Canterbury/Westland Region

REVISED GUIDANCE ON REPAIRING AND REBUILDING HOUSES AFFECTED BY THE CANTERBURY EARTHQUAKE SEQUENCE – NOVEMBER

CLARIFICATION ON TOLERANCES

There has been a lot of confusion around how the tolerances are to be applied to the repair of homes – I have sought clarification from the Ministry of Business, Innovation and Employment around the tolerances commonly being used for insurance based repairs – refer to the attached document. In association with this, I've referred to further clauses out of the Revised Guidance on Repairing and Rebuilding Houses Affected by the Canterbury Earthquake Sequence ("the guidance document") that are more applicable to the architectural / construction tolerances rather than the structural performance tolerances.

The majority of residential buildings in Christchurch are constructed from light timber framing – the New Zealand Standard "NZS3604 Timber-framed buildings" was first published in 1978 and is the most applicable standard for the construction tolerances of these buildings. This standard is referred to in section 2.3 of the guidance document.

> **2.3 Indicator criteria for repairs and rebuilds**
> **Applicable standards for floor level tolerance**
> For construction tolerances (ie, as-completed conditions) the relevant Standards are NZS 3604, NZS 3109 and NZS 3114. Table 2.1 of NZS 3604:2011 states that for timber framing, the maximum deviation from horizontal is 5 mm in 10 m, or a total of 10 mm over any length greater than 10 m. The bottom plate of a wall fits within the definition of 'timber framing', but in new concrete floor construction this would be expected to be packed to level.
> The clearest requirement for floor level tolerances for houses is included in Table 2 of NZS 3124:1987. While this Standard refers to NZS 3604 and NZS 4229 for its application, the reference is unfortunately no longer reciprocal. NZS 3124 requires the variation in bearing surfaces for timber to be within ±5 mm, and also requires the maximum depression from a straight line between two high spots 3 m apart on a floor to be 8 mm. The maximum floor slope associated with the second criterion is 0.53% (1 in 190).
> NZS 3109 and NZS 3114 provide a range of acceptable surface deviations for different situations of flatness and straightness.

Private insurers obligations are also referred to in the guidance document

> **8.1.2 Private insurers**
> The following are the obligations of private insurers:
> 1. The reinstatement requirements of the private insurer will depend on the terms of the contract between that insurer and the insured person.
> 2. These obligations can vary between insurers and even between different policy wordings provided by the same insurer. For example, it is understood that one insurer provides two different policies which respectively require it to:
> • repair the building to the state it was in before the damage or pay the cost of repairing, allowing for depreciation and wear and tear, or
> • repair or rebuild or to an 'as new' condition.

As stated in the attached clarification from the Ministry of Business, Innovation and Employment, the guideline document is not mandatory and the contracts with insurers at the time of the earthquakes take precedence. Be sure that the tolerances referred to in any repair strategy are correct.

Yours faithfully

Greg Young
ADNZ Canterbury/Westland Region
Chair and Regional Delegate

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HIKINA WHAKATUTUKI

29 October 2013

Mr Greg Young
6 Craigieburn Lane
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Dear Mr Young

You have asked for some clarification of the use of the guidance document for repairing and rebuilding houses affected by the Canterbury earthquakes produced by the Ministry of Business, Innovation and Employment.

The methods and proposed solutions in the guidance documentation are not mandatory but are produced to encourage consistency of approach that will meet the Building Code requirements. Further, the guidance aims to minimise the individual investigation and design effort required for each property providing for the targeting of scarce engineering resources to those situations most in need.

The figures provided in the guidance in terms of repair/replacement/rebuild (table 2.3) can be used across the technical categories (TC1, TC2 & TC3) and aid in determining what course of action may be undertaken. The figures provided are not prescriptive and are intended to be read in conjunction with on-the-ground assessment on a case by case basis.

Hillside properties are generally more complex than level-ground properties, and do not lend themselves easily to a standard approach with regard to foundations and stability issues. In most cases, a suitably qualified CPEng geotechnical engineer or suitably experienced engineering geologist should be engaged to advise on site suitability, stability, foundations and retaining wall issues.

The guidance does not replace or supersede any private contractual agreement between the owner and insurer and solely provides a method of repair that is deemed to comply with the Building Code but does not mandate what repair strategy may be considered as an alternative.

All of the differential settlement figures are indicative of whether a structural repair may be necessary. This does not indicate if a repair should, or should not be undertaken in accordance with the home owner's insurance policy, it merely supplies a methodology for how to go about that repair should it be undertaken.

If a home owner's insurance policy provides for the repair to be undertaken, regardless of the differential settlement, then this is a private contractual matter that should be adhered to by both parties. The guidance does not override this policy.

I hope this has been helpful in clarifying the points that you raised.

Yours sincerely

Dave Gittings
Senior Advisor Compliance
Consent System Capability

13. CONSTRUCTION TOLERANCES

Commentary: *The surface tolerances and profile of the floor need to reflect the planned use of the floor. Typically floor regularity is controlled in two ways- flatness (i.e. bumpiness), and levelness. There are several ways in which these variables can be measure and evaluated. It is important, regardless of the method used, that appropriate limits are set. Generally the tighter the tolerances the more expensive the construction method.*

Following NZS 3109 and a U3 finish (trowelled) in NZS 3114 would provide surface tolerances of level +/- 10 mm and gradual deviations of 5mm measured over a 3 m length. Note this requirement is often modified to be +/- 3 mm measured using a 3 m straight edge.

The TR 34 produced by the UK Concrete Society specifies different tolerances for different floor classifications. FM 1 has the tightest tolerances and FM 3 the least restrictive. Levelness is measured by levels taken on a 3m grid, and flatness by elevational distance over a 600mm length. This is typically measured by specialist equipment.

In the US, ACI 302 provides an evaluation method using a F number system. Two numbers are determined using a machine, the floor flatness FF and floor levelness FL.

In this specification it has been assumed that New Zealand Standards will be used, with some modification. If either the TR 34 or the ACI 302 method is used, then appropriate clauses will need to be developed.

13.1 *General*

Following completion, the finished surfaces of the various sections of the pavement shall be tested for conformance to the grades, lines and levels shown in the drawings, and for surface smoothness by the methods detailed hereunder.

13.2 *Surface Levels*

The finished surface of the slab measured on a 3m grid coinciding with the grid used for the sub-base shall conform to the levels, grades and cross sections shown in the drawings to the extent that:

a. All points shall be within +/- (…)mm of the level specified in the drawings.

b. The difference in level between adjacent grid points shall be less than (…)mm.

c. 95% of the results from (b) shall be less that (…)mm.

Commentary: *Note the above clause assumes that the floor is supposed to be flat. It will need to be modified if the floor is to be constructed to a specified fall. NZS 3109 specifies that the limit on (a) is +/-10 mm but provides no tolerance or acceptance criteria associated with these clauses. TR 34 specifies that 100% of the levels of (a) should be within +/- 15 mm. Items (b) and (c) are not a requirement of NZS 3109 but have been taken from TR 34. TR 34 specifies limits of 4.5 mm, 8 mm, and 10 mm for item (b) for FM 1, FM 2, and FM 3 floors respectively. For item (c) these limits are 7.0 mm 12.0 mm, and 15 mm.*

Consideration should be given as to whether to use this clause rather than rely on the clauses relating to surface flatness and slab thickness.

13.3 *Surface Flatness*

The finished surfaces of the various sections of the pavement shall not deviate from the testing edge of an approved 3m straightedge by more than (…)mm. Refer to NZS 3114.

Commentary: *The requirements of NZS 3114 give acceptance criteria for an individual point. There are however, no criteria for what proportion of measurements exceeding the limit might be considered acceptable. Some American specifications provide for financial effects for exceeding or not meeting the flatness specification. The American F number system has been specified on many slabs as it provides a statistical measure of a slab's flatness and levelness. However, this does not measure close to joints or slab edges which will be of interest to an end user. This would require separate acceptance criteria.*

13.4 *Remedial Works*

Where the tolerances of this specification are not achieved, the Contractor shall submit for approval, the proposed remedial work.

Table 2.1 – Timber framing tolerances

Item	Tolerances
Deviation from the position shown on plan for a building	15 mm
Deviation from vertical	15 mm per 2 storey height (5 mm per 2.4 m)
Deviation from vertical for buildings in excess of 2 full storeys	20 mm
Relative displacement between loadbearing walls in adjacent storeys intended to be in vertical alignment	5 mm
Deviation from line in plan: (a) In any length up to 10 m (b) In any length over 10 m	 5 mm 10 mm total
Deviation from horizontal: (a) In any length up to 10 m (b) In any length over 10 m	 5 mm 10 mm total
Straightness of corners (where 2 walls meet at right angles) Other studs (gradual bow)	2 mm in 2.4 m in both studs 6 mm in 2.4 m
Wall framing: (a) At mid-height under 3 m long horizontal straight edge (b) At mid-height under 1.3 m long horizontal straight edge	 6 mm gradual bow 1.5 mm out of line

2.3.3 Separation

As shown in figure 2.1 *framing* timbers shall be separated from direct contact with concrete or masonry by either:

(a) A free-draining air space of not less than 12 mm; or

(b) A bituminous *damp-proof course (DPC)* or other suitable impervious material overlapping the timber by at least 6 mm (see also 4.3.3).

2.3.4 Green and dry timber

This Standard applies to Radiata pine and Douglas fir. The design solutions are for timber which is dry (maximum moisture content 18 %) throughout its design life. Timber may be installed green provided non-vertical members are propped and are not subjected to design loadings until they are dry. This does not include SG 8 (Wet).

The exceptions to the requirement that timber remain dry in service are as follows: *piles* to section 6, *bearers* to table 6.4(b), *stringers* to section 6, *joists* to table 7.1(b), cantilevered *balcony* floor *joists* to table 7.2, *posts* to section 9 and timbers under *roof* overhangs (i.e. the exposed ends of *rafters, purlins, battens* and outriggers) to sections 10 and 15. These members can be installed either dry or green and can be wetted in service.

The cross-section dimensions of timber given in the Standard are the actual minimum dried sizes that shall be used. Where green timber is used its dimensions shall be no less than the green gauged equivalent size given below:

Actual minimum dried size (mm)	35	45	70	90	140	190	240	290
Green gauged equivalent size (mm)	37	47	69	94	144	194	244	294

C2.3.4

The Standard's provisions may be applicable to timbers other than Radiata pine and Douglas fir such as other softwood species. Such use however, needs to be subject to demonstration of adequate structural performance and durability.

Over recent years framing practice has moved from predominantly green gauged framing to dry sizes. Further, those dry sizes are based on the Australian dried softwood sizes rather than the dry dressed sizes specified in NZS 3601. There are significant differences between these two sets of dried sizes in sizes 200 mm and over. To avoid confusion, NZS 3604, including its tables, now gives the actual minimum dried size based on the Australian sizes. This brings the tables into line with Australian practice and is simpler for the consumer.

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