Luggate Hall Initial Seismic Assessment

51 Main Road

Luggate

Luggate Hall ISA
March 2017
131794.00

Holmes Consulting

Holmes Consulting

Report

Luggate Hall ISA

Prepared For:
Queenstown Lakes District Council

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Report Issue Register

DATE	REV. NO.	REASON FOR ISSUE
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EXECUTIVE SUMMARY

This report summaries the findings of an Initial Seismic Assessment (ISA) of the Luggate Memorial Hall. The primary outcome of this report is to provide a summary of the building's ability to withstand a Design Basis Earthquake (DBE) as measured against the current loading standards AS/NZS 1170.0:2002 and NZS 1170.5:2004.

Constructed in 1954, the Luggate Memorial Hall is a single storey building located at 51 Main Road, SH6 Luggate. The building is made up of galvanised iron roofing, on timber purlins which are supported by steel roof trusses. The walls are formed from a mudbrick construction which span between steel columns in the perimeter walls. The foundations consist of a poured concrete perimeter wall and internal concrete piles and footings.

The Luggate Memorial Hall is classified as an Importance Level 2 (IL2) building, as defined in AS/NZS 1170.0:2002 table 3.2 for a "normal" structure.

An Initial Evaluation Procedure (IEP) assessment found the building's capacity to be approximately 20% of current code demand.

Simple calculations on the building's primary lateral load resisting elements were completed as part of this assessment. These calculations found that the earthquake capacity of the building is likely to be around 15% of current code demand. This capacity is governed by the mudbrick cladding spanning between the foundations and the high level concrete bond beam.

Our Initial Seismic Assessment found that the Luggate Memorial Hall has a capacity to resist less than 33% of a Design Basis Earthquake and the building is therefore the building is considered to be Earthquake Prone as defined in Section 122 of the Building Act.

We recommend a Detailed Seismic Assessment be carried out to confirm these findings and provide some strengthening options. In conjunction with this a geotechnical assessment is required to confirm the site soil classification and identify any liquefaction risks. As part of this DSA we require some intrusive investigations to gain a better understanding of the building construction and confirm some initial assumptions made as part of this ISA report.

1 INTRODUCTION

Holmes Consulting Group LP has been engaged by Queenstown Lakes District Council (QLDC) to complete an Initial Seismic Assessment (ISA) of the Luggate Memorial Hall, located at 51 Main Road, SH6 Luggate.

Figure 1-1: Exterior Photos of the Luggate Hall

The assessment has been undertaken in accordance with the guidance provided in the New Zealand Society of Earthquake Engineering's (NZSEE) manuals titled the "Assessment and Improvement of the Structural Performance of Buildings in Earthquakes".

1.1 Scope of Work

The scope of work for this project included the following:-

- Review available structural drawings for the building to determine the nature of the design, primary structural characteristics and adequacy of the lateral force-resisting systems.
- Walk around the building to familiarise our Engineers with the structure, visually assess its condition, observe important structural and seismic characteristics and note obvious deficiencies.
- Assess the likely seismic performance of the building, based on general observations and preliminary analysis where appropriate.
- Report on our findings and recommendations.

1.2 Limitations

Findings presented as a part of this project are for the sole use of the Queenstown Lakes District Council in its evaluation of the subject property. The findings are not intended for use by other parties, and may not contain sufficient information for the purposes of other parties or other uses.

This assessment has been restricted to structural aspects only. Waterproofing elements, electrical and mechanical equipment, fire protection and safety systems, service connections, water supplies and sanitary fittings have not been reviewed, and secondary elements such as windows and fittings have not generally been reviewed.

Invasive investigations have not been carried out as part of this assessment to observe hidden connections and therefore some assumptions have been made as to the likely connections used, based on the era of the construction.

Our professional services are performed using a degree of care and skill normally exercised, under similar circumstances, by reputable consultants practicing in this field at this time. No other warranty, expressed or implied, is made as to the professional advice presented in this report.

2 STATUTORY REQUIREMENTS

In the consideration of existing buildings, the relevant sections of the Building Act are:

- Section 122: *Meaning of earthquake prone building.* Section 122 of the Building Act 2004 deems a building to be earthquake prone if its ultimate capacity (strength) would be exceeded in a "moderate earthquake" and it would be likely to collapse causing injury or death, or damage to other property. The Building Regulations (2005) define a moderate earthquake as one that would generate loads 33% as strong as those used to design an equivalent new building.
- Section 124: *Powers of Territorial Authority.* If a building is found to be earthquake prone, the territorial authority has the power under Section 124 of the Building Act to require strengthening work to be carried out, or to close the building and prevent occupancy.
- Section 131: *Earthquake prone building policy.* Section 131 of the Building Act requires all territorial authorities to adopt a specific policy on dangerous, earthquake prone, and unsanitary buildings.

The Earthquake Prone Building Amendment Act which will supersede the current statutory requirements above was passed into law by Parliament on the 10th of May. It will come into effect in May 2017.
Some of the key definitions are not included in the Bill and will be contained in the yet to be drafted regulations.

2.1 Earthquake Prone Building Amendment Act

Some of the significant changes from the current requirements are outlined below. Some of the key definitions are not included in the Bill and will be contained in the yet to be drafted regulations.

The Earthquake Prone Building Amendment Act which will supersede the current statutory requirements above was passed into law by Parliament on the 10th of May. It will come into effect in May 2017.

Definition of 'Earthquake Prone'

The amended Bill changes the definition of 'Earthquake Prone Building' by:

- clarifying that an Earthquake Prone Building can be one that poses a risk to people on adjoining properties and not just those within the building itself;
- excluding from the definition of Earthquake Prone Building certain residential housing, farm buildings, retaining walls, wharves, bridges, tunnels and monuments;
- Included in the definition of Earthquake Prone Building are hostels, boarding houses and residential housing that is more than two storeys and contains three or more household units.

Seismic Risk

Different locations are assigned different 'seismic risk'. There are three different categories defined by the seismic hazard factor (Z) in the New Zealand Loadings Code (NZS 1170):

- High seismic risk – Z greater than or equal to 0.30, this will include Queenstown which has a seismic hazard factor of 0.32
- Medium seismic risk – Z between 0.15 and 0.30
- Low seismic risk – Z lower than 0.15

The seismic risk relates to timeframes for strengthening and identification of potentially earthquake prone buildings.

Priority Buildings

Priority buildings are defined as buildings that:

- are generally used for health or emergency services or used as educational facilities.
- contain unreinforced masonry that could fall on to busy thoroughfares in an earthquake – such as parapets.
- The territorial Authority has identified as having the potential to impede strategic transport routes after an earthquake.

Priority buildings have shorter timeframes for identification and strengthening of Earthquake Prone Buildings.

Timeframes for Identifying Earthquake Prone Buildings

The amended Bill contains maximum timeframes for Territorial Authorities to assess and identify potentially Earthquake Prone Buildings as outlined below.

- High seismic risk areas:

High Priority buildings	2.5 years
All other buildings	5 years

- Medium seismic risk areas:

High Priority buildings	5 years
All other buildings	10 years

- Low seismic risk areas:

All buildings	15 years

Following identification building owners are required to provide an engineering assessment of the building within twelve months.

Timeframes for Strengthening Earthquake Prone Buildings

The amended Bill contains maximum timeframes for strengthening Earthquake Prone Buildings as outlined below.

- High seismic risk areas 15 years
- Medium seismic risk areas 25 years
- Low seismic risk areas: 35 years

Category 1 Heritage buildings would be eligible to apply for up to a 10 year extension to complete strengthening work.

Building Alterations

Under the amended Bill:

- alterations to Earthquake Prone Buildings will be allowed even if after those alterations the building will not comply with the provisions of the Building Code that relate to means of escape from fire and disabled access. The Territorial Authority must be satisfied that the proposed alteration would contribute towards making the building no longer Earthquake Prone and that carrying out other upgrades would be unduly onerous on the owner;
- the Territorial Authority will be able to require the owner to carry out strengthening works in addition to other alterations where the alterations are 'substantial alterations'. The definition of 'substantial alterations' will be included in regulations that are yet to be drafted.

3 BUILDING DESCRIPTION

The Luggate Memorial Hall is located at 51 Main Road, SH6 Luggate as shown in Figure 3-1 below. The building is used primarily as a function space with main hall, stage, kitchen, supper room and bathroom facilities. Refer to Figure 3-2 below for a basic building plan.

Figure 3-1: Location of the Luggate Memorial Hall

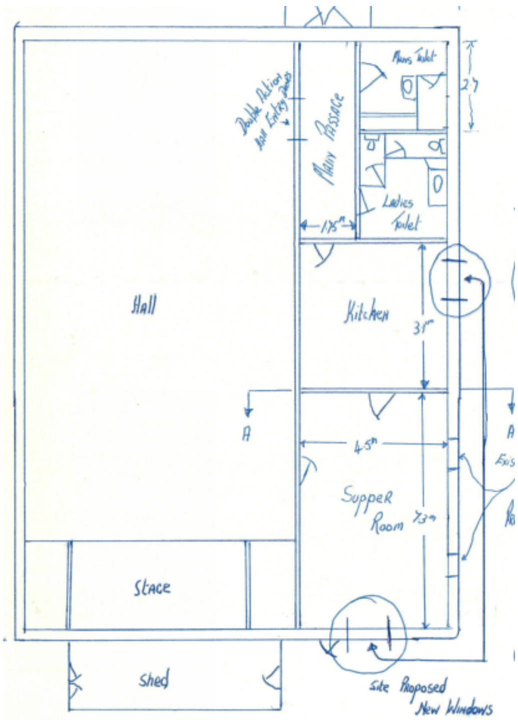

Figure 3-2: Basic Outline Plan of the Luggate Memorial Hall

3.1 Building History

The QLDC Electronic archives for the Luggate Memorial Hall building did not include any original construction drawings or information relating to a Building Consent. We know it was opened in 1954 and designed by J. G. Wilson. The QLDC electronic archives did have information for a consent in 1991 which describes the addition of windows. Documents submitted with this Consent confirmed the layout of the hall and the building materials and it shows some of the construction materials including mudbrick walls, steel roof trusses and steel support columns.

3.2 Building Form

The Luggate Memorial Hall is a single storey building with a footprint of approximately 18m by 13m giving a floor area of roughly 240m^2. The roof structure consists of galvanised metal roofing on timber purlins which are supported by steel roof framing and steel support columns. The exterior of the building contains a double mudbrick with cavity cladding on all facades between the foundation and a high level concrete bond beam. The walls have been timber famed between the bond beam and the roof. The foundations consist of a combination of a concrete perimeter beam and internal concrete piles. The floor is made up of timber floorboards on timber bearers supported on the concrete piles.

The main hall takes up the majority of the building area and consists of a large open space. In this area the roof structure is supported by a series of steel trusses which are in turn supported by steel truss columns located within the external walls. The longer east/west walls have steel columns spaced at approximately 4.5m.

The north/ south faces of the building are shorter in length with steel columns at the corners only. The southern end had a raised stage built against the wall and an extension that was built in 2013. The Building Consent information confirmed this extension is a self-supporting addition and has no effect on the original building.

Figure 3-3: Exterior Photo of Luggate Memorial Hall

3.3 Structural System

The main structural components of the Luggate Memorial Hall are steel columns and steel truss frames.

The steel columns and steel trusses act as a portal frame system to transfer the seismic load from the roof down to ground level. From photos taken during construction it can be seen that one bay of the truss system is cross braced in both the plane of the roof and walls with what appears to be steel members. This will help to resist seismic loads perpendicular to the direction of the portal frames.

The walls are made up of a double mudbrick cladding with cavity that spans between the foundation and concrete bond beam. Timber framing infills between the bond beam and the underside of the roof. It is unclear if the double mudbrick has cavity ties between the two layers. The overall thickness appears to be 300mm.

The foundation system consists of a concrete perimeter wall and internal concrete piles. The steel support columns are supported on concrete bases which are fixed to the concrete foundation wall.

The mudbrick construction is likely to be able to resist seismic loads in the plane of the wall itself but will be vulnerable when looking at seismic loads perpendicular to the wall – referred to as face loads.

Figure 3-4: Original Construction Photo Sourced From Inside the Hall

4 SEISMICITY

4.1 Building Use

The Luggate Memorial Hall is used primarily as a function space with a main hall, kitchen, restrooms and supper room. Refer to the earlier Figure 3-2 for the basic building plan. The building footprint is approximately 240m^2 and therefore it would be considered unlikely to have an occupancy of greater than 300 people. Based on this assumption and the current use the building is considered to be a "normal" Importance Level 2 (IL2) structure in accordance with AS/NZS 1170.0:2002.

4.2 Regional Seismicity

Luggate is located approximately 15km east of Wanaka which is in a high seismic risk region in New Zealand where a reasonably severe level of ground shaking may occur. Facilities lacking good seismic design and construction features may suffer significant damage due to this level of ground shaking.

Figure 4-1: Interior Photo of Luggate Memorial Hall

5 SEISMIC EVALUATION

5.1 Extent of Observations Carried Out

Limited drawings and documents from the QLDC archive files were reviewed for this assessment. These consisted of A Building Consent submitted in 1991 for the addition of two new windows to the building. The sketch for this Consent confirmed the building plan and also included a section confirming the steel column and truss arrangement and the double mudbrick external walls. Drawings for a proposed extension in 2013 were also reviewed. Our building evaluation outlined herein is based on information from these documents, together with a site inspection of both the interior and exterior of the building.

The building has been visually reviewed internally and externally to verify the construction materials and that the current layout matches any record drawings. Based on our observations it is assumed the interior wall constructed types are consistent throughout. Generally the layout appears to match the building plan from the 1991 Consent and 2013 extension.

Invasive investigations have not been carried out as part of this assessment to observe concealed connections and therefore some assumptions have been made as to the likely connections used, based on the era of the construction.

5.2 Initial Evaluation Procedure

NZSEE guidelines recommend a two-stage evaluation process. The Initial Evaluation Procedure (IEP), as outlined in "Assessment and Improvement of Structural Performance of Building in Earthquakes", is intended to be a coarse screening tool involving as few resources as reasonably practical. It is expected that the IEP will be followed by a more detailed assessment for those buildings identified as Earthquake Prone in terms of the provisions of the 2004 Building Act.

The (IEP) assessment found the Luggate Memorial Hall has an earthquake capacity equal to 20% of current code. Refer to Appendix A for the details of this IEP assessment. The main areas contributing to this result are:

- The age of the building
- The site soil classification of soft soil which has been taken from the Seismic Risk in the Otago Region Ground Classification Map. This will need to be confirmed by a geotechnical assessment.
- The relatively heavy weight of the mudbrick with no real structural strength benefit.

5.3 Building Design Loads

In order to determine the building's compliance with current code, the seismic resisting system has been assessed against current earthquake design loading criteria in accordance with the loading standard NZ1170.5:2004. Specific parameters used in the assessment are summarised in Table 5-1 below.

Table 5-1: Seismic Assessment Parameters

Factor	Value
Wanaka Zone Factor, Z	0.30
Return Period Factor, R	1.0 (for an IL2 building)
Structural Performance factor, Sp	1.0
Near fault factor N(T,D)	1.0
Site subsoil class	D (Deep or soft soils)
Ductility factor, μ	1.5 (similar to unreinforced masonry)

5.4 Estimate of Building Strength

Basic hand calculations of the primary load resisting system have been completed to provide an approximate value for the seismic capacity of the building. This was done to verify the conclusions drawn by the IEP. These calculations confirmed that the earthquake capacity of the building is less than 33% of the current code earthquake demand, and therefore the building is classified as Earthquake Prone.

The main issue relates to the double mudbrick cladding and the ability to resist face load earthquake demands. The mudbrick construction is a heavy material that attracts higher seismic loads than lighter weight timber framed construction. Other heavy construction materials such as concrete or blockwork also have inherent strength so are not as seismically vulnerable as the mudbrick. While the mudbrick has some strength and stiffness in the plane of the wall it is very weak when spanning perpendicular to the wall, referred to as out-of-plane. The limiting design criteria is the inability of the mudbrick to span between the foundations and the concrete bond beam. Approximate calculations show this is limited to around 15% of New Building Standard (NBS) requirements.

5.5 Other Potential Issues

As part of our assessment a general review of the building's features including egress routes, potential fall hazards, adjacent buildings and any potential geotechnical issues associated with the building site has been completed.

No significant hazards due to unrestrained parts of the building that might fall in an earthquake have been identified. The parapet above the main entrance is constructed from lightweight timber framing.

The kitchen appears to be newly fitted and it is assumed that any seismic restraint of equipment has been covered by the manufacturer or supplier.

As this is a stand-alone building there is no risk of damage due to adjacent buildings.

5.5.1 Liquefaction Potential

A review of online GIS mapping produced by the QLDC in 2013 indicates the building is located in an area that is susceptible to liquefaction. This is due to the ground being made up of loose gravel, sand, silt and clay in an area that is a flood plain.

5.6 Further Investigations

A number of assumptions have been made in this Initial Structure Assessment of the Luggate Hall building. To further validate the conclusions reached in this report the following additional investigation/assessment work could be completed:

- Confirm the site subsoil classification
- Confirm the structural details of the roof and wall cross bracing shown in the original construction photographs
- Investigate the liquefaction potential for the site and assess the level of risk this represents for the building
- Confirm the details of the concrete bond beam at the top of the mudbrick cladding
- Confirm if there are any cavity ties between the two layers of mudbrick cladding

6 RECOMENDATIONS

We recommend that a Detailed Seismic Assessment (DSA) is performed to verify the conclusions drawn in this report. The DSA will be able to more accurately identify the areas of the building that require strengthening to lift the building performance above Earthquake Prone, and can look to target strengthening to suit considerations such as budget and timeframes.

Along with this DSA we will need a Geotechnical Engineer to provide feedback on the site soil classification and the risk of liquefaction.

It is also likely that some intrusive investigations will be required to confirm some of the structure in the roof and walls, the details of the concrete bond beam and confirm if any cavity ties are present between the two mudbrick cladding walls.

The next step is to allow the QLDC to digest this information and then have a discussion around what they want to achieve with respect to the seismic capacity of the building.

The current national policy within Holmes Consulting is to recommend to Clients that any strengthening work should target a minimum of 67% of current code earthquake load. The outcome of the DSA will identify strengthening options to achieve this level of earthquake capacity and further discussions with the Client can be had to determine what the best approach is for this asset.

Initial Evaluation Procedure (IEP) Assessment - Completed for QLDC

WARNING!! *This initial evaluation has been carried out solely as an initial seismic assessment of the building following the procedure set out in the New Zealand Society for Earthquake Engineering document "Assessment and Improvement of the Structural Performance of Buildings in Earthquakes, June 2006". This spreadsheet must be read in conjunction with the limitations set out in the accompanying report, and should not be relied on by any party for any other purpose. Detailed inspections and engineering calculations, or engineering judgements based on them, have not been undertaken, and these may lead to a different result or seismic grade.*

Street Number & Name:	51 Main Road,	**Job No.:**	131794
AKA:		**By:**	LMH
Name of building:	Luggate Memorial Hall	**Date:**	17/11/2016
City:	Luggate	**Revision No.:**	

Table IEP-1 Initial Evaluation Procedure Step 1

Step 1 - General Information

1.1 Photos (attach sufficient to describe building)

1.2 Sketches (plans etc, show items of interest)

1.3 List relevant features (Note: only 10 lines of text will print in this box. If further text required use Page 1a)

1.4 Note information sources Tick as appropriate

Visual Inspection of Exterior	☑	**Specifications**	☐
Visual Inspection of Interior	☑	**Geotechnical Reports**	☐
Drawings (note type)	☑	**Other (list)**	☐

Limited drawing information was obtained from Council archives but a series of construction photographs were found on a display board in the hall

Initial Evaluation Procedure (IEP) Assessment - Completed for QLDC

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Table IEP-2 Initial Evaluation Procedure Step 2

Step 2 - Determination of *(%NBS)* $_b$

(Baseline *(%NBS)* for particular building - refer Section B5)

2.1 Determine nominal *(%NBS)* = *(%NBS)* $_{nom}$

	Longitudinal	Transverse
a) Building Strengthening Data		
Tick if building is known to have been strengthened in this direction	☐	☐
If strengthened, enter percentage of code the building has been strengthened to	N/A	N/A
b) Year of Design/Strengthening, Building Type and Seismic Zone		
Pre 1935	○	○
1935-1965	⊙	⊙
1965-1976	○	○
1976-1984	○	○
1984-1992	○	○
1992-2004	○	○
2004-2011	○	○
Post Aug 2011	○	○
Building Type:	Public Buildings	Public Buildings
Seismic Zone:		
c) Soil Type		
From NZS1170.5:2004, Cl 3.1.3 :	D Soft Soil	D Soft Soil
From NZS4203:1992, Cl 4.6.2.2 : (for 1992 to 2004 and only if known)		
d) Estimate Period, *T*		
Comment: h_n =	6.5	6.5 m
Assume the mudbrick walls create a short period structure A_c =	1.00	1.00 m^2
Moment Resisting Concrete Frames: $T = \max\{0.09h_n^{0.75}, 0.4\}$	○	○
Moment Resisting Steel Frames: $T = \max\{0.14h_n^{0.75}, 0.4\}$	○	○
Eccentrically Braced Steel Frames: $T = \max\{0.08h_n^{0.75}, 0.4\}$	○	○
All Other Frame Structures: $T = \max\{0.06h_n^{0.75}, 0.4\}$	○	○
Concrete Shear Walls $T = \max\{0.09h_n^{0.75}/A_c^{0.5}, 0.4\}$	○	○
Masonry Shear Walls: $T \leq 0.4$sec	○	○
User Defined (input Period):	⊙	⊙
Where h_n = height in metres from the base of the structure to the uppermost seismic weight or mass. **T:**	0.40	0.40
e) Factor A: Strengthening factor determined using result from (a) above (set to 1.0 if not strengthened) **Factor A:**	1.00	1.00
f) Factor B: Determined from NZSEE Guidelines Figure 3A.1 using results (a) to (e) above **Factor B:**	0.03	0.03
g) Factor C: For reinforced concrete buildings designed between 1976-84 Factor C = 1.2, otherwise take as 1.0. **Factor C:**	1.00	1.00
h) Factor D: For buildings designed prior to 1935 Factor D = 0.8 except for Wellington where Factor D may be taken as 1, otherwise take as 1.0. **Factor D:**	1.00	1.00
(%NBS) $_{nom}$ **= AxBxCxD** ***(%NBS)*** $_{nom}$	3%	3%

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Initial Evaluation Procedure (IEP) Assessment - Completed for QLDC

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Table IEP-2 Initial Evaluation Procedure Step 2 continued

2.2 Near Fault Scaling Factor, Factor E

If $T \leq$ 1.5sec, Factor E = 1

			Longitudinal	Transverse
a) Near Fault Factor, *N(T,D)* (from NZS1170.5:2004, Cl 3.1.6)		N(T,D):	1	1
b) Factor E	= 1/N(T,D)	**Factor E:**	1.00	1.00

2.3 Hazard Scaling Factor, Factor F

a) Hazard Factor, *Z*, for site

Location: Wanaka

Z =	0.3	(from NZS1170.5:2004, Table 3.3)
Z_{1992} =	0.71	(NZS4203:1992 Zone Factor from accompanying Figure 3.5(b))
Z_{2004} =	0.3	(from NZS1170.5:2004, Table 3.3)

b) Factor F

For pre 1992 = $1/Z$

For 1992-2011 = Z_{1992}/Z

For post 2011 = Z_{2004}/Z

	Longitudinal	Transverse
Factor F:	3.33	3.33

2.4 Return Period Scaling Factor, Factor G

a) Design Importance Level, I

(Set to 1 if not known. For buildings designed prior to 1965 and known to be designed as a public building set to 1.25. For buildings designed 1965-1976 and known to be designed as a public building set to 1.33 for Zone A or 1.2 for Zone B. For 1976-1984 set I value.)

b) Design Risk Factor, R_o

(set to 1.0 if other than 1976-2004, or not known)

c) Return Period Factor, R

(from NZS1170.0:2004 Building Importance Level)

Choose Importance Level: ○ 1 ⦿ 2 ○ 3 ○ 4 (Longitudinal); ○ 1 ⦿ 2 ○ 3 ○ 4 (Transverse)

d) Factor G = IR_o/R

	Longitudinal	Transverse
I =	1.25	1.25
R_o =	1	1
R =	1.0	1.0
Factor G:	1.25	1.25

2.5 Ductility Scaling Factor, Factor H

a) Available Displacement Ductility Within Existing Structure

Comment:
As per unreinforced masonry

	Longitudinal	Transverse
μ =	1.50	1.50

b) Factor H

		Longitudinal	Transverse
		k_μ	k_μ
For pre 1976 (maximum of 2)	=	1.29	1.29
For 1976 onwards	=	1	1
Factor H:		1.29	1.29

(where k_μ is NZS1170.5:2004 Inelastic Spectrum Scaling Factor, from accompanying Table 3.3)

2.6 Structural Performance Scaling Factor, Factor I

a) Structural Performance Factor, S_p

(from accompanying Figure 3.4)

Tick if light timber-framed construction in this direction ☐ ☐

b) Structural Performance Scaling Factor = $1/S_p$

	Longitudinal	Transverse
S_p =	0.85	0.85
Factor I:	1.18	1.18

Note Factor B values for 1992 to 2004 have been multiplied by 0.67 to account for Sp in this period

2.7 Baseline %NBS for Building, *(%NBS)* $_b$

(equals **(%NBS)$_{nom}$ x E x F x G x H x I**)

Longitudinal	Transverse
18%	**18%**

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Initial Evaluation Procedure (IEP) Assessment - Completed for QLDC

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Table IEP-3 Initial Evaluation Procedure Step 3

Step 3 - Assessment of Performance Achievement Ratio (PAR)

(Refer Appendix B - Section B3.2)

a) Longitudinal Direction

Critical Structural Weakness — **Effect on Structural Performance** **(Choose a value - Do not interpolate)** — **Factors**

3.1 Plan Irregularity

Effect on Structural Performance ○ *Severe* ○ *Significant* ⊙ *Insignificant* **Factor A** 1.0

Comment

3.2 Vertical Irregularity

Effect on Structural Performance ○ *Severe* ○ *Significant* ⊙ *Insignificant* **Factor B** 1.0

Comment

3.3 Short Columns

Effect on Structural Performance ○ *Severe* ○ *Significant* ⊙ *Insignificant* **Factor C** 1.0

Comment

3.4 Pounding Potential

(Estimate D1 and D2 and set D = the lower of the two, or 1.0 if no potential for pounding, or consequences are considered to be minimal)

a) Factor D1: - Pounding Effect

Note:
Values given assume the building has a frame structure. For stiff buildings (eg shear walls), the effect of pounding may be reduced by taking the coefficient to the right of the value applicable to frame buildings.

Factor D1 For Longitudinal Direction: 1.0

Table for Selection of Factor D1	Severe	Significant	Insignificant
Separation	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Alignment of Floors within 20% of Storey Height	○ 0.7	○ 0.8	⊙ 1
Alignment of Floors not within 20% of Storey Height	○ 0.4	○ 0.7	○ 0.8

Comment

b) Factor D2: - Height Difference Effect

Factor D2 For Longitudinal Direction: 1.0

Table for Selection of Factor D2	Severe	Significant	Insignificant
	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Height Difference > 4 Storeys	○ 0.4	○ 0.7	○ 1
Height Difference 2 to 4 Storeys	○ 0.7	○ 0.9	○ 1
Height Difference < 2 Storeys	○ 1	○ 1	⊙ 1

Comment

Factor D 1.0

3.5 Site Characteristics - *Stability, landslide threat, liquefaction etc as it affects the structural performance from a life-safety perspective*

Effect on Structural Performance ○ *Severe* ○ *Significant* ⊙ *Insignificant* **Factor E** 1.0

Liquifaction risk yet to be determined but assumed insignificant for the purpose of this IEP

3.6 Other Factors - *for allowance of all other relevant characterstics of the building*

For ≤ 3 storeys - Maximum value 2.5
otherwise - Maximum value 1.5.
No minimum.

Factor F 1.0

Record rationale for choice of Factor F:

Comment

3.7 Performance Achievement Ratio (PAR)
(equals **A x B x C x D x E x F**)

PAR
Longitudinal **1.00**

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Initial Evaluation Procedure (IEP) Assessment - Completed for QLDC

Street Number & Name:	**51 Main Road,**	**Job No.:**	**131794**
AKA:		**By:**	**LMH**
Name of building:	**Luggate Memorial Hall**	**Date:**	**17/11/2016**
City:	**Luggate**	**Revision No.:**	

Table IEP-3 Initial Evaluation Procedure Step 3

Step 3 - Assessment of Performance Achievement Ratio (PAR)

(Refer Appendix B - Section B3.2)

b) Transverse Direction

Critical Structural Weakness | **Effect on Structural Performance** (Choose a value - Do not interpolate) | **Factors**

3.1 Plan Irregularity

Effect on Structural Performance ○ *Severe* ○ *Significant* ⊙ *Insignificant* **Factor A** 1.0

Comment

3.2 Vertical Irregularity

Effect on Structural Performance ○ *Severe* ○ *Significant* ⊙ *Insignificant* **Factor B** 1.0

Comment

3.3 Short Columns

Effect on Structural Performance ○ *Severe* ○ *Significant* ⊙ *Insignificant* **Factor C** 1.0

Comment

3.4 Pounding Potential

(Estimate D1 and D2 and set D = the lower of the two, or 1.0 if no potential for pounding, or consequences are considered to be minimal)

a) Factor D1: - Pounding Effect

Note:
Values given assume the building has a frame structure. For stiff buildings (eg shear walls), the effect of pounding may be reduced by taking the coefficient to the right of the value applicable to frame buildings.

Factor D1 For Transverse Direction: 1.0

Table for Selection of Factor D1	Severe	Significant	Insignificant
Separation	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Alignment of Floors within 20% of Storey Height	○ 0.7	○ 0.8	⊙ 1
Alignment of Floors not within 20% of Storey Height	○ 0.4	○ 0.7	○ 0.8

Comment

b) Factor D2: - Height Difference Effect

Factor D2 For Transverse Direction: 1.0

Table for Selection of Factor D2	Severe	Significant	Insignificant
	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Height Difference > 4 Storeys	○ 0.4	○ 0.7	○ 1
Height Difference 2 to 4 Storeys	○ 0.7	○ 0.9	○ 1
Height Difference < 2 Storeys	○ 1	○ 1	⊙ 1

Comment

Factor D 1.0

3.5 Site Characteristics - *Stability, landslide threat, liquefaction etc as it affects the structural performance from a life-safety perspective*

Effect on Structural Performance ○ *Severe* ○ *Significant* ⊙ *Insignificant* **Factor E** 1.0

Liquifaction risk yet to be determined but assumed insignificant for the purpose of this IEP

3.6 Other Factors - *for allowance of all other relevant characterstics of the building*

For ≤ 3 storeys - Maximum value 2.5
otherwise - Maximum value 1.5.
No minimum.

Factor F 1.00

Record rationale for choice of Factor F:

Comment

3.7 Performance Achievement Ratio (PAR)

(equals **A x B x C x D x E x F**)

PAR

Transverse **1.00**

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Initial Evaluation Procedure (IEP) Assessment - Completed for QLDC

Street Number & Name:	51 Main Road,	Job No.:	131794
AKA:		By:	LMH
Name of building:	Luggate Memorial Hall	Date:	17/11/2016
City:	Luggate	Revision No.:	

Table IEP-4 Initial Evaluation Procedure Steps 4, 5 and 6

Step 4 - Percentage of New Building Standard *(%NBS)*

		Longitudinal	Transverse
4.1	**Assessed Baseline *(%NBS)*$_b$** (from Table IEP - 1)	18%	18%
4.2	**Performance Achievement Ratio (PAR)** (from Table IEP - 2)	1.00	1.00
4.3	**PAR x Baseline *(%NBS)*$_b$**	20%	20%
4.4	**Percentage New Building Standard *(%NBS)*** (Use lower of two values from Step 4.3)		20%

Step 5 - Potentially Earthquake Prone? (Mark as appropriate) — *%NBS* $\leq$ 34: YES

Step 6 - Potentially Earthquake Risk? (Mark as appropriate) — *%NBS* < 67: YES

Step 7 - Provisional Grading for Seismic Risk based on IEP

Seismic Grade: D

Additional Comments (items of note affecting IEP score)

Evaluation Confirmed by .... **Signature**

Tony Galavazi **Name**

.... **CPEng. No**

Relationship between Grade and *%NBS* :

Grade:	A+	A	B	C	D	E
% NBS:	> 100	100 to 80	79 to 67	66 to 34	33 to 20	< 20

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