From: Kristy Rusher
To: lgoima
Subject: FW: LGOIMA response re seismic assessments
Date: Thursday, 26 October 2017 04:05:24 p.m.
Attachments:

From: Kristy Rusher
Sent: Wednesday, 25 October 2017 3:53 p.m.
To: 'Chris Morris'
Subject: FW: LGOIMA response re seismic assessments

Hi Chris,

You requested:

1. A list of all council-owned community halls, showing for each:
- The age of the building (where known).
- The status of the building (open/closed).
- The names of any leasee/operator.
- Whether seismic strength assessed or not.
- Its new building standard score or category (eg likely to be earthquake-prone, earthquake risk etc).

2. Copies of all seismic assessment reports relating to halls considered likely to be earthquake prone.

3. Copies of any other seismic assessment reports relating to Dunedin City Council-owned buildings deemed earthquake-prone.

Please find this information attached.

Some additional commentary from DCC General Manager Infrastructure and Networks Ruth Stokes regarding seismic assessments is below.

"All community halls in the DCC property portfolio have now been seismically assessed.

Where a community hall has been assessed as 'earthquake prone', a detailed seismic assessment has been completed with indicative costs identified for remediation works. These costs are currently being assessed and budgets allocated.

Priorities for structural strengthening will be developed as part of a longer term Asset Management Plan. It is our intention to structurally strengthen buildings, where required, well within the stipulated timeframes for remediation or demolition.

It is also important to note that where community halls have been assessed as 'earthquake prone', we have put in place additional risk mitigation measures on the advice of structural consultants. This is a proactive step beyond current regulations.

All other buildings in the DCC's property portfolio have now been seismically assessed, or are currently undergoing assessment. This process is about 80% complete.

In respect to the Sammy's building, as was flagged in the current public consultation on its future use, a preliminary assessment indicates the building needs work. This includes repairs and remedial work on condition, seismic strengthening, fire safety upgrades, and access for people with disabilities.

It is too early at this stage to estimate what the work might cost. The extent of the work required will also depend on the outcome of public consultation and what the Council decides for the building's future use. Any decision by the Council to contribute to a capital development at Sammy's will be considered through the development of the DCC's next Long Term Plan."

Regards,
Kristy Rusher
Manager Civic and Legal, Corporate Services
Dunedin City Council/*Kaunihera-a-rohe o Otepoti*

Need legal advice? Go to LawVu Legal Advice Request Form

50 The Octagon, Dunedin; P O Box 5045, Moray Place, Dunedin 9058, New Zealand
Telephone: 03 477 4000; Fax: 03 474 3594
Email: kristy.rusher@dcc.govt.nz

Halls	**Department**	**Assessment % NBS**	**Earthquake Prone**
Ocean Grove Domain Hall	Parks	100	No
Portobello Domain Hall	Parks	Not assessed	N/A
Harwood Hall	Parks	Not assessed	N/A
Allanton Hall	Property	100	No
Brighton Hall	Property	70	No
East Otago Events Centre	Property	100	No
Fairfield Hall	Property	50	No
Green Island Civic Hall	Property	40	No
Karitane Hall	Property	100	No
Mac Bay Hall	Property	55	No
Maori Hill Hall	Property	25	Yes
Momona Hall	Property	55	No
Mosgiel Coronation Hall	Property	100	No
Ocean View	Property	50	No
Port Chalmers Town Hall	Property	85	No
Portobello Hall	Property	65	No
Ravensbourne Hall	Property	50	No
St Leonards Hall	Property	70	No
Strath Taieri Hall	Property	60	No
Victoria Rd Hall	Property	70	No
Waitati Hall	Property	70	No
Warrington Hall	Property	55	No
West Taieri Hall, Outram	Property	40	No
Other Buildings			
Chingford Stables	Parks	30	Yes
Roberts Park	Parks	15	Yes
Tonga Park Changerooms	Parks	15	Yes
59-61 Ward Street	Property	20	Yes

Hadley & Robinson Ltd.
Consulting Civil & Structural Engineers

21 November 2014

Job Number: 12174

Dunedin City Council
City Property
Rhonda Abercrombie
PO Box 5045
Dunedin 9058

DCC
28 NOV 2014
Business Information

1 Balmacewen Road, Maori Hill, Dunedin 9010 – Coronation Hall
Initial Seismic Assessment Report

Dear Rhonda

We have now completed an Initial Seismic Assessment (ISA) of the Coronation Hall located at 1 Balmacewen Road, Maori Hill, Dunedin 9010 using the Initial Evaluation Procedure (IEP).

Background to the IEP and Its Limitations

The IEP procedure was developed in 2006 by the New Zealand Society for Earthquake Engineering (NZSEE) and updated in 2013 to reflect experience with its application and as a result of experience in the Canterbury earthquakes. It is a tool to assign a percentage of New Building Standard (%NBS) score and associated grade to a building as part of an initial seismic assessment of existing buildings.

The IEP enables territorial authorities, building owners and managers to review their building stock as part of an overall risk management process.

Characteristics and limitations of the IEP include:

- It tends to be somewhat conservative, identifying some buildings as earthquake prone, or having a lower %NBS score, which subsequent detailed investigation may indicate is less than actual performance. However, there will be exceptions, particularly when critical structural weaknesses (CSWs) are present that have not been recognised from the level of investigation employed.
- It can be undertaken with variable levels of available information, e.g. exterior only inspection, structural drawings available or not, interior inspection, etc. The more information available the more representative the IEP result is likely to be. The IEP records the information that has formed the basis of the assessment and consideration of this is important when determining the likely reliability of the result.

Director L M Robinson BE (Hons), NZCE (Dist), FNZSEE, MIPENZ (Geotechnical, Structural), CPEng, IntPE
469 George Street, PO Box 6068, Dunedin 9059, Phone (03) 477 8923, Fax (03) 477 0608
Email: solutions@hadleyrobinson.co.nz Website: www.hadleyrobinson.co.nz
ACENZ

- It is an initial, first-stage review. Buildings or specific issues which the IEP process flags as being problematic or as potentially critical structural weaknesses, need further detailed investigation and evaluation. A Detailed Seismic Assessment is recommended if the seismic status of a building is critical to any decision making.
- The IEP assumes that the buildings have been designed and built in accordance with the building standard and good practice current at the time. In some instances, a building may include design features ahead of its time - leading to better than predicted performance. Conversely, some unidentified design or construction issues not picked up by the IEP process may result in the building performing not as well as predicted.
- It is a largely qualitative process, and should be undertaken or overseen by an experienced engineer. It involves considerable knowledge of the earthquake behaviour of buildings, and judgement as to key attributes and their effect on building performance. Consequently, it is possible that the %NBS derived for a building by independent experienced engineers may differ.
- An IEP may over-penalise some apparently critical features which could have been satisfactorily taken into account in the design.
- An IEP does not take into account the seismic performance of non-structural items such as ceiling, plant, services or glazing.

Experience to date is that the IEP is a useful tool to identify potential issues and expected overall performance of a building in an earthquake. However, the process and the associated %NBS and grade should be considered as only indicative of the building's compliance with current code requirements. A detailed investigation and analysis of the building will typically be required to provide a definitive assessment.

An IEP score above 34%NBS should be considered sufficient to classify the building as not earthquake prone. However, if further information comes available reassessment may be required.

IEP Assessment Results

Our IEP assessment of this building indicates the building can achieve 25%NBS in the longitudinal direction and 25%NBS in the transverse direction. The IEP assessment of this building therefore indicates an overall score of 25%NBS, corresponding to a 'Grade D' building as defined by the New Zealand Society for Earthquake Engineering (NZSEE) building grading scheme. This is below the threshold for earthquake prone buildings (34%NBS) and below the threshold for earthquake risk buildings (67%NBS) as recommended by the NZSEE.

IEP Grades and Relative Risk

Table 2 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 10 times the risk that they would be in a similar new building. For buildings that are potentially Earthquake Risk (less than 67%NBS), but not Earthquake Prone, the risk is at least 5 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 2.

Table 2: Relative Earthquake Risk

Building Grade	Percentage of New Building Strength (%NBS)	Approx. Risk Relative to a New Building	Life-safety Risk Description
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 IEP as a grade D building and is therefore considered to be a high risk.

The New Zealand Society for Earthquake Engineering (which provides authoritative advice to the legislation makers, and should be considered to represent the consensus view of New Zealand structural engineers) classifies a buildings achieving greater than 67%NBS as "Low Risk", and having "Acceptable (improvement may be desirable)" building structural performance.

Seismic Restraint of Non-Structural Items

During an earthquake, the safety of people can be put at risk due to non-structural items falling on them. These items should be adequately seismically restrained, where possible, to the NZS 4219:2009 "The Seismic Performance of Engineering Systems in Buildings".

An assessment has not been made of the bracing of the ceilings, in-ceiling ducting, services and plant. We have also not checked whether tall or heavy furniture has been seismically restrained or not. These issues are outside the scope of this initial assessment but could be the subject of another investigation.

Conclusion

Our ISA assessment for this building, carried out using the IEP indicates an overall score of 25%NBS which corresponds to a Grade D building, as defined by the NZSEE building grading scheme. This is below the threshold for Earthquake Prone Buildings (34%NBS) and below the threshold for Earthquake Risk Buildings (67%NBS) as defined by the NZSEE and the New Zealand Building Code.

The ISA is considered to provide a relatively quick, high-level and qualitative measure of the building's performance. In order to confirm the seismic performance of this building with more reliability you may wish to request a DSA. A DSA would likely focus on the following issues:

Connection details of walls to floors and roof.

A DSA would also investigate other potential weaknesses that may not have been considered in the initial seismic assessment.

N/A

We trust this letter and initial seismic assessment meets your current requirements. We would be pleased to discuss further with you any issues raised in this report.

Regards

Ralf Schruba
Civil & Structural Engineer
Hadley & Robinson Ltd

Enclosed: IEP Assessment
Copy to: N/A

Initial Evaluation Procedure (IEP) Assessment - Completed for Dunedin City Council

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:	1 Balmacewen Road, Maori Hill	**Job No.:**	12174
AKA:		**By:**	Ralf Schruba
Name of building:	Coronation Hall	**Date:**	21/11/2014
City:	Dunedin 9010	**Revision No.:**	

Table IEP-1 Initial Evaluation Procedure Step 1

Step 1 - General Information

1.1 Photos (attach sufficient to describe building)

front (Balmacewen Road)
(google capture Nov 2012)

right

NOTE: THERE ARE MORE PHOTOS ON PAGE 1a ATTACHED

towards back

right

NOTE: THERE ARE MORE SKETCHES ON PAGE 1a ATTACHED

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

This two storey building was originally built in 1911. A substantial alteration to the basement has been carried out in 1994.
The ground floor is suspended timber on engaged brick columns and on steel beams and columns respectively; external walls are double brick (probably not tied) with engaged columns and concrete bond beam at approximately ground floor support level; roof has steel trusses (timber top chord) with sarking and with corrugated iron cladding.
It is the original that governs this IEP.

1.4 Note information sources Tick as appropriate

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

Architectural drawings of minor interior alterations in 1950, 1966 & 1967; structural drawings of alteration in 1994.

Initial Evaluation Procedure (IEP) Assessment - Completed for Dunedin City Council

Street Number & Name:	**1 Balmacewen Road, Maori Hill**	**Job No.:**	**12174**
AKA:		**By:**	**Ralf Schruba**
Name of building:	**Coronation Hall**	**Date:**	**21/11/2014**
City:	**Dunedin 9010**	**Revision No.:**	

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)* = $(\%NBS)_{nom}$

a) Building Strengthening Data

	Longitudinal	Transverse
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

	Longitudinal	Transverse
Pre 1935	●	●
1935-1965	○	○
1965-1976	○	○
1976-1984	○	○
1984-1992	○	○
1992-2004	○	○
2004-2011	○	○
Post Aug 2011	○	○
Building Type:	Others	Others
Seismic Zone:		

c) Soil Type

	Longitudinal	Transverse
From NZS1170.5:2004, Cl 3.1.3 :	C Shallow Soil	C Shallow Soil
From NZS4203:1992, Cl 4.6.2.2 : **(for 1992 to 2004 and only if known)**	Flexible	Flexible

d) Estimate Period, *T*

Comment:

N/A

		Longitudinal	Transverse
h_n =		8	8 m
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:	$T \leq 0.4\text{sec}$	○	○
User Defined (input Period):		●	●
	T:	0.40	0.40

Where h_n = height in metres from the base of the structure to the uppermost seismic weight or mass.

			Longitudinal	Transverse
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:**	0.04	0.04
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:**	0.80	0.80
$(\%NBS)_{nom}$ = AxBxCxD		**$(\%NBS)_{nom}$**	3%	3%

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.*

Initial Evaluation Procedure (IEP) Assessment - Completed for Dunedin City Council

Street Number & Name:	**1 Balmacewen Road, Maori Hill**	**Job No.:**	**12174**
AKA:		**By:**	**Ralf Schruba**
Name of building:	**Coronation Hall**	**Date:**	**21/11/2014**
City:	**Dunedin 9010**	**Revision No.:**	

Table IEP-2 Initial Evaluation Procedure Step 2 continued

2.2 Near Fault Scaling Factor, Factor E

If $T \leq 1.5$sec, 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: Dunedin

$Z =$ 0.13 (from NZS1170.5:2004, Table 3.3)

$Z_{1992} =$ 0.6 (NZS4203:1992 Zone Factor from accompanying Figure 3.5(b))

$Z_{2004} =$ 0.13 (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:	7.69	7.69

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)

d) Factor G = IR_o/R

	Longitudinal	Transverse
I =	1	1
R_o =	1	1
Choose Importance Level	○ 1 ● 2 ○ 3 ○ 4	○ 1 ● 2 ○ 3 ○ 4
R =	1.0	1.0
Factor G:	1.00	1.00

2.5 Ductility Scaling Factor, Factor H

a) Available Displacement Ductility Within Existing Structure

Comment:
External walls are double brick (probably not tied) with engaged columns and concrete bond beam at appoximately ground floor support level.

b) Factor H

		Longitudinal	Transverse
	μ =	1.00	1.00
		k_μ	k_μ
For pre 1976 (maximum of 2)	=	1.00	1.00
For 1976 onwards	=	1	1
	Factor H:	1.00	1.00

(where kμ 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 = $1/S_p$

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

	Longitudinal	Transverse
	☐	☐
S_p =	1.00	1.00
Factor I:	1.00	1.00

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

(equals $(\%NBS)_{nom} \times E \times F \times G \times H \times I$)

Longitudinal	Transverse
22%	22%

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.*

Initial Evaluation Procedure (IEP) Assessment - Completed for Dunedin City Council

Street Number & Name:	1 Balmacewen Road, Maori Hill	**Job No.:**	12174
AKA:		**By:**	Ralf Schruba
Name of building:	Coronation Hall	**Date:**	21/11/2014
City:	Dunedin 9010	**Revision No.:**	

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

potential CSWs

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

N/A

3.2 Vertical Irregularity

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

N/A

3.3 Short Columns

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

N/A

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	○ 1	○ 1	● 1
Alignment of Floors not within 20% of Storey Height	○ 0.4	○ 0.7	○ 0.8

N/A

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

N/A

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

N/A

3.6 Other Factors - *for allowance of all other relevant charactersties 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:

1.56 for damping of unreinforced masonry; 0.65 for cantilever wall (GF).

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

PAR

Longitudinal **1.01**

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.*

Initial Evaluation Procedure (IEP) Assessment - Completed for Dunedin City Council

Street Number & Name:	**1 Balmacewen Road, Maori Hill**	**Job No.:**	**12174**
AKA:		**By:**	**Ralf Schruba**
Name of building:	**Coronation Hall**	**Date:**	**21/11/2014**
City:	**Dunedin 9010**	**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

potential CSWs

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

N/A

3.2 Vertical Irregularity

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

N/A

3.3 Short Columns

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

N/A

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	○ 1	○ 1	● 1
Alignment of Floors not within 20% of Storey Height	○ 0.4	○ 0.7	○ 0.8

N/A

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

N/A

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

N/A

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 1.01

Record rationale for choice of Factor F:

1.56 for damping of unreinforced masonry; 0.65 for cantilever wall (GF).

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

PAR

Transverse **1.01**

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.*

Initial Evaluation Procedure (IEP) Assessment - Completed for Dunedin City Council

Street Number & Name:	1 Balmacewen Road, Maori Hill	**Job No.:**	12174
AKA:		**By:**	Ralf Schruba
Name of building:	Coronation Hall	**Date:**	21/11/2014
City:	Dunedin 9010	**Revision No.:**	

Table IEP-4 Initial Evaluation Procedure Steps 4, 5, 6 and 7

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

		Longitudinal	Transverse
4.1	**Assessed Baseline *%NBS* *(%NBS)*$_b$** (from Table IEP - 1)	22%	22%
4.2	**Performance Achievement Ratio (PAR)** (from Table IEP - 2)	1.01	1.01
4.3	**PAR x Baseline *(%NBS)*$_b$**	25%	25%
4.4	**Percentage New Building Standard *(%NBS)*** (Use lower of two values from Step 4.3)		25%

Step 5 - Potentially Earthquake Prone?

(Mark as appropriate)

%NBS **≤ 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)

N/A

Evaluation Confirmed by **Signature**

Lou Robinson **Name**

38332 **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

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.*

Initial Evaluation Procedure (IEP) Assessment - Completed for Dunedin City Council

Street Number & Name:	1 Balmacewen Road, Maori Hill	**Job No.:**	12174
AKA:		**By:**	Ralf Schruba
Name of building:	Coronation Hall	**Date:**	21/11/2014
City:	Dunedin 9010	**Revision No.:**	

Table IEP-5 Initial Evaluation Procedure Step 8

Step 8 - Identification of potential Severe Critical Structural Weaknesses that could result in significant risk to a significant number of occupants

8.1	Number of storeys above ground level	2
8.2	Presence of heavy concrete floors and/or concrete roof? (Y/N)	N

Occupancy not considered to be significant - no further consideration required

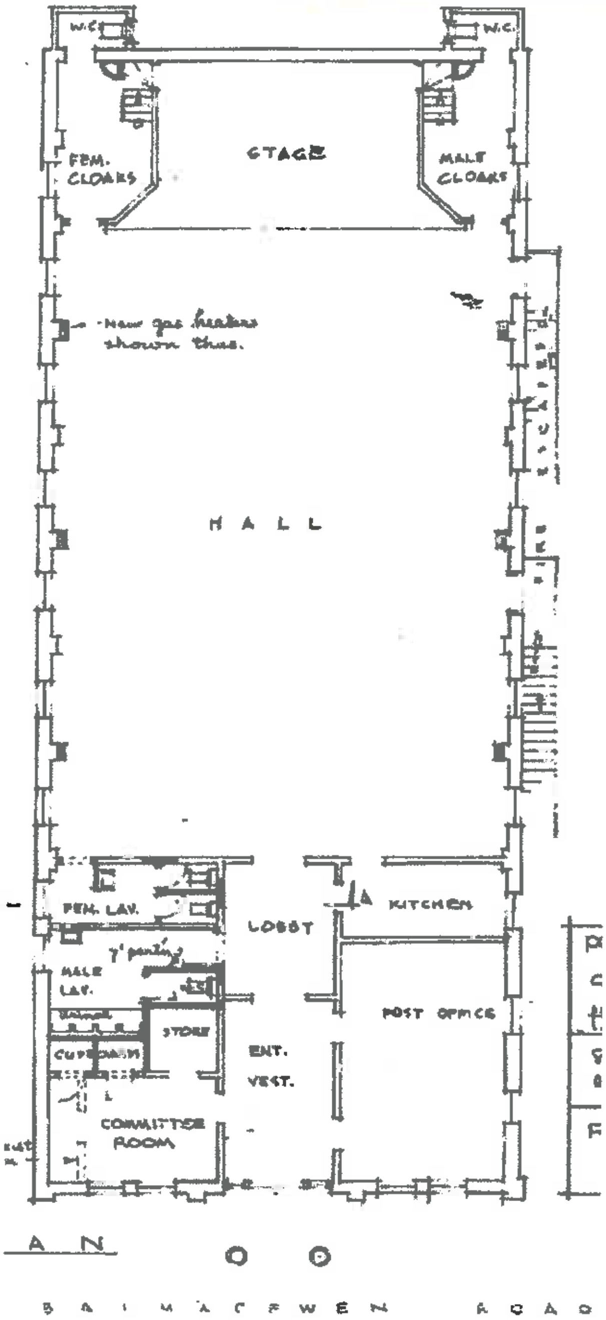
Risk not considered to be significant - no further consideration required

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.*

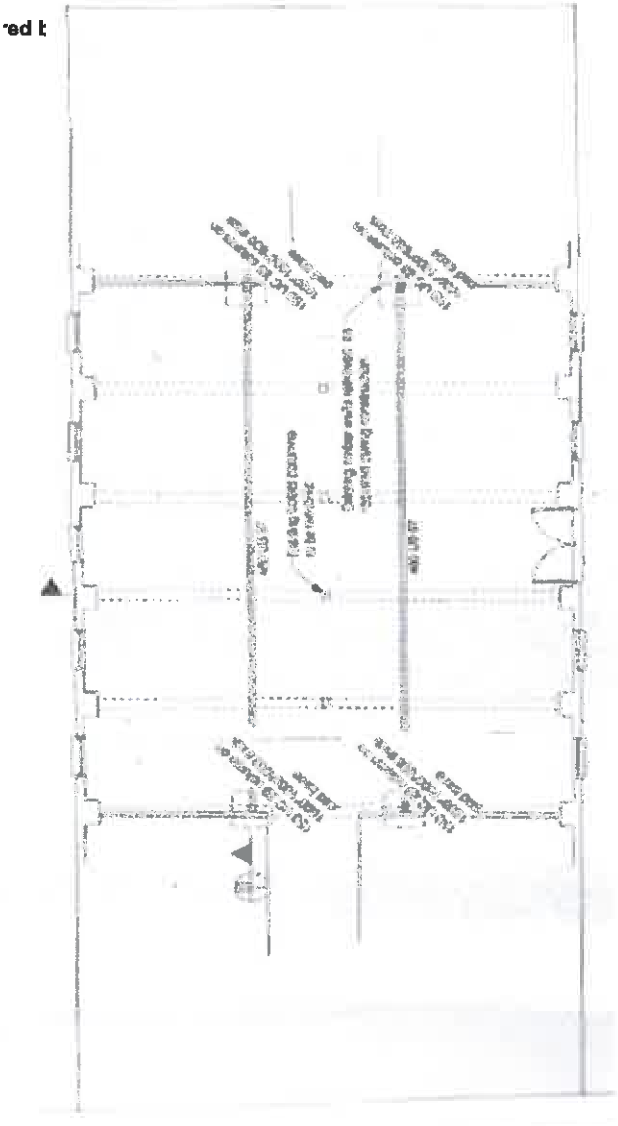
Initial Evaluation Procedure (IEP) Assessment - Completed for Dunedin City Council

Page 1a

Street Number & Name:	**1 Balmacewen Road, Maori Hill**	**Job No.:**	**12174**
AKA:		**By:**	**Ralf Schruba**
Name of building:	**Coronation Hall**	**Date:**	**21/11/2014**
City:	**Dunedin 9010**	**Revision No.:**	



Ground Floor



Basement

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.*

www.beca.com

Report

Detailed Seismic Assessment - Maori Hill Hall

Prepared for Dunedin City Council

Prepared by Beca Limited

26 July 2017

Revision History

Revision Nº	Prepared By	Description	Date
A	Alex Kelly	Draft Issue for Client Review	03/07/2017
B	Alex Kelly	Updated Draft following Further Investigations	26/07/2017

Document Acceptance

Action	Name	Signed	Date
Prepared by	Alex Kelly		26/07/2017
Reviewed by	Matt Fox		26/07/2017
Approved by	Jonathan Barnett		26/07/2017
on behalf of	Beca Ltd		

Executive Summary

Background

This Detailed Seismic Assessment report has been prepared for the Dunedin City Council for Maori Hill Hall, located at 1 Balmacewen Road, Dunedin. It follows on from an Initial Seismic Assessment (ISA) using the New Zealand Society of Earthquake Engineering (NZSEE) Initial Evaluation Procedure (IEP) dated 21 November 2014 (completed by others). In the Initial Seismic Assessment the Maori Hill Hall was assessed to be a Grade D building with an IEP rating of 25%NBS (IL3) (New Building Standard) in accordance with the NZSEE.

This report has been prepared in accordance with the scope of work described in the DCC Maori Hill Hall – Detailed Seismic Assessment proposal dated 4 April 2017.

Building Description

The Maori Hill Hall was constructed in 1911, and consists of two storeys: a ground floor and a basement, which is partially underground. The building is rectangular and the walls are constructed with unreinforced masonry (URM), with a timber framed roof and floor spanning onto the walls and pilasters. The external ground level varies along the length of the building, rising from being at basement level at the north end to being flush with the ground floor at the south end.

Assessed Earthquake Rating

The results of our quantitative seismic assessment for the Maori Hill Hall indicates an earthquake rating of **less than 20%NBS(IL2)** in terms of the expected performance for life safety in accordance with the guideline document *The Seismic Assessment of Existing Buildings - Technical Guidelines for Engineering Assessments*, dated July 2017 (*Engineering Assessment Guidelines*). The earthquake rating is limited by the lack of connection between the South wall and the floor diaphragm.

However, failure of this connection is likely to result in some local loss of floor joist seating and not a global collapse mechanism. The URM walls generally have a capacity of 25-30%NBS but with some relatively minor strengthening works this can be raised to provide more seismic resilience.

Council has advised that they will manage this building as an Importance Level 2 building and not more than 300 people will be allowed to congregate in one area. The building has been assessed as an Importance Level 2 (IL2) building in accordance with the New Zealand Standard for Structural Design Actions NZS1170.

The assessed structure is a **Grade E** building following the definition of the NZSEE building grading scheme. Grade **E** buildings have approximately ***>25*** times the seismic risk relative to a new building, indicating a ***Very High*** risk exposure.

A building with less than 34%NBS and whose collapse would cause injury or death to people in or near the structure is categorised as an Earthquake Prone Building (EPB). Buildings with less than 67%NBS are also categorised as Earthquake Risk Buildings (ERB). The Maori Hill Hall would therefore be categorised as an Earthquake Prone Building.

The following items limit the performance of the building below 34%NBS(IL2):

- There is no mechanical connection (gravity only) between the floor diaphragm and the South end wall.
- The connection from the North end wall to the floor diaphragm is reliant on a single skew nail and cannot adequately accommodate the loading demand.
- There is no visible mechanical connection from the rafters and floor beams into the pilasters. There could potentially be a hidden fixing down into the concrete cap from the floor beams (scanning indicated some metallic content in the bond beam at this location); however, without more intrusive investigations this

could not be relied on and for the purpose of the assessment we have assumed that these connections rely on shear friction alone between the beams and the concrete.

- There is no connection from the roof rafters to the side walls in the southern rooms. These therefore rely solely on friction between the rafters sitting on top of the bricks.
- The cavity brick side walls in the southern rooms are tall and narrow and are therefore vulnerable to out-of-plane failure and collapse.
- The connections from the roof to the North and South end walls (both at eaves and roof levels) are not adequate to resist the loading demand.
- The ceiling/roof in the hall does not act as a continuous diaphragm in the transverse direction as there is no reliable means of transferring load from roof level down to eaves level (at the ends of the open hall area). This means it cannot act to restrain the side walls at eaves level, so the walls act as cantilevers.
- The southern end wall is highly perforated, leaving only very narrow pier elements between the door and windows. This means it has low capacity to resist in-plane loads.

In addition to our findings, and in respect of the overall behaviour of the building noted above, the expected performance of the site and associated seismic risk have also been assessed:

- Soil Class: A site subsoil class C, (NZS1170.5) has been adopted for our assessment, in lieu of any detailed geotechnical information.
- Slope Stability: The slope stability is not considered during our assessment.

Seismic Retrofit Options

We have been asked to provide high level commentary regarding the strengthening that would be required to improve the seismic performance of the building.

For the Maori Hill Hall to achieve 34%NBS(IL2) the following would need to be undertaken:

- Create a connection between the ground floor diaphragm and the southern end wall.
- Create a connection between the roof diaphragm and the perimeter cavity walls.
- Strengthening the existing rafter and floor beam to pilaster connections.
- Strengthening the existing connection from the northern end wall to the floor diaphragm.
- Strengthening the existing connection from the North and South end walls to the roof diaphragm.
- Strengthening the cavity brick side walls by securing the two wythes together and fixing to a system of strongbacks. The timber wall framing could be used for this.
- To strengthen the ground floor pilasters either:
  - Provide restraint at the eaves level by securing the ceiling diaphragm.
  - Or locally strengthen each pilaster by use of FRP or steel strengthening, etc.
- To strengthen the South end wall either:
  - Strengthen the wall to resist greater in-plane loading.
  - And/or add additional lateral load resisting elements through the building to reduce the demand on this element.

To achieve 67%NBS(IL2), the floor diaphragm would need to be strengthened and the parapets secured.

Geotechnical investigations could determine that the site has better soil characteristics than what we have assumed. An improvement in site subsoil class from C to B would increase the building’s %NBS score.

We have assumed the building is an Importance Level 2 structure. We believe that this building could reasonably be classified as either IL2 or IL3 depending on how the building is managed, operated and modified.

Next Steps

We recommend you consider carrying out the following next steps:

- Geotechnical investigations could be undertaken to determine whether the site has better soil characteristics than those assumed for this assessment.
- Carry out detailed design of strengthening solutions and undertake works to increase the building seismic performance to a desired level in terms of %NBS.
- Obtain cost estimates for the proposed strengthening solutions, if required. High-level cost estimates could be obtained from prospective builders, quantity surveyors, or we can assist with this, if required.

Contents

Appendices

1 Introduction

This Detailed Seismic Assessment (DSA) report has been prepared for the Dunedin City Council for Maori Hill Hall, located at 1 Balmacewen Road, Dunedin. It follows on from an Initial Seismic Assessment (ISA) using the New Zealand Society for Earthquake Engineering (NZSEE) Initial Evaluation Procedure (IEP) dated 21 November 2014 (by others).

1.1 Scope of Assessment

The purpose of this assessment is to establish the seismic risk of the Maori Hill Hall and, if necessary, to propose structural remediation to achieve a level of seismic risk acceptable to the Dunedin City Council. Our scope of work includes:

- A review of the drawings provided to Beca.
- Site visit and visual inspection of the structure.
- Carry out detailed engineering calculations to estimate the seismic capacity of the primary structural elements of the super structure. (Wind and gravity checks are excluded).
- The Detailed Seismic Assessment has been carried out in accordance with the guideline document *The Seismic Assessment of Existing Buildings - Technical Guidelines for Engineering Assessments*, dated July 2017 (*Engineering Assessment Guidelines*).
- Assess whether the building is an earthquake-prone building, i.e. achieves less than 34% of the required strength of a new building (<34%NBS).
- Assess whether the building is an earthquake-risk building (i.e. achieves less than 67%NBS).
- Provide high level commentary on the type of strengthening that may be required to improve the building's seismic performance to an appropriate level.
- A summary of the findings and comments on the differences with the initial evaluation, and general recommendations about further actions.

1.2 Initial Seismic Assessment

Hadley and Robinson Ltd. completed an Initial Seismic Assessment (ISA) using the NZSEE Initial Evaluation Procedure (IEP) for the building, which is summarised in their report dated 21 February 2014 (refer Appendix B). The building was assessed on the basis of it being an Importance Level 3 (IL3) building. The ISA evaluation determined that the building has a rating of 25% New Building Standard (%NBS), which corresponds to a **Grade D** building, as defined by the NZSEE building grading scheme. This is less than the minimum *Building Act 2004* threshold for "earthquake prone" buildings (34%NBS) and less than the threshold for "earthquake risk" buildings (67%NBS) as defined by the NZSEE.

An ISA provides a useful indication of a building's potential earthquake rating in an earthquake compared with similar buildings constructed to the current code, and it is only a first stage review. As noted in the ISA review, the building score is limited by the age of the structure in the Initial Evaluation Procedure. This aspect of the building is more reliably accounted for in our current quantitative evaluation.

Figure 1 – Maori Hill Hall (south elevation)

1.3 Regulatory Environment and Design Standards

The Earthquake-prone Building regulatory framework underwent significant changes during 2016 and 2017 as a result of learnings from the Christchurch earthquakes, and the more recent 2016 Kaikoura earthquake. This resulted in the *Building (Earthquake-prone Buildings) Amendment Act 2016*, the *Building (Specified Systems, Change the Use, and Earthquake-prone Buildings) Regulations 2005* including the Earthquake-prone Building Methodology, and the technical guideline document *The Seismic Assessment of Existing Buildings - Technical Guidelines for Engineering Assessments (Engineering Assessment Guidelines).* The important aspects of this regulatory framework are summarised below.

Earthquake-Prone Buildings (EPBs) are defined in Section 133AB of the *Building (Earthquake-prone Buildings) Amendment Act 2016* as buildings whose ultimate capacity will be exceeded in a moderate earthquake and, if it were to collapse, would likely result in injury or death or damage to another property. A moderate earthquake is defined as approximately one-third as strong but of the same duration as the earthquake shaking assumed in the design of a new building.

The official determination of whether or not a building is Earthquake-prone is the responsibility of the relevant Territorial Authority (TA). The earthquake rating resulting from an engineering assessment is only one, albeit significant, aspect considered by the TA in making their determination. If the TA determines a building to be Earthquake-prone, it will issue an EPB notice for the building and include it on the EPB register. The *Building (Earthquake-prone Buildings) Amendment Act 2016* then defines timeframes within which the owner must carry out building work (i.e. upgrade or demolish) to ensure the building is no longer Earthquake-prone. These timeframes range from 7.5 years to 35 years depending on the building type (priority or normal) and location (high, medium or low risk areas).

The *Building (Specified Systems, Change the Use, and Earthquake-prone Buildings) Regulations 2005* made significant changes to the system for identifying and remediating Earthquake-prone buildings. These include:

- providing an operational basis for identifying earthquake-prone buildings – the EPB Methodology
- new definitions for key terms including 'Earthquake-prone Buildings' and 'ultimate capacity'
- a requirement to categorise Earthquake-prone Buildings in terms of their earthquake rating
- providing a national-based system in place of individual earthquake-prone building policies for each TA

The *Engineering Assessment Guidelines* document used by engineers to carry out seismic assessments is an integral part of the EPB Methodology.

In addition, the New Zealand Society for Earthquake Engineering (NZSEE) define a building with an earthquake rating less than 67*%NBS* as an Earthquake-Risk Building (ERB), and recommend a minimum target strengthening level of 67*%NBS*.

It is considered impractical and unaffordable to design every building to withstand the largest earthquake imaginable. Consequently, with respect to the determination of design loads for natural hazards, the New Zealand Loading Standard adopts a probabilistic approach that takes into accord the exposure hazard at a given location, along with factors such as building importance. Thus, the Loading Standard may be said to adopt a risk management approach in setting the loading levels that a given building is required to withstand.

For Importance Level 2 (IL2) buildings (e.g. offices, apartments and the like), the "design" earthquake load is set at the 1 in 500 year return period earthquake event. This event has approximately a 10% probability of exceedance over the assumed 50 year life of a building.

The following design standards and references have been used to undertake the seismic assessment:

- New Zealand Standard NZS1170.0: 2002 *"Structural Design Actions Part 0: General principles".*
- New Zealand Standard NZS1170.1: 2002 *"Structural Design Actions Part 1: Permanent, imposed and other actions".*
- New Zealand Standard NZS1170.5: 2004 *"Structural Design Actions Part 5: Earthquake actions – New Zealand".*
- New Zealand Standard NZS3101:2006 *"Concrete Structures Standard".*
- New Zealand Society for Earthquake Engineering (NZSEE) *"Guidelines on Assessment and Improvement of the Structural Performance of Buildings in Earthquake".* 2006 New Zealand (including corrigenda 1, 2, 3 and 4).
- 2017 Technical Guidelines on the *"The Seismic Assessment of Existing Buildings – Technical Guidelines for Engineering Assessments",* prepared by the New Zealand Society of Earthquake Engineers (NZSEE), the Ministry of Business, Innovation and Employment (MBIE), the Earthquake Commission (EQC), the Geotechnical Society of New Zealand (GSNZ) and the Structural Engineers Society (SESOC).

1.4 Assessment Methodology

We have adopted a stepped analysis approach to undertaking the seismic assessment of the Maori Hill Hall, starting with simpler analysis methods and progressively employing more sophisticated methods of analysis and calculations to determine the seismic vulnerability of the building, where required. The techniques used are generally as outlined in the guideline document *The Seismic Assessment of Existing Buildings - Technical Guidelines for Engineering Assessments*, (the *Engineering Assessment Guidelines).* Previous versions of this guideline document were referred to as the *NZSEE Guidelines*, as they were produced by the New Zealand Society for Earthquake Engineering. The guidelines have now been fully revised, with the new version produced by three technical engineering societies (NZSEE, the Structural Engineering Society (SESOC) and NZ Geotechnical Society (NZGS)), in conjunction with the Ministry of Business, Innovation and Employment (MBIE) and the Earthquake Commission (EQC).

Our methodology is briefly summarised below, which generally follows the key steps of the Simple Lateral Mechanism Analysis (SLaMA) technique described in Appendix 2A of the *Earthquake Engineering Guidelines*:

- A detailed inspection of the building was undertaken to provide sufficient detail to conduct the analysis. This includes measurements of all walls, pilasters, floor and roof beams, and any other items of note.
- Calculation of the expected seismic actions on the building following the current New Zealand loading standards (NZS1170).
- Analysis of the building using Section C8 of the Engineering Assessment Guidelines for URM buildings, which use hand analyses to check the walls in out-of-plane bending and in-plane shear, the diaphragms and the non-structural elements, such as parapets, for collapse.
- Determination of the likely earthquake rating of the building compared with an equivalent new building at the site, in accordance with Engineering Assessment Guidelines. This was based on our inspections, the structural weaknesses identified, our calculations and our engineering judgment.

1.5 Explanatory Statement

- This report has been prepared by Beca at the request of our Client and is exclusively for our Client's use for the purpose for which it is intended in accordance with the agreed scope of work. Beca accepts no responsibility or liability to any third party for any loss or damage whatsoever arising out of the use of or reliance on this report by that party or any party other than our Client.
- The inspections of the building/structures discussed in this report have been undertaken to assist in the structural assessment of the building structure for seismic loads only. This assessment does not consider gravity or wind loading or cover building services or fire safety systems, or the building finishes, glazing system or the weather tightness envelope.
- This assessment does not include an assessment of the building condition or repairs that may be required.
- No geotechnical, subsurface or slope stability assessments have been undertaken by Beca.
- Beca is not able to give any warranty or guarantee that all possible damage, defects, conditions or qualities have been identified. The work done by Beca and the advice given is therefore on a reasonable endeavours basis.
- Except to the extent that Beca expressly indicates in the report, no assessment has been made to determine whether or not the building complies with the building codes or other relevant codes, standards, guidelines, legislation, plans, etc.
- The assessment is based on the information available to Beca at the time of the assessment. Further information may affect the results and conclusion of this assessment.
- Beca has not considered any environmental matters and accepts no liability, whether in contract, tort, or otherwise for any environmental issues.
- The basis of Beca's advice and our responsibility to our Client is set out above and in the terms of engagement with our Client.

2 Building Description

2.1 General

Summary information about the building is presented in the following table. Reference Information used to undertake this seismic assessment is listed in Appendix A.

Table 2.1 – Building Summary Information

Item	Details	Comment
Building name	Maori Hill Hall	Also known as the Coronation Hall.
Street Address	1 Balmacewen Road, Maori Hill, Dunedin	
Age	Originally constructed circa 1911.	
Building Occupancy/Use	Community hall, used by local groups and schools.	
Importance Level	Importance Level 2 (IL2)	Council has advised that they intend to manage this building as an Importance Level 2 building and not more than 300 people will be allowed to congregate in one area.
Building Footprint / Floor Area	415m² (footprint)	Similar floor areas in both levels.
No. of storeys / basements	Single storey with basement. 3.6m high basement, 4.4m high ground floor to eaves.	13m maximum overall height of structure (northern wall)
Structural system	Timber roof rafters spanning onto unreinforced masonry walls. Suspended timber framed floor at ground floor level.	
Earthquake resisting system	Unreinforced masonry walls.	
Foundation system	Concrete strip footing under brick walls. Concrete foundation wall at southern end of basement.	Full extent of foundations unknown. Foundation wall scanned and no reinforcement was present.
Stair system	External timber framed stairs.	There is no internal access between floors.
Other notable features	Large concrete canopy at front. Ground slopes from ground floor level at the front to basement level at the rear. Basement is partially embedded into the ground.	
Construction information	Floor plans of both ground floor and basement available.	
Likely Design Standards	No known national loading standards at time of construction.	

Figure 2: Plan View of Maori Hill Hall with Load Resisting System Labelled

Figure 3 – Elevation of East Wall (west wall is similar)

Figure 4 – Elevation of Northern End Wall – Ground Floor

Figure 5 – Elevation of Northern End Wall – Basement Level

Additional photographs and drawings of the building are included in Appendix C and D.

The main egress route for foot traffic is located on the south elevation through the main doors. Two other egress routes are located on the eastern side of the building, via the external stairs. Access to the basement area is through a door in the eastern elevation as well.

2.2 Site Conditions

A site subsoil class C, shallow soils (NZS1170.5) has been adopted for our assessment based on the 2004 “Ground Class Dunedin Area” map produced by Opus for the Otago Regional Council. This choice is made in the absence of a site-specific geotechnical investigation. Geotechnical investigation could be undertaken to determine the actual site soil conditions. A revision of site subsoil class from C to B would results in an improved %NBS score.

2.3 Building Design

The first unified national loading and building design standard, NZSS95:1935 Model Building By-Law was introduced following the catastrophic 1931 Napier earthquake. This code required the building to be designed for a nominal lateral force applied uniformly up the building. A revision to the loading and building design standard was made in 1955, introducing minor improvements to reinforced concrete design.

There were significant changes to the knowledge base of structural engineers in the mid-1960s and the 1970s. The NZS1900:1965 loading standard considered variations in regional seismicity and effects of dynamic response in the calculation of seismic coefficients. Ductility requirements were introduced in NZS1900:1965, but without clear guidance on how to achieve the ductility capacity.

Much research and development occurred in the late 1960s and early 1970s. Research and development in New Zealand in the 1970s set the early benchmark for the design and detailing of ductile reinforced concrete structures to resist earthquake loading. These findings were incorporated into a new loadings code NZS4203:1976 and a new concrete code NZS 3101:1982.

A ductile structure designed to modern codes is expected to be able to undergo relatively large displacements without collapse. Ductile structures are also able to dissipate energy and resist repeated cycles of seismic loads without excessive strength degradation. Buildings designed with these features provide a higher level of life safety performance in severe earthquakes compared with other buildings without these features.

2.4 Structural Systems

The gravity load system for the roof consists of timber purlins on timber roof rafters spanning onto the URM walls. Within the hall these rafters appear to be cast into a concrete cap at the top of the wall pilasters. There is no bond beam along the top of the brick wall. At the southern end of the building, the rafters are smaller and at closer centres and fixed to a top plate sitting atop the inner wythe of the side walls. The pitched roof therefore relies on the ceiling joists acting as a tension tie to resist the outward thrust force under gravity load. Any lateral movement of the roof will be resisted via friction between the rafter bearing on the bricks and the timber fascia board.

The suspended timber framed floor at ground floor level consists of timber tongue and groove flooring on timber joists on timber flitch beams which span onto the URM wall pilasters. Within the hall the floor has an additional layer of MDF nailed to it. The soffit is not lined. The timber flitch beams consist of three timber beams with steel plates between each and fixed together with bolts along the length of the beam. The original design appears to have used a post at midspan on the beam to support it, however these have been removed at an unknown date and replaced with steel gravity frames at thirds along the beam. At the ends the beams appear to have a steel baseplate cast into the concrete bond beam atop the pilaster.

The walls are typically constructed of two solid layers of brick (or two wythes) in common bond, with header courses typically every four to six courses and no cavity. The side walls in the southern rooms are constructed with two single wythes with a cavity between with ties. There is a reinforced concrete bond beam running around the perimeter of the building at floor level which is 350mm deep and as wide as the wall. Within the hall proper and basement there are pilasters at approximately three metre centres. In the hall these are typically 490mm wide and 170mm deep from the face of the wall. These have a small concrete cap at the top which the roof rafter is cast into. In the basement the pilasters are typically 700mm wide and 350mm deep. The concrete bond beam extends out over the top of the pilasters at these locations.

The lateral load resisting system is the URM wall elements in both the longitudinal and transverse directions. The roof will act as a diaphragm and is lined with tongue and groove sarking set diagonally to the underside of the rafters in the hall; and either straight or diagonal tongue and groove boards on the flat supported by ceiling joists in the other ground floor rooms. The tongue and groove flooring will also act as a diaphragm at floor level.

The side walls have large regular sized penetrations at both basement and ground floor level.

The southern end wall is highly penetrated, along with a 1.3m high parapet and a concrete canopy extending up to 2.0m out from the building. The northern end wall has some door sized penetrations at ground floor level and windows at basement level.

3 Results of Seismic Assessment

3.1 Assessment Results

The results of our quantitative detailed seismic assessment (DSA) indicate the Maori Hill Hall earthquake rating to be **less than 20%NBS(IL2)**. The associated building grade is now **Grade E**. The earthquake rating is limited by the lack of connection between the South wall and the floor diaphragm.

However, failure of this connection is likely to result in some local loss of floor joist seating and not a global collapse mechanism. The URM walls generally have a capacity of 25-30%NBS but with some relatively minor strengthening works this can be raised to provide more seismic resilience.

Table 3.1 presents the evaluated seismic performance in terms of %NBS of the individual structural systems in each loading direction and for each structure.

Table 3.1 - Summary of Building Seismic Performance

System	Direction	Seismic Performance in %NBS	Notes
Ground Floor URM Walls in Out-of-Plane Bending with Pilasters	Transverse	30-33%NBS	Limited by the un-restrained ceiling diaphragm in the hall.
Roof to Pilaster Connection	Transverse	30-33%NBS	
Ground Floor URM End Walls in Out-of-Plane Bending	Longitudinal	25-30%NBS (governed by roof connection capacity)	Would score 70-75%NBS once connection is strengthened.
Roof to End Wall Connection	Longitudinal	25-30%NBS	
Ground Floor URM Cavity Side Walls in Out-of-Plane Bending	Transverse	25-30%NBS (governed by roof connection capacity)	Would remain at 25-30%NBS once connection is strengthened.
Roof to Cavity Wall Connection	Transverse	25-30%NBS	
Basement URM Side Walls in Out-of-Plane Bending	Transverse	35-40%NBS (governed by connection capacity)	Element would score >100%NBS once the connection is strengthened.

System	Direction	Seismic Performance in %NBS	Notes
Floor Beam to Pilaster Connection	Transverse	35-40%NBS	
Basement URM North Wall in Out-of-Plane Bending	Longitudinal	20-25%NBS (governed by connection capacity)	Element would score 90-95%NBS once the connection is strengthened. The wall itself is limited by the poor condition of the foundation.
Floor Diaphragm to North Wall Connection	Longitudinal	20-25%NBS	
Floor Diaphragm to South Wall Connection	Transverse	**<20%NBS**	Limited by lack of connection between floor diaphragm and end wall.
Parapet at Front of Building	Longitudinal	55-60%NBS	
Diaphragm at Roof Level	Transverse	>100%NBS	Note this is for the ceiling diaphragms in the rooms to the south and over the stage. The hall ceiling does not act as a diaphragm in the transverse direction as there is no restraining elements at each end.
	Longitudinal	>100%NBS	
Diaphragm at Floor Level	Transverse	45-50%NBS	Limited by shear strength of the floor.
	Longitudinal	>100%NBS	
Ground Floor URM Walls in In-Plane Shear	Longitudinal	>100%NBS	
	Transverse (North)	>100%NBS	
	Transverse (South)	25-30%NBS	Limited by the large number of penetrations in this wall.
Basement URM Walls in In-Plane Shear	Longitudinal	>100%NBS	
	Transverse (North)	85-90%NBS	

3.2 Factors Affecting Assessment Results

Council has advised that they will manage this building as an Importance Level 2 building and not more than 300 people will be allowed to congregate in one area. This reduces the seismic demand on the building compared to an Importance Level 3 structure (as was assumed for the ISA) as that is based on the design load from a 1 in 1000 year earthquake, as opposed to a 1 in 500 year earthquake considered for an IL2 building.

The following tests and observations were made on site as part of this assessment. These checks provide the strength properties for the various materials in the building:

- A scratch test of the bricks was undertaken. This indicated a material hardness of Medium as per the Engineering Assessment Guidelines (scratches with a 10c coin).
- A check of the original mortar showed that it scratched easily with finger nails. This corresponds to a Soft mortar hardness as per the Engineering Assessment Guidelines.
- Both the roof and floor diaphragms were taken to be in Fair condition, which the Engineering Assesssment Guidelines defines as having “Little or no borer; less than 3 mm of floorboard separation; little or no signs of past water damage; some nail rust but integrity still fair; floorboard-to-joist connection has some but little movement; small degree of timber wear surrounding nails”.

The concrete used in the foundations and bond beams was assumed to have a strength of 10MPa.

The MDF lining in the hall over the floor has not been included in the assessment of the floor diaphragm capacity. Based on the material type, observed thickness and coverage over only part of the ground floor area, it is unlikely that it will contribute much to the strength of the diaphragm.

The following items limit the performance of the building below 34%NBS(IL2):

- There is no mechanical connection (gravity only) between the floor diaphragm and the South end wall.
- The connection from the North end wall to the floor diaphragm is reliant on a single skew nail and cannot adequately accommodate the loading demand.
- There is no visible mechanical connection from the rafters and floor beams into the pilasters. There could potentially be a hidden fixing down into the concrete cap from the floor beams (scanning indicated some metallic content in the bond beam at this location); however, without more intrusive investigations this could not be relied on and for the purpose of the assessment we have assumed that these connections rely on shear friction alone between the beams and the concrete.
- There is no connection from the roof rafters to the side walls in the southern rooms. These therefore rely solely on friction between the rafters sitting on top of the bricks.
- The cavity brick side walls in the southern rooms are tall and narrow and are therefore vulnerable to out-of-plane failure and collapse.
- The connections from the roof to the North and South end walls (both at eaves and roof levels) are not adequate to resist the loading demand.
- The ceiling/roof in the hall does not act as a continuous diaphragm in the transverse direction as there is no reliable means of transferring load from roof level down to eaves level (at the ends of the open hall area). This means it cannot act to restrain the side walls at eaves level, so the walls act as cantilevers.
- The southern end wall is highly perforated, leaving only very narrow pier elements between the door and windows. This means it has low capacity to resist in-plane loads.

4 Commentary on Associated Seismic Risks

4.1 Risks from Adjacent Buildings

The separation between the Hall and the adjacent building is only 10mm. During an earthquake the two structures may “pound” against each other. The Engineering Assessment Guidelines argue that when the eaves of both buildings are at similar heights the effect of any damage is unlikely to impact on the gravity load system in the building, and hence any damage will be non-structural and localised to the site of “pounding”. Based on this, we do not believe that pounding is a structural weakness for this building.

4.2 Risk from Geohazards

Slope stability has not been considered as part of our assessment.

4.3 Risks from Non-structural Building Elements

Non-structural building elements (façade glass, ceilings, internal walls, overhead services) typically constitute a significant portion of the repair / reinstatement cost following an earthquake. In a moderate seismic event, non-structural element damage will likely contribute heavily to downtime and the repair costs.

For a new building, full-height partitions (glazed or Gib-board lining), glazed street facades and ceilings are normally designed to accommodate the building’s deformations. A detailed assessment of the non-structural components may be undertaken to provide insight into their expected performance and their impact on life safety and post-earthquake operability.

5 Assessment of Seismic Risk

5.1 Seismic Risk and Performance Levels

From our assessment, the Maori Hill Hall is likely to achieve **less than 20%NBS**. The building has been assessed as an IL2 building. Therefore the building should be considered as a **Grade E** building, following the definition of the New Zealand Society of Earthquake Engineering (NZSEE) building grading scheme, which could be regarded as exposing the occupants to a very high seismic risk.

The New Building Standard requires an IL2 building to have a low probability of collapse in a 1 in 500-year “design level” earthquake (i.e. an earthquake with a probability of exceedance of approximately 10% over the assumed 50 year design life of a building).

Table 5.1: Relative Earthquake Risk

Building Grade	Percentage of New Building Strength (%NBS)	Approx. Risk Relative to a New Building	Risk Description
A+	>100	<1	low risk
A	80 to 100	1 to 2 times	low risk
B	67 to 80	2 to 5 times	low or medium risk
C	33 to 67	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

A building with less than 34%NBS and whose collapse would cause injury or death to people in or near the structure is categorised as an Earthquake Prone Building (EPB). Buildings with less than 67%NBS are also categorised as Earthquake Risk Buildings (ERB). The Maori Hill Hall would therefore be categorised as an Earthquake Prone Building.

5.2 Comparison of the Initial and Detailed Seismic Assessment Findings

The Initial Seismic Assessment (ISA) of the Maori Hill Hall was limited by the age of the building. The IEP F-Factor used was 1.0, which accounted for a decrease in score due to the ground floor walls acting as cantilevers and an increase in score to account for the extra damping present in unreinforced masonry. The final result indicated the building had a score of 25%NBS(IL3).

The detailed assessment has identified that the Maori Hill Hall has a capacity of less than 20%NBS(IL2), as a result of the lack of connection in the floor diaphragm to the southern foundation wall.

6 Strengthening

We have been asked to provide high level commentary regarding the strengthening that would be required to improve the seismic performance of the building. The overarching problem is that New Zealand’s URM building stock is simply not designed for earthquake loads and lacks a basic degree of connection between structural elements to allow all parts of the building to act together. The basic approach to improving the seismic performance of URM buildings is to:

- Secure all unrestrained parts that represent falling hazards to the public (e.g. chimneys, parapets and ornaments)

- Improve the wall-diaphragm connections or provide alternative load paths; improve the diaphragm; and improve the performance of the face-loaded walls (gables, facades and other walls) by improving the configuration of the building and in-plane walls
- Strengthen specific structural elements, and
- Consider adding new structural components to provide extra support for the building.

For the Maori Hill Hall, the following would need to be undertaken to achieve 34%NBS(IL2):

- Create a connection between the ground floor diaphragm and the southern end wall.
- Create a connection between the roof diaphragm and the perimeter cavity walls.
- Strengthening the existing rafter and floor beam to pilaster connections.
- Strengthening the existing connection from the northern end wall to the floor diaphragm.
- Strengthening the existing connection from the North and South end walls to the roof diaphragm.
- Strengthening the cavity brick side walls by securing the two wythes together and fixing to a system of strongbacks. The timber wall framing could be used for this.
- To strengthen the ground floor pilasters either:
  - Provide restraint at the eaves level by securing the ceiling diaphragm.
  - Or locally strengthen each pilaster by use of FRP or steel strengthening, etc.
- To strengthen the South end wall either:
  - Strengthen the wall to resist greater in-plane loading.
  - And/or add additional lateral load resisting elements through the building to reduce the demand on this element.

To achieve 67%NBS(IL2), the following would need to be undertaken:

- The floor diaphragm should be stiffened to prevent it causing out-of-plane collapse of the basement walls (currently at 45-50%NBS).
- The parapet facing Balmacewen Road should be secured back to the building (currently at 55-60%NBS).

We believe that strengthening to 67%NBS(IL2) could be reasonably achieved as the additional work required to increase the score from 34%NBS(IL2) to 67%NBS(IL2) is relatively minor compared to the work required to achieve 34%NBS(IL2).

Geotechnical investigations could determine that the site has better soil characteristics than what we have assumed. An improvement in site subsoil class from C to B would have a large positive impact on the building's %NBS score.

Following discussion with council, we have assumed the building is an IL2 structure, unlike the ISA completed by Hadley and Robinson Ltd. which assumed the building was IL3. According to the New Zealand Loading Standard (NZS1170.0), the building would need to meet one of the following criteria to be classed as an IL3 building (note only relevant criteria have been mentioned below):

- *"Where more than 300 people can congregate in one area."* This many people could possibly fit into the hall, but each person would only have 0.75m² each, which is very small.
- *"School facilities with a capacity of greater than 250."* This is for the whole building, not just one area. This could be relevant as the hall is used by the adjacent school.
- *"Public assembly buildings, theatres and cinemas of greater than 1000m²."* The building has a total floor area of 830m², so does not meet this criteria.

We believe that this building could reasonably be classed as either IL2 or IL3. The building would have a lower %NBS score if it was determined to be IL3 as these buildings are required to withstand stronger earthquake shaking. We believe that this building could reasonably be classified as either IL2 or IL3 depending on how the building is managed, operated and modified.

Additionally, the critical failure modes (out-of-plane collapse of the walls and the parapet collapse) could present a hazard to the public beyond those using the building, e.g. the parapet collapsing onto the footpath. This should be considered as part of any strengthening work undertaken.

7 Next Steps

We recommend you consider carrying out the following next steps:

- Geotechnical investigations could be undertaken to determine whether the site has better soil characteristics than those assumed for this assessment.
- Carry out detailed design of strengthening solutions and undertake works to increase the building seismic performance to a desired level in terms of %NBS.
- Obtain cost estimates for the proposed strengthening solutions, if required. High-level cost estimates could be obtained from prospective builders, quantity surveyors, or we can assist with this, if required.

Appendix A

Initial Seismic Assessment Report

Hadley & Robinson Ltd.
Consulting Civil & Structural Engineers

21 November 2014

Job Number: 12174

DCC
28 NOV 2014
Business Information

Dunedin City Council
City Property
Rhonda Abercrombie
PO Box 5045
Dunedin 9058

1 Balmacewen Road, Maori Hill, Dunedin 9010 – Coronation Hall
Initial Seismic Assessment Report

Dear Rhonda

We have now completed an Initial Seismic Assessment (ISA) of the Coronation Hall located at 1 Balmacewen Road, Maori Hill, Dunedin 9010 using the Initial Evaluation Procedure (IEP).

Background to the IEP and Its Limitations

The IEP procedure was developed in 2006 by the New Zealand Society for Earthquake Engineering (NZSEE) and updated in 2013 to reflect experience with its application and as a result of experience in the Canterbury earthquakes. It is a tool to assign a percentage of New Building Standard (%NBS) score and associated grade to a building as part of an initial seismic assessment of existing buildings.

The IEP enables territorial authorities, building owners and managers to review their building stock as part of an overall risk management process.

Characteristics and limitations of the IEP include:

- It tends to be somewhat conservative, identifying some buildings as earthquake prone, or having a lower %NBS score, which subsequent detailed investigation may indicate is less than actual performance. However, there will be exceptions, particularly when critical structural weaknesses (CSWs) are present that have not been recognised from the level of investigation employed.
- It can be undertaken with variable levels of available information, e.g. exterior only inspection, structural drawings available or not, interior inspection, etc. The more information available the more representative the IEP result is likely to be. The IEP records the information that has formed the basis of the assessment and consideration of this is important when determining the likely reliability of the result.

Director L M Robinson BE (Hons), NZCE (Dist), FNZSEE, MIPENZ (Geotechnical, Structural), CPEng, IntPE
469 George Street, PO Box 6068, Dunedin 9059, Phone (03) 477 8923, Fax (03) 477 0608
Email: solutions@hadleyrobinson.co.nz Website: www.hadleyrobinson.co.nz
ACENZ

- It is an initial, first-stage review. Buildings or specific issues which the IEP process flags as being problematic or as potentially critical structural weaknesses, need further detailed investigation and evaluation. A Detailed Seismic Assessment is recommended if the seismic status of a building is critical to any decision making.
- The IEP assumes that the buildings have been designed and built in accordance with the building standard and good practice current at the time. In some instances, a building may include design features ahead of its time - leading to better than predicted performance. Conversely, some unidentified design or construction issues not picked up by the IEP process may result in the building performing not as well as predicted.
- It is a largely qualitative process, and should be undertaken or overseen by an experienced engineer. It involves considerable knowledge of the earthquake behaviour of buildings, and judgement as to key attributes and their effect on building performance. Consequently, it is possible that the %NBS derived for a building by independent experienced engineers may differ.
- An IEP may over-penalise some apparently critical features which could have been satisfactorily taken into account in the design.
- An IEP does not take into account the seismic performance of non-structural items such as ceiling, plant, services or glazing.

Experience to date is that the IEP is a useful tool to identify potential issues and expected overall performance of a building in an earthquake. However, the process and the associated %NBS and grade should be considered as only indicative of the building's compliance with current code requirements. A detailed investigation and analysis of the building will typically be required to provide a definitive assessment.

An IEP score above 34%NBS should be considered sufficient to classify the building as not earthquake prone. However, if further information comes available reassessment may be required.

IEP Assessment Results

Our IEP assessment of this building indicates the building can achieve 25%NBS in the longitudinal direction and 25%NBS in the transverse direction. The IEP assessment of this building therefore indicates an overall score of 25%NBS, corresponding to a 'Grade D' building as defined by the New Zealand Society for Earthquake Engineering (NZSEE) building grading scheme. This is below the threshold for earthquake prone buildings (34%NBS) and below the threshold for earthquake risk buildings (67%NBS) as recommended by the NZSEE.

IEP Grades and Relative Risk

Table 2 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 10 times the risk that they would be in a similar new building. For buildings that are potentially Earthquake Risk (less than 67%NBS), but not Earthquake Prone, the risk is at least 5 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 2.

Table 2: Relative Earthquake Risk

Building Grade	Percentage of New Building Strength (%NBS)	Approx. Risk Relative to a New Building	Life-safety Risk Description
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 IEP as a grade D building and is therefore considered to be a high risk.

The New Zealand Society for Earthquake Engineering (which provides authoritative advice to the legislation makers, and should be considered to represent the consensus view of New Zealand structural engineers) classifies a buildings achieving greater than 67%NBS as "Low Risk", and having "Acceptable (improvement may be desirable)" building structural performance.

Seismic Restraint of Non-Structural Items

During an earthquake, the safety of people can be put at risk due to non-structural items falling on them. These items should be adequately seismically restrained, where possible, to the NZS 4219:2009 "The Seismic Performance of Engineering Systems in Buildings".

An assessment has not been made of the bracing of the ceilings, in-ceiling ducting, services and plant. We have also not checked whether tall or heavy furniture has been seismically restrained or not. These issues are outside the scope of this initial assessment but could be the subject of another investigation.

Conclusion

Our ISA assessment for this building, carried out using the IEP indicates an overall score of 25%NBS which corresponds to a Grade D building, as defined by the NZSEE building grading scheme. This is below the threshold for Earthquake Prone Buildings (34%NBS) and below the threshold for Earthquake Risk Buildings (67%NBS) as defined by the NZSEE and the New Zealand Building Code.

The ISA is considered to provide a relatively quick, high-level and qualitative measure of the building's performance. In order to confirm the seismic performance of this building with more reliability you may wish to request a DSA. A DSA would likely focus on the following issues:

Connection details of walls to floors and roof.

A DSA would also investigate other potential weaknesses that may not have been considered in the initial seismic assessment.

N/A

We trust this letter and initial seismic assessment meets your current requirements. We would be pleased to discuss further with you any issues raised in this report.

Regards

Ralf Schruba
Civil & Structural Engineer
Hadley & Robinson Ltd

Enclosed:	IEP Assessment
Copy to:	N/A

Initial Evaluation Procedure (IEP) Assessment - Completed for Dunedin City Council

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:	1 Balmacewen Road, Maori Hill	**Job No.:**	12174
AKA:		**By:**	Ralf Schruba
Name of building:	Coronation Hall	**Date:**	21/11/2014
City:	Dunedin 9010	**Revision No.:**	

Table IEP-1 Initial Evaluation Procedure Step 1

Step 1 - General Information

1.1 Photos (attach sufficient to describe building)

front (Balmacewen Road)
(google capture Nov 2012)

right

NOTE: THERE ARE MORE PHOTOS ON PAGE 1a ATTACHED

towards back

right

NOTE: THERE ARE MORE SKETCHES ON PAGE 1a ATTACHED

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

This two storey building was originally built in 1911. A substantial alteration to the basement has been carried out in 1994.
The ground floor is suspended timber on engaged brick columns and on steel beams and columns respectively; external walls are double brick (probably not tied) with engaged columns and concrete bond beam at approximately ground floor support level; roof has steel trusses (timber top chord) with sarking and with corrugated iron cladding.
It is the original that governs this IEP.

1.4 Note information sources

Tick as appropriate

Visual Inspection of Exterior ☑
Visual Inspection of Interior ☑
Drawings (note type) ☑

Specifications ☐
Geotechnical Reports ☐
Other (list) ☐

Architectural drawings of minor interior alterations in 1950, 1966 & 1967; structural drawings of alteration in 1994.

Initial Evaluation Procedure (IEP) Assessment - Completed for Dunedin City Council

Street Number & Name:	**1 Balmacawen Road, Maori Hill**	**Job No.:**	**12174**
AKA:		**By:**	**Ralf Schruba**
Name of building:	**Coronation Hall**	**Date:**	**21/11/2014**
City:	**Dunedin 9010**	**Revision No.:**	

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)* $_{nom}$

a) Building Strengthening Data

	Longitudinal	Transverse
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

Longitudinal	Transverse
Pre 1935 ●	Pre 1935 ●
1935-1965 ○	1935-1965 ○
1965-1976 ○	1965-1976 ○
1976-1984 ○	1976-1984 ○
1984-1992 ○	1984-1992 ○
1992-2004 ○	1992-2004 ○
2004-2011 ○	2004-2011 ○
Post Aug 2011 ○	Post Aug 2011 ○

	Longitudinal	Transverse
Building Type:	Others	Others
Seismic Zone:		

c) Soil Type

	Longitudinal	Transverse
From NZS1170.5:2004, Cl 3.1.3 :	C Shallow Soil	C Shallow Soil
From NZS4203:1992, Cl 4.6.2.2 : **(for 1992 to 2004 and only if known)**	Flexible	Flexible

d) Estimate Period, *T*

Comment:

N/A

		Longitudinal	Transverse
	h_n =	8	8 m
	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:	$T = \max\{0.14h_n^{0.76}, 0.4\}$	○	○
Eccentrically Braced Steel Frames:	$T = \max\{0.08h_n^{0.75}, 0.4\}$	○	○
All Other Frame Structures:	$T = \max\{0.08h_n^{0.75}, 0.4\}$	○	○
Concrete Shear Walls	$T = \max\{0.09h_n^{0.75}/A_c^{0.5}, 0.4\}$	○	○
Masonry Shear Walls:	$T \leq 0.4sec$	○	○
User Defined (input Period):		●	●
	T:	0.40	0.40

Where h_n = height in metres from the base of the structure to the uppermost seismic weight or mass.

			Longitudinal	Transverse
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:**	0.04	0.04
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:**	0.80	0.80

		Longitudinal	Transverse
(%NBS) $_{nom}$ = AxBxCxD	*(%NBS)* $_{nom}$	3%	3%

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.*

Initial Evaluation Procedure (IEP) Assessment - Completed for Dunedin City Council

Street Number & Name:	**1 Balmacewen Road, Maori Hill**	**Job No.:**	**12174**
AKA:		**By:**	**Ralf Schruba**
Name of building:	**Coronation Hall**	**Date:**	**21/11/2014**
City:	**Dunedin 9010**	**Revision No.:**	

Table IEP-2 Initial Evaluation Procedure Step 2 continued

2.2 Near Fault Scaling Factor, Factor E

If $T \leq 1.5$sec, 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: Dunedin

Z = 0.13 (from NZS1170.5:2004, Table 3.3)

Z_{1992} = 0.6 (NZS4203:1992 Zone Factor from accompanying Figure 3.5(b))

Z_{2004} = 0.13 (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:	7.69	7.69

2.4 Return Period Scaling Factor, Factor G

		Longitudinal	Transverse
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.)	I =	1	1
b) Design Risk Factor, R_o (set to 1.0 if other than 1976-2004, or not known)	R_o =	1	1
c) Return Period Factor, R (from NZS1170.0:2004 Building Importance Level)	*Choose Importance Level*	○ 1 ● 2 ○ 3 ○ 4	○ 1 ● 2 ○ 3 ○ 4
	R =	1.0	1.0
d) Factor G = IR_o/R	Factor G:	1.00	1.00

2.5 Ductility Scaling Factor, Factor H

a) Available Displacement Ductility Within Existing Structure

Comment:

External walls are double brick (probably not tied) with engaged columns and concrete bond beam at appoximately ground floor support level.

		Longitudinal	Transverse
	μ =	1.00	1.00
b) Factor H		k_μ	k_μ
For pre 1976 (maximum of 2)	=	1.00	1.00
For 1976 onwards	=	1	1
	Factor H:	1.00	1.00

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

2.6 Structural Performance Scaling Factor, Factor I

		Longitudinal	Transverse
a) Structural Performance Factor, S_p (from accompanying Figure 3.4)			
Tick if light timber-framed construction in this direction		☐	☐
	S_p =	1.00	1.00
b) Structural Performance Scaling Factor = $1/S_p$	Factor I:	1.00	1.00

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

	Longitudinal	Transverse
2.7 Baseline *%NBS* for Building, $(\%NBS)_b$ (equals $(\%NBS)_{nom} \times E \times F \times G \times H \times I$)	22%	22%

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.*

Initial Evaluation Procedure (IEP) Assessment - Completed for Dunedin City Council

Street Number & Name:	1 Balmacawen Road, Maori Hill	**Job No.:**	12174
AKA:		**By:**	Ralf Schruba
Name of building:	Coronation Hall	**Date:**	21/11/2014
City:	Dunedin 9010	**Revision No.:**	

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

potential CSWs

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

N/A

3.2 Vertical Irregularity

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

N/A

3.3 Short Columns

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

N/A

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	○ 1	○ 1	● 1
Alignment of Floors not within 20% of Storey Height	○ 0.4	○ 0.7	○ 0.8

N/A

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

N/A

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

N/A

3.6 Other Factors - *for allowance of all other relevant characteristics 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:

1.56 for damping of unreinforced masonry; 0.65 for cantilever wall (GF).

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

PAR

Longitudinal **1.01**

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.*

Initial Evaluation Procedure (IEP) Assessment - Completed for Dunedin City Council

Street Number & Name:	1 Belmecewen Road, Meori Hill	**Job No.:**	12174
AKA:		**By:**	Ralf Schruba
Name of building:	Coronation Hall	**Date:**	21/11/2014
City:	Dunedin 9010	**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

potential CSWs

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

N/A

3.2 Vertical Irregularity

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

N/A

3.3 Short Columns

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

N/A

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	○ 1	○ 1	● 1
Alignment of Floors not within 20% of Storey Height	○ 0.4	○ 0.7	○ 0.8

N/A

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

N/A

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

N/A

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

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

Factor F 1.01

Record rationale for choice of Factor F:

1.56 for damping of unreinforced masonry; 0.65 for cantilever wall (GF).

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

PAR

Transverse **1.01**

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.*

Initial Evaluation Procedure (IEP) Assessment - Completed for Dunedin City Council

Page 6

Street Number & Name:	1 Balmacewen Road, Maori Hill	**Job No.:**	12174
AKA:		**By:**	Ralf Schruba
Name of building:	Coronation Hall	**Date:**	21/11/2014
City:	Dunedin 9010	**Revision No.:**	

Table IEP-4 Initial Evaluation Procedure Steps 4, 5, 6 and 7

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

		Longitudinal	Transverse
4.1	**Assessed Baseline *%NBS* (*%NBS*)$_b$** (from Table IEP - 1)	22%	22%
4.2	**Performance Achievement Ratio (PAR)** (from Table IEP - 2)	1.01	1.01
4.3	**PAR x Baseline (*%NBS*)$_b$**	25%	25%
4.4	**Percentage New Building Standard (*%NBS*)** (Use lower of two values from Step 4.3)		25%

Step 5 - Potentially Earthquake Prone? (Mark as appropriate) *%NBS* ≤ 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)

N/A

Evaluation Confirmed by Lou Robinson **Signature**

Lou Robinson **Name**

38332 **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

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.*

Initial Evaluation Procedure (IEP) Assessment - Completed for Dunedin City Council

Street Number & Name:	1 Balmacewen Road, Maori Hill	**Job No.:**	12174
AKA:		**By:**	Ralf Schruba
Name of building:	Coronation Hall	**Date:**	21/11/2014
City:	Dunedin 9010	**Revision No.:**	

Table IEP-5 Initial Evaluation Procedure Step 8

Step 8 - Identification of potential Severe Critical Structural Weaknesses that could result in significant risk to a significant number of occupants

8.1	Number of storeys above ground level	2
8.2	Presence of heavy concrete floors and/or concrete roof? (Y/N)	N

Occupancy not considered to be significant - no further consideration required

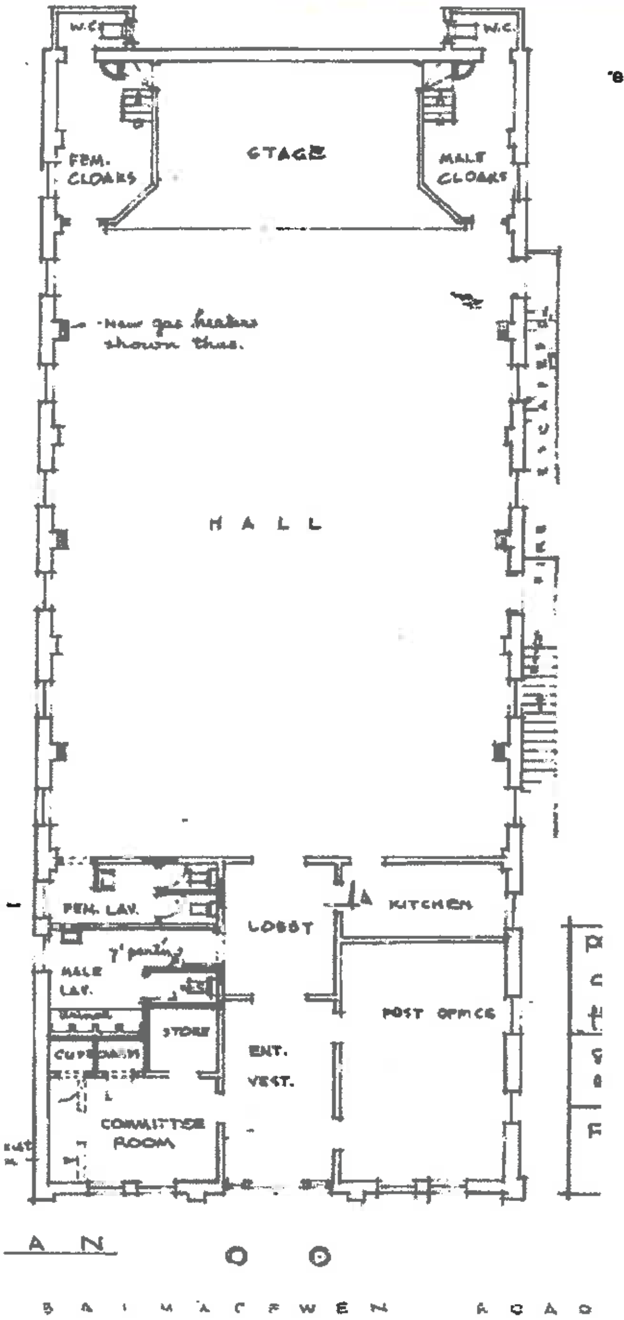
Risk not considered to be significant - no further consideration required

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.*

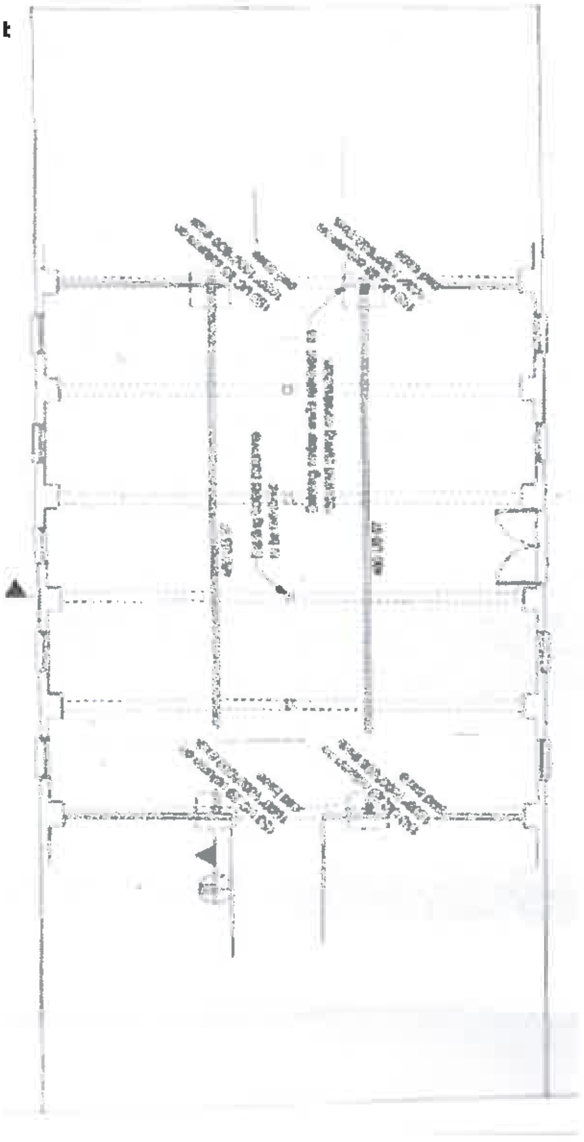
Initial Evaluation Procedure (IEP) Assessment - Completed for Dunedin City Council

Page 1a

Street Number & Name:	1 Balmacewen Road, Maori Hill	**Job No.:**	12174
AKA:		**By:**	Ralf Schruba
Name of building:	Coronation Hall	**Date:**	21/11/2014
City:	Dunedin 9010	**Revision No.:**	



Ground Floor



Basement

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.*

Appendix B

Seismic Assessment Assumptions

Seismic Assessment Assumptions

B.1 Seismic Loading

The seismic design actions have been determined in accordance with NZS1170.5:2004 with the following assumptions:

- Importance Level 2 structure (normal buildings) and a Design Life of 50 years.
- Site Location – 1 Balmacewen Road, Dunedin (2km north of city centre).
- Subsoil class category C.

Only the Ultimate Limit State (ULS) loading is considered in the seismic assessment, which is concerned with life safety of the occupants and collapse prevention.

B.2 Dead and Live Loads

The following assumptions have been made in establishing dead loads for the structure:

- Brick weight of 18 kN/m³.
- Timber structure weight of 6 kN/m³.
- Tongue and groove linings assumed to be 20mm thick.

The live load assumption is based on NZS1170.1:2004 requirements:

- Roof 0.25 kPa from Table 3.2, Type R2, Other roofs.
- Floor 5.00 kPa from Table 3.1, Type C4/5, Areas with possible physical activity or susceptible to overcrowding.

B.3 Assessment Assumptions

The key assumptions made during our assessment were as follows:

Item	Assumption	Comments
Brick Strength	Medium hardness – compressive strength f'_b = 26 MPa	Checked and tested on site as per the Engineering Assessment Guidelines.
Mortar Strength	Soft mortar – compressive strength f'_j = 1 MPa	Checked and tested on site as per the Engineering Assessment Guidelines.
Concrete strength	Old concrete – f'c= 10 MPa	Weak concrete assumed for basement wall shear capacity.
Element Capacity Assessments	Using probable material strengths and a hand analysis.	This was carried out following the recommendations of the Engineering Assessment Guidelines.
Structural Analysis	Hand analysis utilising the SLaMA analysis method.	Simple Lateral Mechanical Analysis (SLaMA).
Diaphragms	Flexible timber diaphragms at roof and ground floor level.	

The achievable earthquake score of the various structural elements has been estimated using the approach described in the Technical Guidelines.

B.4 Seismic Mass

The seismic mass has been computed adopting the NZS1170.5:2004 loading combination $W = G + \Psi_E Q_u = G + 0.3Q_u$.

Appendix C

Building Inspection Photographs

Figure 6 – 200mm x 60mm rafter cast into concrete cap atop pilasters in hall proper.

Figure 7 – 100mm x 45mm roof rafter sitting on wall in south end of building. Note no fixing between rafter and wall.

Figure 8 – 130mm x 50mm ceiling joists supporting tongue and groove ceiling lining. Penetration for services down to lower ceiling in ladies' toilets.

Figure 9 – Tongue and groove floor on 300mm x 45mm timber joists on timber flitch beam. No visible connection from flitch beam to concrete cap on pilaster.

Figure 10 – Timber flitch beam in basement, consisting of 3x 400mm x 150mm timbers and 2x 6mm steel plates.

Figure 11 – North end wall elevation under the stage.

Appendix D

Structural Drawings

DUNEDIN DRAINAGE & SEWERAGE BOARD

A separate application to the Drainage Board for a permit for plumbing and/or drainage work is required. Such work to be executed by a Regd. Plumber or Licensed Drainer, respectively and shall comply fully with the Board's By-laws and the D. & P. Regs., 1959.

Stormwater to be discharged to..............................

Foul sewage to be discharged to New Sanitary fittings & connect to extension of existing foul drain

23/6/67

A.E. Rowe

EXISTING WORK SHOWN ▭

WORK TO BE REMOVED ┄┄┄

NEW WORK SHOWN ▬

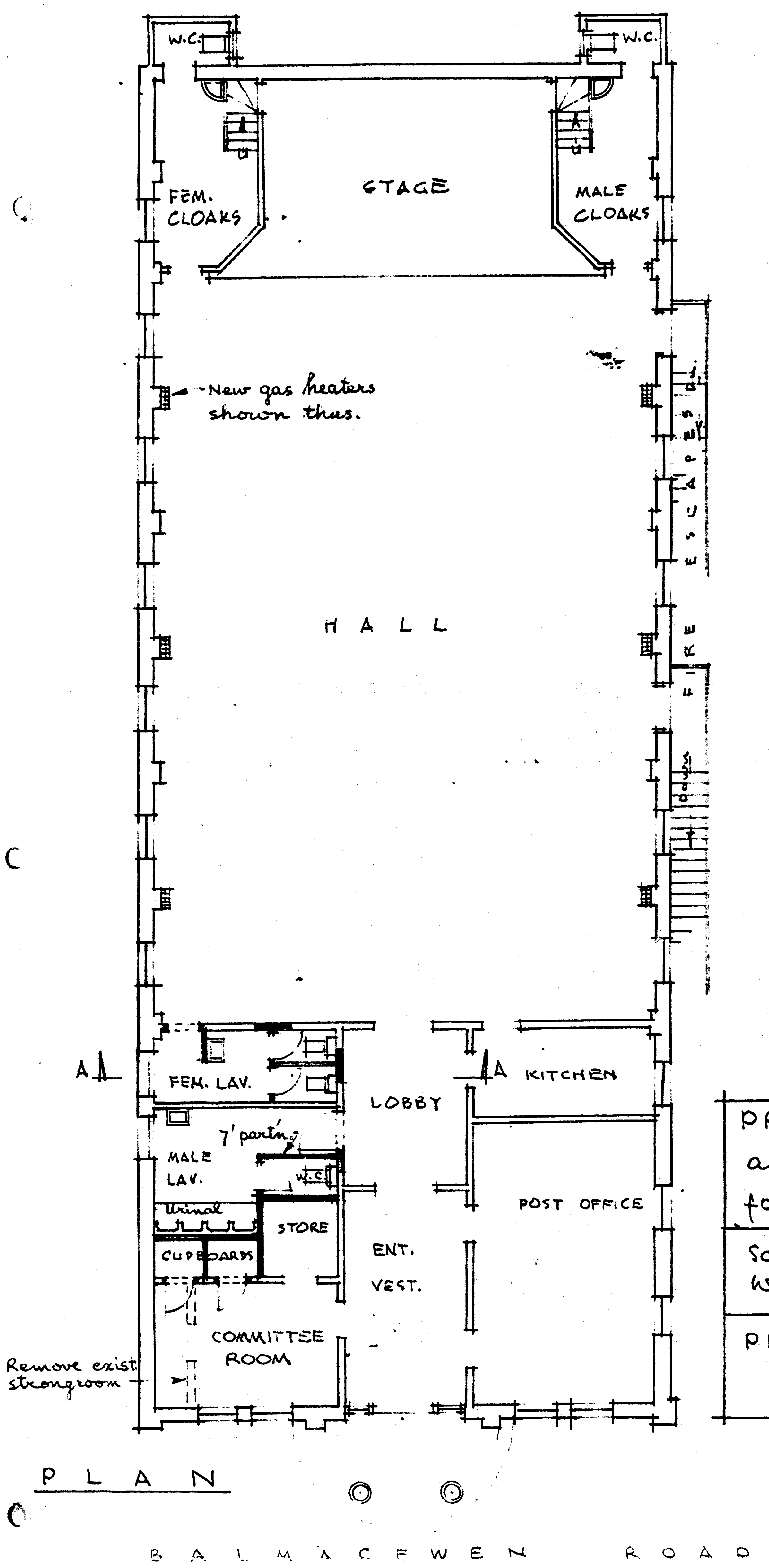
DUNEDIN CITY CORPORATION

COPY OF APPROVED PLAN OR SPECIFICATION

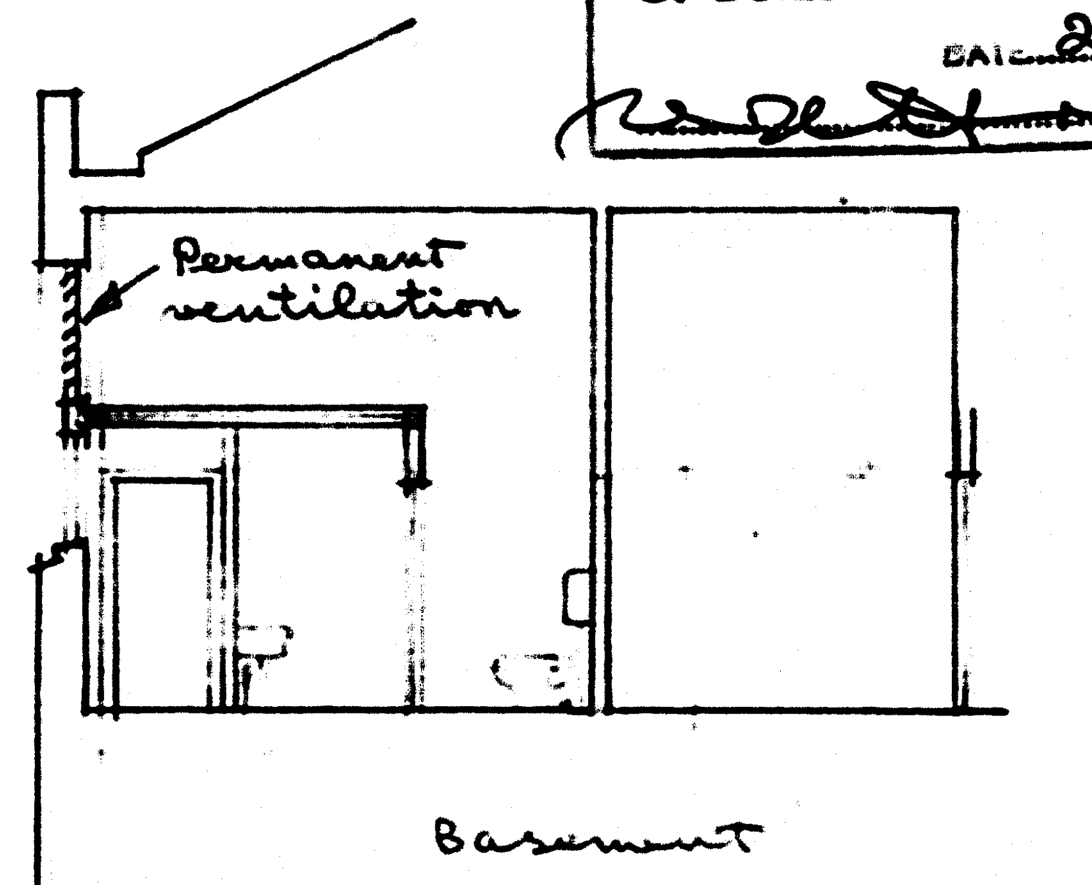
TO BE RETAINED ON WORKS AND PRODUCED ON REQUEST OF BUILDING INSPECTOR.

DATE 27.6.67

.... CITY ENGINEER



PLAN



SECTION A·A

PROPOSED NEW LAVATORIES at CORONATION HALL for the DUNEDIN CITY CORPN

Scale : 1/8" = 1'.0"

Watt. 22.11.66

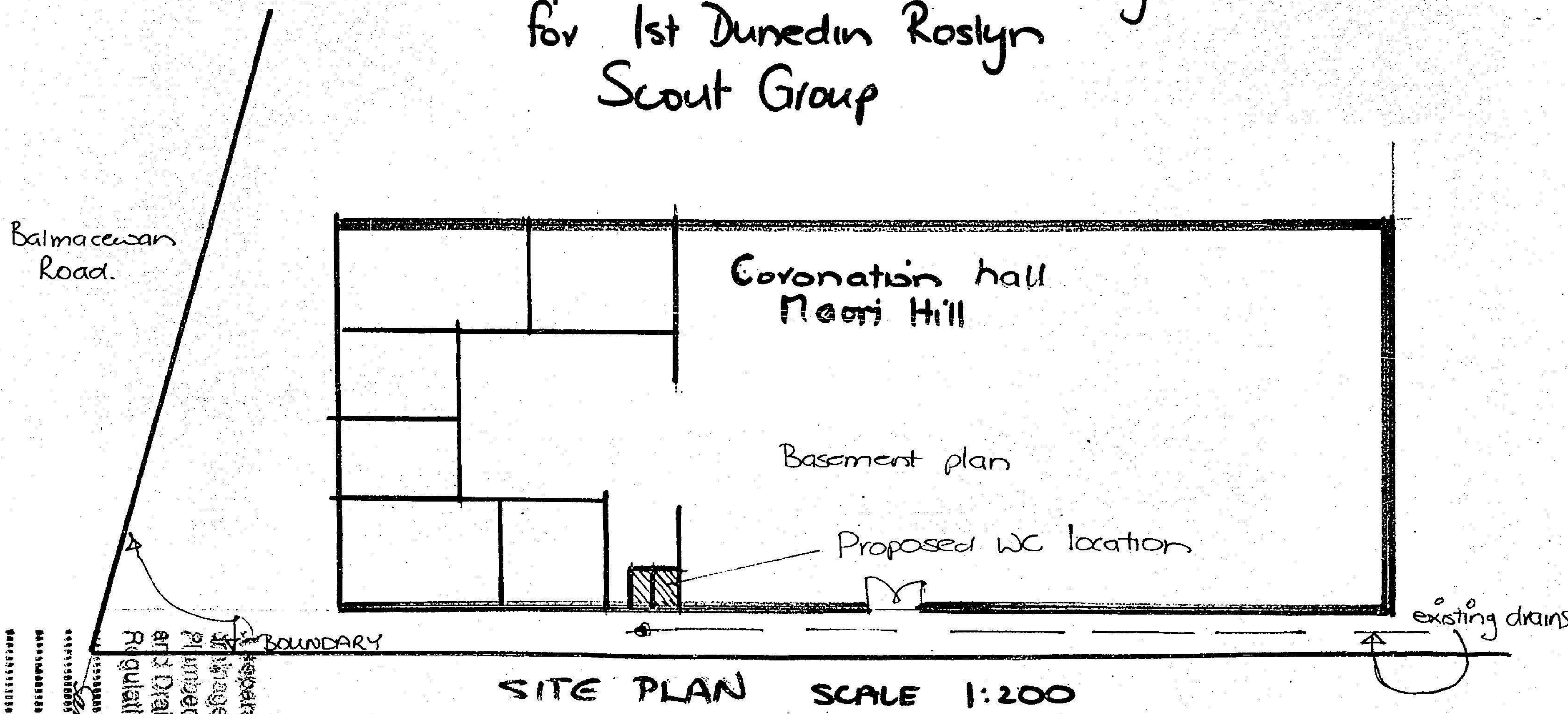
PLAN No 14/1/5

CITY ENGINEER'S OFFICE
DUNEDIN

City Engineer

16924

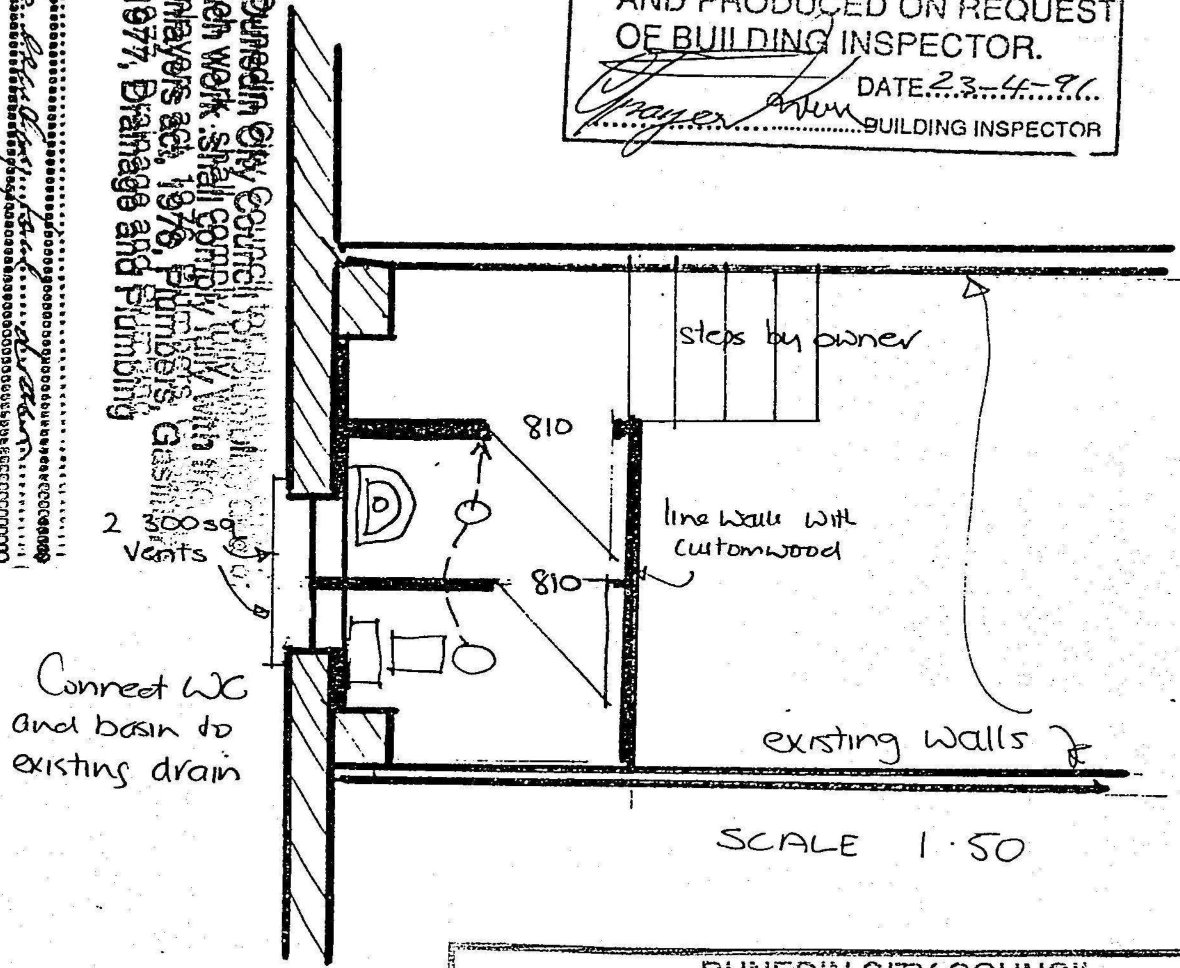
Proposed new toilet facility for 1st Dunedin Roslyn Scout Group

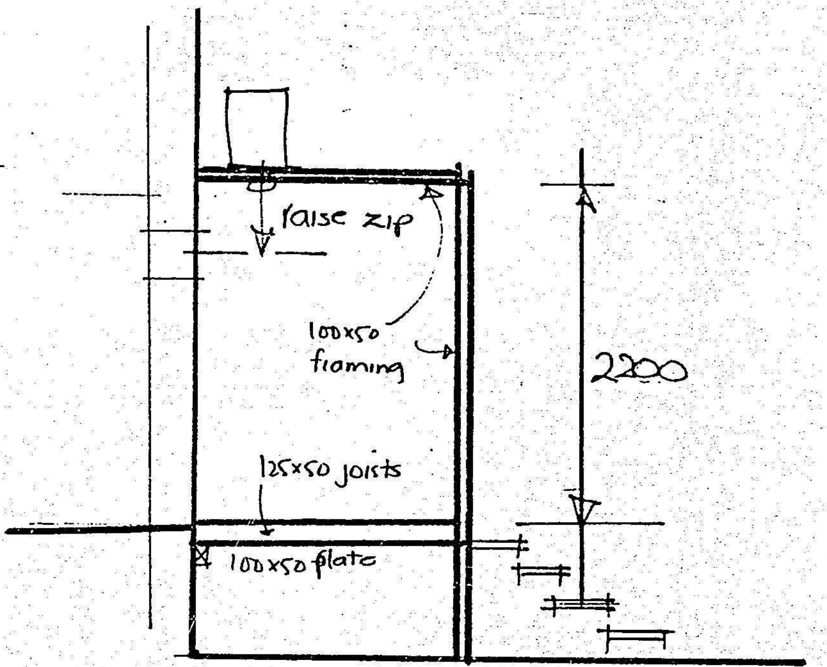


DUNEDIN CITY COUNCIL
Copy of Approved Plan and/or Specification
TO BE RETAINED ON WORKS AND PRODUCED ON REQUEST OF BUILDING INSPECTOR.
DATE 23-4-91
BUILDING INSPECTOR

eparate application to the Dunedin City Council for plumbing ainage work is required. Such work shall comply fully with the Plumbers, Gasfitters and Drainlayers act, 1976, Plumbers, Gasfitters and Drainlayers Regulations 1977, Drainage and Plumbing Regulations, 1978.

Centre





DUNEDIN CITY COUNCIL
Pursuant to the provisions of the District Scheme, these plans and specifications are approved, provided that no change shall be made to the details shown hereon, and contained in the specification attached hereto, and subject to
....
....
....
....
Com B
Signed
Dated 6/8/91

STEWART
Construction Limited
REGISTERED MASTER BUILDERS

2000

Nigel Harwood
ENGINEERING CONSULTANT LTD

Reference 140307
Date 10 March 2014

DCC Property Department
PO Box 5045
Dunedin

Attention: Rhonda Abercrombie/John Varney

Dear Rhonda and John

Initial Seismic Assessment Report - 61 Ward Street, Dunedin
We have now completed an Initial Seismic Assessment (ISA) of the above building using the Initial Evaluation Procedure (IEP). The assessment was carried out after completing a site visit and reviewing the original structural drawings.

Executive Summary
The IEP assessment of this building therefore indicates an overall score of **20%NBS**, corresponding to a **'Grade D' building** which is regarded as being a **high risk building.**

The ISA is considered to provide a relatively quick, high-level and qualitative measure of the building's performance. A more reliable result will be obtained from a Detailed Seismic Assessment (DSA) but is not recommended for this building as it is considered that the building would still be regarded as being earthquake prone.

Introduction
The assessment has been based on the IEP as defined by the NZSEE Guidelines.

Basis for the Assessment
The information we have used for our IEP assessment includes a site visit and review of DCC supplied drawings.

Building Description
The building located at 61 Ward Street, Dunedin. It is currently vacant.

The building has URM walls and a concrete frame on the inside of these. The roof is made of timber trusses with there being no lateral frame strength between the wall and the roof truss.

The original building was constructed in 1930 replacing a smaller building constructed in 1920.

There were various non-structural additions in 1935, 1944, and a mezzanine at the front of the building was built in 1951. Further non-structural building permits were issued in 1966, 1983, 1984 and 1986.

The reinforcing in the concrete columns is not known. The pads under the concrete columns would not be able to effectively resist overturning loads.

There is another building adjacent to the north of the building which could have pounding potential so reducing the seismic capacity. This has been allowed for in this initial analysis.

IEP Assessment Results

Our IEP assessment of this building indicates the building can achieve 25%NBS in the longitudinal direction and 20%NBS in the transverse direction. The IEP assessment of this building therefore indicates an overall score of 20%NBS, corresponding to a 'Grade D' building as defined by the New Zealand Society for Earthquake Engineering (NZSEE) building grading scheme.

This is below the threshold for earthquake prone buildings (34%NBS) as recommended by the NZSEE.

The key assumptions made during our assessment are shown in the Table below. Refer also to the attached IEP assessment.

IEP Item	Assumption	Justification
Date of Building Design	1930	Date on drawing
Soil Type	D/E	Soft to very soft
Building Importance Level	2	Commercial
Ductility of Structure	1	URM cantilever action and in plane loading
Plan Irregularity Factor, A	1	
Vertical Irregularity Factor, B	1	
Short Columns Factor, C	1	
Pounding Factor, D	1 0.8	Perpendicular to the street Parallel to the street
Site Characteristic	1	
F Factor	1	

IEP 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 10 times the risk that they would be in a similar new building.

For buildings that are potentially Earthquake Risk (less than 67%NBS), but not Earthquake Prone, the risk is at least 5 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

Building Grade	Percentage of New Building Strength (%NBS)	Approx. Risk Relative to a New Building	Life-safety Risk Description
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 IEP as a Grade D building and is therefore considered to be a high risk.

The New Zealand Society for Earthquake Engineering (which provides authoritative advice to the legislation makers, and should be considered to represent the consensus view of New Zealand structural engineers) classifies a buildings achieving greater than 67%NBS as “Low Risk”, and having “Acceptable (improvement may be desirable)” building structural performance.

Seismic Restraint of Non-Structural Items

During an earthquake, the safety of people can be put at risk due to non-structural items falling on them. These items should be adequately seismically restrained, where possible, to the NZS 4219:2009 “The Seismic Performance of Engineering Systems in Buildings”.

An assessment has not been made of non-structural items. These issues are outside the scope of this initial assessment but could be the subject of another investigation. This is not recommended given the grading of the building.

Conclusion

Our ISA assessment for this building, carried out using the IEP indicates an overall score of 20%NBS which corresponds to a Grade D building, as defined by the NZSEE building grading scheme. This is below the threshold for earthquake prone buildings (34%NBS) as recommended by the NZSEE.

The ISA is considered to provide a relatively quick, high-level and qualitative measure of the building's performance. In order to confirm the seismic performance of this building with more reliability you may wish to request a DSA. However the status of the building is unlikely to change so this is not recommended.

We trust this letter and initial seismic assessment meets your current requirements.

Please do not hesitate to contact me if you would like clarification of any aspect of this letter.

Yours sincerely

Harwood

Nigel Harwood ME (Civil - Canterbury), FIPENZ, CPEng 45541, IntPE

Encl: IEP Assessment

Background to the IEP and Its Limitations

The IEP procedure was developed in 2006 by the New Zealand Society for Earthquake Engineering (NZSEE) and updated in 2013 to reflect experience with its application and as a result of experience in the Canterbury earthquakes. It is a tool to assign a percentage of New Building Standard (%NBS) score and associated grade to a building as part of an initial seismic assessment of existing buildings. The IEP enables territorial authorities, building owners and managers to review their building stock as part of an overall risk management process.
Characteristics and limitations of the IEP include:

- It tends to be somewhat conservative, identifying some buildings as earthquake prone, or having a lower %NBS score, which subsequent detailed investigation may indicate is less than actual performance. However, there will be exceptions, particularly when critical structural weaknesses (CSWs) are present that have not been recognised from the level of investigation employed.
-
- It can be undertaken with variable levels of available information, e.g. exterior only inspection, structural drawings available or not, interior inspection, etc. The more information available the more representative the IEP result is likely to be. The IEP records the information that has formed the basis of the assessment and consideration of this is important when determining the likely reliability of the result.
-

- It is an initial, first-stage review. Buildings or specific issues which the IEP process flags as being problematic or as potentially critical structural weaknesses, need further detailed investigation and evaluation. A Detailed Seismic Assessment is recommended if the seismic status of a building is critical to any decision making.
- The IEP assumes that the buildings have been designed and built in accordance with the building standard and good practice current at the time. In some instances, a building may include design features ahead of its time - leading to better than predicted performance. Conversely, some unidentified design or construction issues not picked up by the IEP process may result in the building performing not as well as predicted.
- It is a largely qualitative process, and should be undertaken or overseen by an experienced engineer. It involves considerable knowledge of the earthquake behaviour of buildings, and judgement as to key attributes and their effect on building performance. Consequently, it is possible that the %NBS derived for a building by independent experienced engineers may differ.
- An IEP may over-penalise some apparently critical features which could have been satisfactorily taken into account in the design.
- An IEP does not take into account the seismic performance of non-structural items such as ceiling, plant, services or glazing.

Experience to date is that the IEP is a useful tool to identify potential issues and expected overall performance of a building in an earthquake. However, the process and the associated %NBS and grade should be considered as only indicative of the building's compliance with current code requirements. A detailed investigation and analysis of the building will typically be required to provide a definitive assessment.

An IEP score above 34%NBS should be considered sufficient to classify the building as not earthquake prone. However, if further information comes available reassessment may be required.

Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA}

Page 1

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.*

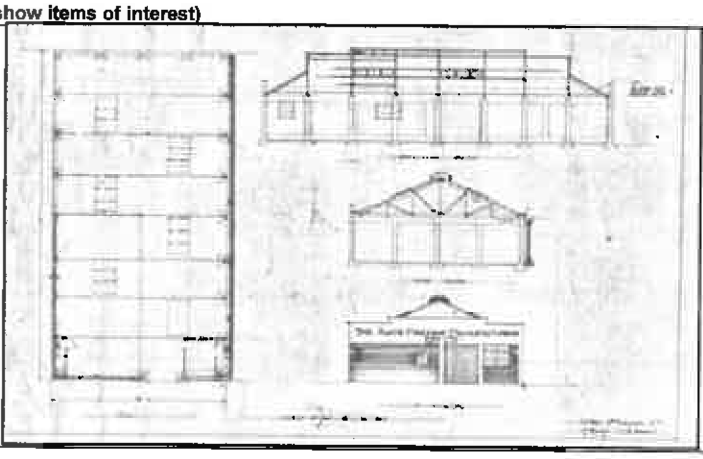
Street Number & Name:	61 Ward St	Job No.:	140307
AKA:		By:	Nigel
Name of building:		Date:	10/03/2014
City:	Dunedin	Revision No.:	0

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 ☑
Visual Inspection of Interior ☑
Drawings (note type) ☑

Specifications ☐
Geotechnical Reports ☐
Other (list) ☐

basic drawings of plan and elevations dated 1930

Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA}

Street Number & Name:	**61 Ward St**	**Job No.:**	**140307**
AKA:		**By:**	**Nigel**
Name of building:		**Date:**	**10/03/2014**
City:	**Dunedin**	**Revision No.:**	**0**

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 ○	Pre 1935 ● 1935-1965 ○ 1965-1976 ○ 1976-1984 ○ 1984-1992 ○ 1992-2004 ○ 2004-2011 ○ Post Aug 2011 ○
Building Type:	Others	Others
Seismic Zone:		
c) Soil Type		
From NZS1170.5:2004, Cl 3.1.3 :	D Soft Soil	E Very 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 =	25	25 m
A_c =	1.00	1.00 m^2

		Longitudinal	Transverse
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.

			Longitudinal	Transverse
		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:**	0.80	0.80
***(%NBS)*$_{nom}$ = AxBxCxD**		***(%NBS)*$_{nom}$**	2%	2%

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.*

Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA}

Street Number & Name:	**61 Ward St**	**Job No.:**	**140307**
AKA:		**By:**	**Nigel**
Name of building:		**Date:**	**10/03/2014**
City:	**Dunedin**	**Revision No.:**	**0**

Table IEP-2 Initial Evaluation Procedure Step 2 continued

2.2 Near Fault Scaling Factor, Factor E

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

a) Near Fault Factor, *N(T,D)*

(from NZS1170.5:2004, Cl 3.1.6)

b) Factor E = 1/N(T,D)

	Longitudinal	Transverse
N(T,D):	1	1
Factor E:	1.00	1.00

2.3 Hazard Scaling Factor, Factor F

a) Hazard Factor, *Z*, for site

Location: Dunedin

Z = 0.13 (from NZS1170.5:2004, Table 3.3)

Z_{1992} = 0.6 (NZS4203:1992 Zone Factor from accompanying Figure 3.5(b))

Z_{2004} = 0.13 (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:	7.69	7.69

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

	Longitudinal	Transverse
I =	1	1
R_o =	1	1
Importance Level	○ 1 ● 2 ○ 3 ○ 4	○ 1 ● 2 ○ 3 ○ 4
R =	1.0	1.0

d) Factor G = IR_o/R

	Longitudinal	Transverse
Factor G:	1.00	1.00

2.5 Ductility Scaling Factor, Factor H

a) Available Displacement Ductility Within Existing Structure

Comment:

Ductility is actually , this reflects greater damping

b) Factor H

For pre 1976 (maximum of 2) = k_μ

For 1976 onwards = 1

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

	Longitudinal	Transverse
μ =	1.50	1.50
k_μ (pre 1976)	1.29	1.29
1976 onwards	1	1
Factor H:	1.29	1.29

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 = $1/S_p$

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

	Longitudinal	Transverse
Light timber-framed	☐	☐
S_p =	0.85	0.85
Factor I:	1.18	1.18

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

(equals $(\%NBS)_{nom} \times E \times F \times G \times H \times I$)

	Longitudinal	Transverse
$(\%NBS)_b$	27%	27%

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.*

Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA}

Street Number & Name:	**61 Ward St**	**Job No.:**	**140307**
AKA:		**By:**	**Nigel**
Name of building:		**Date:**	**10/03/2014**
City:	**Dunedin**	**Revision No.:**	**0**

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

Comment

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

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.*

Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA}

Street Number & Name:	**61 Ward St**	**Job No.:**	**140307**
AKA:		**By:**	**Nigel**
Name of building:		**Date:**	**10/03/2014**
City:	**Dunedin**	**Revision No.:**	**0**

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: 0.8

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

adjacent to building next door

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 0.8

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

Comment

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 **0.80**

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.*

Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA}

Street Number & Name:	61 Ward St	**Job No.:**	140307
AKA:		**By:**	Nigel
Name of building:		**Date:**	10/03/2014
City:	Dunedin	**Revision No.:**	0

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)	27%	27%
4.2	Performance Achievement Ratio (PAR) (from Table IEP - 2)	1.00	0.80
4.3	PAR x Baseline *(%NBS)* $_b$	25%	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* ≤ 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 N J Harwood Signature

Nigel Harwood Name

45541 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

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.*

Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA}

Page 1a

Street Number & Name:	**61 Ward St**	**Job No.:**	**140307**
AKA:		**By:**	**Nigel**
Name of building:		**Date:**	**10/03/2014**
City:	**Dunedin**	**Revision No.:**	**0**

Table IEP-1a Additional Photos and Sketches

roof trusses on concrete frames and URM walls

timber truss supported on southern wall
no obvious tie from one to the other

URM at least 2 layers of brick mortared together

DAVID LITTLETON
CONSULTING ENGINEER
B. Sc. (Hons), Civil Eng. MIPENZ (Structural), CPEng
1038 Mt. Cargill Rd.
RD 2, Waitati
Dunedin
Phone/ Fax (03) 482-1669

2/1/14

Emma Meggitt
Asset Management Officer
Parks and Recreation Services
Dunedin City Council
PO Box 5045, Moray Place,

Dunedin 9058,

Ref: lt13/047/7

Re: Roberts Park Historic Building
Initial Seismic Assessment

I have completed an Initial Seismic Assessment (ISA) of the Roberts Park Historic building at Littlebourne Rd. using the NZSEE's Initial Evaluation Procedure (IEP). The assessment was carried out after completing a site visit. There are no plans of the building in the DCC records.

The Dunedin City Council's Earthquake Prone Building Policy requires the building to be reviewed using New Zealand Society of Earthquake Engineers (NZSEE) procedure (or equivalent method). This procedure is done in 2 steps. The Initial Earthquake Procedure (IEP) is a reasonably quick and inexpensive procedure that filters out the buildings that are earthquake prone from those that are not. If the ISA shows the building to be less than 33% NBS the building is designated as earthquake prone and a more Detailed Seismic Assessment (DSA) needs to be carried out.

The ISA is considered to provide a relatively quick, high-level and qualitative measure of the building's performance. A more reliable result will be obtained from a Detailed Seismic Assessment (DSA).

Executive Summary

Based on the NZSEE's IEP the building has a rating of 15 % and 30% of the New Building Standard for seismic strength in the longitudinal and transverse directions respectively giving the building a provisional seismic E grade. On this basis the building is potentially earthquake prone (< 34% NBS).

Background to the IEP and Its Limitations

The IEP procedure was developed in 2006 by the New Zealand Society for Earthquake Engineering (NZSEE) and updated in 2013 to reflect experience with its application and as a result of experience in the Canterbury earthquakes. It is a tool to assign a percentage of New Building Standard (*%NBS*) score and associated grade to a building as part of an initial seismic assessment of existing buildings.

The IEP enables territorial authorities, building owners and managers to review their building stock as part of an overall risk management process.

Characteristics and limitations of the IEP include:

- It tends to be somewhat conservative, identifying some buildings as earthquake prone, or having a lower *%NBS* score, which subsequent detailed investigation may indicate is less than actual performance. However, there will be exceptions, particularly when critical structural weaknesses (CSWs) are present that have not been recognised from the level of investigation employed.
- It can be undertaken with variable levels of available information, eg exterior only inspection, structural drawings available or not, interior inspection, etc. The more information available the more representative the IEP result is likely to be. The IEP records the information that has formed the basis of the assessment and consideration of this is important when determining the likely reliability of the result.
- It is an initial, first-stage review. Buildings or specific issues which the IEP process flags as being problematic or as potentially critical structural weaknesses, need further detailed investigation and evaluation. A Detailed Seismic Assessment is recommended if the seismic status of a building is critical to any decision making.
- The IEP assumes that the buildings have been designed and built in accordance with the building standard and good practice current at the time. In some instances, a building may include design features ahead of its time - leading to better than predicted performance. Conversely, some unidentified design or construction issues not picked up by the IEP process may result in the building performing not as well as predicted.
- It is a largely qualitative process, and should be undertaken or overseen by an experienced engineer. It involves considerable knowledge of the earthquake behaviour of buildings, and judgment as to key attributes and their effect on building performance. Consequently, it is possible that the *%NBS* derived for a building by independent experienced engineers may differ.
- An IEP may over-penalise some apparently critical features which could have been satisfactorily taken into account in the design.
- An IEP does not take into account the seismic performance of non-structural items such as ceiling, plant, services or glazing.

Experience to date is that the IEP is a useful tool to identify potential issues and expected overall performance of a building in an earthquake. However, the process and the associated *%NBS* and grade should be considered as only indicative of the building's compliance with current code requirements. A detailed investigation and analysis of the building will typically be required to provide a definitive assessment.

An IEP score above 34*%NBS* should be considered sufficient to classify the building as not earthquake prone. However, if further information comes available reassessment may be required.

New Building Standard

The level of 100% New Building Standard (NBS) means the minimum standard of the current Building Code. Most new buildings are built to higher level than the minimum standard. New buildings are designed:

- primarily for the safety of the occupants
- a working life of 50 years
- Ultimate Limit State (ULS) - to withstand a 1 in 500 return period earthquake. In a ULS size event the building is required to stand without collapse and allow all occupants to be able to leave the building safely. The building after a ULS size event may need to be demolished and re-built. The IEP is based on the ULS.

- Serviceability Limit State (SLS) to withstand a 1 in 25 return period earthquake with only minimal and easily repairable damage.

Building Description

The building was built in 1890. The walls are plastered triple brick. The steep roof is timber framed with a heavy slate roof. In the main room the collar ties are 4.9 m off the floor and approximately 1.8 higher than the eaves.

Seismic Concerns

With high collar ties, the outward `spreading' load of this type of roof framing on the top of the wall can make the wall susceptible to out of plane seismic forces. On the west and north walls there are large cracks in the wall possibly due to some ground movement of the steep slope down to Ravensbourne Rd. The west end wall of the main room has a high wall height to wall thickness ratio (1:20) – susceptible to both in plane and out of plane seismic loads. On the south side there is a high slender brick chimney (approximately 0.6m x 0.6m x 4.5 m high).

EP Factor F Rationale

The IEP procedure has one factor (F on page #5) which is an `engineer' judgment factor. This factor can range from 0 to 2.5.

I have given F = 0.8 in the longitudinal direction and 1.0 in the lateral direction. The rationale behind the F factor this decision is based on:

- seismic concerns stated above
- relax penalty on F factor due to low occupancy/ low risk to human life

IEP 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 10 times the risk that they would be in a similar new building. For buildings that are potentially *Earthquake Risk* (less than 67*%NBS*), but not *Earthquake Prone*, the risk is at least 5 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

Building Grade	Percentage of New Building Strength (*%NBS*)	Approx. Risk Relative to a New Building	Life-safety Risk Description
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 IEP as a grade *E* building and is therefore considered to be a *very high* risk.

The New Zealand Society for Earthquake Engineering (which provides authoritative advice to the legislation makers, and should be considered to represent the consensus view of New Zealand structural engineers) classifies a buildings achieving greater than 67% *NBS* as "Low Risk", and having "Acceptable (improvement may be desirable)" building structural performance.

Seismic Restraint of Non-Structural Items

During an earthquake, the safety of people can be put at risk due to non-structural items falling on them. These items should be adequately seismically restrained, where possible, to the NZS 4219:2009 "The Seismic Performance of Engineering Systems in Buildings".

An assessment has not been made of the bracing of the ceilings, in-ceiling ducting, services and plant. We have also not checked whether tall or heavy furniture has been seismically restrained or not. These issues are outside the scope of this initial assessment but could be the subject of another investigation.

IEP Assessment Results

My ISA assessment for this building, carried out using the IEP indicates an overall score of 15% *NBS* which corresponds to a Grade E building, as defined by the NZSEE building grading scheme. This is below the threshold for Earthquake Prone Buildings (34% *NBS*) as defined by the NZSEE and the New Zealand Building Code. The NZSEE method assumes that collapse of the building would cause injury or death to persons or damage to others property. For this building the occupancy rate is so small that the risk of injury, death or damage to others property is extremely low.

The ISA is considered to provide a relatively quick, high-level and qualitative measure of the building's performance. In order to confirm the seismic performance of this building with more reliability I recommend that a DSA be carried out. A DSA would also investigate other potential weaknesses that may not have been considered in the initial seismic assessment.

I trust this letter and initial seismic assessment meets your current requirements. I would be pleased to discuss further with you any issues raised in this report.

Please do not hesitate to contact me if you would like clarification of any aspect of this letter.

Yours sincerely

D Littleton

David Littleton

CPEng

Encl: IEP Assessment

Initial Evaluation Procedure (IEP) Assessment

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:	Littlebourne Rd	**Job No.:**	13/047/7
AKA:		**By:**	D. Littleton
Name of building:	Roberts Park Historic building	**Date:**	2/01/2014
City:	Dunedin	**Revision No.:**	

Table IEP-1 Initial Evaluation Procedure Step 1

Step 1 - General Information

1.1 Photos (attach sufficient to describe building)

NOTE: THERE ARE MORE SKETCHES ON PAGE 1a ATTACHED

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

The single building was built in 1890. The building is L shaped. Walls are plastered triple brick and roof timber framed with slate tiles. The building is currently used for storage. here is high brick chimeny on the east side aproximately 0.6 m x 0.6 m x 4.5 m high. At one end of the main section of the building there is small timber framed mezzanine floor. At the other end of this main room the exterior north and east walls are badly cracked.The ground to the west slopes steeply down to Littelbourne Rd.

1.4 Note information sources Tick as appropriate

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

Initial Evaluation Procedure (IEP) Assessment

Street Number & Name:	**Littlebourne Rd**	**Job No.:**	**13/047/7**
AKA:		**By:**	**D. Littleton**
Name of building:	**Roberts Park Historic building**	**Date:**	**2/01/2014**
City:	**Dunedin**	**Revision No.:**	

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 ○	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 :	C Shallow Soil	C Shallow 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	6 m
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: $T \leq 0.4\text{sec}$	●	●
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:**	0.04	0.04
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:**	0.80	0.80
$(\%NBS)_{nom}$ = AxBxCxD — $(\%NBS)_{nom}$	3%	3%

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.*

Initial Evaluation Procedure (IEP) Assessment

Street Number & Name:	**Littlebourne Rd**	**Job No.:**	**13/047/7**
AKA:		**By:**	**D. Littleton**
Name of building:	**Roberts Park Historic building**	**Date:**	**2/01/2014**
City:	**Dunedin**	**Revision No.:**	

Table IEP-2 Initial Evaluation Procedure Step 2 continued

2.2 Near Fault Scaling Factor, Factor E

If $T \le 1.5$sec, 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: Dunedin

$Z =$ 0.13 (from NZS1170.5:2004, Table 3.3)

$Z_{1992} =$ 0.6 (NZS4203:1992 Zone Factor from accompanying Figure 3.5(b))

$Z_{2004} =$ 0.13 (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:	7.69	7.69

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
a)	I =	1.25	1.25
b)	R_o =	1	1
c)	R =	1.0	1.0
d)	Factor G:	1.25	1.25

2.5 Ductility Scaling Factor, Factor H

a) Available Displacement Ductility Within Existing Structure

Comment:

b) Factor H

		Longitudinal	Transverse
a)	μ =	1.00	1.00
b)		k_μ	k_μ
For pre 1976 (maximum of 2)	=	1.00	1.00
For 1976 onwards	=	1	1
	Factor H:	1.00	1.00

(where kμ 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 = $1/S_p$

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

		Longitudinal	Transverse
a)	S_p =	1.00	1.00
b)	Factor I:	1.00	1.00

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

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

Longitudinal	Transverse
28%	28%

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.*

Initial Evaluation Procedure (IEP) Assessment

Street Number & Name: Littlebourne Rd
AKA:
Name of building: Roberts Park Historic building
City: Dunedin

Job No.: 13/047/7
By: D. Littleton
Date: 2/01/2014
Revision No.:

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** 0.7

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

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

Comment

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 0.8

Record rationale for choice of Factor F:

The lateral capcity of the building has been compromised by large cracks in the north and east walls of the main room.

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

PAR
Longitudinal **0.56**

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.*

Initial Evaluation Procedure (IEP) Assessment

Street Number & Name:	**Littlebourne Rd**	**Job No.:**	**13/047/7**
AKA:		**By:**	**D. Littleton**
Name of building:	**Roberts Park Historic building**	**Date:**	**2/01/2014**
City:	**Dunedin**	**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
Comment				

3.6 Other Factors - *for allowance of all other relevant characteristics 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:

The lateral walls in this direction are more evenly and closer spaced

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

PAR
Transverse **1.00**

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.*

Initial Evaluation Procedure (IEP) Assessment

Street Number & Name:	Littlebourne Rd	**Job No.:**	13/047/7
AKA:		**By:**	D. Littleton
Name of building:	Roberts Park Historic building	**Date:**	2/01/2014
City:	Dunedin	**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)	28%	28%
4.2	**Performance Achievement Ratio (PAR)** (from Table IEP - 2)	0.56	1.00
4.3	**PAR x Baseline *(%NBS)*$_b$**	15%	30%
4.4	**Percentage New Building Standard *(%NBS)*** (Use lower of two values from Step 4.3)		15%

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 E

Additional Comments (items of note affecting IEP score)

The building is used for storage in the smaller rooms with likely very occasional presence of staff. The larger room does not appear to be used. The larger room is the higher risk of collapse in a seismic event. If the building continues to be used with ver low occupancy the risk to human injury or life would be extremley small. Collapse of the building causing damage to adjoining property is also small. The building Act defines an earthquake prone building as one that having regard to its condition and to the ground on which it is built, and because of its construction, the building—(a) will have its ultimate capacity exceeded in a moderate earthquake (as defined in the regulations); and (b) would be likely to collapse causing—
(i) injury or death to persons in the building or to persons on any other property; or (ii) damage to any other property.
The building is very close to the property line with 32 Littbourne Rd but not close to the neighbours house.

Evaluation Confirmed by **Signature**

David Littleton **Name**

138914 **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**

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.*

Initial Evaluation Procedure (IEP) Assessment

Page 1a

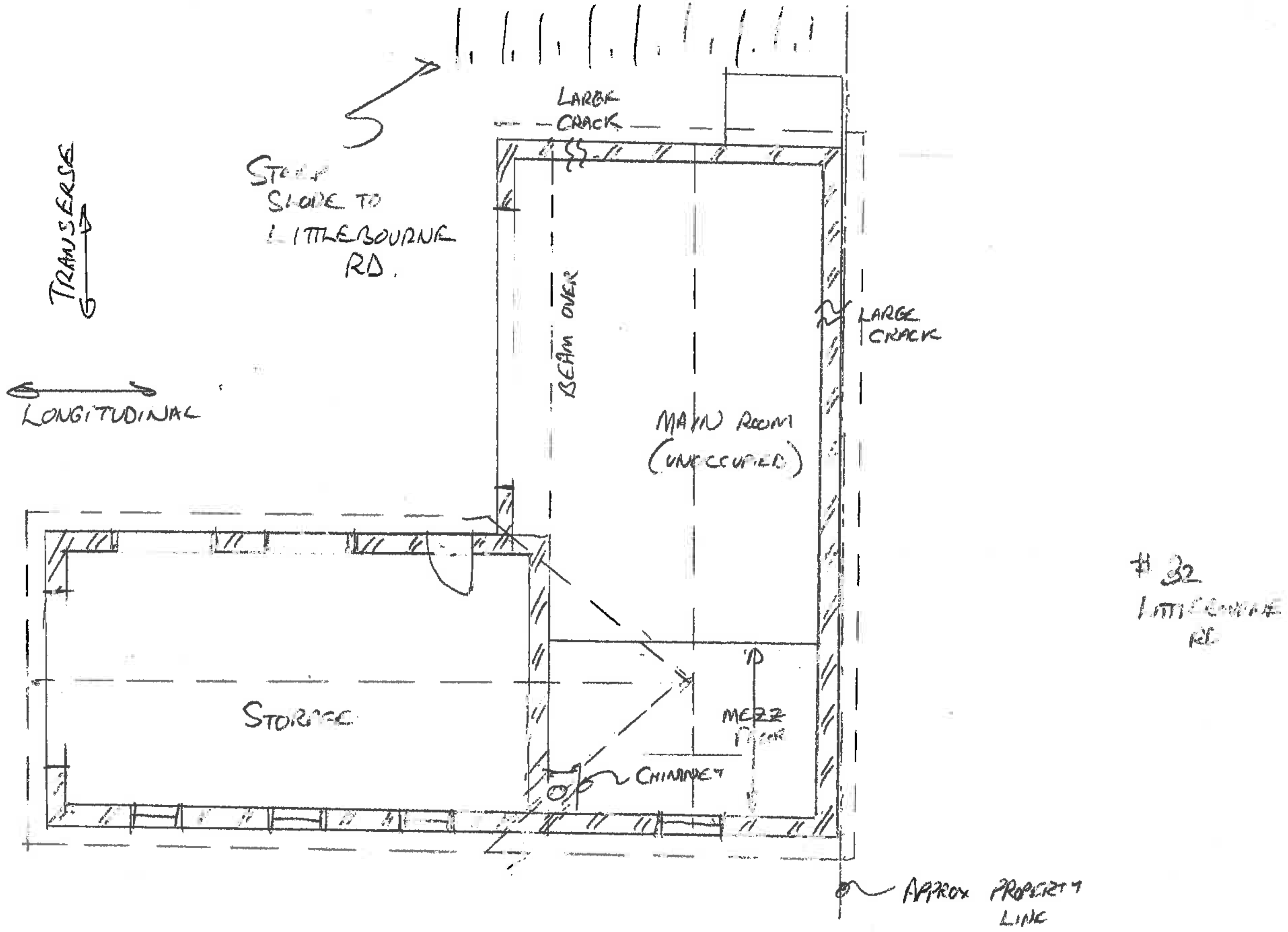
Street Number & Name:	Littlebourne Rd	**Job No.:**	13/047/7
AKA:		**By:**	D. Littleton
Name of building:	Roberts Park Historic building	**Date:**	2/01/2014
City:	Dunedin	**Revision No.:**	

Table IEP-1a Additional Photos and Sketches

Add any additional photographs, notes or sketches required below:

Note: print this page separately

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.*



STRUCTURAL DESIGN
DAVID LITTLETON

David Littleton
B. Sc. (Hons) Civil Eng.
MIPENZ (Structural), CPEng
1036 Mt Cargill Rd, RD2 Waitati, Dunedin
Phone & Facsimile (03) 482-1669
Mobile (027) 4366-239

ISA – Roberts Park Historic building
Littelbourne Rd., Dunedin

Notes: 1/ This drawing is copyright ©of David Littleton
2/ Contractor must verify all dimensionson on site
3/ Do not scale drawings

Issue	Date	Amendment
1	2/1/14	
–	__/__/__	
–	__/__/__	–
–	/ /	–

Sheet
S1
Job No.
13/047/7

DAVID LITTLETON

CONSULTING ENGINEER
B. Sc. (Hons), Civil Eng. MIPENZ (Structural), CPEng
1038 Mt. Cargill Rd.
RD 2, Waitati
Dunedin
Phone/ Fax (03) 482-1669

2/1/14

Emma Meggitt
Asset Management Officer
Parks and Recreation Services
Dunedin City Council
PO Box 5045, Moray Place,

Dunedin 9058,

Ref: lt13/047/8b

Re: Tonga Park Change Rooms, Toilets & Club Room
Initial Seismic Assessment

I have completed an Initial Seismic Assessment (ISA) of the Tonga Park Change Rooms, Toilets & Clubroom at Surrey St. using the NZSEE's Initial Evaluation Procedure (IEP). The assessment was carried out after completing a site visit examining the outside only. The plans of the building in the DCC records were reviewed.

The Dunedin City Council's Earthquake Prone Building Policy requires the building to be reviewed using New Zealand Society of Earthquake Engineers (NZSEE) procedure (or equivalent method). This procedure is done in 2 steps. The Initial Earthquake Procedure (IEP) is a reasonably quick and inexpensive procedure that filters out the buildings that are earthquake prone from those that are not. If the ISA shows the building to be less than 33% NBS the building is designated as earthquake prone and a more Detailed Seismic Assessment (DSA) needs to be carried out.

The ISA is considered to provide a relatively quick, high-level and qualitative measure of the building's performance. A more reliable result will be obtained from a Detailed Seismic Assessment (DSA).

Executive Summary

Based on the NZSEE's IEP the building has a rating of 15 %in the longitudinal direction & 20 % in the transverse direction of the New Building Standard for seismic strength giving the building a provisional seismic E grade. On this basis the building is potentially earthquake prone (< 34% NBS).

Background to the IEP and Its Limitations

The IEP procedure was developed in 2006 by the New Zealand Society for Earthquake Engineering (NZSEE) and updated in 2013 to reflect experience with its application and as a result of experience in the Canterbury earthquakes. It is a tool to assign a percentage of New Building Standard (*%NBS*) score and associated grade to a building as part of an initial seismic assessment of existing buildings.

The IEP enables territorial authorities, building owners and managers to review their building stock as part of an overall risk management process.

Characteristics and limitations of the IEP include:

- It tends to be somewhat conservative, identifying some buildings as earthquake prone, or having a lower *%NBS* score, which subsequent detailed investigation may indicate is less than actual performance. However, there will be exceptions, particularly when critical structural weaknesses (CSWs) are present that have not been recognised from the level of investigation employed.
- It can be undertaken with variable levels of available information, eg exterior only inspection, structural drawings available or not, interior inspection, etc. The more information available the more representative the IEP result is likely to be. The IEP records the information that has formed the basis of the assessment and consideration of this is important when determining the likely reliability of the result.
- It is an initial, first-stage review. Buildings or specific issues which the IEP process flags as being problematic or as potentially critical structural weaknesses, need further detailed investigation and evaluation. A Detailed Seismic Assessment is recommended if the seismic status of a building is critical to any decision making.
- The IEP assumes that the buildings have been designed and built in accordance with the building standard and good practice current at the time. In some instances, a building may include design features ahead of its time - leading to better than predicted performance. Conversely, some unidentified design or construction issues not picked up by the IEP process may result in the building performing not as well as predicted.
- It is a largely qualitative process, and should be undertaken or overseen by an experienced engineer. It involves considerable knowledge of the earthquake behaviour of buildings, and judgment as to key attributes and their effect on building performance. Consequently, it is possible that the *%NBS* derived for a building by independent experienced engineers may differ.
- An IEP may over-penalise some apparently critical features which could have been satisfactorily taken into account in the design.
- An IEP does not take into account the seismic performance of non-structural items such as ceiling, plant, services or glazing.

Experience to date is that the IEP is a useful tool to identify potential issues and expected overall performance of a building in an earthquake. However, the process and the associated *%NBS* and grade should be considered as only indicative of the building's compliance with current code requirements. A detailed investigation and analysis of the building will typically be required to provide a definitive assessment.

An IEP score above 34*%NBS* should be considered sufficient to classify the building as not earthquake prone. However, if further information comes available reassessment may be required.

New Building Standard

The level of 100% New Building Standard (NBS) means the minimum standard of the current Building Code. Most new buildings are built to higher level than the minimum standard. New buildings are designed:

- primarily for the safety of the occupants
- a working life of 50 years
- Ultimate Limit State (ULS) - to withstand a 1 in 500 return period earthquake. In a ULS size event the building is required to stand without collapse and allow all

occupants to be able to leave the building safely. The building after a ULS size event may need to be demolished and re-built. The IEP is based on the ULS.

- Serviceability Limit State (SLS) to withstand a 1 in 25 return period earthquake with only minimal and easily repairable damage.

Building Description

The original change rooms were designed in 1963. The design date for the clubroom addition is not known but is estimated to be late 1960's. The building has wide concrete footings (750 wide) on soft ground. Walls are concrete blockwork 20 series to exterior and 100 mm to interior partitions. It was not determined if the 20 series blockwork is reinforced or grout filled. The roof is timber trusses and corrugated steel. The ground conditions are expected to be `soft'.

Seismic Concerns

The water tank on the roof does not appear (as viewed from the ground) to be braced or restrained. Partition 100 mm concrete block walls face load capacity will depend on how well they are fixed to the ceiling/ roof framing. The building is L shape and the wing with change rooms # 3 to 6 has a high length to width ratio.

EP Factor F Rationale

The IEP procedure has one factor (F on page #5) which is an `engineer' judgment factor. This factor can range from 0 to 2.5.

I have given F = 0.8 in both the longitudinal direction and the transverse direction. The rationale behind the F factor this decision is based on:

- the 100 mm concrete block partitions are not expected to perform well under face loads
- building L shape has been penalised i(factor A) but offsetting this there are a large amount of walls dividing spaces into small cubicles
- roof is light and aside from the water tank, there are no high level seismic risk appendages
- the stand alone wall to one side of the drive through has no return walls and relies on cantilever (reinforcing?) and or lateral support form roof structure (fixing?
- the wall reinforcing (if any) to the blockwork is not known

IEP 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 10 times the risk that they would be in a similar new building. For buildings that are potentially *Earthquake Risk* (less than 67*%NBS*), but not *Earthquake Prone,* the risk is at least 5 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

Building Grade	Percentage of New Building Strength (%NBS)	Approx. Risk Relative to a New Building	Life-safety Risk Description
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 IEP as a grade *E* building and is therefore considered to be a *very high* risk.

The New Zealand Society for Earthquake Engineering (which provides authoritative advice to the legislation makers, and should be considered to represent the consensus view of New Zealand structural engineers) classifies a buildings achieving greater than 67% *NBS* as "Low Risk", and having "Acceptable (improvement may be desirable)" building structural performance.

Seismic Restraint of Non-Structural Items

During an earthquake, the safety of people can be put at risk due to non-structural items falling on them. These items should be adequately seismically restrained, where possible, to the NZS 4219:2009 "The Seismic Performance of Engineering Systems in Buildings".

An assessment has not been made of the bracing of the ceilings, in-ceiling ducting, services and plant. We have also not checked whether tall or heavy furniture has been seismically restrained or not. These issues are outside the scope of this initial assessment but could be the subject of another investigation.

IEP Assessment Results

My ISA assessment for this building, carried out using the IEP indicates an overall score of 15% *NBS* which corresponds to a Grade E building, as defined by the NZSEE building grading scheme. This is below the threshold for Earthquake Prone Buildings (34% *NBS*) as defined by the NZSEE and the New Zealand Building Code.

The ISA is considered to provide a relatively quick, high-level and qualitative measure of the building's performance. In order to confirm the seismic performance of this building with more reliability I recommend that a DSA be carried out.

I trust this letter and initial seismic assessment meets your current requirements. I would be pleased to discuss further with you any issues raised in this report.

Please do not hesitate to contact me if you would like clarification of any aspect of this letter.

Yours sincerely

David Littleton

CPEng

Encl: IEP Assessment

Initial Evaluation Procedure (IEP) Assessment

Page 1

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:	**Surrey St.**	**Job No.:**	**13/047/8b**
AKA:		**By:**	**D. Littleton**
Name of building:	**Tonga Park Change rooms, Toilets, Clubroom**	**Date:**	**2/01/2014**
City:	**Dunedin**	**Revision No.:**	

Table IEP-1 Initial Evaluation Procedure Step 1

Step 1 - General Information

1.1 Photos (attach sufficient to describe building)

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

The building is 20 series exterior concrete block on wide (750 mm) concrete footings. Interior partitions are 100 concrete block Ground is likely to be soft. Roof is light metal on timber rafters and trusses.

1.4 Note information sources Tick as appropriate

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

Initial Evaluation Procedure (IEP) Assessment

Street Number & Name:	**Surrey St.**	**Job No.:**	**13/047/8b**
AKA:		**By:**	**D. Littleton**
Name of building:	**Tonga Park Change rooms, Toilets, Clubroom**	**Date:**	**2/01/2014**
City:	**Dunedin**	**Revision No.:**	

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 =	3	3 m
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):	○	○
T:	0.40	0.40

Where h_n = height in metres from the base of the structure to the uppermost seismic weight or mass.

			Longitudinal	**Transverse**
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%

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.*

Initial Evaluation Procedure (IEP) Assessment

Street Number & Name:	Surrey St.	**Job No.:**	13/047/8b
AKA:		**By:**	D. Littleton
Name of building:	Tonga Park Change rooms, Toilets, Clubroom	**Date:**	2/01/2014
City:	Dunedin	**Revision No.:**	

Table IEP-2 Initial Evaluation Procedure Step 2 continued

2.2 Near Fault Scaling Factor, Factor E
If $T \leq 1.5$sec, 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: Dunedin

Z = 0.13 (from NZS1170.5:2004, Table 3.3)
Z_{1992} = 0.6 (NZS4203:1992 Zone Factor from accompanying Figure 3.5(b))
Z_{2004} = 0.13 (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:	7.69	7.69

2.4 Return Period Scaling Factor, Factor G

		Longitudinal	Transverse
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.)	I =	1.25	1.25
b) Design Risk Factor, R_o (set to 1.0 if other than 1976-2004, or not known)	R_o =	1	1
c) Return Period Factor, R (from NZS1170.0:2004 Building Importance Level)	*Choose Importance Level*	○1 ●2 ○3 ○4	○1 ●2 ○3 ○4
	R =	1.0	1.0
d) Factor G = IR_o/R	Factor G:	1.25	1.25

2.5 Ductility Scaling Factor, Factor H

		Longitudinal	Transverse
a) Available Displacement Ductility Within Existing Structure *Comment:*	μ =	1.00	1.00
b) Factor H		k_μ	k_μ
For pre 1976 (maximum of 2)	=	1.00	1.00
For 1976 onwards	=	1	1
	Factor H:	1.00	1.00

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

2.6 Structural Performance Scaling Factor, Factor I

		Longitudinal	Transverse
a) Structural Performance Factor, S_p (from accompanying Figure 3.4) Tick if light timber-framed construction in this direction		☐	☐
	S_p =	1.00	1.00
b) Structural Performance Scaling Factor = $1/S_p$	Factor I:	1.00	1.00

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

	Longitudinal	Transverse
2.7 Baseline %NBS for Building, *(%NBS)$_b$* (equals $(\%NBS)_{nom}$ x E x F x G x H x I)	27%	27%

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.*

Initial Evaluation Procedure (IEP) Assessment

Street Number & Name: Surrey St.
AKA:
Name of building: Tonga Park Change rooms, Toilets, Clubroom
City: Dunedin
Job No.: 13/047/8b
By: D. Littleton
Date: 2/01/2014
Revision No.:

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** 0.7
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

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
Comment

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** 0.8

Record rationale for choice of Factor F:
Reinforcing and grout fill to concrete block is not known but building is well maintained. Face loads on 100 conc block partition walls susceptible particularly wall between change rooms # 1 & 2. Water tank lack of restraint

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

PAR
Longitudinal 0.56

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.*

Initial Evaluation Procedure (IEP) Assessment

Street Number & Name:	**Surrey St.**	**Job No.:**	**13/047/8b**
AKA:		**By:**	**D. Littleton**
Name of building:	**Tonga Park Change rooms, Toilets, Clubroom**	**Date:**	**2/01/2014**
City:	**Dunedin**	**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

Comment

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 0.80

Record rationale for choice of Factor F:

Reinforcing and grout fill to concrete block is not known but building is well maintained, very simple in plan and small footprint.
Face loads on 100 mm conc blk partitions susceptible . Stand alone wall at side drive

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

PAR
Transverse **0.80**

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.*

Initial Evaluation Procedure (IEP) Assessment

Street Number & Name:	Surrey St.	**Job No.:**	13/047/8b
AKA:		**By:**	D. Littleton
Name of building:	Tonga Park Change rooms, Toilets, Clubroom	**Date:**	2/01/2014
City:	Dunedin	**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)	27%	27%
4.2	Performance Achievement Ratio (PAR) (from Table IEP - 2)	0.56	0.80
4.3	PAR x Baseline *(%NBS)*$_b$	15%	20%
4.4	Percentage New Building Standard *(%NBS)* (Use lower of two values from Step 4.3)		15%

Step 5 - Potentially Earthquake Prone? *%NBS* ≤ 34 YES

(Mark as appropriate)

Step 6 - Potentially Earthquake Risk? *%NBS* < 67 YES

(Mark as appropriate)

Step 7 - Provisional Grading for Seismic Risk based on IEP

Seismic Grade E

Additional Comments (items of note affecting IEP score)

Evaluation Confirmed by ____________ **Signature**

David Littleton **Name**

138914 **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

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.*

Initial Evaluation Procedure (IEP) Assessment

Page 1a

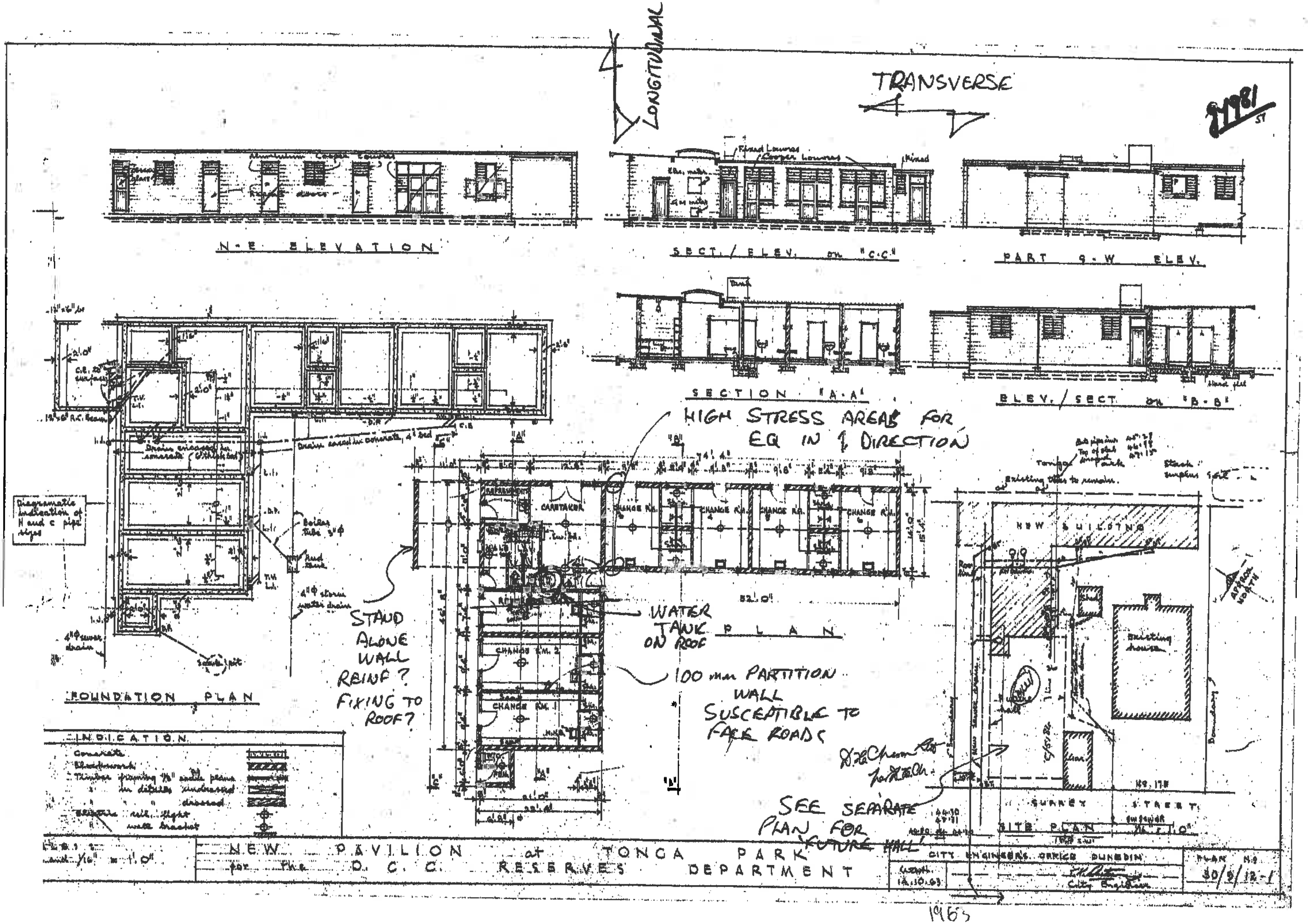
Street Number & Name:	Surrey St.	**Job No.:**	13/047/8b
AKA:		**By:**	D. Littleton
Name of building:	Tonga Park Change rooms, Toilets, Clubroom	**Date:**	2/01/2014
City:	Dunedin	**Revision No.:**	

Table IEP-1a Additional Photos and Sketches

Add any additional photographs, notes or sketches required below:

Note: print this page separately

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.*



NEW PAVILION at TONGA PARK
for the D. C. C. RESERVES DEPARTMENT

SCALE 1/8" = 1'.0"

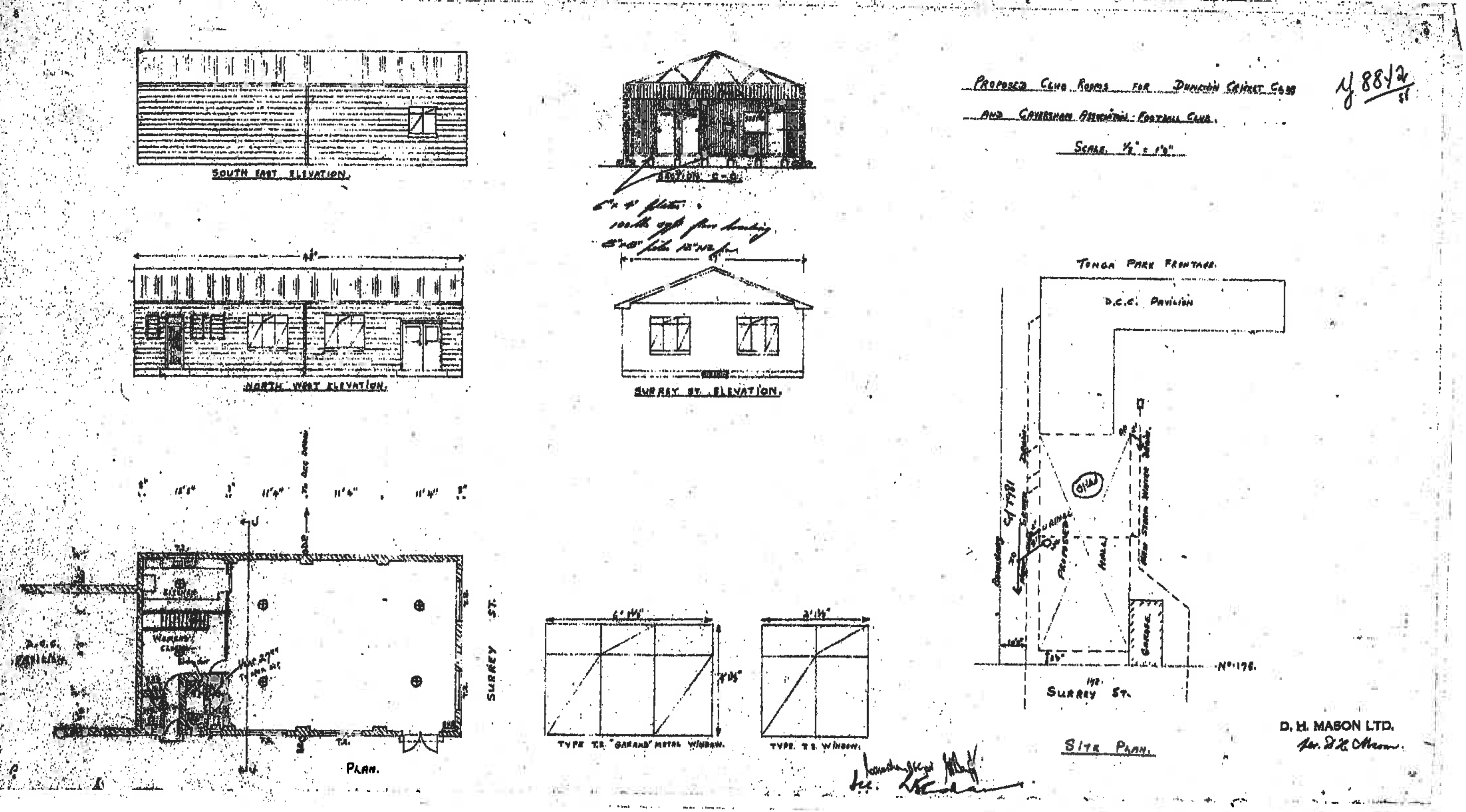
CITY ENGINEER'S OFFICE DUNEDIN
City Engineer
14.10.63

PLAN No 30/9/12-1

Y 88/2
51

PROPOSED CLUB ROOMS FOR DUNEDIN CRICKET CLUB
AND CAVERSHAM ASSOCIATION FOOTBALL CLUB.

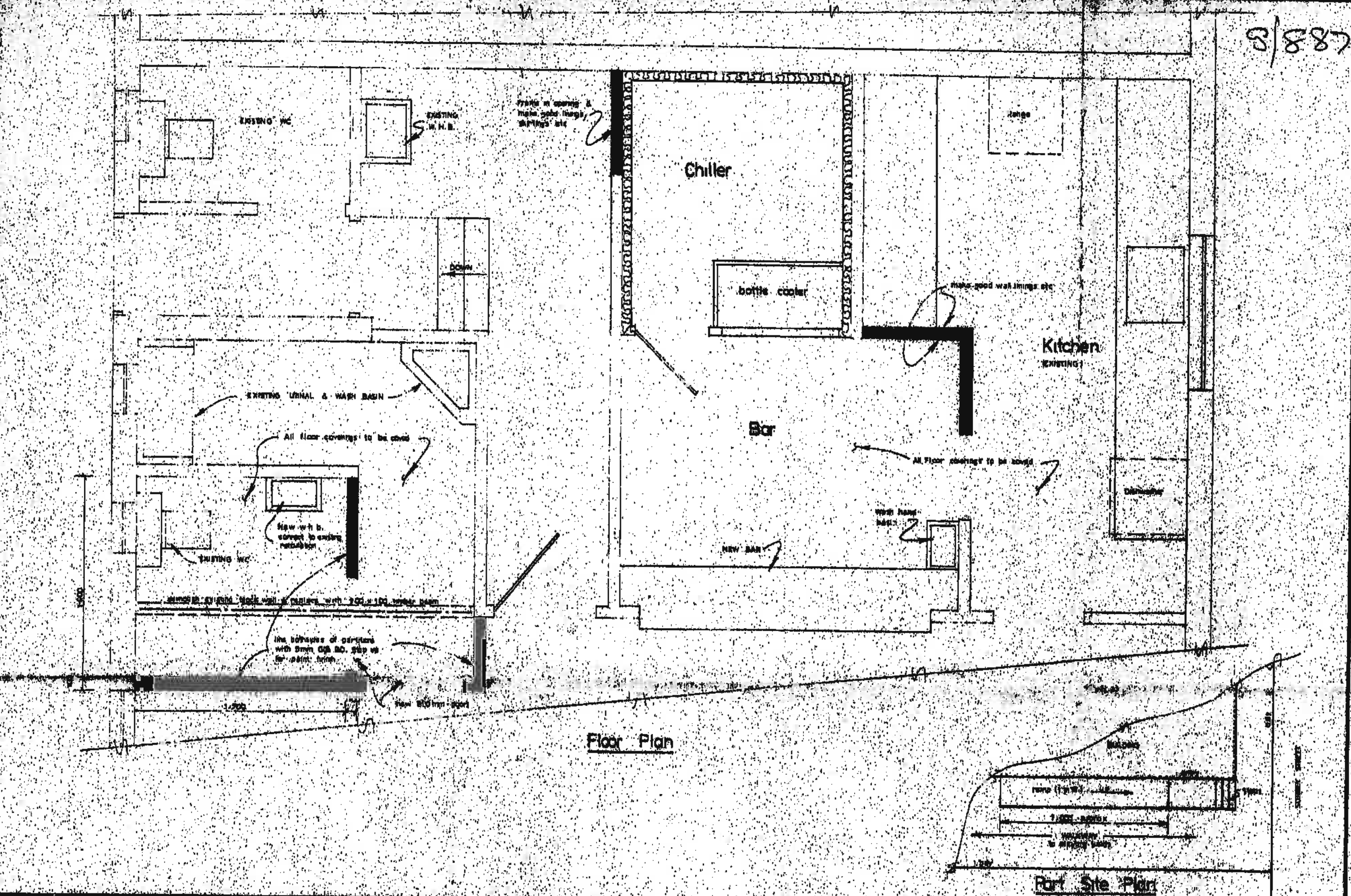
SCALE. 1/2" = 1'0"



D. H. MASON LTD.
per D H Mason

Dave ?

8/8872

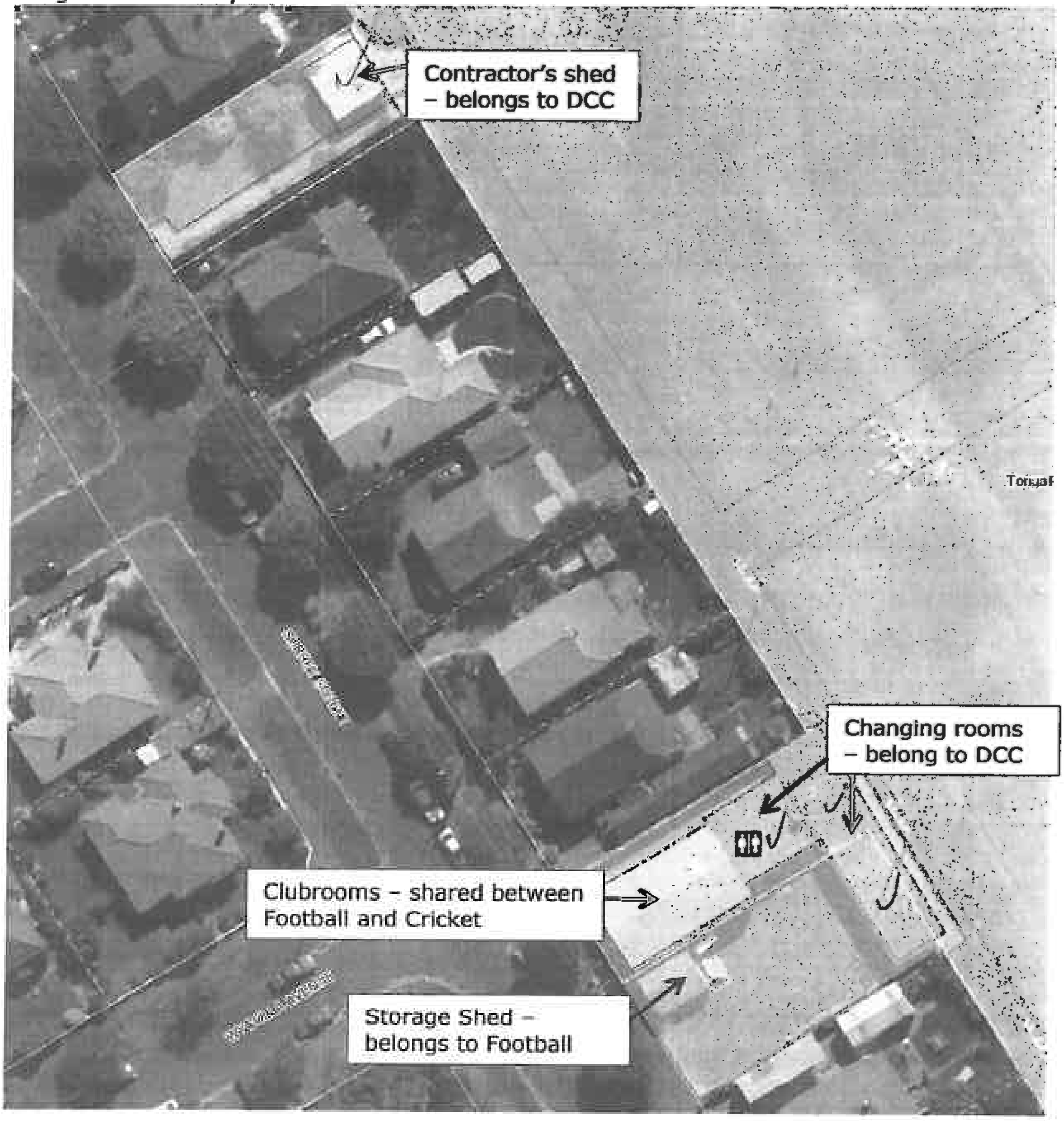


PROPOSED ALTERATIONS to the TONGA PARK CLUB ROOMS at SURREY STREET, DUNEDIN.

Design & Plan Service

1990

Tonga Park – Surrey Street



PO Box 13960, Armagh Street
ANZ Centre 267 High Street, Christchurch 8141, New Zealand
T: +64 3 366 3521 // **F:** +64 3 366 3188
E: info@beca.com // **www.beca.com**

Dunedin City Council
PO Box 5045
Dunedin
New Zealand

22 August 2017

Attention: Laura McElhone
CC: David Carpenter

Dear Laura

Initial Seismic Assessment Report - Sammy's Entertainment Venue

We have now completed an Initial Seismic Assessment (ISA) of the building at 65 Crawford Street, Dunedin using the Initial Evaluation Procedure (IEP) as described in Part B of the guidance document *The Seismic Assessment of Existing Buildings - Technical Guidelines for Engineering Assessments*, dated July 2017 (*Technical Guidelines*). The assessment was carried out after completing a site visit, an internal and external walk over visual non-intrusive inspection and a review of the available plan drawings.

1 Executive Summary

The building at 65 Crawford Street, known as Sammy's Entertainment Venue, formerly His Majesty's Theatre (hereafter referred to as Sammy's) is a large unreinforced masonry brick building constructed in 1897. Based on the IEP method, Sammy's has a potential seismic rating of 10-25%NBS (IL3). The building has been assessed on the basis that it is an Importance Level 3 (IL3) building in accordance with the New Zealand Loadings Standard, NZS1170, as it can accommodate crowds of greater than 300 people.

Sammy's corresponds to a Grade D/E building as defined by the New Zealand Society for Earthquake Engineering (NZSEE) building grading scheme. This is less than the minimum threshold for earthquake prone buildings (34% NBS) and less than the threshold for earthquake risk buildings (67% NBS). This could be regarded as exposing the occupants to a high to very high seismic risk.

The ISA is considered to provide a relatively quick, high-level and qualitative measure of the building's seismic rating. A more reliable result will be obtained from a Detailed Seismic Assessment (DSA). A DSA could find Critical Structural Weaknesses (CSWs) not identified from the IEP, or that a feature initially identified as a potential Critical Structural Weakness has been addressed in the design of the building.

Further investigation of the building structure is recommended to allow for a Detailed Seismic Assessment (DSA) to be undertaken.

2 Introduction

The Dunedin City Council requested Beca to prepare an Initial Seismic Assessment for the Sammy's Entertainment Venue, located at 65 Crawford Street, Dunedin, using the IEP procedure, while also providing background information on the Initial Evaluation Procedure and its limitations. This report has been prepared in response to this request.

3 Background to the IEP Process

The IEP procedure was developed in 2006 by the New Zealand Society for Earthquake Engineering (NZSEE) and updated in 2017 to reflect experience with its application and also as a result of experience from the Canterbury earthquakes of 2010/11. It is a tool to assign a percentage of New Building Standard (%NBS) rating and associated grade to a building as part of an Initial Seismic Assessment of existing buildings.

The IEP enables building owners and managers to review their building stock as part of an overall risk management process.

Characteristics and limitations of the IEP process include:

- An IEP assessment is primarily concerned with life safety. It does not consider the susceptibility of the building to damage and therefore to economic losses (i.e. not assessed for SLS limit state).
- It tends to be somewhat conservative identifying some buildings as earthquake prone, or having a lower %NBS seismic rating, while subsequent detailed investigation may indicate they are likely to perform better than anticipated. However, there will be exceptions, particularly when critical structural weaknesses (CSWs) are present that have not been recognised from the level of investigation employed.
- It can be undertaken with variable levels of available information (e.g.) exterior only inspection, structural drawings available or not, interior inspection, etc. The more information available the more representative the IEP result is likely to be. The IEP records information that has formed the basis of the assessment and consideration of this is important when determining the likely reliability of the result.
- It is an initial, first-stage review. Buildings, or specific issues within a building which the IEP process flags as being potentially problematic or as potential critical structural weaknesses, need further detailed investigation and evaluation. A Detailed Seismic Assessment (DSA) is recommended if the status of a building is critical to any decision making.
- The IEP assumes that the building has been designed and built in accordance with the building standard and good practice current at the time. In some instances, a building may include design features ahead of its time - leading to a potentially better than predicted performance. Conversely, some unidentified design or construction issues not picked up by the IEP process may result in the building performing not as well as predicted.
- It is a largely qualitative process, and should be undertaken or overseen by an experienced engineer. It involves considerable knowledge of the earthquake behaviour of buildings, and judgement as to key attributes and their effect on building performance. Consequently, it is possible that the %NBS derived for a building by independent experienced engineers may differ.
- An IEP may over-penalise some apparently critical features which could have been satisfactorily taken into account in the building's design.
- An IEP does not take into account the seismic performance of non-structural items such as ceiling, plant, services or glazing.

Experience to date is that the IEP is a useful tool to identify potential issues and expected overall performance of a building in an earthquake. However, the process and the associated %NBS and grade should be considered as indicative only. A more detailed investigation and analysis of the building will typically be required to provide a definitive assessment and come up with concept seismic improvement strategies.

The IEP has been based on a review of drawings and an inspection of both the interior and exterior of the building and can be considered to be a comprehensive assessment at the ISA level. The rating determined is less than 34%NBS and therefore, if ratified by the TA, the building should be considered as earthquake prone.

4 Basis for the Assessment

The information we have used for our IEP assessment includes:

- A review of plan drawings obtained from Dunedin City Council Property Files. We received the following drawings:
  - City Surveyors, Dunedin N.Z.: His Majesty's Theatre Crawford St (1907).

  - J. R. G. Hanlon & Partners: His Majesty's Theatre – Dunedin – Development For Use As A Licensed Restaurant Cabaret (1983).
- A site visual inspection conducted on 19 July 2017 of the building interior and exterior which confirmed the nature of the building and relationship to surrounding buildings. The inspection was limited to areas where safe ready access was available to:
  - Confirm the as-constructed buildings were consistent with the drawings and documentation.
  - Identify potential critical structural weaknesses, or irregularities able to be observed.
  - Identify, where possible, items of significant deterioration which might affect %NBS assessment.
- The assessment of the soils under the building have been based on information from the 2004 "Seismic Risk in the Otago Region" maps produced by Opus for the Otago Regional Council.

5 Building Description

Summary information about Sammy's is given in Table 1.

Table 1: Building Summary Information for Sammy's

Item	Details	Notes
Building Name	Sammy's Entertainment Venue	Formerly His Majesty's Theatre. Herein referred to as Sammy's.
Street Address	65 Crawford Street, Dunedin	
Building Area	Approx. gross total area of 1400m^2	Total building foot print of 36m x 25m (900m^2). Gallery area of 275m^2 and basement area under the stage of 220m^2.
Age	120 years old (built in 1897)	Known modifications in 1983 to internal layout. Various unknown alterations include removing the theatre seating and strengthening to some perimeter brick walls.
No. of Storeys / Basements	Single storey with mezzanine and basement under the stage.	
Occupancy / Use	Currently unoccupied.	Previously used as a music venue.
Gravity System	Lightweight metal sheeting on timber purlins spanning onto steel trusses (I-beam rafters and steel rod bottom chord and ties) onto unreinforced masonry brick walls.	Piers at truss locations and at regular intervals on rear wall behind stage.
Lateral Stability System	Solid unreinforced masonry brick perimeter walls.	No drawings of the construction details are available.
Foundation System	Assumed to be concrete strip footings with an unreinforced slab on grade floor.	
Other Notable Features	Existing strengthening work to building includes the addition of two lattice truss steel columns to the northwest elevation, and flat steel plate straps at eaves and roof level on both gable end walls.	
Construction Information	Floor plans from 1907 survey and 1983 internal layout modifications.	

5.1 Site Soil Parameters

A site subsoil class D, deep or soft soils (NZS1170.5) has been adopted for our assessment based on the 2004 “Ground Class Dunedin Area” map. The “Liquefaction & Settlement Susceptibility Dunedin Area” map indicates that the site is “Possibly Susceptible” to liquefaction. Both these maps have been produced by Opus for the Otago Regional Council. We have relied on this information in the absence of a site-specific geotechnical investigation. Geotechnical investigation could be undertaken to determine the actual site soil conditions.

Figure 1: Site Location Plan, Sammy’s Entertainment Venue (DCC WebMap)

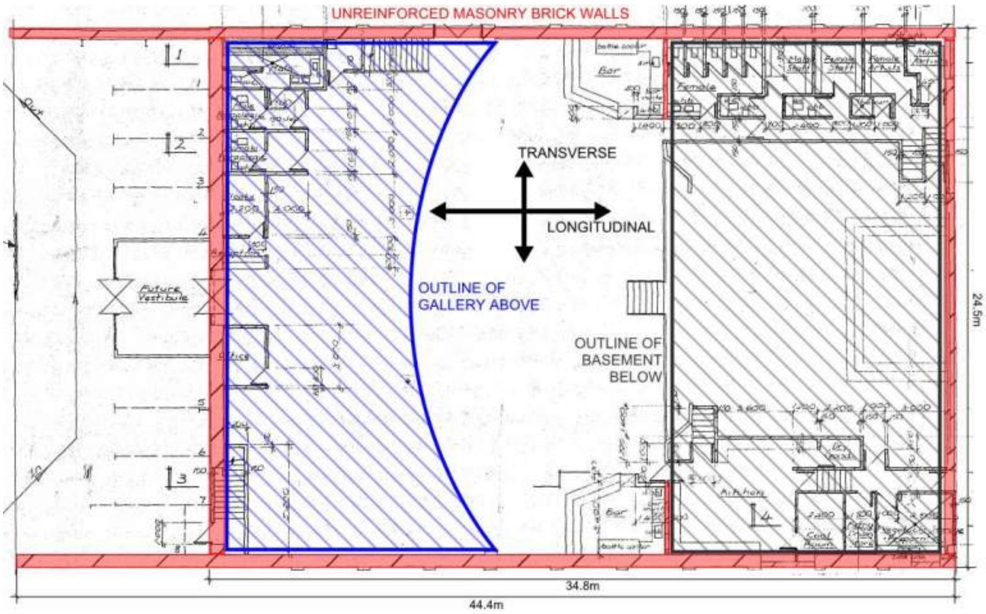


Figure 2: Key Elements in Building

6 IEP Assessment Results

Our IEP assessment of Sammy’s indicates the building can achieve 37%NBS(IL3) in the longitudinal direction and 25%NBS (IL3) in the transverse direction. The IEP assessment of this building therefore indicates an overall potential seismic rating of 25%NBS(IL3), corresponding to a ‘Grade D’ building as defined by the New Zealand Society for Earthquake Engineering (NZSEE) building grading scheme.

The key assumptions made during our assessment are shown in the table below. Refer also to the attached IEP assessment.

Table 2: Sammy’s IEP Assessment Results

IEP Item	Assumption	Justification
Date of Building Design	Pre-1935 Category	The building was originally constructed in 1897.
Soil Type	D – Deep or soft soils	The soil type is considered to be D based on the available geotechnical information from the Otago Regional Council.
Building Importance Level	3	The building is considered a structure that could contain people in crowds of greater than 300 people as defined in AS/NZS 1170.0.
Ductility of Structure	μ=1.50 (Longitudinal and Transverse)	The lateral load resisting system consists of unreinforced masonry brick walls. The likely failure mode is out-of-plane failure which has limited capacity beyond the yield displacement. As the walls appear to be in reasonably good condition we have assumed the maximum ductility allowed in the Technical Guidelines (refer table BA.2).
Plan Irregularity, Factor A	1.0 (Longitudinal and Transverse)	The load resisting system relies on the perimeter brick walls. As there are minimal penetrations and the weight of the building is predominately in the walls and roof, the eccentricity is minimal (≤ 0.3b).
Vertical Irregularity, Factor B	1.0	The building is single storey. The structure supporting the gallery area is gravity only and is not stiff enough to trigger a reduction due to vertical discontinuity (>0.1 total building stiffness contributed by discontinuous part).
Short Columns, Factor C	1.0	N/A.
Pounding, Factor D	1.0 (Longitudinal)	Faces Crawford and Vogel Streets at each end.
	0.7 (Transverse)	Adjacent buildings are built hard against the side walls of Sammy’s with floors and roofs at intermediate points along the height of the walls. However Sammy’s is a shear wall structure so the effect of pounding can be reduced from 0.4 to 0.7 as noted in the IEP spreadsheet.
Site Characteristics, Factor E	1.0	The Otago Regional Council mapping indicates the site could be susceptible to liquefaction. If the superstructure was more resilient liquefaction could potentially cause a life safety hazard, however due to the vulnerability of the walls to out-of-plane failure it is considered unlikely to be significant prior to building collapse.

IEP Item	Assumption	Justification
Factor F	1.0	No Critical Structural Weaknesses (CSW) or significant structural deterioration was noted that would penalise the building. The lack of seismic detailing typical in URM structures is already penalised in the building age section. While the building has been previously strengthened, we have no details of the work or the level of strengthening undertaken and therefore no allowance has been made for this.

For unreinforced masonry buildings built prior to 1935, the Technical Guidelines offer an additional method of assessing these buildings. This uses an attribute scoring method to assess the seismic capacity of the building and determines the %NBS rating directly from these attributes.

The key assumptions made during our assessment are shown in the table below:

Table 3: Sammy's IEP Assessment Results – Attribute Scoring Methodology

Item	Attribute Ranking	Justification
Structural Continuity	3 (Poor)	The building is constructed in unreinforced masonry brick. No concrete bond beams were noted.
Plan Regularity	0 (Excellent)	As noted for Factor A in Table 2, the building has minimal plan eccentricity.
Vertical Regularity	0 (Excellent)	As noted for Factor B in Table 2, the building has minimal vertical irregularity.
Diaphragm Shape	0 (Excellent)	No large wing walls which could disrupt the diaphragm (if one were present).
Condition of Structure	1 (Good)	Minimal deterioration of the structural elements were observed. Some minor loss of pointing was noted.
Cracking or Movement	0 (Not Evident)	No visible cracking or movement of the walls was observed.
Out of Plane Performance	3 (Poor)	Based on a wall height of 12.3m, the wall would need to be over 9 wythes thick to achieve a "Good" rating. We have assumed a wall thickness of 3 wythes for this assessment.
In Plane Performance	1 (Good)	Based on a A_p/A_w ratio of 18.7, for 132m of perimeter wall which is 3 wythes thick (assumed), and a total building area (A_p) of 815m².
Diaphragm Coverage	3 (No diaphragm)	No diaphragm was noted in the ceiling space during our site visit.
Diaphragm Shape	3 (No diaphragm)	No diaphragm was noted in the ceiling space during our site visit.
Diaphragm Openings	3 (No diaphragm)	No diaphragm was noted in the ceiling space during our site visit.
Engineered Connection from Roof to Walls	3 (No)	No engineered connection has been assumed to exist between the roof and the walls.

Item	Attribute Ranking	Justification
Foundations	3 (Poor)	Typical foundations for URM buildings are concrete strip footings with the brick built directly on top. This provides no connectivity between the foundation and the wall.
Separation	3 (Inadequate)	The adjacent buildings are built hard against the side walls of the structure.
Total Attribute Score	**26**	

The total attribute score indicates an overall potential seismic rating of 12%NBS(IL3), corresponding to a 'Grade E' building as defined by the New Zealand Society for Earthquake Engineering (NZSEE) building grading scheme.

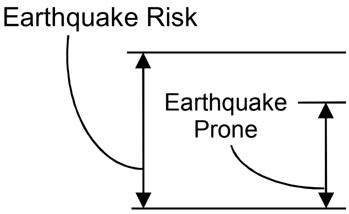
We have also done a high level calculation of the URM walls acting in out-of-plane bending. This was checked both with and without a roof diaphragm. The results were either 10%NBS(IL3) without a diaphragm at roof level or 25%NBS(IL3) with a roof diaphragm providing lateral support to the top of the wall.

Based on our assessment, Sammy's has a potential seismic rating of between 10-25%NBS(IL3), which corresponds to a Grade D or E building.

7 IEP Grades and Relative Risk

Table 3 below taken from the NZSEE Guidelines provides the basis of a proposed grading system for existing buildings, as one way of interpreting the *%NBS* seismic rating.

Table 3: Building Grading System for Earthquake Risk



Building Grade	Percentage of New Building Standard (%NBS)	Approx. Risk Relative to a New Building	Life-Safety Risk Description
A+	>100	<1 times	Low risk
A	80 – 100	1 – 2 times	Low risk
B	67 – 79	2 – 5 times	Low risk
C	34 – 66	5 – 10 times	Medium risk
D	20 – 33	10 – 25 times	High risk
E	<20	more than 25 times	Very high risk

Sammy's has been classified by the IEP as a Grade D/E building and is therefore considered to be a ***High to Very High Risk***.

The New Zealand Society for Earthquake Engineering (which provides authoritative advice to the legislation makers, and should be considered to represent the consensus view of New Zealand structural engineers) classifies a building achieving greater than 67%NBS as "Low Risk" and having "Acceptable (improvement may be desirable)" building structural performance. However, NZSEE classifies a building achieving less than 33%NBS as “High Risk” and having “Unacceptable (improvement required under the Act)” building structural performance.

8 Assessment of Egress Stairs and Building Parts

It is considered important recent learnings from the Christchurch Earthquake be incorporated into the initial assessment. In particular, concern has been raised around the poor performance of stairs and their supports, and also the risk presented by heavy building appendages next to public access ways, such as old masonry parapets, chimneys and canopies.

The gable end walls, particularly on the southeast elevation facing Vogel Street, could potentially collapse during a seismic event. While this is unlikely to cause a global collapse mechanism to form, it could present a significant hazard to people outside the structure.

The lightweight internal stairs observed in the building are unlikely to be vulnerable to building drift and so unlikely to collapse prior to a global collapse mechanism forming.

9 Seismic Restraint of Non – Structural Items

During an earthquake, the safety of people can be put at risk due to non-structural items falling on them. These items should be adequately seismically restrained, where possible, to the NZS 4129:2009 “The Seismic Performance of Engineering Systems in Buildings”.

An assessment has not been made of the bracing of the ceilings, in-ceiling ducting, services and plant. We have also not checked whether tall or heavy furniture has been seismically restrained or not. These issues are outside the scope of this initial assessment but could be the subject of another investigation.

10 Explanatory Notes

- This report has been prepared by Beca at the request of our Client and is exclusively for our Client’s use for the purpose for which it is intended in accordance with the agreed scope of work. Beca accepts no responsibility or liability to any third party for any loss or damage whatsoever arising out of the use of or reliance on this report by that party or any party other than our Client.
- Our inspection was limited to a high level visual examination of the buildings where safe and ready access existed at the time, and we have not undertaken any intrusive inspections or testing. This report is necessarily limited in that respect and does not address any matter that is not discoverable from such an inspection, including any damage or defect in inaccessible places and/or latent defects. Beca is not able to give any warranty or guarantee that all possible damage, defects, conditions or qualities have been identified. The work done by Beca and the advice given is therefore on a reasonable endeavours basis.
- The building assessment is necessarily reliant on the accuracy, currency and completeness of the information provided to us, including the structural drawings, and we have not sought to independently verify any of the information provided.
- The Initial Seismic Building Assessment is based on the Initial Evaluation Procedure (IEP) methodology as detailed in the New Zealand Society for Earthquake Engineering’s handbook “Assessment and Improvement of the Structural Performance of Buildings in Earthquake”. This procedure provides an assessment of the likely seismic rating of the building in comparison with a new building designed to the current code (100% New Building Standard (100%NBS)). Except to the extent that Beca expressly indicates in the report, no assessment has been made to determine whether or not the building complies with the building codes or other relevant codes, standards, guidelines, legislation, plans, etc.

- The focus of the assessment is seismic performance only. No gravity or wind load assessments have been undertaken.

11 Conclusions and Recommendations

Our ISA assessment for Sammy's Entertainment Venue, located at 65 Crawford Street, Dunedin, carried out using the IEP, indicates an overall score of 10-25%NBS(IL3), which corresponds to a Grade D/E building, as defined by the NZSEE grading scheme. This is below the threshold for Earthquake-Prone Buildings (34%NBS) and the threshold for Earthquake-Risk Buildings (67%*NBS*) as defined by the NZSEE guidelines.

The ISA is considered to provide a relatively quick, high-level and qualitative measure of the building's performance. A more reliable result will be obtained from a Detailed Seismic Assessment (DSA), however it is unlikely to change the grading of the building significantly from that obtained by the ISA. We would recommend that a strengthening scheme is developed for Sammy's, which would include assessing the building and providing remedial solutions to any deficiencies found.

We trust this letter and initial seismic assessment meets your current requirements. We would be pleased to discuss further with you any issues raised or if you would like clarification on any aspect of this letter.

Yours sincerely

Alex Kelly
Structural Engineer

on behalf of
Beca Ltd
Direct Dial: +64 3 367 2465
Email: alex.kelly@beca.com

Yours sincerely

JBarnett

Jonathan Barnett
Technical Director - Structural Engineering

on behalf of
Beca Ltd
Direct Dial: +64 3 951 2357
Email: jonathan.barnett@beca.com

Attachments:

- Sammy's Entertainment Venue - IEP
- Existing Drawings

Initial Evaluation Procedure (IEP) Assessment - Completed for Dunedin City Council Page 1

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:	**65 Crawford Street**	**Job No.:**	**5329140**
AKA:	**Sammy's; formerly His Majesty's Theatre**	**By:**	**ASK**
Name of building:	**Sammy's Entertainment Venue**	**Date:**	**22/08/2017**
City:	**Dunedin**	**Revision No.:**	**0**

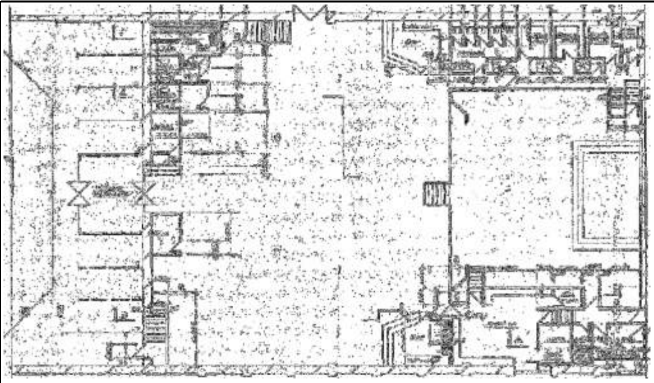
Table IEP-1 Initial Evaluation Procedure Step 1

Step 1 - General Information

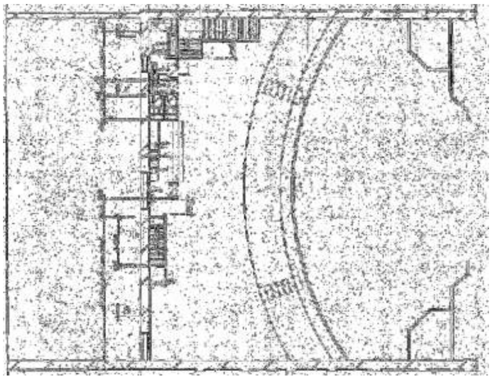
1.1 Photos (attach sufficient to describe building)

NOTE: THERE ARE MORE PHOTOS ON PAGE 1a ATTACHED

1.2 Sketches (plans etc, show items of interest)



Ground Floor Plan



Gallery Plan

NOTE: THERE ARE MORE SKETCHES ON PAGE 1a ATTACHED

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

-Sammy's Entertainment Venue, formerly His Majesty's Theatre, was originally constructed in 1897.
-The roof consists of timber purlins spanning onto steel trusses, consisting of I-beam rafters and steel rod bottom chord and ties, spanning onto the perimeter brick walls.
-The perimeter walls are constructed of URM brick, which are an unknown number of wythes thick.
-Lateral loads will be resisted by the URM walls.
-Strengthening of unknown scope has been undertaken at an unknown time.
-Note drawings are floor plans only.

1.4 Note information sources Tick as appropriate

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

– City Surveyors, Dunedin N.Z.: His Majesty’s Theatre Crawford St (1907).
– J. R. G. Hanlon & Partners: His majesty’s Theatre – Dunedin – Development For Use As A Licensed Restaurant Cabaret (1983).

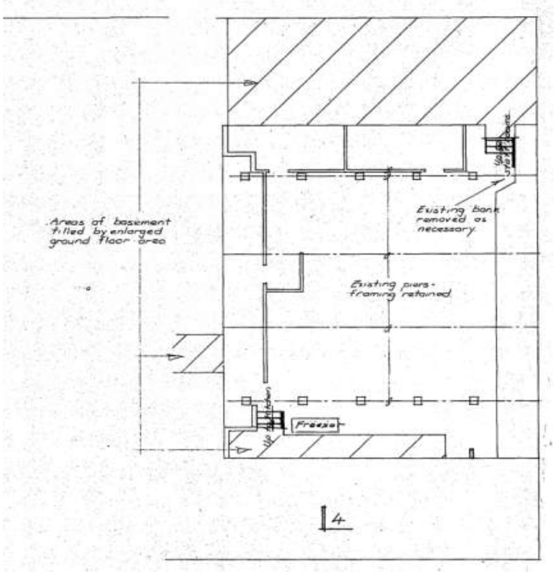
Initial Evaluation Procedure (IEP) Assessment - Completed for Dunedin City Council

Street Number & Name:	65 Crawford Street	**Job No.:**	5329140
AKA:	Sammy's; formerly His Majesty's Theatre	**By:**	ASK
Name of building:	Sammy's Entertainment Venue	**Date:**	22/08/2017
City:	Dunedin	**Revision No.:**	0

Table IEP-1a Additional Photos and Sketches

Add any additional photographs, notes or sketches required below:

Note: print this page separately



Basement Plan

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.*

Initial Evaluation Procedure (IEP) Assessment - Completed for Dunedin City Council

Street Number & Name:	**65 Crawford Street**	**Job No.:**	**5329140**
AKA:	**Sammy's; formerly His Majesty's Theatre**	**By:**	**ASK**
Name of building:	**Sammy's Entertainment Venue**	**Date:**	**22/08/2017**
City:	**Dunedin**	**Revision No.:**	**0**

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)* $_{nom}$

a) Building Strengthening Data

	Longitudinal	**Transverse**
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

	Longitudinal	Transverse
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

	Longitudinal	Transverse
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)**	Flexible	Flexible

d) Estimate Period, *T*

Comment:

Conservative low end estimate of period for URM brick structures.

		Longitudinal	Transverse
h_n =		25	25 m
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:	$T \leq$ 0.4sec	○	○
User Defined (input Period):		●	●
	T:	0.75	0.75

Where h_n = height in metres from the base of the structure to the uppermost seismic weight or mass.

			Longitudinal	Transverse
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:**	0.04	0.04
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:**	0.80	0.80
(%NBS) $_{nom}$ **= AxBxCxD**		***(%NBS)*** $_{nom}$	3%	3%

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.*

Initial Evaluation Procedure (IEP) Assessment - Completed for Dunedin City Council

Street Number & Name:	**65 Crawford Street**	**Job No.:**	**5329140**
AKA:	**Sammy's; formerly His Majesty's Theatre**	**By:**	**ASK**
Name of building:	**Sammy's Entertainment Venue**	**Date:**	**22/08/2017**
City:	**Dunedin**	**Revision No.:**	**0**

Table IEP-2 Initial Evaluation Procedure Step 2 continued

2.2 Near Fault Scaling Factor, Factor E

If *T* ≤ 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: Dunedin **Refer right for user-defined locations**

$Z =$ 0.13 (from NZS1170.5:2004, Table 3.3)

$Z_{1992} =$ 0.6 (NZS4203:1992 Zone Factor from accompanying Figure 3.5(b))

$Z_{2004} =$ 0.13 (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:		7.69	7.69

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

	Longitudinal	Transverse
I =	1.25	1.25
R_o =	1	1
Importance Level	○ 1 ○ 2 ● 3 ○ 4	○ 1 ○ 2 ● 3 ○ 4
R =	1.3	1.3

d) Factor G = IR_o/R

	Longitudinal	Transverse
Factor G:	0.96	0.96

2.5 Ductility Scaling Factor, Factor H

a) Available Displacement Ductility Within Existing Structure

Comment:

URM brick walls in reasonably good condition - use maximum allowed ductility from guidelines.

		Longitudinal	Transverse
	μ =	1.50	1.50
b) Factor H		k_μ	k_μ
For pre 1976 (maximum of 2)	=	1.50	1.50
For 1976 onwards	=	1	1
	Factor H:	1.50	1.50

(where kμ 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

		Longitudinal	Transverse
		☐	☐
	S_p =	0.85	0.85
b) Structural Performance Scaling Factor = $1/S_p$	**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

	Longitudinal	Transverse
2.7 Baseline *%NBS* for Building, $(\%NBS)_b$ (equals $(\%NBS)_{nom}$ x E x F x G x H x I)	**37%**	**37%**

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.*

Initial Evaluation Procedure (IEP) Assessment - Completed for Dunedin City Council

Street Number & Name:	**65 Crawford Street**	**Job No.:**	**5329140**
AKA:	**Sammy's; formerly His Majesty's Theatre**	**By:**	**ASK**
Name of building:	**Sammy's Entertainment Venue**	**Date:**	**22/08/2017**
City:	**Dunedin**	**Revision No.:**	**0**

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

potential CSWs — **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

The load resisting system relies on the perimeter brick walls. As there are minimal penetrations and the weight of the building is predominately in the walls and roof, the eccentricity is minimal (≤ 0.3b).

3.2 Vertical Irregularity

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

The building is single storey. The structure supporting the gallery area is gravity only and is not stiff enough to trigger a reduction due to vertical discontinuity (>0.1 total building stiffness contributed by discontinuous part).

3.3 Short Columns

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

N/A.

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	○ 1	○ 1	● 1
Alignment of Floors not within 20% of Storey Height	○ 0.4	○ 0.7	○ 0.8

Faces Crawford and Vogel Streets at each end.

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

Faces Crawford and Vogel Streets at each end.

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

If the superstructure was more resilient liquefaction could potentially cause a life safety hazard, however due to the vulnerability of the walls to out-of-plane failure it is considered unlikely to be significant prior to building collapse.

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:

No CSW or significant structural deterioration was noted that would penalise building. Lack of seismic detailing in URM structure already penalised in building age section. While the building has been previously strengthened, we have no details of the work or the level of strengthening undertaken and therefore no allowance has been made for this.

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

PAR
Longitudinal **1.00**

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.*

Initial Evaluation Procedure (IEP) Assessment - Completed for Dunedin City Council

Street Number & Name:	**65 Crawford Street**	**Job No.:**	**5329140**
AKA:	**Sammy's; formerly His Majesty's Theatre**	**By:**	**ASK**
Name of building:	**Sammy's Entertainment Venue**	**Date:**	**22/08/2017**
City:	**Dunedin**	**Revision No.:**	**0**

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

Factors

potential CSWs **Effect on Structural Performance**
(Choose a value - Do not interpolate)

3.1 Plan Irregularity

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

The load resisting system relies on the perimeter brick walls. As there are minimal penetrations and the weight of the building is predominately in the walls and roof, the eccentricity is minimal (≤ 0.3b).

3.2 Vertical Irregularity

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

The building is single storey. The structure supporting the gallery area is gravity only and is not stiff enough to trigger a reduction due to vertical discontinuity (>0.1 total building stiffness contributed by discontinuous part).

3.3 Short Columns

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

N/A.

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: 0.7

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	○ 1	○ 1	○ 1
Alignment of Floors not within 20% of Storey Height	○ 0.4	● 0.7	○ 0.8

Adjacent buildings hard against side walls, with floorsat intermediate points along height. Shear walls so can reduce to 0.7.

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

Sammy's is single storey, adjacent buildings are three storey or less.

Factor D 0.7

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

If the superstructure was more resilient liquefaction could potentially cause a life safety hazard, however due to the vulnerability of the walls to out-of-plane failure it is considered unlikely to be significant prior to building collapse.

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

For $\leq$ 3 storeys - Maximum value 2.5
otherwise - Maximum value 1.5.
No minimum.

Factor F 1.00

Record rationale for choice of Factor F:

No CSW or significant structural deterioration was noted that would penalise building. Lack of seismic detailing in URM structure already penalised in building age section. While the building has been previously strengthened, we have no details of the work or the level of strengthening undertaken and therefore no allowance has been made for this.

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

PAR
Transverse **0.70**

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.*

Initial Evaluation Procedure (IEP) Assessment - Completed for Dunedin City Council

Street Number & Name:	**65 Crawford Street**	**Job No.:**	**5329140**
AKA:	**Sammy's; formerly His Majesty's Theatre**	**By:**	**ASK**
Name of building:	**Sammy's Entertainment Venue**	**Date:**	**22/08/2017**
City:	**Dunedin**	**Revision No.:**	**0**

Table IEP-4 Initial Evaluation Procedure Steps 4, 5, 6 and 7

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

		Longitudinal	Transverse
4.1	**Assessed Baseline *%NBS* *(%NBS)*$_b$** (from Table IEP - 1)	37%	37%
4.2	**Performance Achievement Ratio (PAR)** (from Table IEP - 2)	1.00	0.70
4.3	**PAR x Baseline *(%NBS)*$_b$**	37%	25%
4.4	**Percentage New Building Standard *(%NBS)*** (Use lower of two values from Step 4.3)		25%

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)

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

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:	65 Crawford Street	Job No.:	5329140
AKA:	Sammy's; formerly His Majesty's Theatre	By:	ASK
Name of building:	Sammy's Entertainment Venue	Date:	22/08/2017
City:	Dunedin	Revision No.:	0

Table IEP-5 Initial Evaluation Procedure Step 8

Step 8 - Identification of potential Severe Critical Structural Weaknesses that could result in significant risk to a significant number of occupants

8.1	Number of storeys above ground level	2
8.2	Presence of heavy concrete floors and/or concrete roof? (Y/N)	N

Occupancy not considered to be significant - no further consideration required

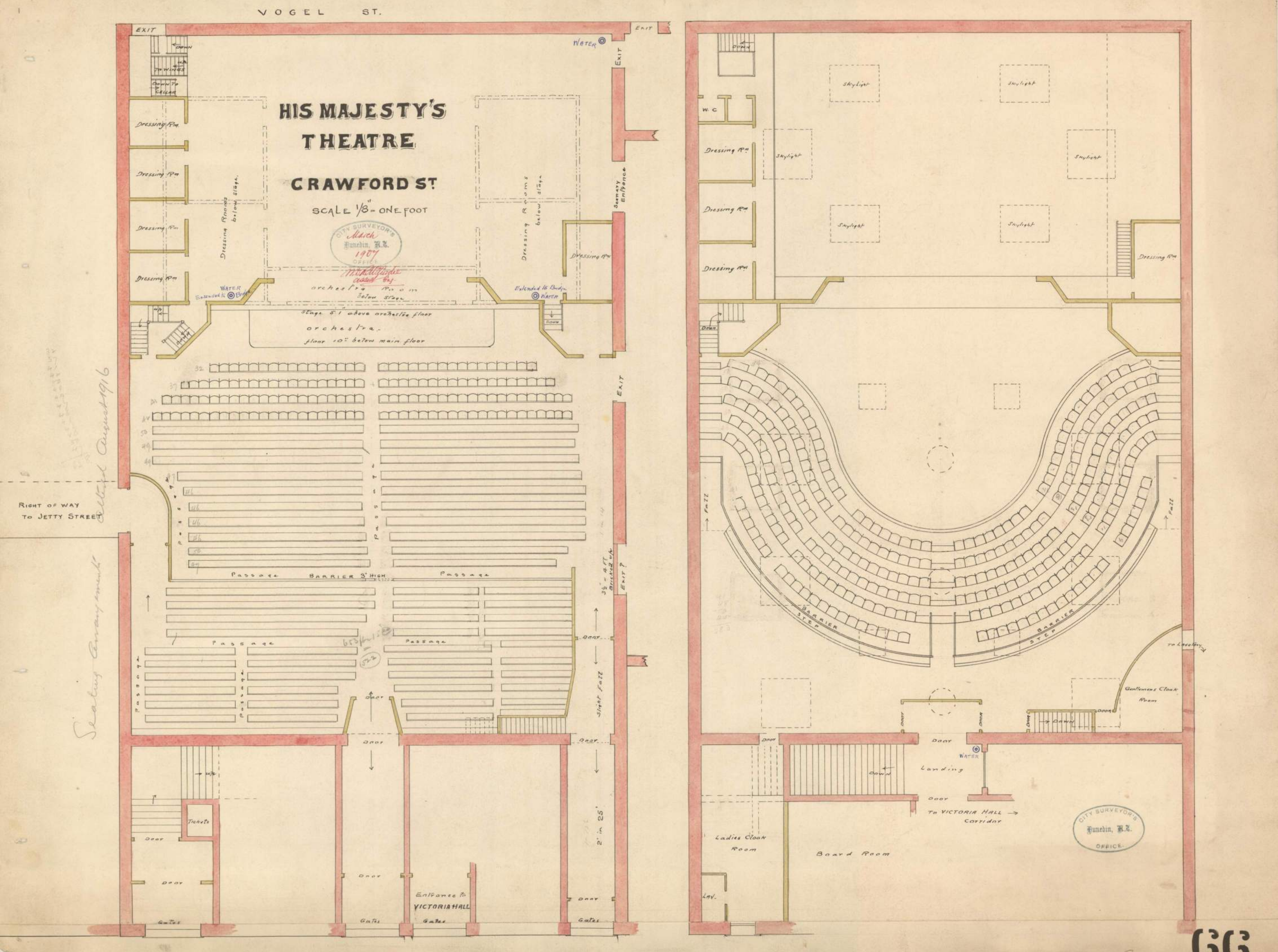
Risk not considered to be significant - no further consideration required

IEP Assessment Confirmed by **Signature**

John Heenan **Name**

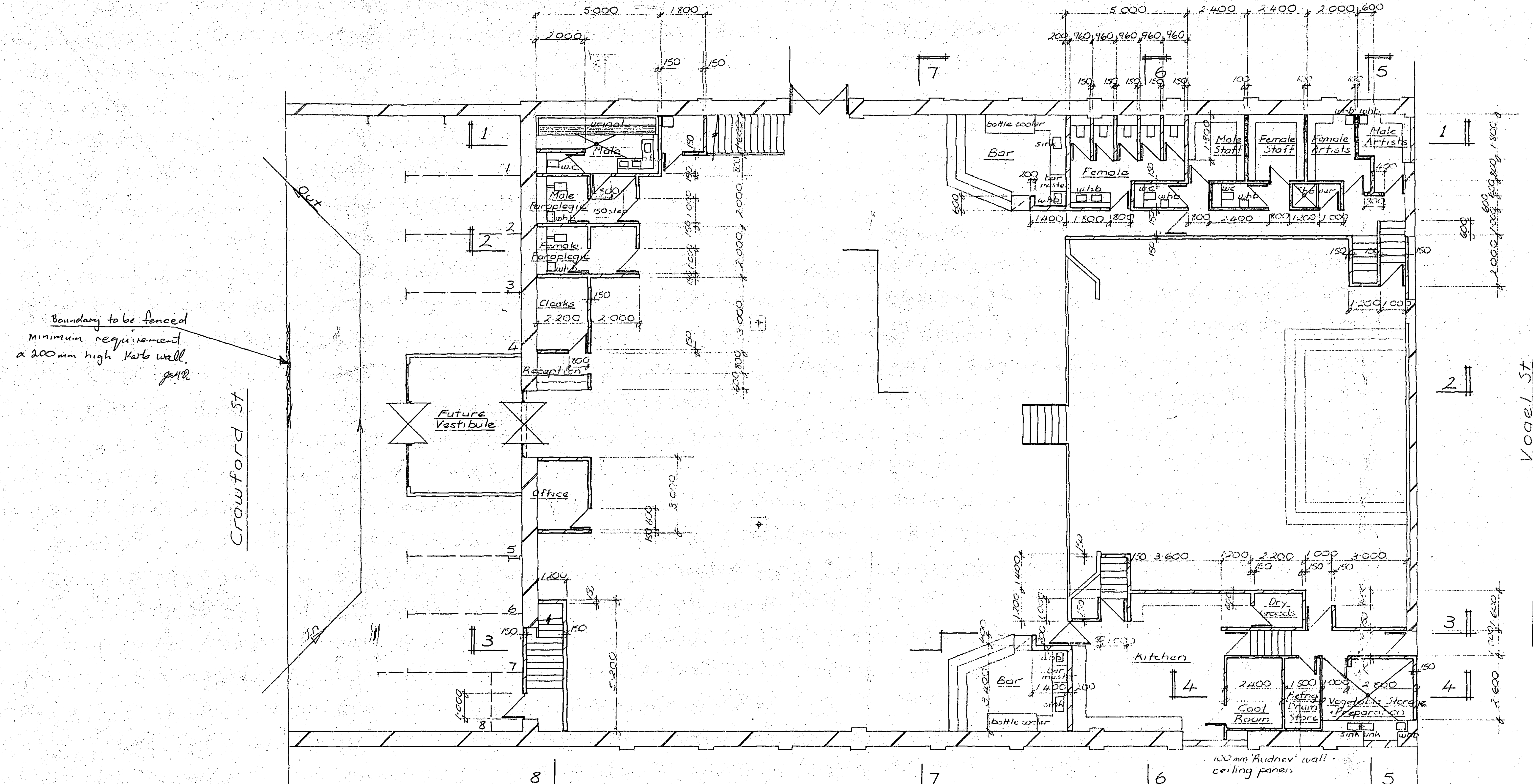
111129 **CPEng. No**

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.*



Seating arrangement altered August 1916

66



Boundary to be fenced
minimum requirement
a 200mm high Kerb wall.
JMR

Ground Floor Layout Plan (1:100)

SEE AMENDED PLANS
DATED MARCH 1983

DUNEDIN CITY CORPORATION
COPY OF APPROVED PLAN OR SPECIFICATION
TO BE RETAINED ON WORKS AND PRODUCED ON REQUEST OF BUILDING INSPECTOR.
DATE 7.4.83
R.E. Jennings CITY ENGINEER

CITY ENGINEER'S

Required level at Street Boundary Any entrance or fence [illegible] level of 120 mm above top of Kerb ~~and~~ constructed to the same grade as the adjoining street.

Vehicle Crossing Fee / ~~Deposit~~ $756 for 3.0 m. Heavy Duty Crossing.

Special Conditions $100 Deposit for reinstatement.

J.M. McQueen For City Engineer Date 2/3/82

NOTE This endorsement overrules any levels or instructions shown on the plan

A separate application to the Drainage Board for plumbing and/or drainage work is required. Such work shall comply fully with the Plumbers, Gasfitters and Drainlayers Act 1976, Plumbers, Gasfitters and Drainlayers Regulations 1977, Drainage and Plumbing Regulations 1978, and the Board's By-laws.

~~Stormwater to be discharged to~~
SANITARY FITTINGS TO EXTENSION OF EXISTING FOUL DRAIN AND TO NEW FOUL DRAIN TO FOUL SEWER IN VOGEL ST.
MECHANICAL VENTILATION REQUIRED FROM WC & ISOLATION COMPARTMENTS - GREASE TRAP REQUIRED.
23.2.83

CITY HEALTH DEPARTMENT

Date Uplifted 12/3/83
Seen By
Date 18/3/83
Subject to compliance with Food Hygiene & Related Regulations and MOH approval

CITY PLANNING DEPARTMENT

Pursuant to the provisions of the District Scheme, these plans and specifications are approved, provided that no change shall be made to the details shown hereon, and contained in the specification attached hereto, and subject to

Approved by Sub Committee 15/6/82.
17/2/83.

I2 - Ind. B.
Signed
for City Planning Officer

4607

J.R.G. HANLON & PARTNERS
REGISTERED STRUCTURAL ENGINEERS
219 HIGH STREET DUNEDIN PHONE 777475

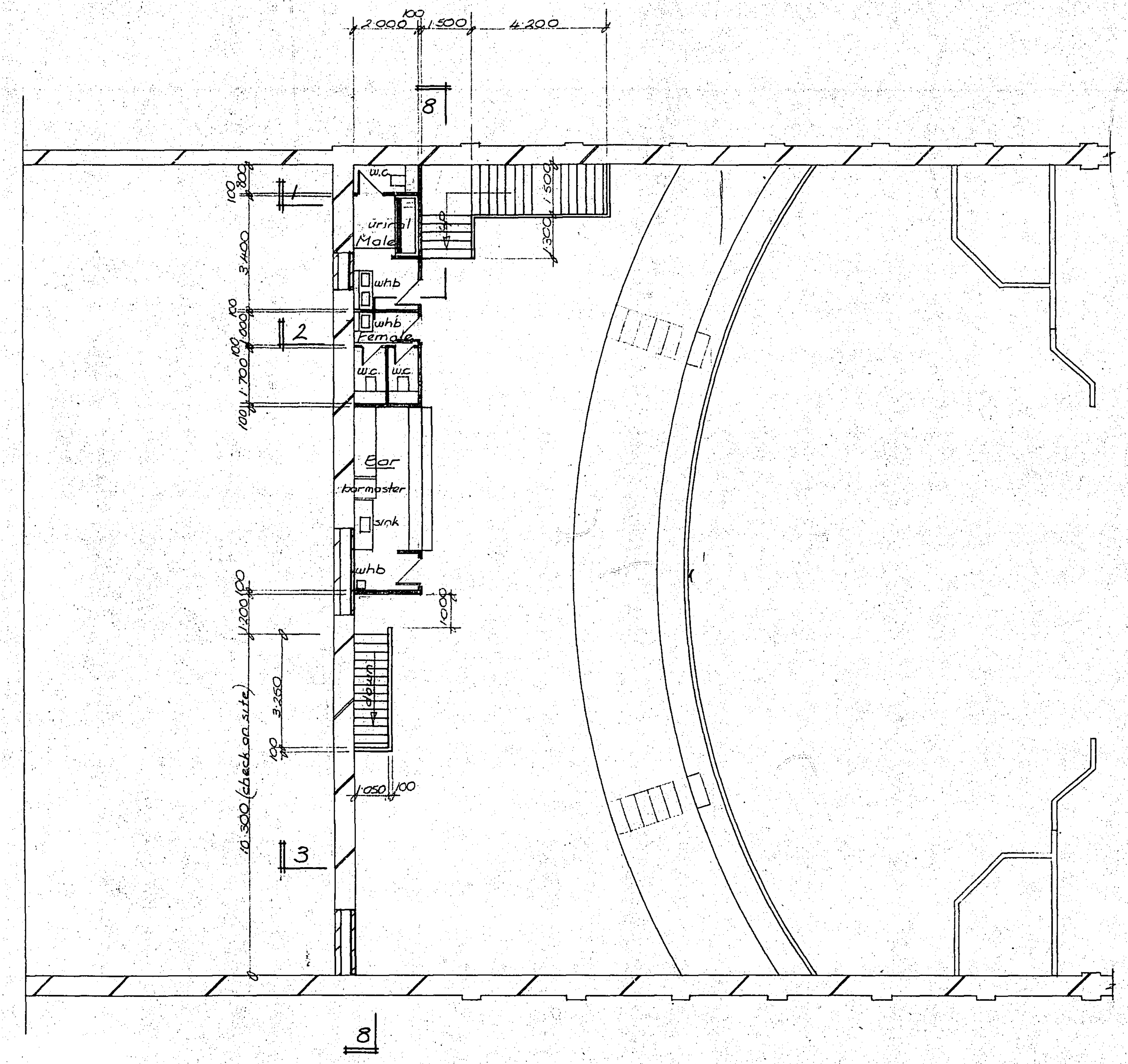
Structural Drawings must be read in conjunction with Architectural Drawings. This Drawing is Copyright and may not be reproduced wholly or in part without the permission of the Engineers.

HIS MAJESTY'S THEATRE - DUNEDIN
Development For Use As A Licensed Restaurant - Cabaret

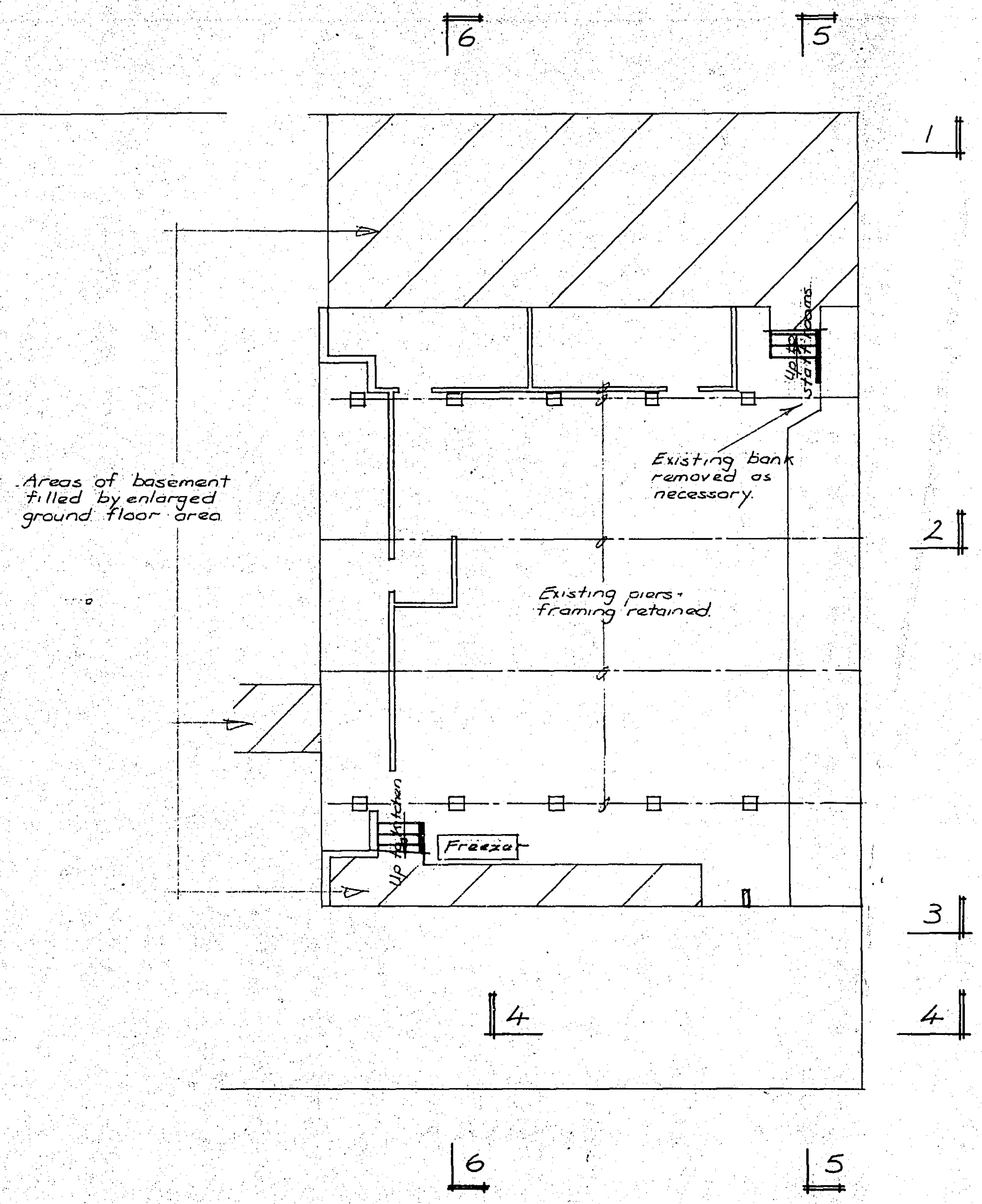
NO.	DATE	AMENDMENTS

SCALES 1:100
JOB NO.
SHEET NO. 1 of sheets
DRAWN
DATE

16 FEB 1983



Gallery Layout Plan (1:100)



Basement Area Beneath Stage Layout Plan (1:100)

4607

J.R.G. HANLON & PARTNERS REGISTERED STRUCTURAL ENGINEERS 219 HIGH STREET DUNEDIN PHONE 777475		Structural Drawings must be read in conjunction with Architectural Drawings. This Drawing is Copyright and may not be reproduced wholly or in part without the permission of the Engineers.	HIS MAJESTY'S THEATRE - DUNEDIN Development For Use As A Licensed Restaurant Cabaret	NO. DATE AMENDMENTS	SCALES 1:100 DRAWN B Chisholm	JOB NO. 1856 DATE February 1983	SHEET NO. 2 of sheets

10 MAR 1983

DAVID LITTLETON
CONSULTING ENGINEER
B. Sc. (Hons), Civil Eng. MIPENZ (Structural), CPEng
1038 Mt. Cargill Rd.
RD 2, Waitati
Dunedin
Phone/ Fax (03) 482-1669

3/1/14

Emma Meggitt
Asset Management Officer
Parks and Recreation Services
Dunedin City Council
PO Box 5045, Moray Place,

Dunedin 9058,

Ref: lt13/047/9

Re: Chingford Park Stables
Initial Seismic Assessment

I have completed an Initial Seismic Assessment (ISA) of the Chingford Park Stables at North Rd. using the NZSEE's Initial Evaluation Procedure (IEP). The assessment was carried out after completing a site visit examining the interior and exterior. The plans of the 1981 alterations were also reviewed.

The Dunedin City Council's Earthquake Prone Building Policy requires the building to be reviewed using New Zealand Society of Earthquake Engineers (NZSEE) procedure (or equivalent method). This procedure is done in 2 steps. The Initial Earthquake Procedure (IEP) is a reasonably quick and inexpensive procedure that filters out the buildings that are earthquake prone from those that are not. If the ISA shows the building to be less than 33% NBS the building is designated as earthquake prone and a more Detailed Seismic Assessment (DSA) needs to be carried out.

The ISA is considered to provide a relatively quick, high-level and qualitative measure of the building's performance. A more reliable result will be obtained from a Detailed Seismic Assessment (DSA).

Executive Summary

Based on the NZSEE's IEP the building has a rating of 40 %in the longitudinal direction & 30 % in the transverse direction of the New Building Standard for seismic strength giving the building a provisional seismic D grade. On this basis the building is potentially earthquake prone (< 34% NBS).

Background to the IEP and Its Limitations

The IEP procedure was developed in 2006 by the New Zealand Society for Earthquake Engineering (NZSEE) and updated in 2013 to reflect experience with its application and as a result of experience in the Canterbury earthquakes. It is a tool to assign a percentage of New Building Standard (*%NBS*) score and associated grade to a building as part of an initial seismic assessment of existing buildings.

The IEP enables territorial authorities, building owners and managers to review their building stock as part of an overall risk management process.

Characteristics and limitations of the IEP include:

- It tends to be somewhat conservative, identifying some buildings as earthquake prone, or having a lower *%NBS* score, which subsequent detailed investigation may indicate is less than actual performance. However, there will be exceptions, particularly when critical structural weaknesses (CSWs) are present that have not been recognised from the level of investigation employed.
- It can be undertaken with variable levels of available information, eg exterior only inspection, structural drawings available or not, interior inspection, etc. The more information available the more representative the IEP result is likely to be. The IEP records the information that has formed the basis of the assessment and consideration of this is important when determining the likely reliability of the result.
- It is an initial, first-stage review. Buildings or specific issues which the IEP process flags as being problematic or as potentially critical structural weaknesses, need further detailed investigation and evaluation. A Detailed Seismic Assessment is recommended if the seismic status of a building is critical to any decision making.
- The IEP assumes that the buildings have been designed and built in accordance with the building standard and good practice current at the time. In some instances, a building may include design features ahead of its time - leading to better than predicted performance. Conversely, some unidentified design or construction issues not picked up by the IEP process may result in the building performing not as well as predicted.
- It is a largely qualitative process, and should be undertaken or overseen by an experienced engineer. It involves considerable knowledge of the earthquake behaviour of buildings, and judgment as to key attributes and their effect on building performance. Consequently, it is possible that the *%NBS* derived for a building by independent experienced engineers may differ.
- An IEP may over-penalise some apparently critical features which could have been satisfactorily taken into account in the design.
- An IEP does not take into account the seismic performance of non-structural items such as ceiling, plant, services or glazing.

Experience to date is that the IEP is a useful tool to identify potential issues and expected overall performance of a building in an earthquake. However, the process and the associated *%NBS* and grade should be considered as only indicative of the building's compliance with current code requirements. A detailed investigation and analysis of the building will typically be required to provide a definitive assessment.

An IEP score above 34*%NBS* should be considered sufficient to classify the building as not earthquake prone. However, if further information comes available reassessment may be required.

New Building Standard

The level of 100% New Building Standard (NBS) means the minimum standard of the current Building Code. Most new buildings are built to higher level than the minimum standard. New buildings are designed:

- primarily for the safety of the occupants
- a working life of 50 years
- Ultimate Limit State (ULS) - to withstand a 1 in 500 return period earthquake. In a ULS size event the building is required to stand without collapse and allow all

occupants to be able to leave the building safely. The building after a ULS size event may need to be demolished and re-built. The IEP is based on the ULS.

- Serviceability Limit State (SLS) to withstand a 1 in 25 return period earthquake with only minimal and easily repairable damage.

Building Description

The original building was built in 1872. The lower level stone walls are up to 600 mm thick reducing to 300 thick to the upper level. The upper level floor and roof are timber framed. The roof is slate tiles (heavy). In 1981 alterations were made to the building to add toilets and a kitchen. A wall was removed in the south room and the vertical support replaced with a beam and posts. This wall could have been useful to provide lateral support in the longitudinal direction as the valley rafters land along this line. The upper level diaphragm floor would be required to transfer loads for the full width of the building and the removal of the wall would reduce its effectiveness.

On the east and west walls there are 2 chimneys which are relatively squat (low height to width ratio) which viewed from the ground appear sound.

There are 5 steel tension rods through the building at upper floor level. These can be viewed from the exterior of the building but are hidden inside. There is no documentation regarding these ties in the DCC records.

The wall above the high level window on the east side has a crack in the lintel – otherwise there are no indication of settlement or other movement distress.

The building is very simple in plan and has good proportions for seismic resistance.

Seismic Concerns

A review of the 1981 work which removed the wall should be done to see if the lateral strength in the longitudinal direction was compromised. The 2 brick chimneys and ties of the stone gables to the roof framing should also be reviewed.

EP Factor F Rationale

The IEP procedure has one factor (F on page #5) which is an `engineer' judgment factor. This factor can range from 0 to 2.5.

I have given F = 1.5 in both the longitudinal direction and the transverse direction. The rationale behind the F factor this decision is based on:

- the simple and symmetrical plan
- building is well maintained and shows little sign of distress from past movement
- existing tying of walls with steel rods

IEP 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 10 times the risk that they would be in a similar new building. For buildings that are potentially *Earthquake Risk* (less than 67%*NBS*), but not *Earthquake Prone*, the risk is at least 5 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

Building Grade	Percentage of New Building Strength (%*NBS*)	Approx. Risk Relative to a New Building	Life-safety Risk Description
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 IEP as a grade *D* building and is therefore considered to be a *high* risk.

The New Zealand Society for Earthquake Engineering (which provides authoritative advice to the legislation makers, and should be considered to represent the consensus view of New Zealand structural engineers) classifies a buildings achieving greater than 67% *NBS* as "Low Risk", and having "Acceptable (improvement may be desirable)" building structural performance.

Seismic Restraint of Non-Structural Items

During an earthquake, the safety of people can be put at risk due to non-structural items falling on them. These items should be adequately seismically restrained, where possible, to the NZS 4219:2009 "The Seismic Performance of Engineering Systems in Buildings".

An assessment has not been made of the bracing of the ceilings, in-ceiling ducting, services and plant. I have also not checked whether tall or heavy furniture has been seismically restrained or not. These issues are outside the scope of this initial assessment but could be the subject of another investigation.

IEP Assessment Results

My ISA assessment for this building, carried out using the IEP indicates an overall score of 30% *NBS* which corresponds to a Grade D building, as defined by the NZSEE building grading scheme. This is below the threshold for Earthquake Prone Buildings (34% *NBS*) as defined by the NZSEE and the New Zealand Building Code.

The ISA is considered to provide a relatively quick, high-level and qualitative measure of the building's performance. In order to confirm the seismic performance of this building with more reliability I recommend that a DSA be carried out.

I trust this letter and initial seismic assessment meets your current requirements. I would be pleased to discuss further with you any issues raised in this report.

Please do not hesitate to contact me if you would like clarification of any aspect of this letter.

Yours sincerely

David Littleton

CPEng

Encl: IEP Assessment

Initial Evaluation Procedure (IEP) Assessment

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: North Rd.
AKA:
Name of building: Chingford Park Stables
City: Dunedin
Job No.: 13/047/9
By: D. Littleton
Date: 3/01/2014
Revision No.:

Table IEP-1 Initial Evaluation Procedure Step 1

Step 1 - General Information

1.1 Photos (attach sufficient to describe building)

1

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

The building was constructed in 1872.
Lower level walls are up to 600 thick stone. The walls to the upper level (roof space) are 300 thick brick & stone. Upper floor and roof are timber framed. Roof is slate.

In 1981 alterations were made to add toilets, kitchen (timber framed partitions) and remove a wall in the west side and replace vertical support with a beam.

Steel anchor rods have been fitted across the building at upper floor level to tietogether the exterior walls. The date of this strenthening work is not

1.4 Note information sources Tick as appropriate

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

Drawings of 1981 alterations were reviewed

Initial Evaluation Procedure (IEP) Assessment

Street Number & Name:	North Rd.	**Job No.:**	13/047/9
AKA:		**By:**	D. Littleton
Name of building:	Chingford Park Stables	**Date:**	3/01/2014
City:	Dunedin	**Revision No.:**	

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 :	C Shallow Soil	C Shallow Soil
From NZS4203:1992, Cl 4.6.2.2 : **(for 1992 to 2004 and only if known)**		

d) Estimate Period, *T*

Comment:

		Longitudinal	Transverse
	h_n =	3	3 m
	A_c =	1.00	1.00 m²
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:	$T \leq 0.4\text{sec}$	●	●
User Defined (input Period):		○	○
	T:	0.40	0.40

Where h_n = height in metres from the base of the structure to the uppermost seismic weight or mass.

			Longitudinal	Transverse
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:**	0.04	0.04
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:**	0.80	0.80

		Longitudinal	Transverse
***(%NBS)* $_{nom}$ = AxBxCxD**	***(%NBS)* $_{nom}$**	3%	3%

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.*

Initial Evaluation Procedure (IEP) Assessment

Street Number & Name: North Rd.
AKA:
Name of building: Chingford Park Stables
City: Dunedin

Job No.: 13/047/9
By: D. Littleton
Date: 3/01/2014
Revision No.:

Table IEP-2 Initial Evaluation Procedure Step 2 continued

2.2 Near Fault Scaling Factor, Factor E

If $T \leq 1.5$sec, 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: Dunedin

Z = 0.13 (from NZS1170.5:2004, Table 3.3)
Z_{1992} = 0.6 (NZS4203:1992 Zone Factor from accompanying Figure 3.5(b))
Z_{2004} = 0.13 (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:	7.69	7.69

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

d) Factor G = IR_o/R

		Longitudinal	Transverse
a)	I =	1.25	1.25
b)	R_o =	1	1
c)	Choose Importance Level	○ 1 ● 2 ○ 3 ○ 4	○ 1 ● 2 ○ 3 ○ 4
c)	R =	1.0	1.0
d)	Factor G:	1.25	1.25

2.5 Ductility Scaling Factor, Factor H

a) Available Displacement Ductility Within Existing Structure
Comment:

b) Factor H
For pre 1976 (maximum of 2)
For 1976 onwards

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

		Longitudinal	Transverse
a)	μ =	1.00	1.00
b)	k_μ		
For pre 1976 (maximum of 2)	=	1.00	1.00
For 1976 onwards	=	1	1
	Factor H:	1.00	1.00

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 = $1/S_p$
Note Factor B values for 1992 to 2004 have been multiplied by 0.67 to account for Sp in this period

		Longitudinal	Transverse
Tick if light timber-framed construction in this direction		☐	☐
a)	S_p =	1.00	1.00
b)	Factor I:	1.00	1.00

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

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

Longitudinal	Transverse
28%	28%

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.*

Initial Evaluation Procedure (IEP) Assessment

Street Number & Name: North Rd.
AKA:
Name of building: Chingford Park Stables
City: Dunedin

Job No.: 13/047/9
By: D. Littleton
Date: 3/01/2014
Revision No.:

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** 0.7
1981 removal of wall reduce lateral capacity & effectiveness of fl diaphragm. Load path for valley rafters is no longer direct.				
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

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
Comment				

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 1.5

Record rationale for choice of Factor F:

- the simple and symmetrical plan
- building is well maintained and shows little sign of distress from past movement
- existing tying of walls with steel rods

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

PAR
Longitudinal **1.05**

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.*

Initial Evaluation Procedure (IEP) Assessment

Street Number & Name:	North Rd.	**Job No.:**	13/047/9
AKA:		**By:**	D. Littleton
Name of building:	Chingford Park Stables	**Date:**	3/01/2014
City:	Dunedin	**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

Comment

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 1.50

Record rationale for choice of Factor F:

- the simple and symmetrical plan
- building is well maintained and shows little sign of distress from past movement
- existing tying of walls with steel rods

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

PAR
Transverse 1.50

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.*

Initial Evaluation Procedure (IEP) Assessment

Street Number & Name:	North Rd.	**Job No.:**	13/047/9
AKA:		**By:**	D. Littleton
Name of building:	Chingford Park Stables	**Date:**	3/01/2014
City:	Dunedin	**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)	28%	28%
4.2	**Performance Achievement Ratio (PAR)** (from Table IEP - 2)	1.05	1.50
4.3	**PAR x Baseline *(%NBS)*$_b$**	30%	40%
4.4	**Percentage New Building Standard *(%NBS)*** (Use lower of two values from Step 4.3)		30%

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)

The wall removed and replaced with a beam and posts in the 1981 alterations would have provided a more balanced lateral support in the longitudinal directions. It is not known if this was considered as part of theis structural alteration.

The steel rods tying the exterior walls would provide considerable stability to the building. Except for what is visible on the exterior face - little is known about thses rods as the DCC records do not mention them.

The building is well maintained and has very good wall height to wall thickness ratios.

A closer look at the 2 chimney is recommended.

Evaluation Confirmed by ______ **Signature**

David Littleton **Name**

138914 **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**

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.*

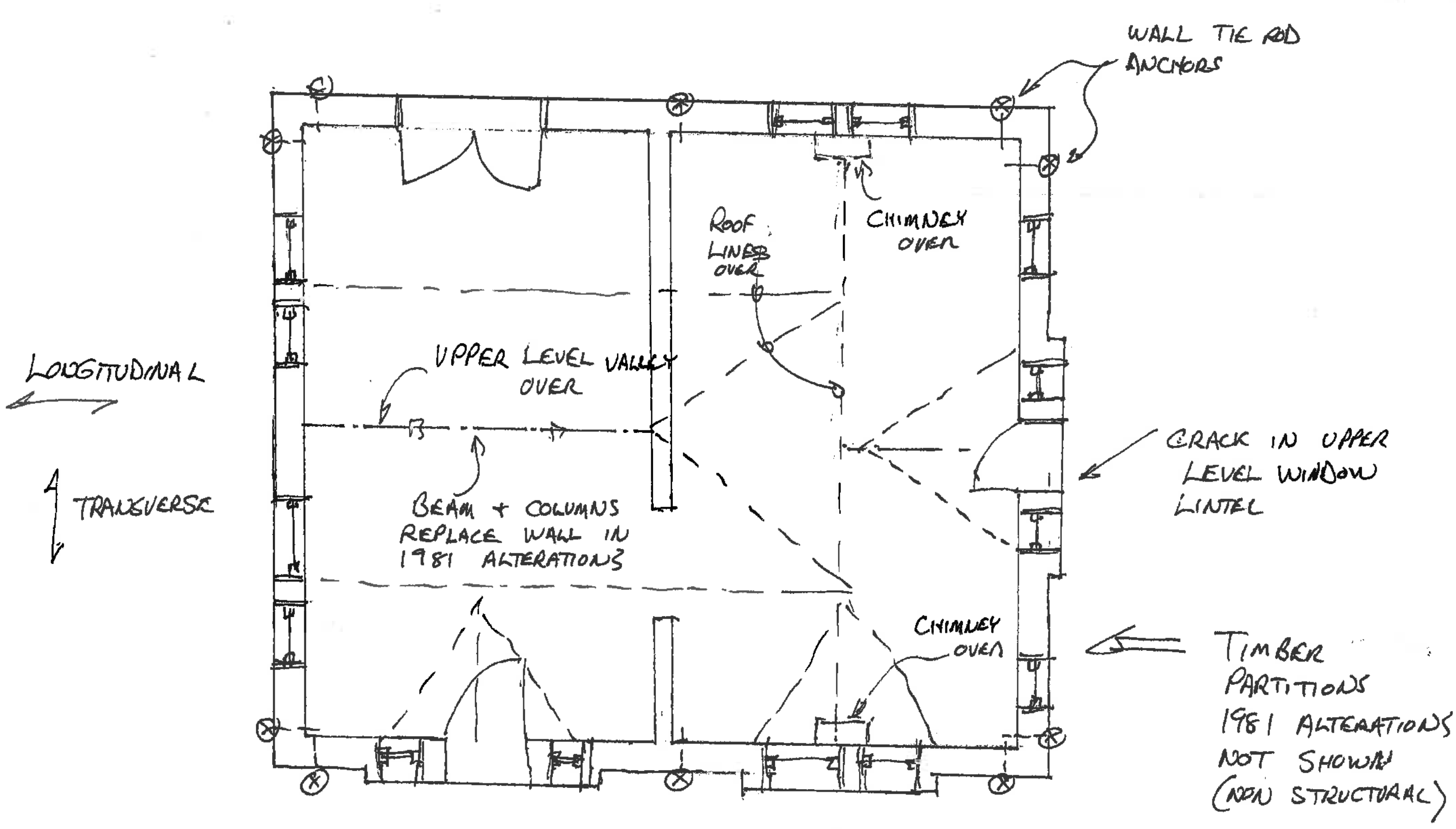
Initial Evaluation Procedure (IEP) Assessment

Street Number & Name:	North Rd.	**Job No.:**	13/047/9
AKA:		**By:**	D. Littleton
Name of building:	Chingford Park Stables	**Date:**	3/01/2014
City:	Dunedin	**Revision No.:**	

Table IEP-1a Additional Photos and Sketches

Add any additional photographs, notes or sketches required below:

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.*



STRUCTURAL DESIGN
DAVID LITTLETON

David Littleton
B. Sc. (Hons) Civil Eng.
MIPENZ (Structural), CPEng

1038 Mt Cargill Rd, RD2 Waitati, Dunedin
Phone & Facsimile (03) 482-1669
Mobile (027) 4388-239

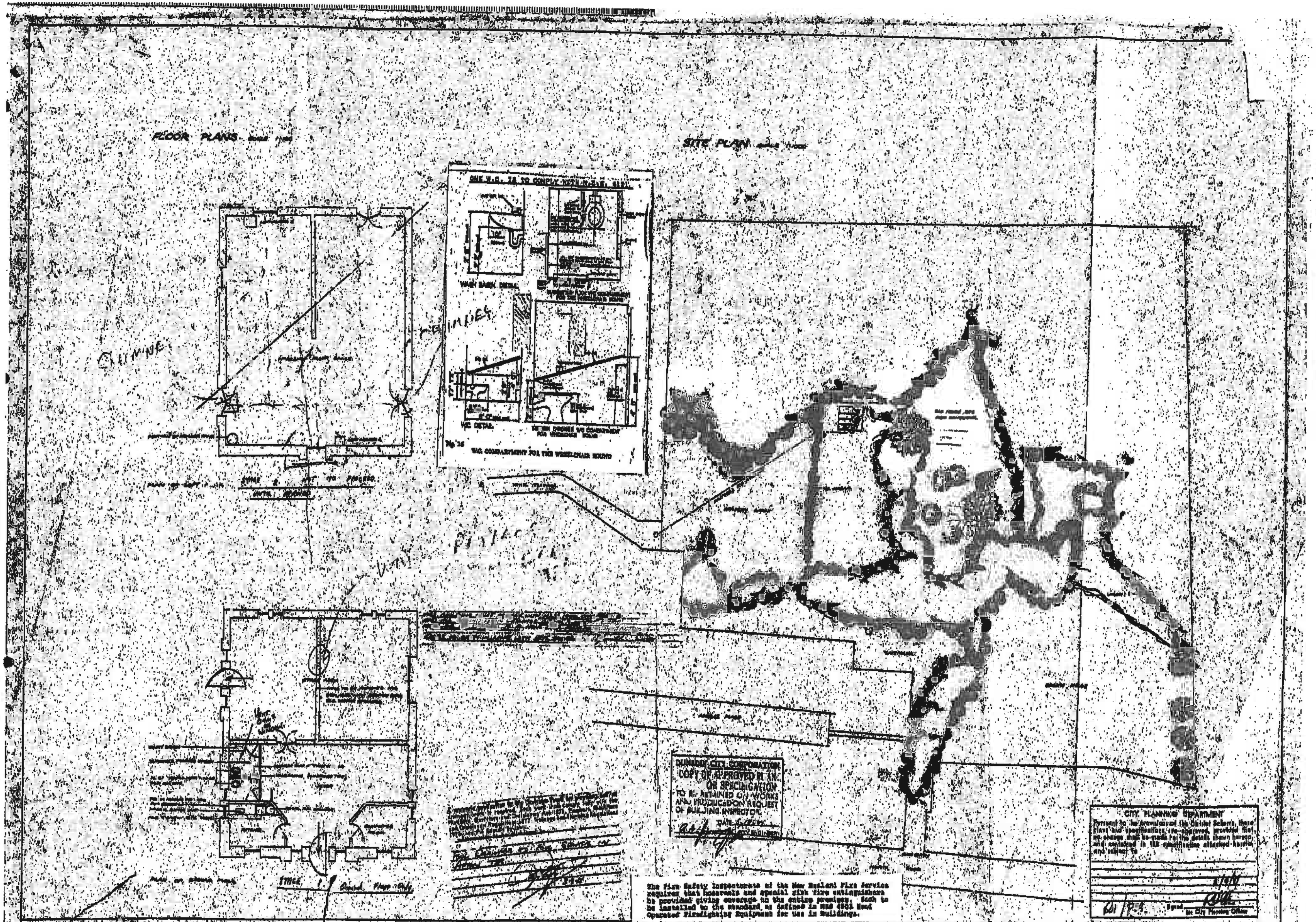
ISA – Chingford Park Stables
North Rd., Dunedin

Notes: 1/ This drawing is copyright ©of David Littleton
2/ Contractor must verify all dimensionson on site
3/ Do not scale drawings

Issue	Date	Amendment
1	3/1/14	
–	__/__/__	
–	__/__/__	–
–	__/__/__	–

Sheet
S1

Job No.
13/047/9



CITY PLANNING DEPARTMENT

Pursuant to the provisions of the District Scheme, these plans and specifications are approved, provided that no change shall be made to the details shown hereon and contained in the specification attached hereto and subject to

Signed ________ for City Planning Officer

DUNEDIN CITY CORPORATION
COPY OF APPROVED PLAN OR SPECIFICATION
TO BE RETAINED ON WORKS AND PRODUCED ON REQUEST OF BUILDING INSPECTOR.
DATE
CITY ENGINEER

The Fire Safety Inspectorate of the New Zealand Fire Service requires that hosereels and special risk fire extinguishers be provided giving coverage to the entire premises. Such to be installed to the standard as defined in NZS 4503 Hand Operated Firefighting Equipment for use in Buildings.

STAGE 1 Ground Floor Only

SCALE	AS SHOWN
DATE	10 . 8 . 81
DESIGNED	
DRAWN	B. L. C.

1961

PLAN OF EXISTING LAYOUT and PROPOSED MODIFICATIONS

CHINGFORD — ARTS — WORKSHOP
CHINGFORD PARK NORTH ROAD
DUNEDIN.
2099