BATCHELAR McDOUGALL CONSULTING
Structural & Civil Engineers

INITIAL SEISMIC ASSESSMENT REPORT (ISA PLUS)

Mediaworks, Ambrosia, Key-Wee Lock & Repair Company, Les Sheikh Design

2-10 Kelvin Street, Invercargill

Client Name: HWCP Management Limited

BMC Reference: 1711-2266

Date Issued: 09/04/2018

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Issue Register:

Revision	Date	Description		
A	09/04/2018	ISA (Plus)		
		Prepared by	Reviewed by	Approved by
	Name	Charlotte Corston	Matt Stewart	Andrew Marriott
	Signature	Be(hons), MEngNZ	BSCE (USA-CA), PE (USA-CA), CMEngNZ	BE, CPEng, CMEngNZ, IntPE(NZ), MICOMOS

Revision History:

Rev. No	Date	Issue Description	Prepared by	Reviewed by

Contents:

1 Executive Summary

The following report summarises the findings of an Initial Seismic Assessment (ISA Plus) of the building at 2-10 Kelvin Street, Invercargill. This building has "Tier 2" heritage status in the "Proposed Invercargill City District Plan", dated January 2017.

The two-storey building is constructed of unreinforced masonry (URM) walls, timber floor and roof framing. The building was constructed circa 1904-1924. The building is known to have been renovated three times (1940,1971 and 1981) since its construction. The building is located in the Invercargill CBD. This location is a 'medium' seismic risk region with a seismic hazard factor of 0.17. For comparison, Christchurch has a seismic hazard design value of 0.30 and is a 'high' seismic risk region, while Dunedin has a seismic hazard value of 0.13 and is a 'low' seismic risk region.

Documentation available to Batchelar McDougall Consultants Limited (BMC) for the purposes of this assessment is summarised in Section 4.1. This assessment is based on these documents and site visit observations only.

For the purposes of this evaluation, the building has been assessed as a structure of Importance Level 2 (IL2) – Normal Building.

BMC have completed an NZSEE Initial Evaluation Procedure (IEP) spreadsheet. In addition, BMC has provided an initial assessment of the building and carried out a calculation of the out-of-plane performance of a critical wall.

From this assessment, the building is considered to have lateral load carrying capacity of 15-20% New Building Standard (%NBS) for an IL2 building as follows,

Loading direction	Building %NBS (IL2)	Seismic Grade	Limiting performance
East-West (Longitudinal)	15-20% NBS	E	Out-of-plane capacity of shopfront URM walls
North-South (Transverse)	15-20% NBS	E	Out-of-plane capacity of shopfront URM walls, in-plane soft storey at the shopfront

Refer to Section 5 for explanation and summary of assessment.

A 'Desk Top' geotechnical assessment from nearby sites has been referenced in relation to likely geotechnical conditions for this site. The building is assumed to have shallow strip footing foundations which will likely be subject to some differential settlement as a result of liquefaction under a significant (ULS) seismic event.

Our ISA Plus found that the building at 2-10 Kelvin Street, Invercargill has a capacity less than 34%NBS (IL2), and the building, therefore, is considered to be potentially Earthquake Prone as defined in the Building Act.

Note the ISA Plus is considered to provide a relatively quick, high-level and mostly qualitative measure of the building's performance. If a more defined level of performance is required then a Detailed Seismic Assessment (DSA) would need to be carried out.

2 Scope of Our Engagement

As requested by HWCP Management Limited, Batchelar McDougall Consulting Limited (BMC) has undertaken a comprehensive Initial Seismic Assessment (ISA Plus) of the seismic capacity of the building at the above noted address.

The seismic assessment and reporting have been undertaken in accordance with the qualitative procedures detailed in "The Seismic Assessment of Existing Buildings, Technical Guidelines for Engineering Assessments" issued by the Ministry of Business, Innovation and Employment (MBIE) and now cited in the Building (Earthquake-prone buildings) Amendment Act 2016 (which has now been integrated into the Building Act 2004) with reference to potentially earthquake prone buildings. BMC have included a simple calculation / assessment of an element of the building form(s) or structure(s) that BMC have assessed as limiting the global seismic capacity of the building.

This structural assessment includes:

- Review of existing building plans or production of a scale layout plan and review of any prior reports, if available.
- Undertaking interior and exterior visual inspection of exposed elements on-site, where access is available.
- Consideration of the general established geotechnical evidence for the site (from the initial 'Desktop Study' relevant to the CBD block by Geosolve Limited).
- Completion of an Initial Evaluation Procedure (IEP) spreadsheet(s).
- Engineering assessment and/or calculation of a primary or critical structural element that is considered to limit the global seismic capacity of the building.
- Production of a summary report.

The assessment is made with regard to Clause B1 – Structure of the New Zealand Building Code. No other Building Code Clauses have been assessed by this report.

This structural assessment is based on the visual evidence and indications present at the time of inspection. No specific invasive investigation work has been carried out (although wall thicknesses and wall/parapet heights may be determined). The findings of this report may therefore be subject to revision pending further and more detailed investigation or assessment and/or deterioration of elements from earthquake or ground settlement. This report does not address any hidden or latent defects that may have been incorporated in the original design and construction.

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

The scope of this evaluation is limited to the initial or first stage assessment of the potential performance of the building in an earthquake ONLY. No assessment has been made of other load cases such as wind, snow and gravity.

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

This report is provided solely for use by HWCP Management Limited and shall not be relied on by any other parties without written approval from BMC.

3 Building Description

3.1 General Overview

The building is located at 2-10 Kelvin Street, Invercargill, as shown below in Figure 1. The building is a two-storey unreinforced masonry (URM) brick structure tenanted by Mediaworks on the first floor and four tenancies on the ground floor – Ambrosia, the old Vodafone, Key-Wee Lock & Repair Company and Les Sheikh Hair Design.

Figure 1 - Location of 2-10 Kelvin Street, Invercargill

The building at 2-10 Kelvin Street is one of a three-part building complex constructed between 1904-1924, on the corner of Kelvin Street and Tay Street, as outlined in Figure 1. These three buildings have been identified as follows:

- 12-16 Kelvin Street shares a façade with 2-10 Kelvin Street. Each structure has separate first floors and perimeter roof parapets. Hence, these have been treated as two buildings
- 2-10 Kelvin Street and 58 Tay Street share one first floor area. Each structure have separate façades and perimeter roof parapets. Hence, have been treated as two buildings

Renovations of the Cecil Hotel were undertaken by Allan C Ford in 1940 for W.T.Stroud Esq. In 1971 further alterations to Cecil Hotel were completed by Smith, Rice, Lawrence and Mollison for the Invercargill Licencing Trust and again in 1981 by T.H.Jenkins & Associates for Foveaux radio.

The shopfronts at ground floor, facing Kelvin St and Tay St, have full height glazing. The façade at first floor has arched windows in the URM structure with a parapet above. A shopfront canopy extends the full width of the building. The building has been classified by Invercargill City Council as a site of local significance in the "Proposed Invercargill City District Plan", dated January 2017. The building description is summarised below in Table 1.

Building Feature	Description
Building address:	2-10 Kelvin Street, Invercargill
Footprint dimension:	33 m x 14 m
Number of storeys:	2
Gross floor area (approximate):	890 m^2
Building history:	Built circa 1904-1924, Renovation by Allan Ford in 1940 Renovation by Smith, Rice, Lawrence and Mollison in 1971 Renovation by T.H. Jenkins & Associates in 1981.
Archive Plan Availability	1940 Architectural Drawings by Allan C Ford 1971 Architectural Drawings by Smith, Rice, Lawrence and Mollison 1981 Structural Drawings by T.H.Jenkins & Associates
Occupancy:	Retail
Importance Classification: (AS/NZS 1170.0:2002: Table 3.2)	IL2 Normal building
Heritage Classification:	Tier 2

Table 1: Building Description

3.2 Construction Materials & Configuration

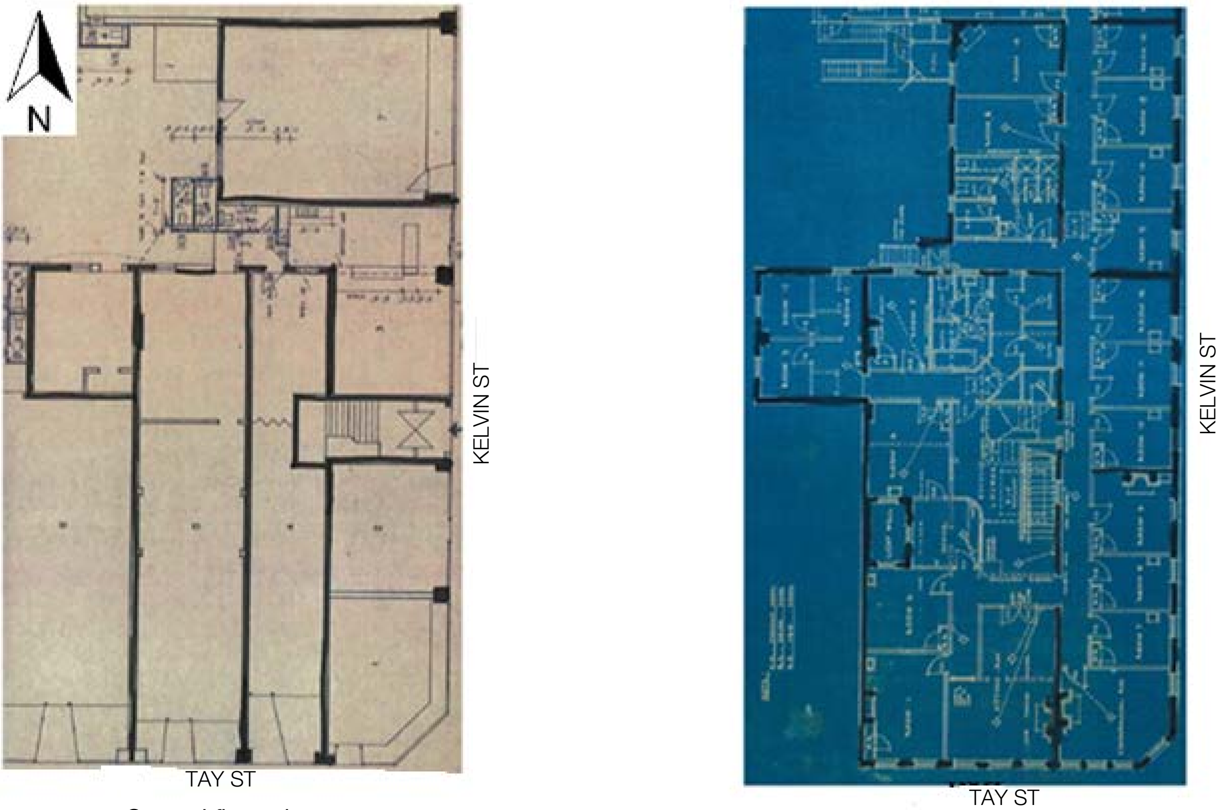
The two-storey building covers a corner site at the intersection of Kelvin Street and Tay Street. The ground floor plan and first floor plan are shown below in Figure 2. The ground floor plan is from the 1971 Architectural Drawings by Smith, Rice, Lawrence and Mollison and the first-floor plan is from the 1940 Architectural Drawings by Allan C Ford.

The perimeter north walls, west walls and intertenancy walls are full height URM. At the shopfronts, the ground floor is "open" with URM wall/piers above. The URM wall/piers above are likely supported by steel beams spanning between steel posts and URM walls/piers across the shopfront. A canopy protrudes over the footpath along the shopfronts. The canopy is supported at the shopfront wall and supported by steel gravity posts at the footpath edge.

The roof is constructed of corrugated iron roofing on timber purlins spanning between timber trusses. The timber trusses are supported on perimeter URM side walls and interior supports.

The first floor is assumed to be constructed of timber planks on timber joists that span between the perimeter side walls and the interior supports.

The ground floor construction was identified as slab on grade. The URM brick walls are assumed to be supported on concrete footings.



Ground floor plan

First floor plan

Figure 2 - Building floor plan

The general condition of the building is average at ground floor. At first floor there is water ingress seen where external cracks in the URM were observed. Externally cracks in the URM wall indicate that the structure has potentially sustained earthquake damage.

3.3 Lateral Load Resisting Structural System

The main components of the lateral load resisting system are full height URM walls and the timber diaphragms. At the first floor, the diaphragm is the timber floor framing. At roof level, the diaphragm is the timber roof framing and a corrugated iron roof.

The intended lateral load path for such a structure is as follows. The timber diaphragms and in-plane URM walls work together to transfer the seismic loads from each building level down to ground level. At each building level, the diaphragm spans horizontally, like a beam, between its support points – the in-plane URM walls. The diaphragm 'effectively' distributes the seismic loads to the in-plane URM walls. The URM walls transfer the seismic loads to ground level. The lateral bracing system relies on the in-plane shear capacity of URM walls, the strength of the timber diaphragm, and the connection of the timber diaphragm to the URM wall.

For this era and construction type, it was normal for timber floor framing to be supported in "pockets" in the URM wall. With this connection style, there are no positive connections from the timber diaphragm to the URM walls. The only lateral connection is the friction from the timber floor joist bearing on the URM wall.

For seismic loads in the north south direction (longitudinal direction), the lateral loads are resisted by the perimeter west URM walls and the intertenancy URM walls.

For seismic loads in the east west direction (transverse direction), the lateral loads are resisted by the northern external URM walls and intertenancy URM walls.

3.4 Foundations & Geotechnical

There are no obvious signs of significant settlement in foundations or wall cracking. No settlement cracking was observed. Foundation details are unknown. It is assumed that the URM walls sit on concrete footings.

A 'Desk Top' geotechnical study titled Invercargill CBD Project Stage 1 dated February 2018 by Geosolve Limited (Ref: 171019) has been completed. This study focussed on the likely ground conditions for the Old Government Life & Old Southland Times buildings but does relate generally to the CBD block as a whole.

Key findings from the Geosolve report that are likely to relate to this building assessment are:

- Ground / Soil Class D is to be used for the purposes of seismic assessment.
- Some liquefaction induced differential settlement is likely in a significant (ULS) seismic event.
- Bearing conditions for typical strip footings are less than 'good ground' as defined by NZS3604 (approximately half). Note BMC has not checked actual foundation bearing pressures for this building.

4 Building Inspection

4.1 Documentation

Documentation received by BMC that was considered relevant to this report includes: -

Description	Revision	Issue Date
Proposed alterations to Hotel Cecil, Kelvin Street for W.T.Shroud Esq. by Allan C Ford	N/A	1940
Alterations to the Cecil Hotel for the Invercargill Licencing Trust by Smith, Rice, Lawrence and Mollison	4	1971
Cecil Buildings Renovations for Foveaux Radio by T.H.Jenkins & Associates	9	1980
Invercargill City: Central City Area Heritage Buildings Re-Assessment 2016 by Dr. Andrea Farminer and Robin Miller	N/A	2016

4.2 Observations and/or Damage

The building was inspected by Andrew Marriott and Charlotte Corston of BMC on 26/02/2018. This was a visual inspection only. The inspection included the internal ground floor only and external accessible areas of the building. No invasive investigations were carried out.

Items of structural damage observed:

- Cracking in URM walls and parapet due to earthquake action
- Bowing of URM wall due to earthquake action
- Water ingress

The following photo images and observations and specific comments relate to the inspection. A complete photo record of the inspection is available on request.

No#	Photo	Comments
1		Outline of roof area at 2-10 Kelvin Street
2		Cracks, in western URM wall, extending from window corners
3		Vertical crack in URM wall

No#	Photo	Comments
4		Horizontal crack in URM wall extending from fire escape balcony
5		URM chimney and fire escape leading to nowhere

No#	Photo	Comments
6	  	Bow in URM wall at first floor along eastern elevation. Bow greater than 100 mm. As a result of bow cracks greater than 10 mm evident in URM wall. Cracking/bowing due to internal URM wall shunting external elevation at this location.
		Internal wall that has shunted and bowed external wall above

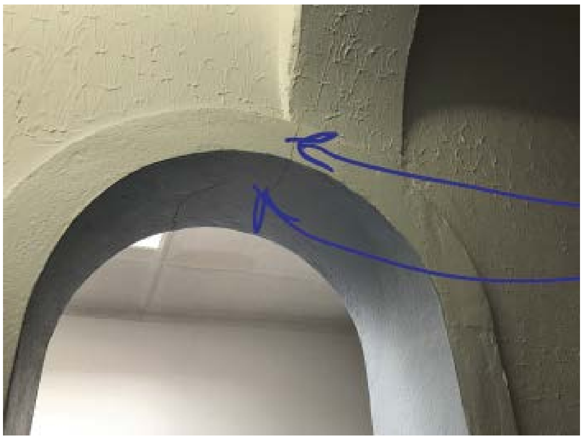
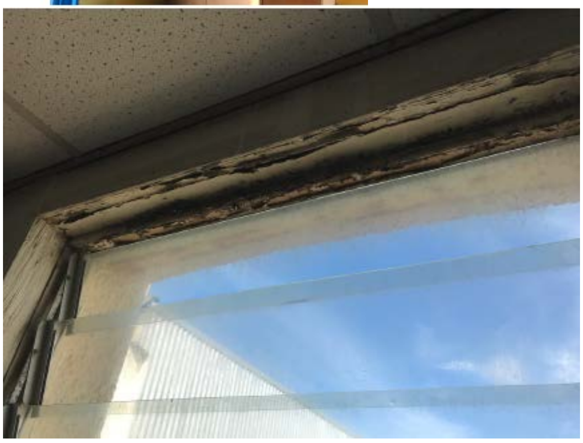
No#	Photo	Comments
7		Cracking to arch
8	 	Evidence of water ingress

Table 2 – Photos of observations and damage

5 Assessment

5.1 Specific Calculations / Engineering assessment

In the transverse direction, the limiting element of the lateral load carrying capacity is the out-of-plane capacity of the URM wall at the shopfront and a soft storey along Tay Street. A soft storey in a building occurs when a significantly more flexible building level supports a more rigid building level. This occurs at the shopfront, where a relatively heavy rigid first floor façade is supported by a "open" ground floor framing with no distinct lateral force resisting elements, see Figure 3.

Figure 3 - Building elevation of soft storey structure example

In the longitudinal direction, the ground floor has three URM walls. At the first floor there are perimeter walls only. As such, the ground floor would likely be stiffer than first floor therefore there will be no soft storey in the longitudinal direction. If the Kelvin St shopfront is a lateral load resisting wall it would be classified as a horizontal offset.

The out-of-plane capacity of the shopfront façades were calculated to be approximately 20%NBS (IL2). The shopfront wall was taken as 355 mm thick, 6 m height (first floor to top of parapet) and supported on double steel beams above the open shopfront. The wall appears to have no positive connection to the timber diaphragm at first floor or at roof level. As such, the wall essentially cantilevers from its support point with little to no lateral support above. For out-of-plane wall calculation, refer to Appendix A.

The soft storey is a critical structural weakness and the estimated capacity of the lateral force resisting system is approximately 15-20%NBS (IL2).

The overall estimated lateral load resisting capacity of the building is 15-20%NBS.

5.2 IEP Spreadsheet Calculations

The NZ Society of Earthquake Engineers (NZSEE) has developed an assessment calculation (the IEP Spreadsheet) to be used in a preliminary estimation of the seismic capacity (Percentage of New Build Standard (%NBS)) of a building. This is primarily based on comparing the current seismic design Loadings Code (NZS1170.5) in 2018 with the seismic design load at the time the building was designed. It assumes that the original design was built to at least 100%NBS of the design load at this time. It allows for other 'engineering judgement' and observation factors to be incorporated but the process is at best a preliminary estimation.

BMC has carried out an IEP assessment for this building. The results were 15%NBS (IL2). The lateral capacity of the building is limited by the soft storey weakness and the age of the building.

The IEP assessment of this building therefore indicates an overall score of 15%NBS (IL2) corresponding to a 'Grade E' 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. The IEP Spreadsheets are (for both parts of the building) included as Appendix A.

6 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 false ceilings, in-ceiling ducting, services and plant or contents. These issues are outside the scope of this initial assessment but could be the subject of another investigation. False (or suspended) ceilings exist on both ground and first floor levels of this building.

7 Continued Occupancy Recommendations

Based on our assessment of the building, BMC considers continued occupancy is appropriate for 6-12 months *subject to the conditions of the Building (Earthquake-prone buildings) Amendment Act 2016*.

If required, a Detailed Seismic Assessment (DSA) or a more detailed assessment could be carried out with intrusive investigation work into the nature and capacity of the timber framing connections to the front and rear URM walls at the roof and first floor level. This more detailed assessment could enable an understanding of other aspects of its seismic performance and potentially raise the lateral capacity of the building to above 34%NBS.

8 Conclusions

Based on our assessment, the building has a seismic load carrying capacity of less than 34%NBS and the building, therefore, is considered to be potentially Earthquake Prone as defined by the Building Act.

This building has "Tier 2" heritage status in the "Proposed Invercargill City District Plan", dated January 2017.

If a more defined level of performance is required, then a DSA would need to be carried out.

For more summary comments, refer to the Executive Summary.

APPENDIX A - NZSEE IEP Spreadsheet & Out-of-Plane Wall Calculation

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 "The Seismic Assessment of Existing Buildings" Technical Guidelines for Engineering Assessments, July 2017. 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.*

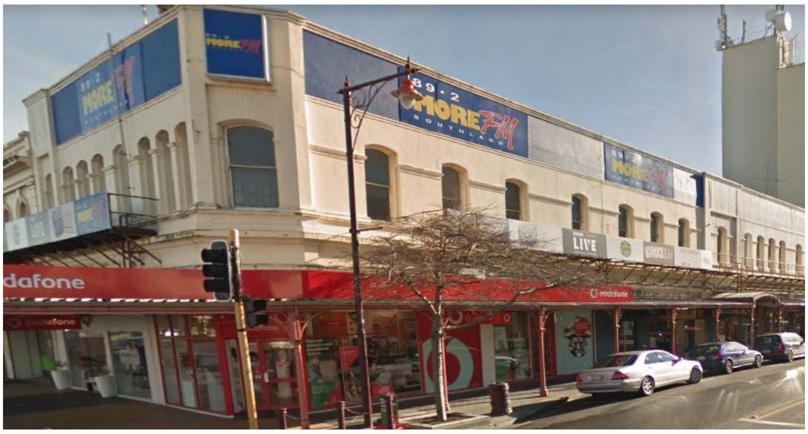
Street Number & Name:	**2-10 Kelvin St**	**Job No.:**	**1711-2266**
AKA:		**By:**	**Charlotte Corston**
Name of building:		**Date:**	**6/04/2018**
City:	**Invercargill**	**Revision No.:**	

Table IEP-1 Initial Evaluation Procedure Step 1

Step 1 - General Information

1.1 Photos (attach sufficient to describe building)

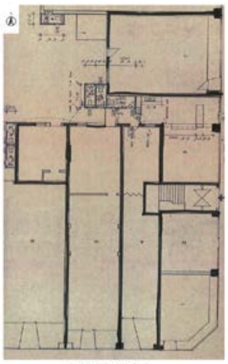
See ISA report



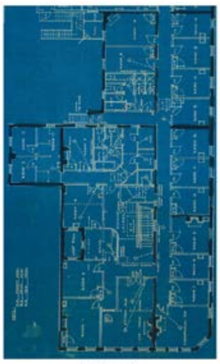
NOTE: THERE ARE MORE PHOTOS ON PAGE 1a ATTACHED

1.2 Sketches (plans etc, show items of interest)

See ISA report



Ground Floor Plan



First Floor 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)

See ISA report

1.4 Note information sources Tick as appropriate

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

1940 Architectural Drawings by Allan C Ford
1971 Architectural Drawings by Smith, Rice, Lawrence and Mollison, and 1980 Structural drawings by T.H.Jenkins & Associates

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

Street Number & Name:	2-10 Kelvin St	Job No.:	1711-2266
AKA:		By:	Charlotte Corston
Name of building:		Date:	6/04/2018
City:	Invercargill	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:	Others	Others
Seismic Zone:	Not applicable	Not applicable
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)	Not applicable	Not applicable

d) Estimate Period, *T*

Comment:

URM Shear walls

		Longitudinal	Transverse
h_n =		9	9 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 and Napier (1931-1935) where Factor D may be taken as 1.0, 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 Seismic Assessment of Existing Buildings" Technical Guidelines for Engineering Assessments, July 2017. 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:	2-10 Kelvin St	Job No.:	1711-2266
AKA:		By:	Charlotte Corston
Name of building:		Date:	6/04/2018
City:	Invercargill	Revision No.:	

Table IEP-2 Initial Evaluation Procedure Step 2 continued

2.2 Near Fault Scaling Factor, Factor E

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

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

2.3 Hazard Scaling Factor, Factor F

a) Hazard Factor, *Z*, for site

Location: Invercargill — Refer right for user-defined locations

Z = 0.17 (from NZS1170.5:2004, Table 3.3)

Z_{1992} = 0.68 (NZS4203:1992 Zone Factor from accompanying Figure 3.5(b))

Z_{2004} = 0.17 (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:	5.88	5.88

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:

URM Shear Walls

		Longitudinal	Transverse
	μ =	1.25	1.25
b) Factor H		k_μ	k_μ
For pre 1976 (maximum of 2)	=	1.14	1.14
For 1976 onwards	=	1	1
	Factor H:	1.14	1.14

(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 =	0.93	0.93
b) Structural Performance Scaling Factor = $1/S_p$	Factor I:	1.08	1.08

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**)	**17%**	**17%**

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

Street Number & Name:	2-10 Kelvin St	Job No.:	1711-2266
AKA:		By:	Charlotte Corston
Name of building:		Date:	6/04/2018
City:	Invercargill	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

3.2 Vertical Irregularity

Effect on Structural Performance ○ Severe ◉ Significant ○ Insignificant — Factor B: 0.7

Soft storey

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	◉ 1	○ 1	○ 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: 0.70**

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Name of building:		Date:	6/04/2018
City:	Invercargill	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

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

3.2 Vertical Irregularity

Effect on Structural Performance ○ *Severe* ◉ *Significant* ○ *Insignificant* **Factor B** 0.7

Soft Storey

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	◉ 1	○ 1	○ 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 1.00

Record rationale for choice of Factor F:

Comment

PAR

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

Transverse **0.70**

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Name of building:		Date:	6/04/2018
City:	Invercargill	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)	17%	17%
4.2	**Performance Achievement Ratio (PAR)** (from Table IEP - 2)	0.70	0.70
4.3	**PAR x Baseline *(%NBS)*$_b$**	15%	15%
4.4	**Percentage New Building Standard *(%NBS)* - Seismic Rating** (Use lower of two values from Step 4.3)		15%

Step 5 - Is *%NBS* < 34? YES

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

Step 7 - Provisional Grading for Seismic Risk based on IEP

Seismic Grade E

Additional Comments (items of note affecting IEP based seismic rating)

Relationship between Grade and *%NBS* :

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

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

Street Number & Name:	2-10 Kelvin St	Job No.:	1711-2266
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Name of building:		Date:	6/04/2018
City:	Invercargill	Revision No.:	

Table IEP-5 Initial Evaluation Procedure Step 8

Step 8 - Identification of potential Severe Structural Weaknesses (SSWs) 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

Potential Severe Structural Weaknesses (SSWs):

Note: Options that are greyed out are not applicable and need not be considered.

Occupancy not considered to be significant - no further consideration required•

Risk not considered to be significant - no further consideration required•

The following potential Severe Structural Weaknesses (SSWs) have been identified in the building that could result in significant risk to a significant number of occupants:

1. None identified

2. Weak or soft storey (except top storey)

3. Brittle columns and/or beam-column joints the deformations of which are not constrained by other structural elements

4. Flat slab buildings with lateral capacity reliant on low ductility slab-to-column connections

5. No identifiable connection between primary structure and diaphragms

6. Ledge and gap stairs

IEP Assessment Confirmed by ______ **Signature**

Andrew Marriott **Name**

72638 **CPEng. No**

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

Street Number & Name:	**2-10 Kelvin St**	**Job No.:**	**1711-2266**
AKA:		**By:**	**Charlotte Corston**
Name of building:		**Date:**	**6/04/2018**
City:	**Invercargill**	**Revision No.:**	

Table IEP-1a Additional Photos and Sketches

Add any additional photographs, notes or sketches required below:

Note: print this page separately

BATCHELAR McDOUGALL CONSULTING STRUCTURAL & CIVIL ENGINEERS		2-10 Kelvin Street - ISA Plus
Wanaka Office: Level 3, 99 Ardmore Street		*2-10 Kelvin Street, Invercargill*
Phone: (03) 443 4531	www.bmconsult.co.nz	1711-2266 | Apr-18 | *CJC*
Subject:	URM wall out of plane capacity check of shopfront elevation	

URM Wall Properties / **NZS 1170.5 (2004) parameters**

γ_{wall}	18	kN/m^3	Soil Class	D	
$t_{w\ nom}$	0.355	m	C_h (0)	1.12	From Table 3.1, use values in brackets
$t_{w\ eff}$	0.348	m	N(T,D)	1	Refer to Section 3.1.6
$Q_{Cladding}$		kPa	Z	0.17	Refer to Section 3.1.4
h	6	m	R	1	Refer to Section 3.1.5
W	38.3	kN	C(0)	0.19	
e_b	0.124	m	R_P	1	From Table 8.1
y_b	3.00	m	h_n	9	m (Total Height)
γ	1.49	participatior	h_i	6	m (Average height of part)
T_p	1.98	sec	C_{Hi}	2.00	
Δ_i	0.25	m	$C_{hc}(T_p)$	0.67	
Δ_m	0.07	m	$C_p\ (T_p)$	0.25	
D_{ph}	**0.37**	**m**			
%NBS	**20**	**%**			

Case	Applicable	C_{Hi}
h_i < 12 m	YES	2
$h_i < 0.2h_n$	NO	N/A
$h_i \geq 0.2h_n$	YES	3

C_p(0.75)

C_{hc}(0.75)	1.48	g
C_p (0.75)	0.99	g

Anchorage Design

C_m	0.06	g
C_{con}(0.75)	0.06	g
F^*_{top}	**2.2**	**kN**

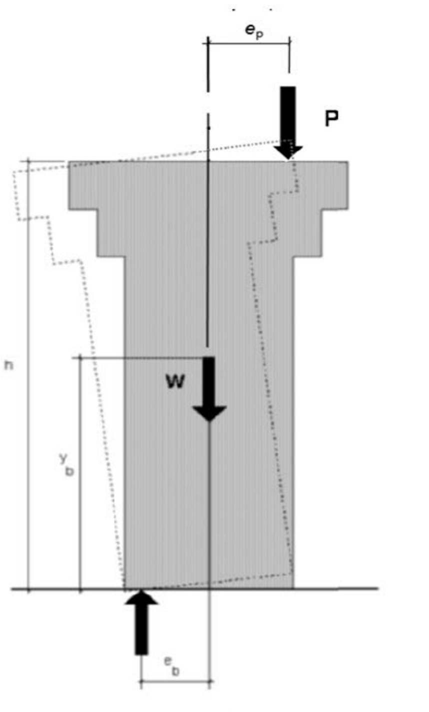

Figure 10B.3: **Single cantilever**