G Outstanding Claims Liabilities – Detailed Methodology

G.1 Construction of individual event / sub-claim distributions

The outstanding claim liabilities were estimated using separate models for each valuation group (i.e. by sub-claim and event). The models vary significantly for each sub-claim group with further variations included as required to adequately model each event. The output from each model produced an estimated ultimate claims cost distribution (including inflation and demand surge) for the relevant event / sub-claim group as well as CHE.

G.1.1 Land sub-claims cost distribution

Canterbury earthquakes

The land sub claims cost distribution has been created with input from T+T. The model calculates property-by-property land costs using the following parameters, which were stochastic in nature:

- Category 1 – 7 damage
  - Cost per property
- IFV Damage
  - Qualification indicators
  - Indemnity value expressed as proportion of CV
- ILV damage
  - Qualification indicators
  - Indemnity value expressed as proportion of CV
  - Percentage of ILV area to be repaired
  - Remediation costs for vacant land
- Allowance for Port Hills land damage (aggregate)
- Allowance for removal of silt from beneath houses (aggregate)

The liability model was run 10,000 times with the inputs being allowed to vary each simulation.

The claims costs were then projected using an assumed payment pattern and base and demand surge inflation was applied.

BAU

An aggregate frequency severity stochastic model was adopted for this component of the liability estimation.

The frequency (i.e. number) of claims was taken to be the number of claims recorded in ClaimCentre as well as an estimated number of future IBNR claims. These were then grouped by loss cause and sub-claim profile (i.e. which combination of sub-claims was notified for a given claim).

Duplicate claims were removed from ClaimCentre and a further allowance was made for nil claims (e.g. declined).
The number of estimated non-nil claims for each event / location group was then multiplied
by the claim profile group’s average claim size (weighted by loss cause proportion).
Variance for each claim profile group was added to create aggregate loss distributions –
from which a loss was simulated. The simulations from each claim profile group were then
aggregated to a single land aggregate distribution.

The above process was repeated 10,000 times to create an estimated claims cost
distribution for each event.

The claims costs were then projected using an assumed payment pattern and base inflation
was applied.

G.1.2 Building sub-claims cost distribution

Canterbury earthquakes

The building sub-claim cost distribution uses the ACE apportionment data and EQR repair
data to estimate the ultimate cost distribution.

The ACE model uses an individual property stochastic claims model to estimate the cost of
Canterbury earthquake building sub-claims.

The model relies on two sets of data:

- ACE apportionment data
- EQR completed properties repair data

The model consists of three main components:

- Modelling the probability a building sub-claim will settle for nil cost. This is based
  on both ACE data and EQR data.
- Modelling average property damage estimates across all events for non-nil sub-
  claims. This is based on both ACE data and EQR completed repairs data
- Modelling event damage apportionment. This is based solely on ACE
  apportionment data.

The ACE data is biased towards highly damaged properties. Thus we expect the settled
properties in the ACE database to be significantly different to the other damaged properties
without an ACE estimate. The EQR data is also biased but towards properties with mid-
range damage. Generalised Linear Models (GLMs) were used to account for biases in the
ACE data and EQR data. The GLMs project average claim sizes and nil claim rates onto
properties without an ACE or EQR estimate.

See Sections 3.1.2 and 4.2 for more details on the ACE apportionment data.

The following diagram illustrates how the ACE model estimates the ultimate building sub-
claim cost.
Additional provisions

The ACE model is based on the experience to date and will therefore tend to predict that the outstanding claims will behave in a manner similar to those already settled.

There will therefore need to be additional provisions to allow for tail deterioration and reopened claims.

- Tail deterioration is the expectation that the remaining properties are likely to be more difficult to settle than those that are already settled and will probably cost more.
- Reopened claims includes building warranty issues, complaints and insurer washup.
  - Building warranties apply to all properties that have been settled through the Fletcher EQR programme. There will be some proportion of these that require remediation.
  - Complaints may come from any undercap property. A proportion of these may result in a higher ultimate settlement.
  - Insurer washup relates to the overcap properties where there may be some dispute as to how the building damage has fallen across the events and therefore how EQC’s liability should have fallen.

Tail deterioration has been modelled within the GLMs in the ACE model. Residual open EQR claims incur a higher estimated settlement amount than the EQR properties that have closed to date. The Reopened Claims provisions are modelled using a frequency / severity model.

BAU

The outstanding BAU building sub-claims were gроссed up by a ratio to reflect future development. A ratio was applied to calculate both a mean and 85th percentile for the aggregate distribution – from which a distribution was inferred.
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The claims costs were then projected using an assumed payment pattern and base inflation was applied.

G.1.3 Contents sub-claims cost distribution

Canterbury earthquakes

An aggregate frequency severity stochastic model was adopted for this component of the liability estimation.

The frequency (i.e. number) of claims was a known value for all events, and was taken from ClaimCentre. These claims were grouped by event and sub-claim profile (i.e. which combination of sub-claims were notified for a given claim).

Duplicate claims were removed from ClaimCentre and a further allowance was made for future nil claims (arising from duplicate claims and other reasons e.g. declined).

The number of estimated non-nil claims for each event / location group was then multiplied by the event / claim profile group’s average claim size. Variance for each event / claim profile was added to create aggregate loss distributions by event – from which a loss was simulated. The simulations from each event / claim profile group were then aggregated to a single event distribution.

The above process was repeated 10,000 times to create an estimated claims cost distribution for each event.

The claims costs were then projected using an assumed payment pattern and base inflation was applied.

BAU

Outstanding contents BAU sub-claims were estimated using the same methodology as per land and building sub-claims.

G.1.4 Claims handling expenses distribution

Canterbury earthquakes & BAU

The estimation of central estimate of CHE (before inflation) for each event was discussed in Appendix F. A cost distribution was then assumed around this central estimate.

The CHE costs were then projected using an assumed payment pattern and base inflation was applied.

G.2 Construction of individual event distributions

The individual sub-claim event distributions derived above were combined to form aggregate gross claims cost distributions (including inflation) for each event. A multivariate copula was used to aggregate these individual distributions.

The variance of each event’s aggregate claim cost distribution was adjusted to allow for model (internal systemic) risk and environmental (external systemic) risk. The details of the systemic risk adjustment are set out in Appendix H.2.2. The output of this is the final estimated gross claim cost distribution assumed for each event.
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The impacts of reinsurance recoveries were applied to each event’s gross distribution to obtain net distributions for each event.

Gross and net paid to date were deducted from the estimated gross and net ultimate distributions to create corresponding outstanding claims distributions.

Discounting for the time value of money was carried out after projecting the aggregate claims costs using an assumed payment pattern.

G.3 Construction of the total EQC entity level distribution
The discounted outstanding net distributions for each event were then combined using a multivariate copula. This created a total aggregate outstanding claims liability distribution for EQC at the entity level from which the final outstanding central estimate and risk margin were obtained.
H Outstanding Claims Liabilities – Detailed Assumptions

H.1 Construction of individual event sub-claim distributions

H.1.1 Land sub-claims cost distribution – Canterbury earthquakes

Cost component summary

The land sub-claims model is based on the T+T land liability data and assumptions used to assess land damage. A number of these have been adjusted by MJW to produce the results in this report.

There are a number of detailed assumptions that drive this model, which are shown in the table below. Composite uniform distributions were derived for each parameter using the percentiles below. Non-numerical parameters were modelled on a scenario basis.

*Please contact the authors for further information on the DoV percentage assumptions

The percentiles for most parameters were based on scenarios provided by T+T. An assumed correlation matrix for these parameters is available on request.

Offer & Payment pattern

Estimates for the timing of offers and settlement were provided by the EQC finance team. The table below summarises the assumed, uninflated payment pattern. From this, an estimated mean term to settlement was derived and this was allowed to vary in the model.
The term to settlement was not assumed to be independent of the cost distribution – on average an increase in total land sub-claim costs was associated with a longer settlement pattern. The payment pattern was used in the calculation of base inflation and demand surge.

**Base Inflation and Demand Surge**

The total costs were inflated according to when the payment was estimated to be made using the recommended Treasury rate of 2.5% p.a.

Demand surge was simulated on a semi-annual basis – for each half year a demand surge event was simulated using a Bernoulli process and the percentage increase in cost (on top of base inflation) was also simulated. Any payments during that year were correspondingly grossed up. The following table summarises the demand surge assumption adopted.

**Demand surge**

<table>
<thead>
<tr>
<th>Quarter Ending</th>
<th>31 December 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Demand Surge</td>
</tr>
<tr>
<td></td>
<td>Probability</td>
</tr>
<tr>
<td>31/03/2016</td>
<td>90.0%</td>
</tr>
<tr>
<td>30/06/2016</td>
<td>90.0%</td>
</tr>
<tr>
<td>30/09/2016</td>
<td>90.0%</td>
</tr>
<tr>
<td>31/12/2016</td>
<td>90.0%</td>
</tr>
<tr>
<td>31/03/2017</td>
<td>90.0%</td>
</tr>
<tr>
<td>30/06/2017</td>
<td>90.0%</td>
</tr>
<tr>
<td>30/09/2017</td>
<td>90.0%</td>
</tr>
<tr>
<td>31/12/2017</td>
<td>90.0%</td>
</tr>
</tbody>
</table>

**H.1.2 Building sub-claims cost distribution – Canterbury earthquakes**

**Nil claim rates**

Prior to the 31 December 2014 valuation Generalised Linear Models were used to calculate a nil claim rate for each property with a valid EQC claim.

Given the extent of the completed settlement process it is now considerably clearer which claims will settle for a non-nil amount. Identified nil claims are now removed from the data set prior to damage modelling. This results in a lower estimate of ultimate incurred claims liability.
Claim size and event apportionment

Generalised Linear Models were used to predict the damage each property incurred – both the mean and standard deviation of damage were estimated.

Apportionment was derived from the ACE apportioned cost estimates as well as the statistical apportionment model.

EQC excesses and limits were then applied to the estimates to calculate the average EQC liability per property for each event.

As a result of using GLMs, the raw assumptions are complex and are best given in a digital format, we are happy to supply these upon request.

GLM predicted damage amounts were only applied to the Non ACE or EQR properties. Average damage costs for ACE and EQR properties were given by their respective estimates.

Modelled damage apportionments were only applied to the Non ACE properties. Damage apportionment for ACE properties was given by their ACE apportionment estimates.

Payment pattern

The timing of cash flow payments was based on information initially provided by EQC finance.

Base Inflation and Demand Surge

The total costs were inflated according to when the payment was estimated to be made using the long-term Treasury rate of 2.5% p.a.

Demand surge was simulated on an semi-annual basis – for each half year a demand surge event was simulated using a Bernoulli process and the percentage increase in cost (on top of base inflation) was also simulated. Any payments during that year were correspondingly increased. The following table summarises the demand surge assumption adopted.

<table>
<thead>
<tr>
<th>Quarter Ending</th>
<th>31 December 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Demand Surge</td>
</tr>
<tr>
<td>31/03/2016</td>
<td>90.0%</td>
</tr>
<tr>
<td>30/06/2016</td>
<td>90.0%</td>
</tr>
<tr>
<td>30/09/2016</td>
<td>90.0%</td>
</tr>
<tr>
<td>31/12/2016</td>
<td>90.0%</td>
</tr>
<tr>
<td>31/03/2017</td>
<td>90.0%</td>
</tr>
<tr>
<td>30/06/2017</td>
<td>90.0%</td>
</tr>
<tr>
<td>30/09/2017</td>
<td>90.0%</td>
</tr>
<tr>
<td>31/12/2017</td>
<td>90.0%</td>
</tr>
</tbody>
</table>
H.1.3 Contents sub-claims cost distribution – Canterbury earthquakes

Nil claim rates

The nil claim rates for each event/sub-claim profile group were set to zero for the 31 December 2015 valuation. This assumption implies that all nil contents claims have been identified as such.

Estimated claim size average and standard deviation

The average claim size and variance for claims in each event/sub-claim profile group were estimated using closed contents sub-claims paid amounts.

Average Claim Size

<table>
<thead>
<tr>
<th>Profile</th>
<th>EQ1</th>
<th>EQ2</th>
<th>EQ3</th>
<th>EQ4</th>
<th>AS</th>
</tr>
</thead>
<tbody>
<tr>
<td>-BC</td>
<td>4,620</td>
<td>10,547</td>
<td>9,003</td>
<td>2,034</td>
<td>2,794</td>
</tr>
<tr>
<td>-C</td>
<td>2,064</td>
<td>6,132</td>
<td>3,614</td>
<td>1,954</td>
<td>2,457</td>
</tr>
<tr>
<td>LBC</td>
<td>10,270</td>
<td>12,633</td>
<td>4,494</td>
<td>3,214</td>
<td>3,309</td>
</tr>
<tr>
<td>L-C</td>
<td>7,282</td>
<td>4,813</td>
<td>4,644</td>
<td>3,521</td>
<td>1,705</td>
</tr>
</tbody>
</table>

Claim Size Standard Deviation

<table>
<thead>
<tr>
<th>Profile</th>
<th>EQ1</th>
<th>EQ2</th>
<th>EQ3</th>
<th>EQ4</th>
<th>AS</th>
</tr>
</thead>
<tbody>
<tr>
<td>-BC</td>
<td>7,290</td>
<td>13,130</td>
<td>13,074</td>
<td>3,198</td>
<td>4,497</td>
</tr>
<tr>
<td>-C</td>
<td>2,484</td>
<td>7,117</td>
<td>5,410</td>
<td>2,883</td>
<td>3,549</td>
</tr>
<tr>
<td>LBC</td>
<td>8,660</td>
<td>11,369</td>
<td>5,560</td>
<td>5,381</td>
<td>5,280</td>
</tr>
<tr>
<td>L-C</td>
<td>10,381</td>
<td>5,369</td>
<td>5,647</td>
<td>5,286</td>
<td>1,633</td>
</tr>
</tbody>
</table>

Contents sub-claims aggregate distribution

For each event/sub-claim profile group the number of non-nil claims was multiplied by their corresponding estimated average claim size and variances to provide an aggregate distribution mean and variance. For the purposes of estimating the contents claims cost distribution a normal distribution was then fitted to these parameters.

Payment pattern

EQC Finance provided a payment pattern predicting all remaining contents claims settling evenly over the next quarter.

<table>
<thead>
<tr>
<th>Month ending</th>
<th>Cumulative paid</th>
</tr>
</thead>
<tbody>
<tr>
<td>31-Dec-15</td>
<td>-</td>
</tr>
<tr>
<td>31-Jan-16</td>
<td>33%</td>
</tr>
<tr>
<td>29-Feb-16</td>
<td>67%</td>
</tr>
<tr>
<td>31-Mar-16</td>
<td>100%</td>
</tr>
<tr>
<td>30-Apr-16</td>
<td>100%</td>
</tr>
<tr>
<td>31-May-16</td>
<td>100%</td>
</tr>
</tbody>
</table>

Base Inflation and Demand Surge

Costs were then inflated according to when the payment was estimated to be made using the recommended long-term Treasury rate of 2.5% p.a.
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No demand surge inflation was assumed for contents sub-claims.

**H.1.4 Claims handling expenses – Canterbury earthquakes**

The central estimate of CHE (before inflation) was discussed in Section 5.8. A coefficient of variation of 20% was assumed and applied to the inflated CHE central estimate. For the purposes of estimating the CHE cost distribution, a normal distribution was fitted to these parameters.

**Payment pattern**

CHE payments arising from the Canterbury earthquake claims were assumed to follow a payment pattern which is consistent with the EQC budget projections.

<table>
<thead>
<tr>
<th>Half year ending</th>
<th>Cumulative inflated paid</th>
</tr>
</thead>
<tbody>
<tr>
<td>30/06/2016</td>
<td>76%</td>
</tr>
<tr>
<td>31/12/2016</td>
<td>85%</td>
</tr>
<tr>
<td>30/06/2017</td>
<td>95%</td>
</tr>
<tr>
<td>31/12/2017</td>
<td>97%</td>
</tr>
<tr>
<td>30/06/2018</td>
<td>98%</td>
</tr>
<tr>
<td>31/12/2018</td>
<td>99%</td>
</tr>
<tr>
<td>30/06/2019</td>
<td>100%</td>
</tr>
<tr>
<td>31/12/2019</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Base Inflation and Demand Surge**

Costs were then inflated according to when the payment was estimated to be made using the recommended Treasury rate of 2.5% p.a.

No demand surge inflation was assumed for CHE. It is noted that the duration of the rebuild programme will have a more material impact on the overall CHE costs than any margin for demand surge.

**H.1.5 Land, Building & Contents sub-claims cost distributions – BAU & BAU Past Periods**

**Nil claim rates**

The nil claim rates for each sub-claim type and profile were set with regard to assumptions for the 31 December 2015 outstanding claims estimation. The number of non-nil contents sub-claims for the group was then simulated according to a binomial distribution. The probability of a nil claim for each event / sub-claim profile is set out below. The assumptions adopted for BAU and BAU Past Periods were the same.

<table>
<thead>
<tr>
<th>Nil claim probability</th>
<th>Profile</th>
<th>Land</th>
<th>Building</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>5.0%</td>
<td>7.5%</td>
<td>2.5%</td>
<td></td>
</tr>
<tr>
<td>-B</td>
<td>5.0%</td>
<td>7.5%</td>
<td>2.5%</td>
<td></td>
</tr>
<tr>
<td>-BC</td>
<td>5.0%</td>
<td>7.5%</td>
<td>2.5%</td>
<td></td>
</tr>
<tr>
<td>-C</td>
<td>5.0%</td>
<td>7.5%</td>
<td>2.5%</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>5.0%</td>
<td>7.5%</td>
<td>2.5%</td>
<td></td>
</tr>
<tr>
<td>LB</td>
<td>5.0%</td>
<td>7.5%</td>
<td>2.5%</td>
<td></td>
</tr>
<tr>
<td>LBC</td>
<td>5.0%</td>
<td>7.5%</td>
<td>2.5%</td>
<td></td>
</tr>
<tr>
<td>L-C</td>
<td>5.0%</td>
<td>7.5%</td>
<td>2.5%</td>
<td></td>
</tr>
</tbody>
</table>
Released under the Official Information Act 1982

Sub-claim transitions (SCT)

The rate of sub-claim transition (i.e. claims which will change their sub-claim profile before settling – in this case to add a contents sub-claim) for each sub-claim type and profile were set with regard to those set for 31 December 2015.

Claims with no contents sub-claim which are predicted to ultimately register a contents sub-claim are also expected to have a reduced average claim size. The following tables set out these assumptions for each sub-claim type and profile.

<table>
<thead>
<tr>
<th>Sub-claim transition probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profile</td>
</tr>
<tr>
<td>-B-</td>
</tr>
<tr>
<td>-C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sub-claim transition cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profile</td>
</tr>
<tr>
<td>-B-</td>
</tr>
<tr>
<td>-C</td>
</tr>
</tbody>
</table>

Estimated claim size average and standard deviation

The average claim size and variance for claims in each for each sub-claim type and profile were estimated using a GLM on all sub-claims which had loss adjuster estimates. However the GLM predicted claim sizes were only applied to open claims without a loss adjuster estimate.

The risk factors used in the GLM were:
- Loss date
- Loss cause
- Sub-claim profile
- Initial computer estimate

The following tables illustrate the final averages used in the model.

**BAU**

### Average Claim Size

<table>
<thead>
<tr>
<th>Profile</th>
<th>Land</th>
<th>Building</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>-B-</td>
<td>3,497</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BC</td>
<td>6,319</td>
<td>1,479</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>1,438</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L--</td>
<td>8,619</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LB-</td>
<td>27,715</td>
<td>16,877</td>
<td></td>
</tr>
<tr>
<td>LBC</td>
<td>59,081</td>
<td>36,609</td>
<td>4,676</td>
</tr>
<tr>
<td>L-C</td>
<td>14,936</td>
<td></td>
<td>1,602</td>
</tr>
</tbody>
</table>

### Claim Size Standard Deviation

<table>
<thead>
<tr>
<th>Profile</th>
<th>Land</th>
<th>Building</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>-B-</td>
<td>7,103</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BC</td>
<td>12,687</td>
<td>2,147</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>2,109</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L--</td>
<td>18,948</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LB-</td>
<td>50,096</td>
<td>26,479</td>
<td></td>
</tr>
<tr>
<td>LBC</td>
<td>80,727</td>
<td>37,956</td>
<td>5,814</td>
</tr>
<tr>
<td>L-C</td>
<td>20,903</td>
<td></td>
<td>2,131</td>
</tr>
</tbody>
</table>
BAU PP

Average Claim Size

<table>
<thead>
<tr>
<th>Profile</th>
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<th>Building</th>
<th>Contents</th>
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<td></td>
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</tr>
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<td></td>
<td>1,438</td>
<td></td>
</tr>
<tr>
<td>L-</td>
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<td></td>
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</table>

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<table>
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</tr>
<tr>
<td>-C</td>
<td></td>
<td></td>
<td>2,109</td>
</tr>
<tr>
<td>L-</td>
<td>18,948</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LB-</td>
<td>50,096</td>
<td>26,479</td>
<td></td>
</tr>
<tr>
<td>LBC</td>
<td>80,727</td>
<td>37,956</td>
<td>5,814</td>
</tr>
<tr>
<td>L-C</td>
<td>20,903</td>
<td></td>
<td>2,131</td>
</tr>
</tbody>
</table>

Contents sub-claims aggregate distribution

For each sub-claim type and profile group the number of non-nil claims and sub-claim transitions was multiplied by their corresponding estimated average claim size and variances to provide an aggregate distribution mean and variance. For the purposes of estimating the contents claims cost distribution a lognormal distribution was then fitted to these parameters.

Payment pattern

An analysis of historical experience informed the choice of the following assumed payment pattern which is summarised below.

<table>
<thead>
<tr>
<th>Half year ending</th>
<th>Cumulative paid BAU</th>
<th>Cumulative paid BAU PP</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 Jun 2017</td>
<td>82%</td>
<td>88%</td>
</tr>
<tr>
<td>31 Dec 2017</td>
<td>92%</td>
<td>95%</td>
</tr>
<tr>
<td>30 Jun 2018</td>
<td>97%</td>
<td>98%</td>
</tr>
<tr>
<td>31 Dec 2018</td>
<td>99%</td>
<td>99%</td>
</tr>
<tr>
<td>30 Jun 2019</td>
<td>99%</td>
<td>100%</td>
</tr>
<tr>
<td>31 Dec 2019</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Base Inflation and Demand Surge

Costs were then inflated according to when the payment was estimated to be made using the recommended Treasury rate of 2.5% p.a.

No demand surge inflation was assumed for BAU sub-claims.

H.2 Construction of individual event distributions

H.2.1 Sub-claim distribution aggregation

The individual sub-claim distributions for each event were combined to a single event claim cost distribution. A Gaussian copula dependency structure was assumed between each sub-claim distribution with the following correlation matrix.
H.2.2 Systemic risk adjustment

The following systemic risk assumptions were applied to each event distribution to recognise risks not allowed for in the stochastic nature of the model.

<table>
<thead>
<tr>
<th>Systemic risk assumptions</th>
<th>Land</th>
<th>Building</th>
<th>Contents</th>
<th>CHE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficients of variation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model risk</td>
<td>10.0%</td>
<td>20.0%</td>
<td>15.0%</td>
<td>10.0%</td>
</tr>
<tr>
<td>Environmental risk</td>
<td>10.0%</td>
<td>15.0%</td>
<td>2.5%</td>
<td>5.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Correlation matrices</th>
<th>Land</th>
<th>Building</th>
<th>Contents</th>
<th>CHE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model risk</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>25%</td>
</tr>
<tr>
<td>Building</td>
<td>0%</td>
<td>100%</td>
<td>25%</td>
<td>25%</td>
</tr>
<tr>
<td>Contents</td>
<td>0%</td>
<td>25%</td>
<td>100%</td>
<td>25%</td>
</tr>
<tr>
<td>CHE</td>
<td>25%</td>
<td>25%</td>
<td>25%</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Environmental risk</strong></th>
<th>Land</th>
<th>Building</th>
<th>Contents</th>
<th>CHE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land</td>
<td>100%</td>
<td>50%</td>
<td>0%</td>
<td>25%</td>
</tr>
<tr>
<td>Building</td>
<td>50%</td>
<td>100%</td>
<td>0%</td>
<td>25%</td>
</tr>
<tr>
<td>Contents</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>CHE</td>
<td>25%</td>
<td>25%</td>
<td>0%</td>
<td>100%</td>
</tr>
</tbody>
</table>

H.2.3 Reinsurance

The reinsurance rules assumed follow from the terms and conditions of the reinsurance in place for each event and are discussed in Appendix C.

H.2.4 Payment patterns

In respect of each event, net payments to date were deducted from the estimated net ultimate distribution to create the corresponding estimated outstanding net claims cost distribution.

The net payment pattern mirrored the gross payment pattern subject to the application of the reinsurance layers. Net payments were zero during the reinsurance layers (subject to small amounts of co-insurance), and resume after gross payments exceeded the upper reinsurance retention limit.

Net payments made during the coinsurance layers were assumed to be made at the same time as the reinsurance deductible and thus are subject to less discounting than might be expected.
H.3 Construction of the total EQC entity level distribution

The individual event distributions were combined to a single EQC entity claim cost distribution. A Gaussian copula dependency structure was assumed between each event distribution with the following correlation matrix.

<table>
<thead>
<tr>
<th>Event correlation</th>
<th>EQ1</th>
<th>EQ2</th>
<th>EQ3</th>
<th>EQ4</th>
<th>AS</th>
<th>BAU</th>
<th>BAU PP</th>
</tr>
</thead>
<tbody>
<tr>
<td>EQ1</td>
<td>100%</td>
<td>50%</td>
<td>50%</td>
<td>50%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>EQ2</td>
<td>50%</td>
<td>100%</td>
<td>50%</td>
<td>50%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>EQ3</td>
<td>50%</td>
<td>50%</td>
<td>100%</td>
<td>50%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>EQ4</td>
<td>50%</td>
<td>50%</td>
<td>50%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>AS</td>
<td>50%</td>
<td>50%</td>
<td>50%</td>
<td>50%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>BAU</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>50%</td>
</tr>
<tr>
<td>BAU PP</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>50%</td>
<td>100%</td>
</tr>
</tbody>
</table>
I  Discount Rates

Where cashflows have been discounted for the time value of money, the following discount rates were adopted as specified by Treasury. Discounts rates used for the 31 June 2015 valuation have been included for comparative purposes only.

<table>
<thead>
<tr>
<th>Valuation Year</th>
<th>Forward Rate as at 31 Dec 2015</th>
<th>Forward Rate as at 30 June 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>2.57%</td>
<td>2.93%</td>
</tr>
<tr>
<td>2017</td>
<td>2.75%</td>
<td>2.81%</td>
</tr>
<tr>
<td>2018</td>
<td>2.99%</td>
<td>2.99%</td>
</tr>
<tr>
<td>2019</td>
<td>3.25%</td>
<td>3.19%</td>
</tr>
<tr>
<td>2020</td>
<td>3.49%</td>
<td>3.43%</td>
</tr>
<tr>
<td>2021</td>
<td>3.73%</td>
<td>3.69%</td>
</tr>
<tr>
<td>2022</td>
<td>3.95%</td>
<td>3.94%</td>
</tr>
<tr>
<td>2023</td>
<td>4.16%</td>
<td>4.15%</td>
</tr>
<tr>
<td>2024</td>
<td>4.36%</td>
<td>4.32%</td>
</tr>
<tr>
<td>2025</td>
<td>4.53%</td>
<td>4.45%</td>
</tr>
<tr>
<td>2026</td>
<td>4.68%</td>
<td>4.54%</td>
</tr>
<tr>
<td>2027</td>
<td>4.81%</td>
<td>4.58%</td>
</tr>
<tr>
<td>2028</td>
<td>4.92%</td>
<td>4.62%</td>
</tr>
</tbody>
</table>

The forward rates at various durations are appropriate to use in our model as we have projected future yearly cash flows which we then discount to the present.

All other things being equal, the reduction in discount rates would lead to an increase in EQC discounted claims liability.
Glossary

Accounting standard

In New Zealand, the accounting standards of the NZ Institute of Chartered Accountants apply. The standard most relevant to insurance entities is NZ IFRS4 Insurance Contracts.

Actuarial Data Extract (ADE)

A data extract used to facilitate an actuarial valuation. The data is typically sourced from the claims and policy administration systems.

Actuary

In general, in New Zealand an actuary is a Fellow or Accredited Member of the New Zealand Society of Actuaries or equivalent body.

Aggregate excess of loss reinsurance

See catastrophe reinsurance.

Apportioned Cost Estimate (ACE) data

A number of properties have had their dwelling damage apportioned between events in a manual fashion. This process uses all available information on that property (quantity surveyor reports, land damage information, neighbourhood damage, customer reports etc.) to inform the apportionment. These apportionments are called Apportioned Cost Estimates and will be included the ACE data set. The ACE data set includes all overcap properties and a number of undercap properties too.

Attachment date

See inception date.

Best estimate

In the context of scenarios, a best estimate means a realistic future scenario, rather than a deliberately pessimistic or optimistic one. Also see central estimate.

Brokerage

An alternative term for commission paid to a broker.

Broker

An intermediary who acts for an insured in negotiating their insurance. The broker usually receives payment by way of commission from the insurer with whom the business is placed.

Business as Usual (BAU)

A distinction has been drawn between claims that are related to the Canterbury earthquake events and those that are from other events (earthquake or other). These non-Canterbury earthquake events are referred to as Business as Usual (BAU) events.
Released under the Official Information Act 1982

Canterbury Earthquake Sequence (‘CES’)

The sequence of earthquakes and aftershocks in the Canterbury area from 4 September 2010 to the end of 2011. This included four main earthquakes on 4 September 2010, 22 February 2011, 13 June 2011 and 23 December 2011.

Case estimate

The amount recorded by the insurer’s claims personnel (including external claims assessors) as being the amount required to settle an open claim, based on the information available on that particular case. When a claim is first reported and recorded, a nominal placeholder estimate may be entered into the system. Estimates should be updated as extra information comes to light and adjusted to reflect any partial payments that may be made prior to final settlement.

Catastrophe

A catastrophe event for an insurer is generally considered to be a single event that results in one or more claims for very large amounts or in an aggregation of many claims collectively costing an extremely large amount. The nature and impact of potential catastrophe events will vary by insurer according to their business, amount of capital and risk management arrangements. Examples include earthquakes and terrorism.

Catastrophe reinsurance

Usually an aggregate excess of loss reinsurance arrangement providing cover to an insurer against very high losses arising from a catastrophe event, which meets the definition of ‘catastrophe’ as specified in the reinsurance policy. The nature and extent of the cover available / provided depends on the nature of the underlying insurer’s business and the terms available for such protection. For some events, such as storm or earthquake, the reinsurer may impose a specified time limit on when claims may be covered under the catastrophe treaty.

Cedant or ceding insurer

An insurer who has ceded (passed on) all or part of the risks it has underwritten by way of reinsurance. Analogous to an insured who cedes risk to an insurer.

Central Estimate

An estimate that contains no deliberate or conscious over- or under-estimation. NZ Accounting standards define this to be the mean of the probability distribution of future outcomes. Also see probability of adequacy.

Claim frequency

The number of claims divided by exposure over a given time period. This could apply to reported or incurred claims.

Claims handling expenses (CHE)

The expenses involved in the processing and settlement of claims. Note that this term usually relates only to indirect claims expenses such as internal general administration claims costs. Expenses such as assessors’ fees or legal costs, that arise in relation to specific claims, are termed direct expenses and are usually treated as part of the cost of those claims.
Claims paid

The amount paid in respect of claims.

Claims provision and claims reserve

These are both terms used to refer to the amount held or required to provide for future payments on outstanding claims. These terms are sometimes seen as being interchangeable. However, there are variations in the precise usage of both terms according to the context in which they appear.

A claims provision is often used to refer to the amount held in an insurer’s accounts. In management accounts, claims reserve may refer to the total case estimates, possibly with an additional amount for IBNR claims. In actuarial contexts the technical terms are, respectively, incurred claims liability and outstanding claims liability. These amounts might also include allowances for CHE, discounting, claims paid, and a risk margin. Figures may be given net or gross of reinsurance.

Closed claims

Those claims for which records have been closed, because settlement has been made and no recoveries are expected. However, see reopened claims.

Cover

The extent and nature of protection provided by an insurance policy. This will be defined in the policy documentation.

Deductible

See excess.

Demand surge

The increase in the cost of insurance claims following a major loss event. The event puts pressure on the demand for labour and materials to pay for repairs which, in the absence of increased supply, increases the price of these costs.

Discounting

Discounting refers to the (absolute) reduction, for the time value of money, of any future cashflows. The extent of discounting is a consequence of two factors: length of time until payment and the discount rate with an increase in either of these increasing the impact of discounting. Cashflows which have been discounted are said to be present values.

Discounting is usually applied in the calculation of liabilities for long-tail business when payments from incurred claims or unexpired risks may not be made for a significant length of time. Actuarial professional standards state that risk-free discount rates must be used to calculate present values.

Effective date

The effective date of an ILVR is the date to which the valuation calculations apply.
Released under the Official Information Act 1982

Excess

The amount of an insured loss that must be borne by the policyholder before the insurer becomes liable to make a claim payment. The amount of the excess will be set out in the policy documentation.

Excess of loss reinsurance

A non-proportional form of reinsurance whereby the insurer pays the cost of a claim up to a specified point (their retention) and the reinsurer pays the remainder of the cost. The amount payable by the reinsurer is usually subject to a specified maximum amount which may apply per claim or to the total amount. Also see catastrophe reinsurance.

Experience

The term used to describe the results of blocks of insurance business, particularly when the results are the subject of detailed analysis.

Financial soundness

A measure of the sufficiency of the assets of an insurer to support its continuing operation.

Future Claim Liability (FCL)

A term sometimes used to refer to the premium liability arising from unearned policies. It is the value of future claim payments and related CHE, arising from future events for which the insurer is liable.

Gross

Refers to the amounts of premiums, claims and expenses before allowing for the costs or income (including commission as well as claim recoveries) from reinsurance and other non-reinsurance recoveries.

Increased Flooding Vulnerability (IFV)

The physical change to land as a result of an earthquake which adversely affects the use and amenity that could otherwise be associated with the land by increasing the vulnerability of that land to flooding events.

Increased Liquefaction Vulnerability (ILV)

The physical change to land as a result of ground subsidence from an earthquake which materially increases the vulnerability of that land to liquefaction damage in future earthquakes.

Incurred

A term relating to claims arising from events that occurring in a specified period.

There are differences in the precise usage of the term according to the context in which it appears. In some contexts it may refer to the group of claims occurring in the period (whether reported to the insurer or not) and their eventual cost. In accounting contexts, the term may refer to the amount of claims payments made plus the change in outstanding claims provisions from the start to the end of the period.
Released under the Official Information Act 1982

In an actuarial context, 'incurred' costs are taken to mean the claim costs which arise, or come to light) during the period. An alternative expression of this is: claim payments made plus outstanding estimates (inclusive of IBNR and IBNER).

Further differences may also apply in regard to the inclusion (or not) of CHE and risk margins. Clarification should be provided in the actuarial commentary as to the precise meaning applied. It should also be stated whether there has been allowance for discounting in the quantification of future payments to be made on these claims. Also see discounting and ultimate cost.

**Incurred but not reported (IBNR)**

Any claim or claim amount for which, at a particular point in time, the loss event has occurred but the insurer has not yet been notified and/or the claim entered into the claims system. Any outstanding claims liability must include an allowance for these claims.

**Incurred but not enough reported (IBNER)**

A monetary amount relating to reported claims. IBNER is defined as the ultimate cost of the claim less the current case estimate and could be positive or negative. The outstanding claims liability must include an allowance for this.

**Incurred claims**

Claims that were incurred during a specified time period.

**Incurred claims liability**

See Outstanding Claims Liability.

**Indirect claims handling expenses**

See claims handling expenses

**Insurance liability valuation report (ILVR)**

A report detailing a valuation by the actuary of the insurance liabilities of an insurer.

**Liability adequacy test (LAT)**

A test applied under the accounting standard which consists of a comparison of the unearned premium, less deferred acquisition costs (DAC), against the premium liability. If the test indicates a deficiency, the DAC must be written down by an appropriate amount in the entity’s income statement. If the deficiency is greater than the DAC, a premium deficiency reserve must be set up.

**Material**

In the context of an actuarial report, an item is deemed material if it is significant in the professional judgment of the actuary. This may not necessarily correspond exactly with 'material' as applied in an accounting context.
Released under the Official Information Act 1982

Net

Refers to the amounts of premiums, claims and expenses after allowing for the costs or income (including commission as well as claim recoveries) from reinsurance and other non-reinsurance recoveries.

Net outstanding claims liability

See outstanding claims liability.

Open claims

Those claims that have been reported to the insurer but are not regarded as finally settled as claim payments and/or recoveries associated with the claim, may occur in future.

Outstanding Claims Liability (OCL)

The expected value of future payments on claims that were incurred on or before the effective valuation date. This usually includes future CHE associated with those claims, allows for discounting, and includes a specified risk margin. It may be calculated gross or net of reinsurance and non-reinsurance recoveries.

Outstanding Claims Provisions

The amount in the insurer’s accounts providing for outstanding claims liabilities at the accounting date.

Probability of adequacy

The statistical probability that a reserve or provision will ultimately prove to be adequate to provide for all relevant payments to be made.

Professional Standard

The form of professional guidance as issued by the New Zealand Society of Actuaries, or such other professional body as may be stated.

Reported

Claims are said to be reported if the insurer has been notified of their existence. This is in contrast to IBNR claims.

Reinstatement premiums

Premiums that become payable under reinsurance treaties, particularly catastrophe reinsurances, when all or part of a layer of cover has been ‘used’ by the insurer making a claim, but the insurer wishes to reinstate full coverage for the remaining term of the treaty. A ‘free reinstatement’ may sometimes be included in the original terms of a treaty.

Reopened claims

Claims that had been regarded as settled (i.e. no further claim payments or recoveries) but for which claims records have since been reopened because an additional payment or receipt has been made or is now expected to be made. The Outstanding Claims Liability must take the possibility of claims reopening in future into account.
Retention

The amount of risk retained by the direct insurer above which an excess of loss reinsurance will be triggered. Also see excess.

Risk-free discount rates

These are the rates of interest that would be available on a theoretical, riskless investment. In practice, they are the rates available on very secure investments, such as government bonds of suitable durations, which may be assumed to be free of default risk.

Risk Margin

The amount of extra provision over and above the central estimate which is intended to allow for the inherent uncertainty of insurance liabilities. The relevant probability of adequacy associated with the increased amount should be stated.

Sensitivity

The uncertainty in the calculation of insurance liabilities due to the assumptions involved. Accounting and professional standards require statements of the effects on the results to be illustrated by sensitivity tests. These involve reviewing the calculations after varying key assumptions.

Uncertainty

Where full, known information is not available, uncertainty exists as to the exact nature and extent of the ultimate outcome. In particular, there is inherent uncertainty in any estimation of insurance liabilities, which are necessarily based on assumptions, usually derived from analyses of past experience. Deviations from estimates are normal and are to be expected. See also central estimate, probability of adequacy and sensitivity.

Unearned Premium

The proportion of written premium that relates to the risk still to be covered after the balance date or effective date of the valuation. The calculation usually assumes that premium is earned evenly over the term of a policy, except for unusual types of risk where this is clearly not the case (for example, Contractors All Risks). Should a policy be cancelled, the unearned premium as at the cancellation date may be refunded to the policyholder, possibly after allowance for expenses incurred. Also see earned premiums and unexpired risk.

Unearned Premium Reserve (UPR)

The total amount of unearned premiums held, reflecting the periods of future cover to be provided under policies in force at the balance date or effective date of the valuation.

Valuation date

The effective date as at which a valuation has been made.