BATCHELAR McDOUGALL CONSULTING
Structural & Civil Engineers

INITIAL SEISMIC ASSESSMENT REPORT (ISA PLUS)

42 Tay Street, Invercargill

Client Name:	HWCP Management Ltd)
BMC Reference:	1711-2266
Date Issued:	9/04/2018

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Issue Register:

Revision	Date	Description		
A	9/04/2018	ISA (Plus)		
		Prepared by	Reviewed by	Approved by
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Revision History:

Rev. No	Date	Issue Description	Prepared by	Reviewed by

Contents:

1 Executive Summary

The following report covers the Initial Seismic Assessment (ISA Plus) of the building at 42 Tay Street, Invercargill. The building has been classified as having a "Tier 2" heritage being a site of local significance in the "Proposed Invercargill City Council Plan", dated January 2017. However, in the Invercargill City Central City Area Heritage Building Review Re-assessment of November 2016 it was recommended for *"Removal from the list"* due to it having *"Low streetscape or architectural and historical value 1935 frontage not an attractive example of Art Deco design".*

The two storey building comprises one retail unit arranged to ground floor and first floor being vacant. The building is constructed of a mix of unreinforced masonry (URM) bricks to the North and East boundary walls and first floor of the West boundary walls and Reinforced concrete wall / frame to the facade with timber roof construction and a timber floor supported by down stand timber beams to Cast Iron columns all constructed circa 1900 and the frontage remodelled circa 1935. The North West quadrant of the building was replaced in 1965 by a concrete framed building which is not identified as part of the heritage listing and which will be assessed as a non-heritage building elsewhere. 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 factor of 0.3 and is a 'high' seismic risk region, while Dunedin has a seismic hazard factor of 0.13 and is a 'low' seismic risk region.

Documentation available to 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 above described building has been assessed as a structure of Importance Level 2 (IL2) – Normal Building.

The primary lateral load resisting wall elements (and general structural elements) are considered to be in a fair condition for its age.

BMC have completed an NZSEE Initial Evaluation Procedure (IEP) spreadsheet. In addition BMC has provided an assessment of the out-of-plane performance of a critical URM wall.

From this assessment the building is considered to have a lateral load carrying capacity of % New Building Standard (IL2) as follows,

Location	Building %NBS (IL2)	Seismic Grade	Limiting performance
Retail Units	10-20%NBS	E	Out-of-plane capacity of East boundary URM walls

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 has 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 42 Tay 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 2004.

Note the ISA 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 Ltd), we have 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 Ltd);
- 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.

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

This report is provided solely for use by HWCP Management Ltd) and shall not be relied on by any other parties without written approval from Batchelar McDougall Consulting.

3 Building Description

3.1 General Overview

The building located at 42 Tay Street, Invercargill is a single storey structure with some mezzanine floors. The building is currently partly tenanted by Art Fun Wear and partly untenanted with a previous retail use.

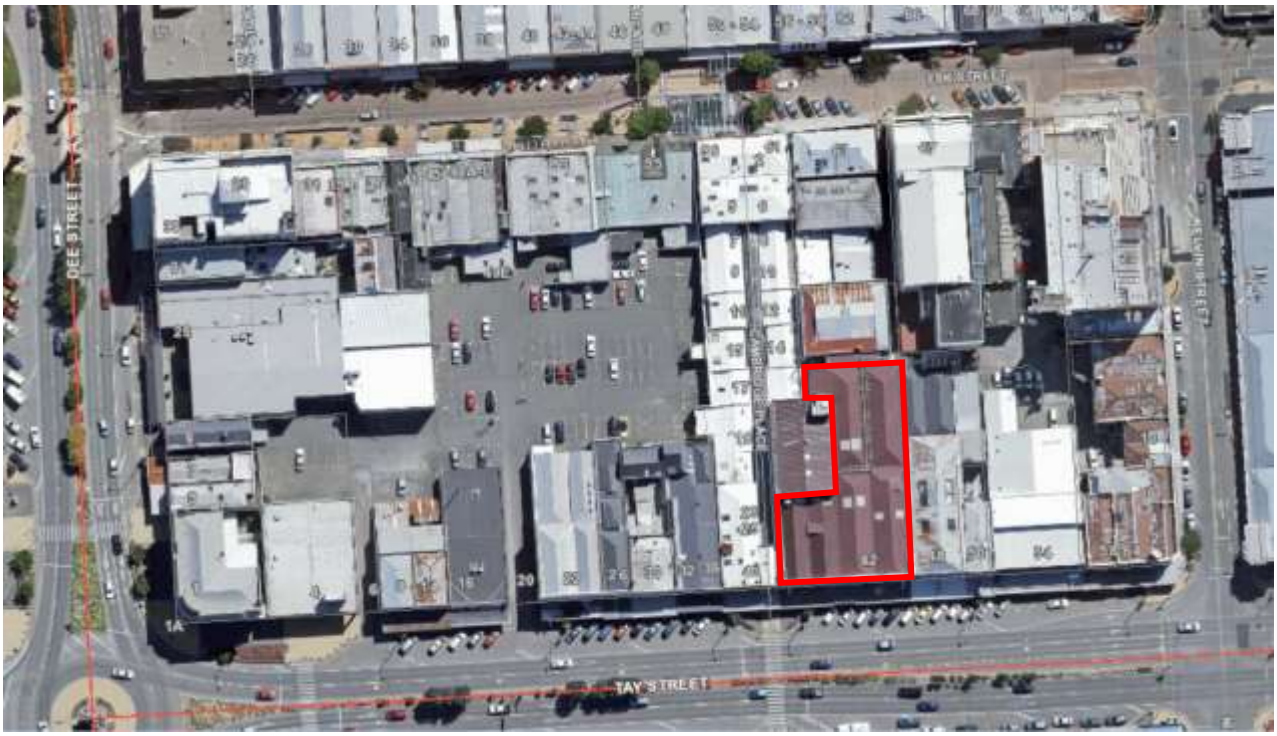

Figure 1: Location of 42 Tay Street.

A full description of the building(s) is provided in Table 1 below.

Building Feature	Description
Building address:	42 Tay Street, Invercargill
Overall plan dimensions:	30.0 (E-W) x 49 m (N-S) there is a 13.7 (E-W) x 29.3m (N-S) inset to the North West corner for the 3 storey concrete building and part of the Cambridge Place Arcade.
Number of storeys:	2
Gross floor area:	Approximately 2137m2

Building Feature	Description
Building history:	Constructed circa 1900, frontage rebuilt circa 1935.
Archive Plan Availability	Yes, 1965 3 storey element drawings
Occupancy:	Tenanted Art Fun Wear - Ground Floor Untenanted Vacant - First Floor
Importance Classification: (AS/NZS 1170.0:2002: Table 3.2)	IL2 Normal building
Heritage Classification:	Recommended for removal from ICC Tier 2 Local List in 2016 (ref:- Invercargill City: Central City Heritage Building Review Re-assessment November 2016).

Table 1: Building Description

3.2 Construction Materials & Configuration

Based on the visual observations the following structure has been identified.

The roof structure of the building consists of corrugated iron roofing likely on timber purlin / rafters supported on timber trusses to the duo pitch roof form, the building having 4 bays of the duo-pitched trusses across its width, with hip ends to the East half of the roof and a hipped detail to its mid length to form a valley.

The first floor is timber joists supported on, potentially, steel beams spanning (N-S) between the cast iron columns to the roof valley lines above and to the 350mm wide (3 wythes) unreinforced masonry (URM) brick walls an the RC façade wall. The ground floor is a reinforced concrete ground bearing slab.

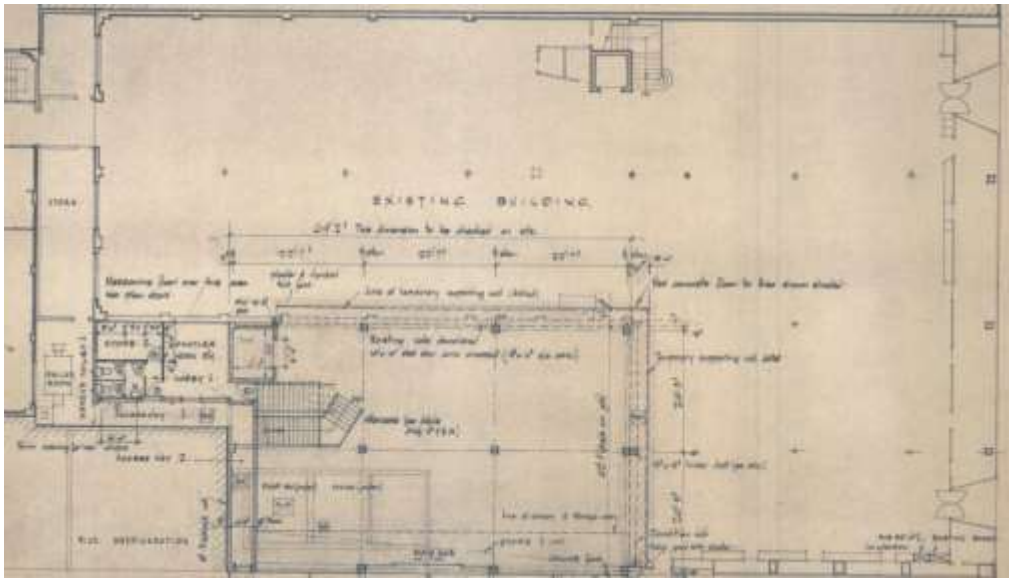

Figure 2: Building Ground Floor Plan from 1965 drawing by Smith Rice Lawrence & Mollison.

Gravity loads are transferred to the foundations via URM walls or the internal cast iron columns, and timber first floor with steel beams and timber roof trusses and purlins.

Foundations are most likely reinforced concrete strip footings under external walls and RC pads to the cast iron columns.

The building is in a fair condition given its age with evidence of cracking defects to the exposed façade elevation.

3.3 Lateral Load Resisting Structural System

The lateral load resisting system for this section of the building relies on the in-plane shear capacity of the external brick walls in both the rear 'across' (E-W) and both 'along' (N-S) directions and the frame action of the units façade walls in the 'across' direction (E-W). Out-of-plane wall / floor / roof seismic loads or forces are transferred through the first-floor and / or roof structure via diaphragm action to orthogonal walls. This diaphragm action is unlikely to be effective particularly at roof level given its length and its potential loading. There are no effective connections noted or visible at roof or first floor level for diaphragm action.

3.4 Foundations & Geotechnical

There are no obvious signs of significant settlement in foundations or wall cracking. Foundation details for the perimeter of the building are unknown (assumed to be strip footings under the walls).

A 'Desk Top' geotechnical study titled Invercargill CBD Project Stage 1 dated February 2018 by Geosolve Ltd (Ref: 171019) has been completed. This study focused 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 36 Tay Street 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 (approx. half). Note BMC has not checked actual foundation bearing pressures for this building.

4 Building Inspection

4.1 Documentation

Documentation received by us that we consider relevant to this report includes:-

Description	Revision	Issue Date
D.I.C Tay Street Invercargill New Arcade Extensions (for the 3 storey RC framed building) Sheets 1, 2, 4 & 6 by Smith, Rice Lawrance & Mollison - Architects	0	Apr 1965
D.I.C. Proposed Arcade Additions – Foundation Plan Job No 23/205 Sheet 1 By E R Garden & Partners - Engineers	E	Oct 1965

4.2 Observations and/or Damage

The building was inspected by Warren Holt of BMC on 27/02/2018. This was a visual inspection only of the internal and external accessible areas of the building. No invasive inspection works were carried out other than drilling of the walls to confirm composition.

Items of structural damage were observed including horizontal & vertical cracks to the exposed façade elevation wall.

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		The South wall comprises RC wall and frame construction with minimal bracing structure to ground floor. This is potentially a structural weakness for the building. Note there is no seismic gap to the buildings to the North, East or East and there is variable lateral load resistance in these buildings meaning that load from 19- 21 Cambridge Place, 40 and 48 Tay Street and the 3 storey RC frame element addition may be passed into the structure of the building in question if all the buildings remain in place.
2		The floor plan is fully open with gravity only supports within the space. The floor and roof diaphragms are therefore critical to the buildings stability.
3		The Cast iron column to beam connection indicates no mechanism to provide any resistance to horizontal loading of the building globally. Cast Iron has very low capacity to cyclic moment loading in any case.
4		The East URM wall is detailed with window at high level which will limit the in- plane and out of plane resistance of the walls.

5 Assessment

5.1 Specific Calculations / Engineering assessment

The following additional items of calculation / consideration have been undertaken as part of this assessment.

The East side boundary wall element with respect to out-of-plane (OOP) performance, acts as a cantilever from ground floor level, given the lack of effective restraint provided by the roof construction detailing typical of this era of building. This is likely to be the critical element from a seismic perspective for this part of the building. The assumed parameters relating to this vertical cantilever brick wall are, height = 9.3m approx., thickness = 350mm. BMC has carried out an OOP calculation resulting in a 17%NBS performance for this wall (see Appendix A for calc sheet). Note this does not allow for the either the loss of brick section or mortar jointing which is not visually evident on site or the stress concentration resulting for the integrated windows.

The in-plane performance of the brick walls is likely to also be inadequate (<34%NBS) given the degree of window openings to the underside of first floor and roof along the buildings length.

5.2 IEP Spreadsheet Calculations

The NZ Society of Earthquake Engineers (NZSEE) have 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.

We have carried out an IEP assessment for this building with the following results:

IEP Score – 10-15%NBS (limited by out-of-plane performance of the two storey element walls, soft story issues and potential diaphragm fixing issues)

The ISA assessment of this building therefore indicates an overall score of 10-20%NBS (IL2) if the building is taken as a whole, including the specific assessment results, 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.

There was no evidence of significant elements of a non-structural nature that would cause for concern from tis effect.

7 Continued Occupancy Recommendations

Based on our assessment of the building, BMC consider continued occupancy is appropriate *subject to the conditions of the Building (Earthquake-prone Buildings) Amendment Act 2016*.

If required a DSA or a more detailed assessment with intrusive investigation work into the nature and capacity of the timber diaphragm connections to the bricks wall at roof plane and 1st floor levels walls was to be undertaken it could potentially raise its capacity to above 34 and/or 67%NBS and also enable an understanding of other aspects of its seismic performance.

8 Conclusions

Based on our assessment, the building has a seismic load carrying capacity of less than 34%NBS (IL2) and the building therefore, is considered to be potentially Earthquake-prone as defined by the Building Act, the rear more recent single storey extension has been ignored for this assessment.

The building has been classified by Invercargill City Council as a site of local significant, giving it a “Tier 2” heritage status in the “Proposed Invercargill City District Pan, dated January 2017. However, it it was recommended for removal from the listing by “Invercargill City: Central City Area Heritage Building Review Re-assessment 2016”. The buildings current condition is determined as being fair.

If a more defined level of performance is required then a Detailed Seismic Assessment (DSA) would need to be carried out.

For more summary comments please refer to the Executive Summary.

APPENDIX A - NZSEE IEP Spreadsheet(s) & OOP Wall calc

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:	**42 Tay Street**	**Job No.:**	**1711-2266**
AKA:	**Art Fun Wear (old Farmers Store)**	**By:**	**W Holt**
Name of building:		**Date:**	**27/02/2018**
City:	**Invercargill**	**Revision No.:**	**A**

Table IEP-1 Initial Evaluation Procedure Step 1

Step 1 - General Information

1.1 Photos (attach sufficient to describe building)

See attached Report

NOTE: THERE ARE MORE PHOTOS ON PAGE 1a ATTACHED

1.2 Sketches (plans etc, show items of interest)

See attached Report

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 attached 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)**	☐

various architectural plans through building development

Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA} Page 2

Street Number & Name:	**42 Tay Street**	**Job No.:**	**1711-2266**
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Table IEP-2 Initial Evaluation Procedure Step 2

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

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

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

	Longitudinal	Transverse
a) Building Strengthening Data		
Tick if building is known to have been strengthened in this direction	☐	☐
If strengthened, enter percentage of code the building has been strengthened to	N/A	N/A
1927		
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:		
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)	Flexible	Flexible
d) Estimate Period, *T*		
Comment:		
h_n =	10	10 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: $T \le 0.4$sec	◉	◉
User Defined (input Period):	○	○
Where h_n = height in metres from the base of the structure to the uppermost seismic weight or mass.		
T:	0.40	0.40
e) Factor A: Strengthening factor determined using result from (a) above (set to 1.0 if not strengthened)	**Factor A:** 1.00	1.00
f) Factor B: Determined from NZSEE Guidelines Figure 3A.1 using results (a) to (e) above	**Factor B:** 0.03	0.03
g) Factor C: For reinforced concrete buildings designed between 1976-84 Factor C = 1.2, otherwise take as 1.0.	**Factor C:** 1.00	1.00
h) Factor D: For buildings designed prior to 1935 Factor D = 0.8 except for Wellington where Factor D may be taken as 1, otherwise take as 1.0.	**Factor D:** 0.80	0.80
***(%NBS)* $_{nom}$ = AxBxCxD**	***(%NBS)* $_{nom}$** 2%	2%

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Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA} Page 3

Street Number & Name:	**42 Tay Street**	**Job No.:**	**1711-2266**
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City:	**Invercargill**	**Revision No.:**	**A**

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: Invercargill

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

Factor F:	5.88	5.88

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.)

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 Generally RC elements added 1935

μ =	1.50	1.50

b) Factor H

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

(where 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 ☐ ☐

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

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

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

	20%	**20%**

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Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA} Page 4

Street Number & Name:	**42 Tay Street**	**Job No.:**	**1711-2266**
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Name of building:		**Date:**	**27/02/2018**
City:	**Invercargill**	**Revision No.:**	**A**

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

Comment

3.2 Vertical Irregularity

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

mass variation - ground floor mass less than 0.9 of first floor front and arcade side elevations

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 0.7

Record rationale for choice of Factor F:

Brickwork condition - reasonable although OOP capacity limited given floor heights
West elevation integral with 3 storey concrete refurbishment.

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

PAR

Longitudinal **0.49**

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Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA} Page 5

Street Number & Name:	**42 Tay Street**	**Job No.:**	**1711-2266**
AKA:	**Art Fun Wear (old Farmers Store)**	**By:**	**W Holt**
Name of building:		**Date:**	**27/02/2018**
City:	**Invercargill**	**Revision No.:**	**A**

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
Comment

3.2 Vertical Irregularity
Effect on Structural Performance ○ Severe ◉ Significant ○ Insignificant — **Factor B** 0.7
mass variation - ground floor mass less than 0.9 of first floor

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 0.70

Record rationale for choice of Factor F:
Large daiphragm span uses 3 storey element but without this there is little capacity.
Brickwork rear wall good condition
Out of plane URM walls to East and West elevations capacity limited

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

PAR
Transverse **0.49**

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Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA} Page 6

Street Number & Name:	**42 Tay Street**	**Job No.:**	**1711-2266**
AKA:	**Art Fun Wear (old Farmers Store)**	**By:**	**W Holt**
Name of building:		**Date:**	**27/02/2018**
City:	**Invercargill**	**Revision No.:**	**A**

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)	**20%**	**20%**
4.2	**Performance Achievement Ratio (PAR)** (from Table IEP - 2)	**0.49**	**0.49**
4.3	**PAR x Baseline *(%NBS)*$_b$**	**10%**	**10%**
4.4	**Percentage New Building Standard *(%NBS)*** (Use lower of two values from Step 4.3)		**10%**

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 **E**

Additional Comments (items of note affecting IEP score)

Indeterminable diaphragm capacity and connection

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

Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA} Page 7

Street Number & Name:	42 Tay Street	Job No.:	1711-2266
AKA:	Art Fun Wear (old Farmers Store)	By:	W Holt
Name of building:		Date:	27/02/2018
City:	Invercargill	Revision No.:	A

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**

Warren Holt **Name**

1026871 **CPEng. No**

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Initial Evaluation Procedure (IEP) Assessment - Completed for {Client/TA} Page 1a

Street Number & Name:	**42 Tay Street**	**Job No.:**	**1711-2266**
AKA:	**Art Fun Wear (old Farmers Store)**	**By:**	**W Holt**
Name of building:		**Date:**	**27/02/2018**
City:	**Invercargill**	**Revision No.:**	**A**

Table IEP-1a Additional Photos and Sketches

Add any additional photographs, notes or sketches required below:

Note: print this page separately

BMC BATCHELAR McDOUGALL CONSULTING
STRUCTURAL & CIVIL ENGINEERS
Wanaka Office: Level 3, 99 Ardmore Street
Phone: (03) 443 4531 www.bmconsult.co.nz

Art Fun Wear
42 Tay Street
Invercargill

1711-2266	Apr-18	*WH*

Subject: Cantilevered Wall Out-of-Plane

URM Wall Properties

γ_{wall}	20	kN/m^3
$t_{w\,nom}$	0.35	m
$t_{w\,eff}$	0.343	m
$t_{cladding}$	0.0000	m
h	9.3	m
W	65.1	kN
W_{clad}	0.0	kN
P	0.0	kN (Overbur
e_b	0.114	m
e_p	0.000	m
y_b	4.65	m
a	303	Nm
b	7	Nm
J	191	kgm^2
J_{anc}	0	kgm^2
γ	1.50	participatior
T_p	2.47	sec
Δ_i	0.23	m
ϕ	0.3	
Δ_m	0.07	m
D_{ph}	**0.41**	**m**
%NBS	**17**	**%**

NZS 1170.5 (2004) parameters

Soil Class	D	
C_h (0)	1.12	From Table 3.1, use values in brackets
N(T,D)	1	Refer to Section 3.1.6
Z	0.17	Refer to Section 3.1.4
R	1	Refer to Section 3.1.5
C(0)	0.19	
R_P	1	From Table 8.1
h_n	9.3	m (Total Height)
h_i	4.65	m (Average height of part)
C_{Hi}	1.78	
$C_{hc}(T_p)$	0.54	
C_p (T_p)	0.18	

Case	Applicable	C_{Hi}
h_i < 12 m	YES	1.775
h_i < 0.2h_n	NO	N/A
h_i ≥0.2h_n	YES	3

C_p(0.75)

C_{hc}(0.75)	1.48	g
C_p (0.75)	0.80	g

Anchorage Design

C_m	0.04	g
C_{con}(0.75)	0.04	g
F^*_{top}	**2.4**	**kN/m**

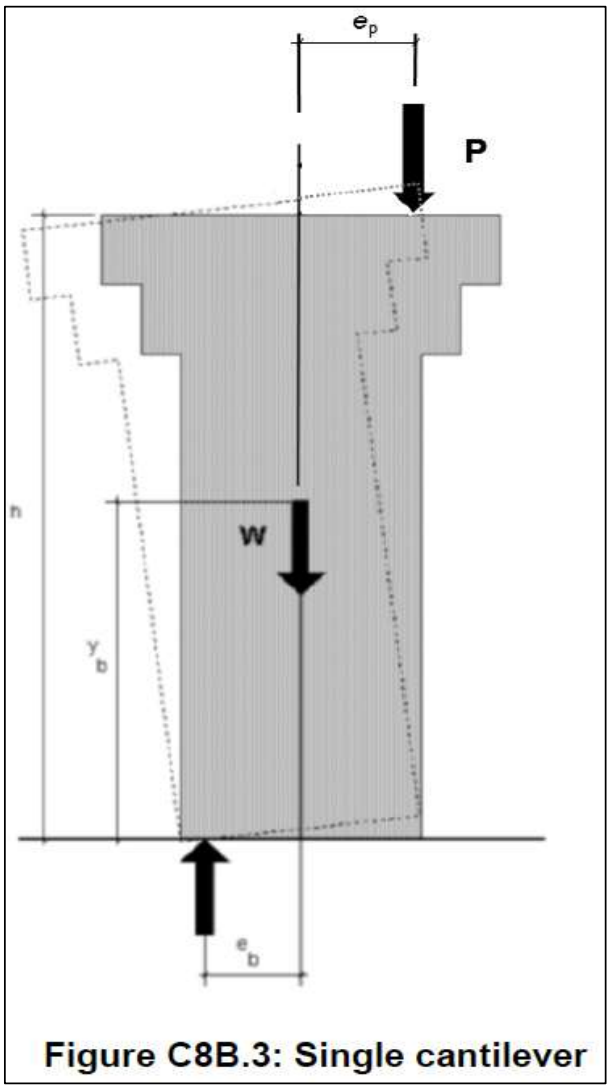

Figure C8B.3: Single cantilever