BATCHELAR McDOUGALL CONSULTING
Structural & Civil Engineers

**INITIAL SEISMIC ASSESSMENT REPORT (ISA PLUS)**

Balance and Flow - Pilates Studio

30 Tay Street, Invercargill


Client Name: HWCP Management Limited

BMC Reference: 1711-2266

Date Issued: 9/04/2018

Wanaka Office: Level 3, 99 Ardmore Street, Wanaka 9343. Ph: +64 3 443 4531
Queenstown Office: Suite 7 Level One, 34 Grant Road, Frankton, Queenstown 9371. Ph: +64 3 441 3351
Christchurch Office: Level 3, 335 Lincoln Road, Addington, Christchurch 8024. Ph: +64 3 338 3351
www.bmconsult.co.nz

# Quality Statement and Document Control

This Initial Seismic Assessment report has been prepared for HWCP Management Limited by Batchelar McDougall Consulting Limited. No liability is accepted by this company or any employee or sub-consultant of this company with respect to its use by any other parties.

This disclaimer shall apply notwithstanding that the documents may be made available to other persons for an application for permission or approval to fulfil a legal requirement.

Issue Register:

| Revision | Date | Description | | |
|---|---|---|---|---|
| A | 9/04/2018 | ISA (Plus) | | |
| | | Prepared by | Reviewed by | Approved by |
| | Name | Katie Symons | Matt Stewart | Andrew Marriott |
| | Signature |  MA, MEng, CEng(UK), MIStructE, MICE, CMEngNZ |  BSCE (USA-CA) PE (USA-CA) CMEngNZ) |  Director |

## 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 30 Tay Street, Invercargill. This building has "Tier 2" heritage status in the "Proposed Invercargill City District Plan", dated January 2017. Tier 2 heritage status signifies a site of local significance.

The two-storey building is constructed of unreinforced masonry (URM) perimeter walls, timber floors and roof framing. The building was constructed circa 1933. Numerous alterations are thought to have been carried out, including some circa 2004, consisting of the removal of a mezzanine floor and remodelling of the shop front. The building is located in the Invercargill CBD, which is identified as having a 'medium' seismic risk with a seismic hazard factor of 0.17. For comparison, Christchurch has a seismic hazard design value of 0.3 and is labelled as 'high' seismic risk, while Dunedin has a seismic hazard value of 0.13 and is labelled as '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 a 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 |
|---|---|---|---|
| North-South (Longitudinal) | 15-25% | E | Out-of-plane capacity of shopfront URM wall (south wall, facing Tay Street) |
| East-West (Transverse) | 15-20% | E | In-plane soft storey at the shopfront |

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 30 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.

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, 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 existing 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;
- Engineering assessment and/or calculation of primary or critical structural elements 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 Limited and shall not be relied on by any other parties without written approval from BMC.

# 3 Building Description

## 3.1 General Overview

The property is located at 30 Tay Street, Invercargill, as shown below in Figure 1. The main building is primarily a two-storey structure in Art Deco style, featuring a horizontal woven decorative band above the windows on the front façade. It is currently serving as a yoga studio on the upper floor; the ground floor is vacant, having been tenanted by Music Works, a music retailer, until at least October 2016.

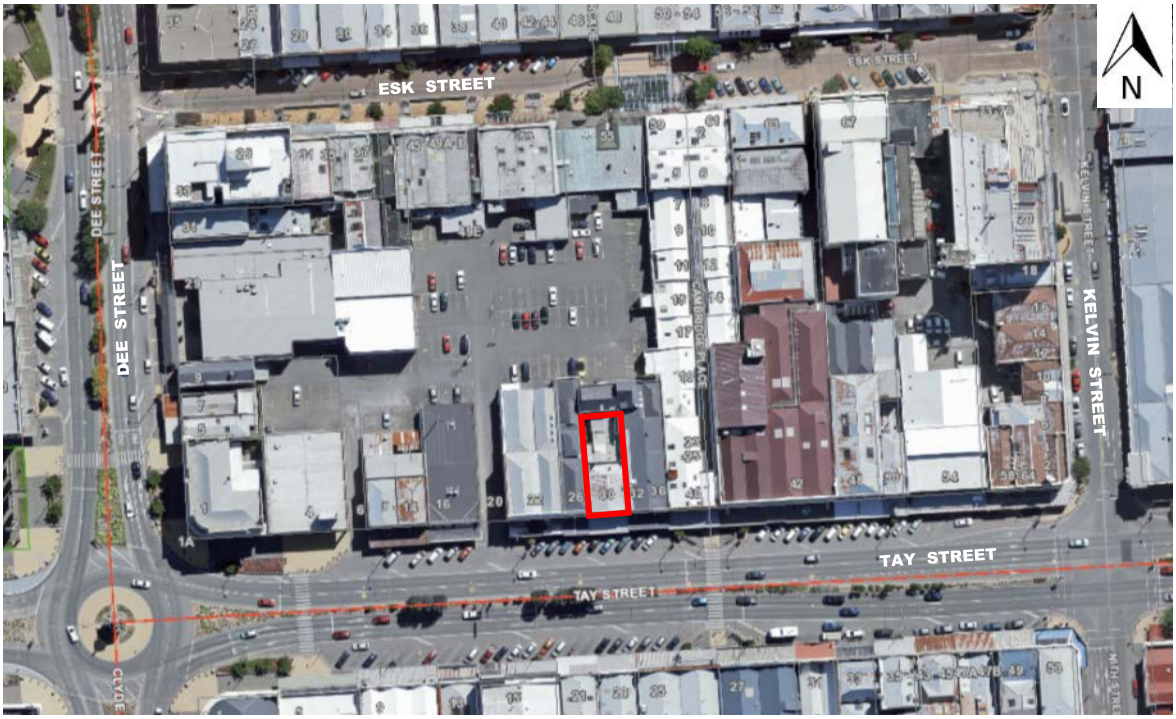



Figure 1 - Location of 30 Tay Street, Invercargill

According to drawings seen by BMC, the main building was designed and constructed in 1933 by CJ Brodrick and TP Royds registered architects, for a Miss Ibbotson (see Figure 2). The main building appears to have undergone a number of alterations, including a single storey extension to the rear of the plot. Access was not possible to all of these single storey areas and so could not be fully assessed. Alteration plans by McMillan Design Ltd (that appear to be dated 2004) indicate the removal of internal walls, internal stair and mezzanine floor.

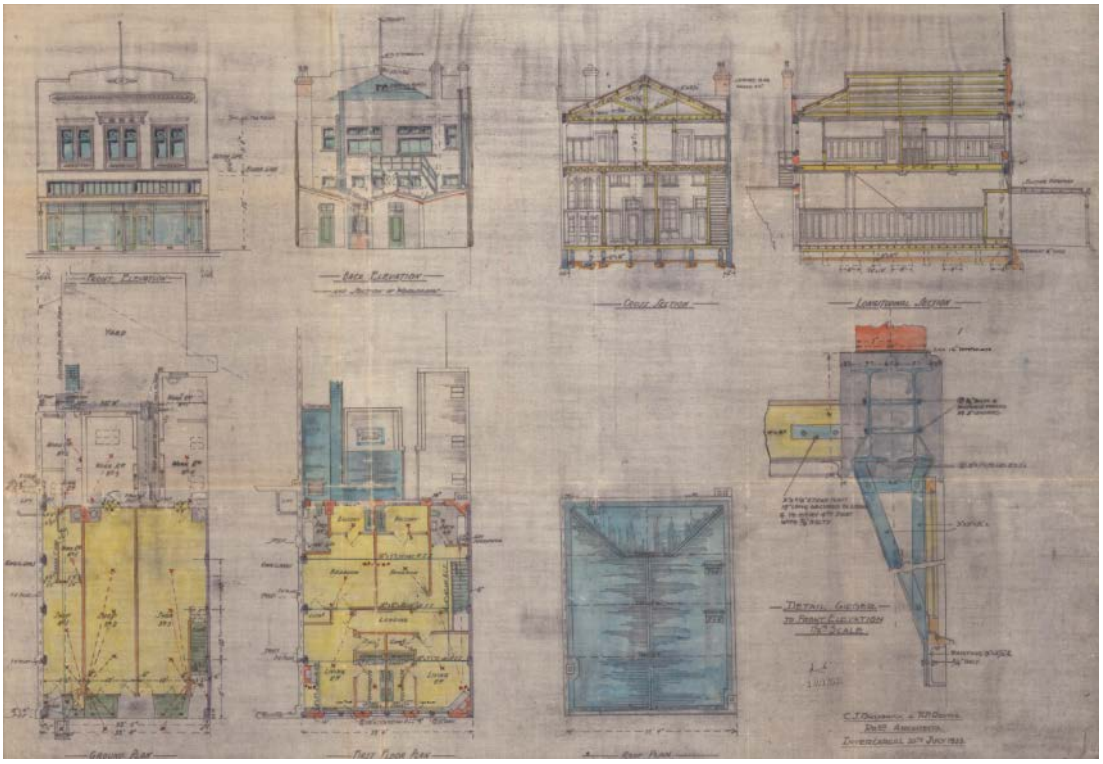


Figure 2 - 1933 Construction information

The shopfront on Tay Street has full height glazing at ground level, a strip window running the full width of the building above the external canopy, and four windows at first floor level. The building has been given "Tier 2" heritage status in the "Proposed Invercargill District Plan" (January 2017), signifying it is a site of local significance. The building description is summarized below in Table 1.

| Building Feature | Description |
|---|---|
| Building address: | 30 Tay Street, Invercargill 9810, Lot 2 DP 2359 |
| Overall plan dimensions: | 11 m x 10 m (approximately) at upper floor<br>24 m x 10 m (approximately) at ground floor |
| Number of storeys: | 2 |
| Gross floor area (approximate): | 285 m2 |
| Building history: | Built circa 1933. Numerous alternations, including 2004. |
| Archive Plan Availability | 1933 plans and 2004 extension plans provided |
| Occupancy: | Retail |
| Importance Classification:<br>(AS/NZS 1170.0:2002: Table 3.2) | IL2<br>Normal building |
| Heritage Classification: | Tier 2 |

Table 1 - Building Description

## 3.2 Construction Materials & Configuration

At upper floor level, the building plan is roughly square. At ground level, the building plan is longer, the original single storey area having been extended north. The storefront of the building is at the south end of the building, facing Tay Street. The side walls are on the east and west sides of the building. Scale plans of ground and upper floors were produced during the site inspection, and are shown in Figure 3.


Figure 3 - Approximate floor plans from site survey

The side walls are full height and constructed of unreinforced masonry (URM). The rear wall to the two storey part of the building is URM, but has been reduced from its original form to a series of piers, rather than a continuous wall. The front wall onto the street is fully glazed at ground floor level, with 14 inch (350 mm) URM wall/piers above, supported by a twin steel beam girder spanning between piers at the ends of the side walls. The front canopy is supported by 3 steel posts at the pavement edge and is tied back into the front wall of the building.

The roof construction is unknown. The roof to the two storey part of the original building is duopitch, assumed to be timber trusses and sarking and corrugated iron over, with trusses spanning between the URM side walls. The front gable is hidden by a URM parapet; there is a hipped roof line behind a lower parapet at the rear.

The roofs to the single storey areas at the rear of the property are shallow mono- and duo-pitch construction, assumed to be timber rafters spanning between internal and external walls/supports with timber sarking and lightweight metal deck over.

The first floor is constructed of timber tongued and grooved planks on timber joists that span between 3 no. steel beams supported on piers (concrete or masonry) within the URM side walls.

The ground floor framing is assumed to be timber framing supported by timber piles. The URM brick walls are assumed to be supported on concrete footings.

## 3.3 Lateral Load Resisting Structural System

The main components of the lateral load resisting system are the perimeter URM walls and the timber diaphragm at the upper floor and roof levels. At upper floor level, the diaphragm is the timber floor framing, At roof level, the diaphragm is the timber roof framing and the corrugated iron roof.

The intended lateral load path 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 URM walls acting in-plane. The URM walls transfer the seismic loads to ground level. The lateral bracing system relies on the in-plane shear capacity of the URM walls, the strength of the timber diaphragm, and the connection of the timber diaphragm to the URM wall.

The connections of the timber floor framing to the URM wall were not visible. From the exterior, there were no signs of positive connections to the walls, such as plate anchors. A detail from the 1933 construction drawings show a bolted connection between the double steel girder supporting the shopfront wall with every 4th floor joist. There is no detail of the connection between the floor joists and the internal steel beams, or the steel beams to the URM walls. 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, just the timber floor joist bearing on the URM wall. The lateral loads from the diaphragm are transferred at the bearing surface of the framing on the URM wall by friction, in both the in-plane and out-of-plane direction. This diaphragm action is unlikely to be effective, particularly at roof level and at the end walls.

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

For seismic loading in the east west direction (transverse direction), the lateral loads are resisted by the URM piers of the rear wall and piers within the URM side walls.

## 3.4 Foundations & Geotechnical

There are no obvious signs of significant settlement in foundations or wall cracking. The construction drawings indicate internal piled foundations internally and concrete footings and pads beneath the URM perimeter walls and piers.

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 (approx. 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 |
|---|---|---|
| Invercargill City: Central City Area Heritage Buildings Re-Assessment 2016<br>By: Dr. Andrea Farminer and Robin Miller | N/A | 2016 |
| Architectural drawings, titled "Shops and Flats, Tay St, for Miss Ibbotson"<br>By CJ Brodrick and TP Royds registered architects | N/A | 1933 |
| Existing and Proposed floorplans and elevations for 30 Tay St Alterations<br>By McMillan Design Ltd | N/A | 2004? |

## 4.2 Observations and/or Damage

The building was inspected by Andrew Marriott and Charlotte Corston of BMC on 26/02/2018. It was limited to a visual inspection only, no invasive investigation work was carried out.

Cracking was observed in the URM walls. Specific areas of URM cracking are noted below.

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

| No# | Photo | Comments |
|---|---|---|
| 1 |  | Note there is no seismic gap between the buildings on either side. |
| 2 |  | Potential soft storey at ground floor front wall. |
| 3 |  | Vertical crack at top of URM parapet to front elevation wall. |

| No# | Photo | Comments |
|---|---|---|
| 4 |  | Cracking and spalling of plaster at base of parapet to rear (North) elevation wall, indicating potential out-of-plane failure of this element |
| 5 |   | Loose bricks in masonry wall of party wall adjacent to single storey area of building, presenting a hazard. |

| No# | Photo | Comments |
|---|---|---|
| 6 |  <br>  | Corrosion of steel lintel above door in N elevation ground floor wall, expansion of this element has caused deformation of the masonry wall over. |

| No# | Photo | Comments |
|---|---|---|
| 7 |  | Spalling of plaster above window in N elevation upper storey wall. |

Table 2 – Photos of observation or damage

# 5 Assessment

## 5.1 Specific Calculations / Engineering Assessment

In the longitudinal direction (north-south direction), the limiting element of the lateral load carrying capacity is the out-of-plane capacity of the URM wall at the shopfront. The wall was taken as 350 mm thick, 5 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 the double steel beam support at the upper floor with little to no lateral support. The out-of-plane capacity of this wall was calculated to be 27%NBS (IL2), see calculations in Appendix A. Failure of this URM wall would likely result in the wall collapsing on the walkway below and possibly blocking the egress of the building.

In the transverse direction (east-west direction), there is a soft storey critical structural weakness. A soft storey in a building occurs when a more flexible building level supports a more rigid building level. This occurs at the shopfront, where the heavy and rigid upper floor façade is supported by an “open” ground floor framing, with no distinct lateral force resisting elements. At ground level, the only lateral load resisting elements in the transverse direction are the URM piers that remain from the original rear URM wall. The piers in the side walls could potentially cantilever from their base to provide some additional resistance, but it is highly unlikely the foundations supporting them are capable of providing the required resistance under these lateral loads.

The lateral load carrying capacity of the building in the transverse direction is 15-20%NBS (IL2).

Overall the building was found to have a lateral load carrying capacity of 15-20%NBS (IL2). The limiting elements in the capacity of the lateral load resisting systems are the soft storey critical structural weakness and the out-of-plane capacity of the URM shopfront wall.

## 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 (NZS1170.5:2004) 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 Spreadsheet is included in 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, in accordance with NZS 4219:2009 "The Seismic Performance of Engineering Systems in Buildings".

False (or suspended) ceilings exist on both ground and upper floor levels of this building. 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.

# 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 Detailed Seismic Assessment (DSA) or a more detailed assessment with intrusive investigation work into the nature and capacity of the upper floor connections to the URM walls. This more detailed assessment could enable an understanding of other aspects of its seismic performance and potentially raise the lateral capacity of building to above 34%NBS(IL2).

# 8 Conclusions

Based on our assessment, the building has a seismic rating of less than 34%NBS(IL2) capacity and thus 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 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 & Out-of-Plane URM 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:** | **30 Tay Street** | **Job No.:** | **1711-2266** |
| **AKA:** | | **By:** | **Katie Symons** |
| **Name of building:** | **Yoga Studio** | **Date:** | **5/04/2018** |
| **City:** | **Invercargill** | **Revision No.:** | **1** |

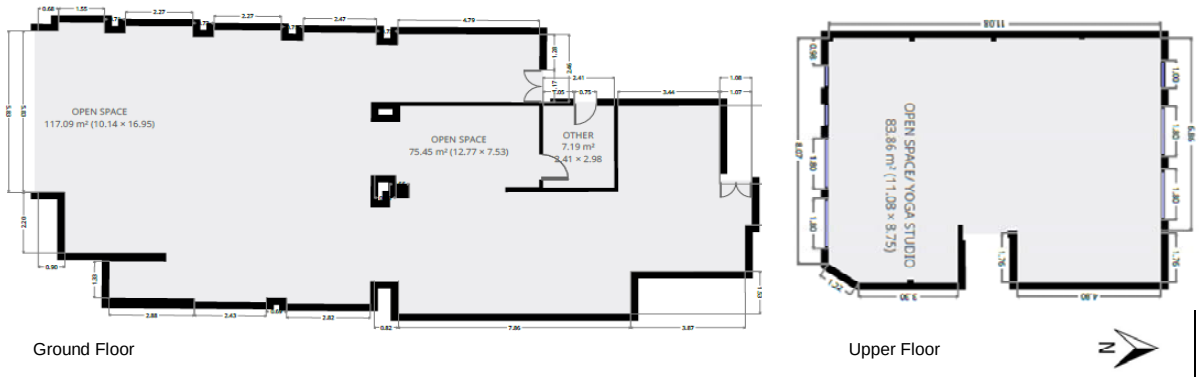
### Table IEP-1 Initial Evaluation Procedure Step 1

**Step 1 - General Information**

**1.1 Photos (attach sufficient to describe building)**


**NOTE: THERE ARE MORE PHOTOS ON PAGE 1a ATTACHED**

**1.2 Sketches (plans etc, show items of interest)**




Ground Floor Upper Floor

**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)**

Refer to ISA Plus 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)** | ☐ |

Architectural drawings, titled "Shops and Flats, Tay St, for Miss Ibbotson", by CJ Brodrick and TP Royds registered architects, dated 1933;
Existing and Proposed floorplans and elevations for 30 Tay St Alterations, by McMillan Design Ltd, assumed dated 2004.

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

| | | | |
|---|---|---|---|
| **Street Number & Name:** | **30 Tay Street** | **Job No.:** | **1711-2266** |
| **AKA:** | | **By:** | **Katie Symons** |
| **Name of building:** | **Yoga Studio** | **Date:** | **5/04/2018** |
| **City:** | **Invercargill** | **Revision No.:** | **1** |

## 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:* | $h_n$ = 10 | 10 m |
| URM Walls | $A_c$ = 1.00 | 1.00 $m^2$ |
| Moment Resisting Concrete Frames: $T = \max\{0.09h_n^{0.75}, 0.4\}$ | ○ | ○ |
| Moment Resisting Steel Frames: $T = \max\{0.14h_n^{0.75}, 0.4\}$ | ○ | ○ |
| Eccentrically Braced Steel Frames: $T = \max\{0.08h_n^{0.75}, 0.4\}$ | ○ | ○ |
| All Other Frame Structures: $T = \max\{0.06h_n^{0.75}, 0.4\}$ | ○ | ○ |
| Concrete Shear Walls $T = \max\{0.09h_n^{0.75}/A_c^{0.5}, 0.4\}$ | ○ | ○ |
| Masonry Shear Walls: $T \leq 0.4$sec | ○ | ○ |
| User Defined (input Period): | ◉ | ◉ |
| *Where $h_n$ = height in metres from the base of the structure to the uppermost seismic weight or mass.* | **T:** 0.40 | 0.40 |
| **e) Factor A:** Strengthening factor determined using result from (a) above (set to 1.0 if not strengthened) | **Factor A:** 1.00 | 1.00 |
| **f) Factor B:** Determined from NZSEE Guidelines Figure 3A.1 using results (a) to (e) above | **Factor B:** 0.03 | 0.03 |
| **g) Factor C:** For reinforced concrete buildings designed between 1976-84 Factor C = 1.2, otherwise take as 1.0. | **Factor C:** 1.00 | 1.00 |
| **h) Factor D:** For buildings designed prior to 1935 Factor D = 0.8 except for Wellington 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} Page 3

| | | | |
|---|---|---|---|
| **Street Number & Name:** | **30 Tay Street** | **Job No.:** | **1711-2266** |
| **AKA:** | | **By:** | **Katie Symons** |
| **Name of building:** | **Yoga Studio** | **Date:** | **5/04/2018** |
| **City:** | **Invercargill** | **Revision No.:** | **1** |

## 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 — **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 | = | $Z_{2004}/Z$ |

**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*

| | Longitudinal | Transverse |
|---|---|---|
| 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:*

$\mu$ = 1.25 | 1.25

**b) Factor H**

| | | Longitudinal $k_\mu$ | Transverse $k_\mu$ |
|---|---|---|---|
| For pre 1976 (maximum of 2) | = | 1.14 | 1.14 |
| For 1976 onwards | = | 1 | 1 |
| **Factor H:** | | 1.14 | 1.14 |

(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 ☐ | ☐

$S_p$ = 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

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

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

**17%** | **17%**

**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:** | **30 Tay Street** | **Job No.:** | **1711-2266** |
| **AKA:** | | **By:** | **Katie Symons** |
| **Name of building:** | **Yoga Studio** | **Date:** | **5/04/2018** |
| **City:** | **Invercargill** | **Revision No.:** | **1** |

## 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** 1.0

Comment

**3.3 Short Columns**

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

Comment

**3.4 Pounding Potential**

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

**a) Factor D1: - Pounding Effect**

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

**Factor D1 For Longitudinal Direction:** 1.0

| ***Table for Selection of Factor D1*** | Severe | Significant | Insignificant |
|---|---|---|---|
| *Separation* | 0<Sep<.005H | .005<Sep<.01H | Sep>.01H |
| *Alignment of Floors within 20% of Storey Height* | ○ 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:**

**PAR**

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

**Longitudinal** **1.00**

**WARNING!!** *This initial evaluation has been carried out solely as an initial seismic assessment of the building following the procedure set out in "The 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} Page 5

| | | | |
|---|---|---|---|
| **Street Number & Name:** | **30 Tay Street** | **Job No.:** | **1711-2266** |
| **AKA:** | | **By:** | **Katie Symons** |
| **Name of building:** | **Yoga Studio** | **Date:** | **5/04/2018** |
| **City:** | **Invercargill** | **Revision No.:** | **1** |

## 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
Potential soft story

**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* — **Factor F** 1.00

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

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

**PAR**

**3.7 Performance Achievement Ratio (PAR)**
(equals **A x B x C x D x E x F** ) — **Transverse** **0.70**

**WARNING!!** *This initial evaluation has been carried out solely as an initial seismic assessment of the building following the procedure set out in "The 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:** | **30 Tay Street** | **Job No.:** | **1711-2266** |
| **AKA:** | | **By:** | **Katie Symons** |
| **Name of building:** | **Yoga Studio** | **Date:** | **5/04/2018** |
| **City:** | **Invercargill** | **Revision No.:** | **1** |

### 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) | **1.00** | **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 |

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

| | | | |
|---|---|---|---|
| Street Number & Name: | 30 Tay Street | Job No.: | 1711-2266 |
| AKA: | | By: | Katie Symons |
| Name of building: | Yoga Studio | Date: | 5/04/2018 |
| City: | Invercargill | Revision No.: | 1 |

### 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**

**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} Page 1a

| | | | |
|---|---|---|---|
| **Street Number & Name:** | **30 Tay Street** | **Job No.:** | **1711-2266** |
| **AKA:** | | **By:** | **Katie Symons** |
| **Name of building:** | **Yoga Studio** | **Date:** | **5/04/2018** |
| **City:** | **Invercargill** | **Revision No.:** | **1** |

### 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

| *30 Tay Street - ISA Plus* | | |
|---|---|---|
| *30 Tay Street, Invercargill* | | |
| 1711-2266 | Apr-18 | *KS* |

Subject: Out-of-plane Capacity of URM at Shopfront

**URM Wall Properties**

| | | |
|---|---|---|
| $\gamma_{wall}$ | 18 | kN/m$^3$ |
| $t_{w\ nom}$ | 0.35 | m |
| $t_{w\ eff}$ | 0.343 | m |
| $Q_{Cladding}$ | 0 | kPa |
| h | 5 | m |
| W | 31.5 | kN |
| $e_b$ | 0.172 | m |
| $y_b$ | 2.50 | m |
| γ | 1.49 | participatior |
| $T_p$ | 1.81 | sec |
| $\Delta_i$ | 0.34 | m |
| $\Delta_m$ | 0.10 | m |
| **$D_{ph}$** | **0.39** | **m** |
| **%NBS** | **27** | **%** |

**Anchorage Design**

| | | |
|---|---|---|
| $C_m$ | 0.07 | g |
| $C_{con}(0.75)$ | 0.07 | g |
| **$F^*_{top}$** | **2.2** | **kN** |

**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 |
| $h_n$ | 10 | m (Total Height) |
| $h_i$ | 7.5 | m (Average height of part) |
| $C_{Hi}$ | 2.25 | |
| $C_{hc}(T_p)$ | 0.74 | |
| $C_p$ ($T_p$) | 0.32 | |

| Case | Applicable | $C_{Hi}$ |
|---|---|---|
| $h_i$ < 12 m | YES | 2.25 |
| $h_i$ < 0.2$h_n$ | NO | N/A |
| $h_i$ ≥0.2$h_n$ | YES | 3 |

**$C_p$(0.75)**

| | | |
|---|---|---|
| $C_{hc}(0.75)$ | 1.48 | g |
| $C_p$ (0.75) | 1.10 | g |

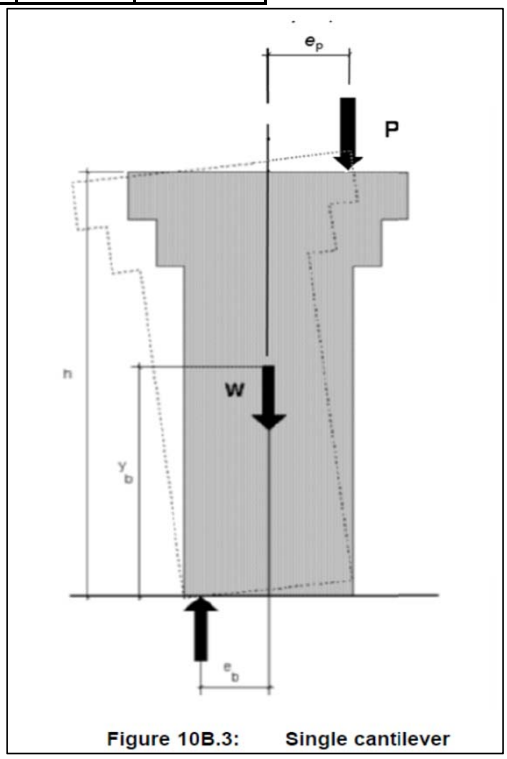



Figure 10B.3: Single cantilever