solid plaster	$13,311.00
Painting	$22,178.20
Scaffold	$5,643.15
Preliminary and general	$22,302.26
Builders margin	$34,090.10
Cost of native timber flooring	$27,211.90
Total:	**$291,877.91**

Costs for which there was no adjustment	$226,863.29
Costs reduced by 15 per cent	$291,877.91
Total:	**$518,741.20**

Professional fees @ 10 per cent	$51,874.12
Total:	**$570,615.32**

Contract works insurance @ 0.5 per cent	2,853.07
Total:	**573,468.39**

GST @ 15 per cent	86,020.25
FINAL TOTAL:	**659,488.64**

[298] With the Sadats' home having one kitchen and one bathroom, I do not consider it would have been reasonable for Tower to make a simple pro rata 15 per cent adjustment to the accepted rebuild costs because of under-insurance. A number of costs would have remained constant despite the smaller area. Given the good faith obligations inherent in an insurance contract, with an appropriate adjustment for the under-insured area, the Sadats would still have been entitled to $659,488.64 had they been able to prove Tower were liable for a complete rebuild, including the garage and external paving.

Claim against EQC

[299] EQC's fundamental defence to the Sadats' claim was that their home had not been damaged by the September 2010 earthquake. In submissions, Mr Wood submitted that its case, as with Tower, was that:

> The repair work necessary to restore the structural performance and integrity of the Sadats house after the 4 September 2010 earthquake was not materially different from the repair work necessary to restore the structure performance and integrity of the house before that earthquake.

[300] EQC accept that, because the Sadats' home was insured under a contract of fire insurance with Tower at the time of the September 2010 earthquake, it was insured with EQC for up to $115,000 including GST at that time. Lawns, driveways, paths, fences and paving were not insured under the EQC Act.[27] If a property suffers natural disaster damage during the period for which it is insured under the EQC Act, EQC must settle any claim to the extent to which it is liable under that Act. At EQC's option, EQC may settle by payment, replacement or reinstatement, or by a combination of payment and replacement or reinstatement to the limits of the statutory cap.

[301] The definition of "natural disaster damage" for which there is EQC insurance, is defined in the Act:

> **Natural disaster damage** means, in relation to property –
>
> (a) any physical loss or damage to the property occurring as the direct result of a natural disaster;

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[27] Earthquake Commission Act 1993, s 21(1)(a) & schedule 2.

Natural disaster is, in turn, defined as including an earthquake.

[302] So, as EQC accept, the risk against which the EQC Act provides insurance is, in this case, any physical loss or damage to the residential building occurring as the direct result of an earthquake.

[303] I agree the Act does not provide insurance against damage from subsidence that is not the direct result of a natural disaster. Consistent with that, the definition of "natural landslip" in s 21 expressly does not include "the movement of ground due to below-ground subsidence, soil expansion, soil shrinkage, soil compaction or erosion".

[304] I accept the submission for EQC that the Sadats had to prove there was a physical change, alteration or disturbance to the home which was material, not de minimis. In the context here, where the Sadats' claim for rebuild cost was based on damage to the structural components of the house, the Sadats had to prove there was a physical change, alteration or disturbance to the foundations which impaired the value or the usefulness of the foundations as a component in the building.

[305] I also accept that, for the physical change to be material, the Sadats had to establish that, on the balance of probabilities, damage of that sort did occur to the foundations as a direct result of the September 2010 earthquake. Furthermore, that such damage from the September 2010 earthquake required reinstatement work, ie the rebuild, additional to what would have been required either as a result of the pre-earthquake state of the foundations or earthquakes and events subsequent to the September 2010 earthquake.

[306] For the reasons which I have earlier discussed in detail, the Sadats have not been able to prove that the September 2010 earthquake caused such damage.

[307] In the particular circumstances of this case, the Sadats have not proved that the September 2010 earthquake caused material damage to their home necessitating a rebuild. They have not proved that the September 2010 earthquake caused damage

to the property which would have cost more to repair than the $43,586.72 they have already received. On that basis, the Sadats' claim against EQC must fail.

General damages

[308] The Sadats claimed general damages against both Tower and EQC. Given the plaintiffs' have failed on their claims against both defendants', they must also fail on their claim for general damages.

[309] The basis on which there might be an award of general damages in an insurance context case was discussed in detail by Gendall J in *Young v Tower Insurance Ltd*.[28] General damages may be awarded as a foreseeable loss as a consequence of the insurer's breach of contract, or because the stress or anxiety, which is to be compensated by an award of general damages, results from a breach of an implied term of good faith, and that breach is sufficient to warrant a remedy in damages.[29] The High Court in *Edwards v AA Mutual Insurance Co* held that, whilst damages are not generally recoverable for emotional harm (ie injured/upset feelings and annoyance), they may be recoverable for an inconvenience, as it relates to an unreasonable failure to indemnify the plaintiff for loss.[30] This is so where such an inconvenience is: substantial; not remote; a direct result of the breach, and reasonably in the contemplation of the defendant as likely to follow a failure to indemnify. There must be something "unjustifiable" in the insurer's rejection of the plaintiff's claim.[31]

[310] Counsel for the Sadats did not, in either pleadings or through submissions, identify any particular ways in which either Tower or EQC had responded to the Sadats' claims that would justify an award of general damages. EQC, within a reasonable time, made payments in response to the Sadats' claim against them. Tower became liable under their policy only if damage from the September 2010 earthquake was going to cost more than $115,000 to repair. There was a considerable delay until the Sadats initiated a claim for damages in excess of the

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28 *Young v Tower Insurance Ltd* [2016] NZHC 2956.
29 At [152].
30 *Edwards v AA Mutual Insurance Co* [1985] 3 ANZ Insurance Cases 60-668.
31 *Young v Tower Insurance Ltd*, above n 28, at [156], referring to *Bloor v IAG New Zealand* [2010] 16 ANZ Insurance Cases 61-845, and *Edwards v AA Mutual Insurance Co*, above n 30.

payments initially made by EQC. When they did this in April 2014, it was on the basis of the earthquake services report which crucially did not identify damage caused by the September 2010 earthquake as distinct from the other major earthquakes in the Canterbury Earthquake Sequence.

[311] Even after the High Court had identified that the issue in this case was over what damage had been caused by the September 2010 earthquake, there was a considerable delay until the Sadats provided an expert report dealing with that issue. The first explanation advanced for apportioning most of the damage to the September 2010 earthquake was Dr Wu's Richter scale analysis associated with the joint structural engineers' report to the Court of 10 March 2016. On any view, and as I have already found, his use of that analysis was deeply flawed. Both EQC and Tower had a reasonable basis on which to assert that the September 2010 earthquake caused no material damage to the Sadats' home. It was not unreasonable of them to defend the proceedings against them and to have the issues ultimately determined by the High Court.

[312] Even if the plaintiffs had succeeded on their primary claims, the circumstances of this case and of the way the claims progressed are such that I do not consider that any award of general damages against either Tower or EQC would have been appropriate.

Conclusion

[313] Counsel for both Tower and EQC responsibly acknowledged that this is a sad case. The Sadats have come to New Zealand as refugees. They had a home which they were happy to be in. The Canterbury earthquakes were traumatic for them, and that has affected the way they feel about their home. There are a number of serious structural issues with the home which will make it difficult for them to sell that property. Those structural issues were probably there when they first bought the property and probably continued to worsen. They were obvious by 2008 and also by August 2010 when the Sadats made their first insurance claim.

[314] The situation the Sadats face with their home is thus difficult for them. It would have been a windfall for them if the September 2010 earthquake had resolved all these problems by requiring EQC and their insurer to pay for a new home. Whether or not EQC and Tower were legally required to do this, fell squarely for determination with regard to Tower's obligations under its insurance policy, and EQC's obligations under the EQC Act.

[315] Unfortunately for the Sadats, on considering the evidence and having identified the defendants' legal obligations, I cannot hold either Tower or EQC liable to meet the costs of a new home for them.

[316] On the plaintiffs' claims against them, Tower and EQC are entitled to judgment, and the claims are accordingly dismissed.

[317] The defendants are entitled to costs. There may be an issue as to whether the Sadats' experts, Mr Thompson and Dr Wu, should have to personally make a contribution towards the defendants' costs, particularly so because of the new evidence they presented just prior to the hearing. Earthquake Services Limited was a litigation funder for these proceedings.

[318] The Sadats are to provide the defendants with full details as to the terms of the litigation funding agreement with Earthquake Services Limited or any other litigation funder forthwith.

[319] EQC and Tower are to file memoranda as to costs within 28 days of receiving that information. Counsel for the Sadats is to ensure those memoranda are forwarded to Earthquake Services Limited, Dr Wu and Mr Thompson. Memoranda for those three parties and the Sadats are to be filed in response to the defendants' memoranda within a further 21 days. The defendants are to file memoranda in reply within a further 14 days. The memoranda are to be no longer than 10 pages.

[320] I will deal with costs issues on the basis of the written memoranda unless, after considering those memoranda, I consider it would be appropriate to hear further

submissions from all parties or if any of those concerned in their memoranda ask to be heard further as to costs issues.

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