

**Our Ref: 26117**

27 October 2016

Aldan Lodge  
86 Wellington Street  
**PICTON 7220**

**ATTENTION:** D McDonald

re: **ALDAN LODGE, 86 WELLINGTON STREET, PICTON  
TWO STOREY MASONRY BLOCK MOTEL UNITS**

We have now completed a Detailed Structural Assessment (DSA) of the seismic performance of the above building. The assessment was carried out after completing a site visit on 20 September 2016 and a review of the original structural drawings.

1. **Executive Summary**

The result of this assessment shows that the building achieves 38 percent of the current Seismic building standard (AS/NZS 1170: 2011). We therefore conclude that the building should not currently be defined as *earthquake prone* as defined under section 122 of the Building Act 2004. The building is, however, considered to be an *earthquake risk*, falling into grade C of the New Zealand Society for Earthquake Engineering (NZSEE) guidelines, which represents a *medium risk* to life safety.

2. **Building Description**

The building is a two storey, reinforced masonry structure designed in 1973. The footprint is rectangular with transverse dividing masonry walls splitting the building into five upper storey and five lower storey units. A partial loft space (including an alteration to the roof line) of timber frame construction in each of the first floor units provides additional bedrooms. This loft space was not shown on the original plans and it is assumed that it was added at a later date. The first floor consists of a reinforced concrete slab spanning longitudinally between the transverse masonry walls. The roof is of timber frame construction spanning longitudinally over the transverse walls with sheet metal cladding. The longitudinal external masonry walls have multiple openings for windows and doors.



The original drawing principally shows only three units per floor, although there is an indication on some drawings of additional units, with "Stage 1" and "Stage 2" noted in the design documentation. It appears that the fourth and fifth units were added later.

Lateral bracing against seismic loads is by the six reinforced masonry shear walls in the transverse (north-south) direction and by the front and back external reinforced masonry walls in the longitudinal (east-west) direction. A longitudinal shear wall shown on the original drawings, at ground floor level in the middle of the central unit, was found not to exist. Upon inspection, it was clear that the bracing capacity in the longitudinal direction is significantly less than in the transverse direction due to the proliferation of openings in the north and south walls. These walls were thus the main focus for our structural assessment.

### 3. **Basis for the Assessment**

The assessment is based on measurements taken during our initial inspection as well as the information provided in the original structural and architectural drawings. No invasive investigation has been undertaken.

The following methodologies, factors and key assumptions were applied to the assessment:

- AS/NZS1170:2011 Equivalent static method implemented
- All cells filled blockwork
- Building Importance Level 2
- Ductility Factor taken as  $\mu=1.25$  (nominally ductile)
- 1.5kPa Live Load
- Unobserved construction assumed (NZS 4320: Type C)
- Soil Class C (Shallow Soil)

### 4. **Results**

Our assessment shows that the building can achieve 38% NBS. This is above the NZSEE threshold for *earthquake prone* buildings ( $\geq 34\%$  NBS), but below the threshold for *earthquake risk* buildings ( $< 67\%$ ).

The primary failure mode was found to be shear failure of the longitudinal ground floor masonry walls. In some cases, flexural failure of an individual "pier" between doors / windows was found to occur first, in which case the element was discounted from the analysis and the seismic loads redistributed between the remaining elements until the critical structural weakness was identified.

The following hierarchy of structural failures were identified:

Floor	Item	Failure Mechanism	%NBS
Ground	North Wall	Shear	38%
Ground	South Wall	Shear	40%
First	Transverse Wall	Flexural – face loading	40%
Ground	North Wall	Flexural	43%
Ground	South Wall	Shear	43%
First	North Wall	Shear	57%
First	South Wall	Shear	64%
First	North Wall	Flexural	68%
First	South Wall	Flexural	69%

## 5. NZSEE Grades and Relative Risk

Table 1 taken from the NZSEE Guidelines provides the basis of a proposed grading system for existing buildings, as one way of interpreting the %NBS building score. It can be seen that occupants in *Earthquake Prone* buildings (less than 34%NBS) are exposed to more than ten times the risk that they would be in a similar new building. For buildings that are potentially an *Earthquake Risk* (less than 67%NBS), but not *Earthquake Prone*, the risk is at least five times greater than that of an equivalent new building. Broad descriptions of the life-safety risk can be assigned to the building grades as shown in Table 1.

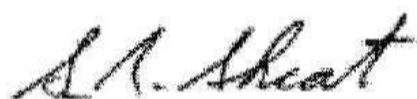
**Table 1: Relative Earthquake Risk**

<b>Building Grade</b>	<b>Percentage of New Building Strength (%NBS)</b>	<b>Approx. Risk Relative to a New Building</b>	<b>Life-safety Risk Description</b>
A+	>100	<1	low risk
A	80 to 100	1 to 2 times	low risk
B	67 to 79	2 to 5 times	low or medium risk
C	34 to 66	5 to 10 times	medium risk
D	20 to 33	10 to 25 times	high risk
E	<20	more than 25 times	very high risk

This building has been classified by the DSA as a grade C building and is therefore considered to be a medium risk.

This assessment has been prepared solely for the benefit of Aldan Lodge as our client with respect to the brief. The reliance by other parties on the information or opinions contained in this report shall, without our review and agreement in writing, be at such parties sole risk.

**DAVIDSON GROUP LTD**



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