

INITIAL SEISMIC ASSESSMENT REPORT (ISA PLUS)

19-21 Cambridge Place Arcade, Invercargill



Client Name: HWCP Management Ltd

BMC Reference: 1711-2266




Date Issued: 9/04/2018

## Quality Statement and Document Control

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### Issue Register:

Revision	Date	Description		
A	9/04/2018	ISA (Plus)		
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### Revision History:

Rev. No	Date	Issue Description	Prepared by	Reviewed by

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# 1 Executive Summary

The following report covers the Initial Seismic Assessment (ISA Plus) of the building at 19-21 Cambridge Place Arcade, 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.

The single storey building comprises 1No retail unit arranged to the West side of a retail arcade stretching from the rear of 59-61 Esk Street to the North and 40 Tay Street to the South constructed of a mix of unreinforced masonry (URM) bricks to the cross walls (E-W) and the boundary walls (N-S) and Reinforced concrete walls to internal (N-S) walls with timber roof construction constructed circa 1905 and mostly rebuilt in 1934 after a fire and refurbished in 2010. 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.

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.

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

From this assessment the building is considered to have a lateral load carrying capacity of 10-20% New Building Standard (IL2) as follows,

Location	Building %NBS (IL2)	Seismic Grade	Limiting performance
Retail Unit	10-20%NBS	E	Out-of-plane capacity of West boundary URM walls (facing carpark) and undeterminable roof diaphragm connections.

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 19-21 Cambridge Place Arcade, 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 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 19-21 Cambridge Place Arcade, Invercargill is a single storey structure. The building is currently tenanted by Venom Hairdressers.

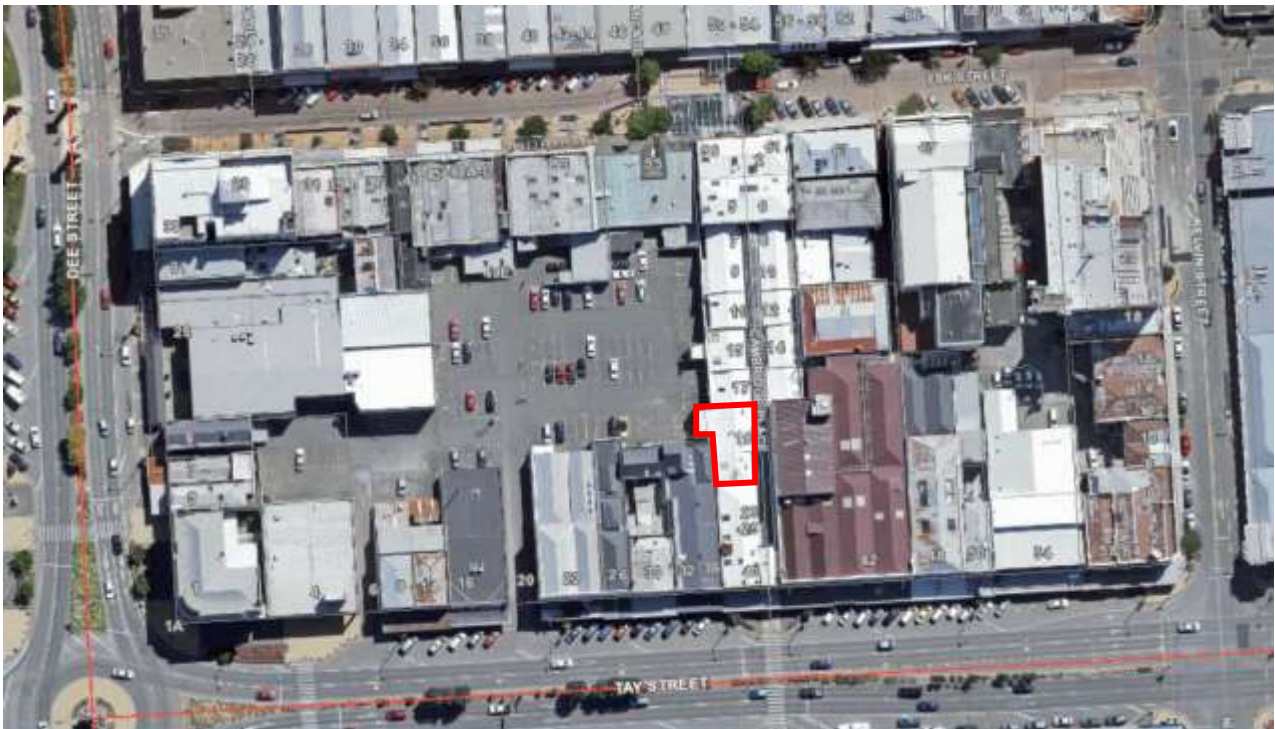


Figure 1: Location of 19-21 Cambridge Place Arcade.

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

Building Feature	Description
Building address:	19-21 Cambridge Place Arcade, Invercargill
Overall plan dimensions:	8.4 (E-W) x 18.3 m (N-S) with 3.4 (E-W) x 6.1m (N-S) entrance porch to West
Number of storeys:	1
Gross floor area:	Approximately 175m <sup>2</sup>
Building history:	Constructed circa 1905, mostly rebuilt in 1934 and refurbishments 2010.

Building Feature	Description
Archive Plan Availability	Refurbishment Drawings from DesignBase Limited APR 2010.
Occupancy:	Tenanted by - Venom Hairdressers (Retail).
Importance Classification: (AS/NZS 1170.0:2002: Table 3.2)	IL2 Normal Building
Heritage Classification:	ICC Tier 2 Site of Local Significance

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 arcade walkway roof comprises steel framing and a duo pitch glazed roof supported by the adjacent property, 42 Tay Street.

The ground floor is a reinforced concrete ground bearing slab to the walkway and suspended timber floors to the units. The arcade front façades of the units are 150mm thick reinforced concrete walls / frames with large areas of glazing with West wall and intertenancy walls 230mm thick URM. The entrance porch comprises approx. 120mm thick PC tilt panel wall units and a timber flat roof.

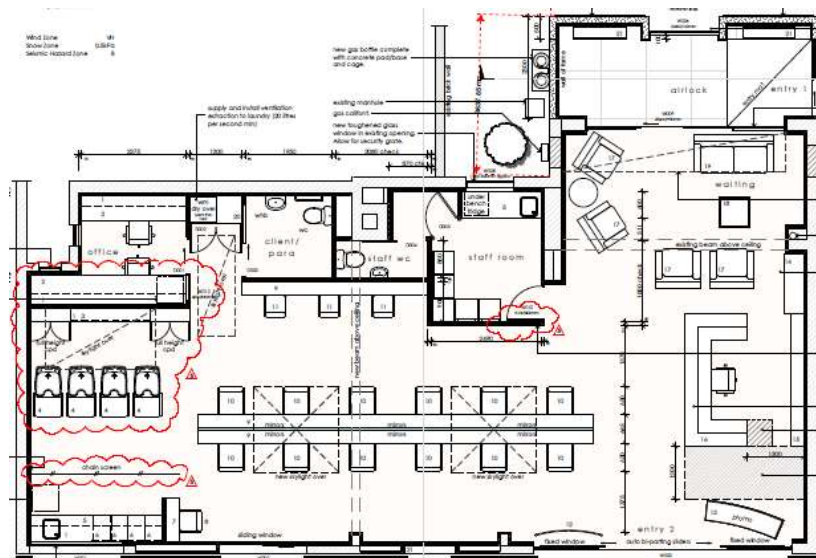


Figure 2: Building Floor Plan from 2010 drawing by Design Base Ltd

Gravity loads are transferred to the foundations via URM walls, and steel or timber roof beams / trusses / purlins.

Foundations are most likely reinforced concrete strip footings under external walls.

The building is in a fair condition given its age with no evidence of significant defects to the exposed elevations.

### 3.3 Lateral Load Resisting Structural System

The lateral load resisting system for this building relies on the in-plane shear capacity of the external brick walls in both the ‘across’ (E-W) and ‘along’ (N-S) directions and the frame action of the units arcade façade wall in the ‘along’ direction (N-S). Out-of-plane wall / floor / roof seismic loads or forces are transferred through the mezzanine-floor and / or roof structure via diaphragm action to orthogonal walls. This diaphragm action is unlikely to be effective particularly at roof level. There are no effective connections noted or visible at roof level for diaphragm action and the central glazed area over the walkway effectively cuts the diaphragm in half in the longitudinal direction. The porch is stabilized by the in-plane capacity of the PC tilt panel walls and their connection to the abutting wall panels and their connection to the foundation.

### 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 walls). The extension sits on a concrete Ground Bearing slab with thickenings for the wall foundations.

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
Refurbishment Plans Job No. 09082 Sheets A101-A110 by DesignBase Limited	Varies	Apr 2010




### 4.2 Observations and/or Damage

The building was inspected by Warren Holt of BMC on 26/02/2018. 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.



No specific / significant items of structural damage were observed other than vertical cracks to the West boundary wall from the valley points on the saw tooth wall to the pier just below.

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		<p>The West boundary wall comprises 230mm thick URM brickwork walls to the original building and 120mm thick PC tilt panels to the entrance porch. The former is most likely the critical structural element for the building.</p> <p>Note there is no seismic gap to the buildings to the North, South or East and there is less lateral load resistance in these buildings meaning that load from 59-61 Esk and 40 Tay Street will be passed into the structure of this building and 8-17 Cambridge Place if all the buildings remain in place.</p>
2		<p>The internal wall between units 19 and 21 was removed in the 2010 refurbishments with no defined bracing structure added so the roof diaphragm not spans twice its original length.</p>
3		<p>The RC wall / frame to the arcade elevation stabilises the building in the N-S direction but is not separated from the adjacent properties hence loading from these building may affect the buildings overall capacity.</p> <p>The glazed skylight effectively cuts or separates the roof plane diaphragm and will be susceptible to failure under any differential roof plane deflections.</p>

## 5 Assessment

### 5.1 Specific Calculations / Engineering assessment

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

The West 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. Assuming the parameters relating to this vertical cantilever brick wall are, height = 5.5m approx., thickness = 230mm. 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 visually evident on site

The in-plane performance of the brick walls is likely to be adequate (>34%NBS).

### 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 - 15-20%NBS** (limited by out-of-plane performance of the URM walls and potential diaphragm strength and 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.

False (or suspended) ceilings exist on ground floor level of this building.

## 7 Continued Occupancy Recommendations

Based on our assessment of the building, BMC consider continued occupancy is appropriate for 6-12 months *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 1<sup>st</sup> floor levels walls was to be undertaken it could potentially raise its capacity to above 34%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 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 Plan, dated January 2017, and is linked to the listing for 59-61 Esk Street at the North end of the arcade and 40 Tay Street to the South end of the arcade. The buildings current condition is determined as being in a fair condition.

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}**

**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:	19-21 Cambridge Place Arcade	Job No.:	1711-2266
AKA:	Venom Hairdressing	By:	W Holt
Name of building:	Cambridge Place Arcade	Date:	26/02/2018
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	<input checked="" type="checkbox"/>
Visual Inspection of Interior	<input checked="" type="checkbox"/>
Drawings (note type)	<input checked="" type="checkbox"/>

Specifications	<input type="checkbox"/>
Geotechnical Reports	<input type="checkbox"/>
Other (list)	<input type="checkbox"/>

Architects plans for unit redevelopment (Design Base)



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

<b>Street Number &amp; Name:</b>	<b>19-21 Cambridge Place Arcade</b>	<b>Job No.:</b>	<b>1711-2266</b>
<b>AKA:</b>	<b>Venom Hairdressing</b>	<b>By:</b>	<b>W Holt</b>
<b>Name of building:</b>	<b>Cambridge Place Arcade</b>	<b>Date:</b>	<b>26/02/2018</b>
<b>City:</b>	<b>Invercargill</b>	<b>Revision No.:</b>	<b>A</b>

**Table IEP-2 Initial Evaluation Procedure Step 2**

**Step 2 - Determination of (%NBS)<sub>b</sub>**

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

**2.1 Determine nominal (%NBS)<sub>nom</sub>**

	<u>Longitudinal</u>	<u>Transverse</u>
<b>a) Building Strengthening Data</b>		
Tick if building is known to have been strengthened in this direction	<input type="checkbox"/>	<input type="checkbox"/>
If strengthened, enter percentage of code the building has been strengthened to	N/A	N/A
	1927	
<b>b) Year of Design/Strengthening, Building Type and Seismic Zone</b>		
	Pre 1935 <input checked="" type="checkbox"/> 1935-1965 <input type="checkbox"/> 1965-1976 <input type="checkbox"/> 1976-1984 <input type="checkbox"/> 1984-1992 <input type="checkbox"/> 1992-2004 <input type="checkbox"/> 2004-2011 <input type="checkbox"/> Post Aug 2011 <input type="checkbox"/>	Pre 1935 <input checked="" type="checkbox"/> 1935-1965 <input type="checkbox"/> 1965-1976 <input type="checkbox"/> 1976-1984 <input type="checkbox"/> 1984-1992 <input type="checkbox"/> 1992-2004 <input type="checkbox"/> 2004-2011 <input type="checkbox"/> Post Aug 2011 <input type="checkbox"/>
<b>Building Type:</b>	Others	Others
<b>Seismic Zone:</b>		
<b>c) Soil Type</b>		
From NZS1170.5:2004, CI 3.1.3 :	D Soft Soil	D Soft Soil
From NZS4203:1992, CI 4.6.2.2 : (for 1992 to 2004 and only if known)	Flexible	Flexible
<b>d) Estimate Period, T</b>		
<i>Comment:</i>		
	h <sub>n</sub> = 5	5 m
	A <sub>c</sub> = 1.00	1.00 m <sup>2</sup>
Moment Resisting Concrete Frames: T = max(0.09h <sub>n</sub> <sup>0.75</sup> , 0.4)	<input type="checkbox"/>	<input type="checkbox"/>
Moment Resisting Steel Frames: T = max(0.14h <sub>n</sub> <sup>0.75</sup> , 0.4)	<input type="checkbox"/>	<input type="checkbox"/>
Eccentrically Braced Steel Frames: T = max(0.08h <sub>n</sub> <sup>0.75</sup> , 0.4)	<input type="checkbox"/>	<input type="checkbox"/>
All Other Frame Structures: T = max(0.06h <sub>n</sub> <sup>0.75</sup> , 0.4)	<input type="checkbox"/>	<input type="checkbox"/>
Concrete Shear Walls: T = max(0.09h <sub>n</sub> <sup>0.75</sup> /A <sub>c</sub> <sup>0.5</sup> , 0.4)	<input type="checkbox"/>	<input type="checkbox"/>
Masonry Shear Walls: T ≤ 0.4sec	<input type="checkbox"/>	<input type="checkbox"/>
User Defined (input Period):	<input type="checkbox"/>	<input type="checkbox"/>
Where h <sub>n</sub> = height in metres from the base of the structure to the uppermost seismic weight or mass.	T: 0.40	0.40
<b>e) Factor A:</b> Strengthening factor determined using result from (a) above (set to 1.0 if not strengthened)	Factor A: 1.00	1.00
<b>f) Factor B:</b> Determined from NZSEE Guidelines Figure 3A.1 using results (a) to (e) above	Factor B: 0.03	0.03
<b>g) Factor C:</b> For reinforced concrete buildings designed between 1976-84 Factor C = 1.2, otherwise take as 1.0.	Factor C: 1.00	1.00
<b>h) Factor D:</b> 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
<b>(%NBS)<sub>nom</sub> = AxBxCxD</b>	<b>(%NBS)<sub>nom</sub> 2%</b>	<b>2%</b>

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

<b>Street Number &amp; Name:</b>	<b>19-21 Cambridge Place Arcade</b>	<b>Job No.:</b>	<b>1711-2266</b>
<b>AKA:</b>	<b>Venom Hairdressing</b>	<b>By:</b>	<b>W Holt</b>
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**Table IEP-2 Initial Evaluation Procedure Step 2 continued**

**2.2 Near Fault Scaling Factor, Factor E**

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

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

(from NZS1170.5:2004, Cl 3.1.6)

Longitudinal

N(T,D):

Transverse

b) Factor E

=  $1/N(T,D)$

Factor E:

**2.3 Hazard Scaling Factor, Factor F**

a) Hazard Factor, Z, for site

Location:

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

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

$Z_{2004}$  =  (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:

**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 =

b) Design Risk Factor,  $R_o$

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

$R_o$  =

c) Return Period Factor, R

(from NZS1170.0:2004 Building Importance Level)

Choose Importance Level

1  2  3  4

R =

1  2  3  4

d) Factor G

=  $IR_o/R$

Factor G:

**2.5 Ductility Scaling Factor, Factor H**

a) Available Displacement Ductility Within Existing Structure

Comment:

URM Generally

$\mu$  =

b) Factor H

For pre 1976 (maximum of 2)  
For 1976 onwards

=  $k_{\mu}$   
=   
=

Factor H:

$k_{\mu}$

(where  $k_{\mu}$  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

$S_p$  =

b) Structural Performance Scaling Factor

=  $1/S_p$

Factor I:

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

**2.7 Baseline %NBS for Building, (%NBS)<sub>b</sub>**

(equals (%NBS)<sub>nom</sub> x E x F x G x H x I )

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

Street Number & Name:	19-21 Cambridge Place Arcade	Job No.:	1711-2266
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**Table IEP-3 Initial Evaluation Procedure Step 3**

**Step 3 - Assessment of Performance Achievement Ratio (PAR)**

(Refer Appendix B - Section B3.2)

**a) Longitudinal Direction**

potential CSWs	Effect on Structural Performance (Choose a value - Do not interpolate)	Factors
<b>3.1 Plan Irregularity</b> Effect on Structural Performance <input type="checkbox"/> Severe <input checked="" type="checkbox"/> Significant <input checked="" type="checkbox"/> Insignificant Comment		Factor A 1.0
<b>3.2 Vertical Irregularity</b> Effect on Structural Performance <input type="checkbox"/> Severe <input checked="" type="checkbox"/> Significant <input checked="" type="checkbox"/> Insignificant Comment		Factor B 1.0
<b>3.3 Short Columns</b> Effect on Structural Performance <input type="checkbox"/> Severe <input checked="" type="checkbox"/> Significant <input checked="" type="checkbox"/> Insignificant Comment		Factor C 1.0
<b>3.4 Pounding Potential</b> (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 0<Sep<.005H	Significant .005<Sep<.01H	Insignificant Sep>.01H
Alignment of Floors within 20% of Storey Height	<input checked="" type="checkbox"/> 1	<input checked="" type="checkbox"/> 1	<input checked="" type="checkbox"/> 1
Alignment of Floors not within 20% of Storey Height	<input checked="" type="checkbox"/> 0.4	<input checked="" type="checkbox"/> 0.7	<input checked="" type="checkbox"/> 0.8
Comment			

**b) Factor D2: - Height Difference Effect**

**Factor D2 For Longitudinal Direction:** 1.0

Table for Selection of Factor D2	Severe 0<Sep<.005H	Significant .005<Sep<.01H	Insignificant Sep>.01H
Height Difference > 4 Storeys	<input checked="" type="checkbox"/> 0.4	<input checked="" type="checkbox"/> 0.7	<input checked="" type="checkbox"/> 1
Height Difference 2 to 4 Storeys	<input checked="" type="checkbox"/> 0.7	<input checked="" type="checkbox"/> 0.9	<input checked="" type="checkbox"/> 1
Height Difference < 2 Storeys	<input checked="" type="checkbox"/> 1	<input checked="" type="checkbox"/> 1	<input checked="" type="checkbox"/> 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 <input type="checkbox"/> Severe <input checked="" type="checkbox"/> Significant <input checked="" type="checkbox"/> 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 1.0

**Record rationale for choice of Factor F:**  
 Brickwork condition - reasonable although OOP capacity limited  
 Concrete walls to internal walls and frames to walkway  
 Reinforced Concrete entrance structure 2010 PC

**3.7 Performance Achievement Ratio (PAR)**

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

Longitudinal PAR 1.00

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

<b>Street Number &amp; Name:</b>	<b>19-21 Cambridge Place Arcade</b>	<b>Job No.:</b>	<b>1711-2266</b>
<b>AKA:</b>	<b>Venom Hairdressing</b>	<b>By:</b>	<b>W Holt</b>
<b>Name of building:</b>	<b>Cambridge Place Arcade</b>	<b>Date:</b>	<b>26/02/2018</b>
<b>City:</b>	<b>Invercargill</b>	<b>Revision No.:</b>	<b>A</b>

**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
<b>3.1 Plan Irregularity</b>		
Effect on Structural Performance	<input type="checkbox"/> Severe <input type="checkbox"/> Significant <input checked="" type="checkbox"/> Insignificant	<b>Factor A</b> <input type="text" value="1.0"/>
Comment		
<b>3.2 Vertical Irregularity</b>		
Effect on Structural Performance	<input type="checkbox"/> Severe <input type="checkbox"/> Significant <input checked="" type="checkbox"/> Insignificant	<b>Factor B</b> <input type="text" value="1.0"/>
Comment		
<b>3.3 Short Columns</b>		
Effect on Structural Performance	<input type="checkbox"/> Severe <input type="checkbox"/> Significant <input checked="" type="checkbox"/> Insignificant	<b>Factor C</b> <input type="text" value="1.0"/>
Comment		
<b>3.4 Pounding Potential</b>		
(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:**

Table for Selection of Factor D1	Severe	Significant	Insignificant
	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Alignment of Floors within 20% of Storey Height	<input checked="" type="checkbox"/> 1	<input checked="" type="checkbox"/> 1	<input checked="" type="checkbox"/> 1
Alignment of Floors not within 20% of Storey Height	<input checked="" type="checkbox"/> 0.4	<input checked="" type="checkbox"/> 0.7	<input checked="" type="checkbox"/> 0.8
Comment			

**b) Factor D2: - Height Difference Effect**

**Factor D2 For Transverse Direction:**

Table for Selection of Factor D2	Severe	Significant	Insignificant
	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Height Difference > 4 Storeys	<input checked="" type="checkbox"/> 0.4	<input checked="" type="checkbox"/> 0.7	<input checked="" type="checkbox"/> 1
Height Difference 2 to 4 Storeys	<input checked="" type="checkbox"/> 0.7	<input checked="" type="checkbox"/> 0.9	<input checked="" type="checkbox"/> 1
Height Difference < 2 Storeys	<input checked="" type="checkbox"/> 1	<input checked="" type="checkbox"/> 1	<input checked="" type="checkbox"/> 1
Comment			

**Factor D**

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

Effect on Structural Performance	<input type="checkbox"/> Severe <input type="checkbox"/> Significant <input checked="" type="checkbox"/> Insignificant	<b>Factor E</b> <input type="text" value="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**

**Record rationale for choice of Factor F:**

Brickwork crosswalls good condition  
Out of plane URM walls to West elevation  
Internal cross walls removed from original plan

**3.7 Performance Achievement Ratio (PAR)**

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

**PAR**  
**Transverse**

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**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) <sub>b</sub> (from Table IEP - 1)	20%	20%
4.2 Performance Achievement Ratio (PAR) (from Table IEP - 2)	1.00	0.70
4.3 PAR x Baseline (%NBS) <sub>b</sub>	20%	15%
4.4 Percentage New Building Standard (%NBS) ( Use lower of two values from Step 4.3)		15%

**Step 5 - Potentially Earthquake Prone?** %NBS ≤ 34   
(Mark as appropriate)

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

**Step 7 - Provisional Grading for Seismic Risk based on IEP** Seismic Grade

**Additional Comments (items of note affecting IEP score)**

Indeterminable diaphragm capacity and connection

**Relationship between Grade and %NBS:**

<b>Grade:</b>	<b>A+</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<b>%NBS:</b>	<b>&gt; 100</b>	<b>100 to 80</b>	<b>79 to 67</b>	<b>66 to 34</b>	<b>33 to 20</b>	<b>&lt; 20</b>

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

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**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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Name of building:	Cambridge Place Arcade	Date:	26/02/2018
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**Table IEP-1a Additional Photos and Sketches**

**Add any additional photographs, notes or sketches required below:**

*Note: print this page separately*

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Subject:

Cantilevered Wall Out-of-Plane

**URM Wall Properties**

$\gamma_{wall}$	20	kN/m <sup>3</sup>
$t_{w\ nom}$	0.23	m
$t_{w\ eff}$	0.225	m
$t_{cladding}$	0.0000	m
$h$	5.5	m
$W$	25.3	kN
$W_{clad}$	0.0	kN
$P$	0.0	kN (Overbur)
$e_b$	0.075	m
$e_p$	0.000	m
$y_b$	2.75	m
$a$	70	Nm
$b$	2	Nm
$J$	26	kgm <sup>2</sup>
$J_{anc}$	0	kgm <sup>2</sup>
$\gamma$	1.50	participator
$T_p$	1.90	sec
$\Delta_i$	0.15	m
$\phi$	0.3	
$\Delta_m$	0.05	m
$D_{ph}$	0.26	m
%NBS	17	%

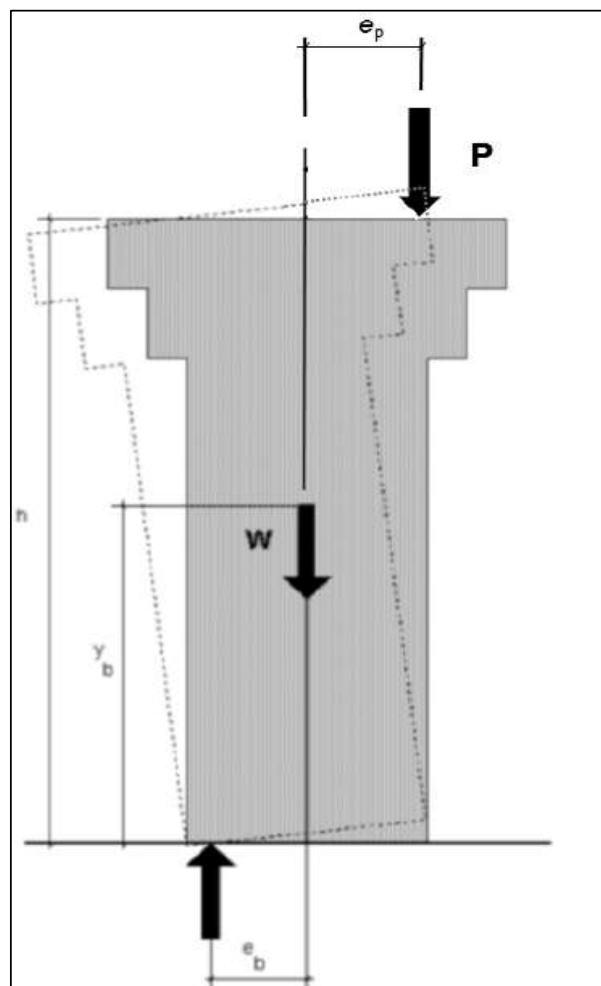
**NZS 1170.5 (2004) parameters**

Soil Class	D	
$C_n(0)$	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
$h_n$	5.5	m (Total Height)
$h_i$	2.75	m (Average height of part)
$C_{Hi}$	1.46	
$C_{hc}(T_p)$	0.71	
$C_p(T_p)$	0.20	
<b><math>C_p(0.75)</math></b>		
$C_{hc}(0.75)$	1.48	g
$C_p(0.75)$	1.04	g

Case	Applicable	$C_{Hi}$
$h_i < 12\ m$	YES	1.45833333
$h_i < 0.2h_n$	NO	N/A
$h_i \geq 0.2h_n$	YES	3

**Anchorage Design**

$C_m$	0.04	g
$C_{con}(0.75)$	0.04	g
$F^*_{top}$	1.0	kN/m



**Figure C8B.3: Single cantilever**