[redacted]

9683

29 July 2019

Hutt City Council
Private Bag 31912
Wellington Mail Centre
Attn: [redacted]

Dear [redacted]

Initial Seismic Assessment Report
Stokes Valley Swimming Pool, 187 George Street

We have now completed an Initial Seismic Assessment (ISA) of the building at 187 George Street, using the Initial Evaluation Procedure (IEP) as described in Part B of the guideline document, *The Seismic Assessment of Existing Buildings-Technical Guidelines for Engineering Assessments*, dated August 2017. The assessment was carried out after reviewing structural and architectural drawings, reviewing the specifications, and completing a site visit on Monday 08 July 2019. This can be considered a comprehensive assessment at the ISA level.

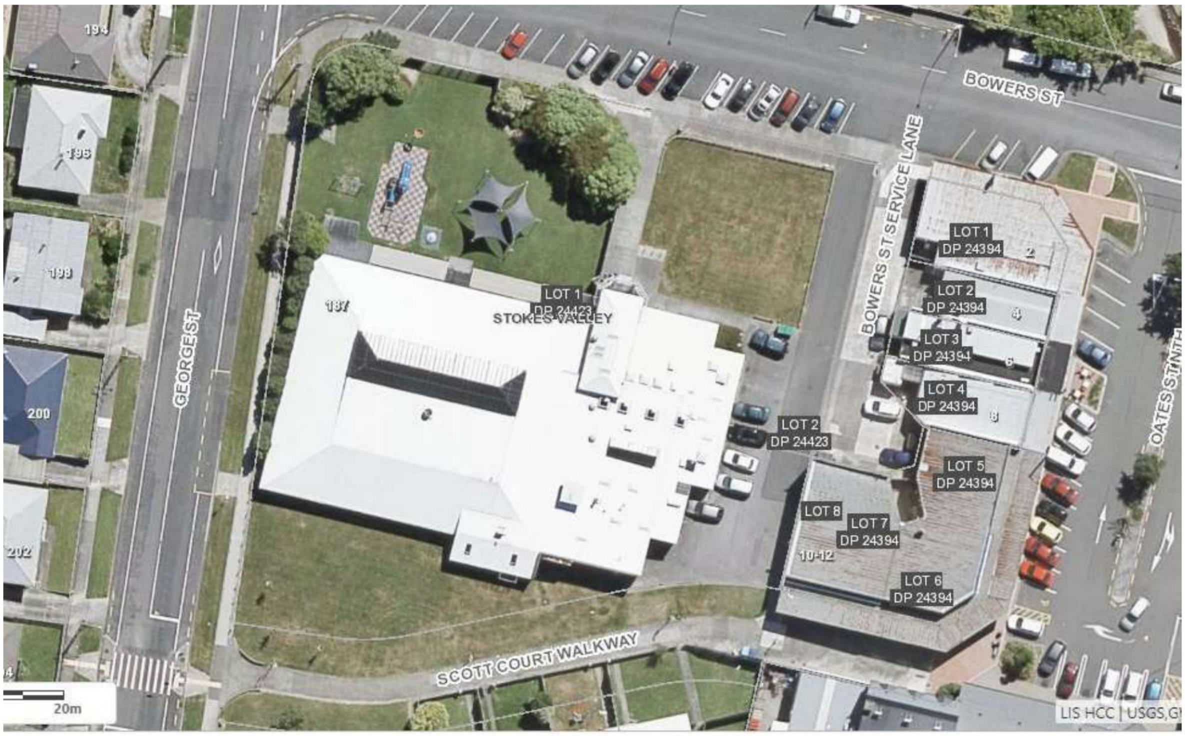


Plate 1. Aerial View of Building

Executive Summary

This building has been rated against the new building standard for a structure that may contain people in crowds. Structures that may contain people in crowds are regarded as Importance Level 3 (IL3) in accordance with NZS1170.5:2004.

The assessed potential earthquake rating is 100%NBS (IL3) in the longitudinal (east-west) direction 100%NBS (IL3) in the transverse (north-south) direction, which gives it a seismic 'Grade A+'. Therefore, the potential status of the building is not earthquake risk.

[redacted]

A “Severe Structural Weakness” (SSW) is a structural weakness for which rupture would lead to a catastrophic collapse. No potential SSWs were identified in this building.

The Initial Seismic Assessment (ISA) is considered to provide a relatively quick, high-level and qualitative measure of the building’s performance. A more reliable result would be obtained from a Detailed Seismic Assessment (DSA). A DSA could find structural aspects of concern that have not been identified from the IEP. Alternatively, a detailed structural assessment may show that structural aspects of potential concern identified in this IEP may have in fact been addressed in the design of the building.

Introduction

The Hutt City Council has engaged [redacted] to carry out an Initial Seismic Assessment (ISA) of the Stokes Valley Swimming Pool at 187 George Street. This ISA is based on the Initial Evaluation Procedure (IEP) as defined in *Technical Guidelines for Engineering Assessments* referenced above.

Earthquake Prone Building (EPB) methodology is used to identify earthquake-prone buildings, and has been produced by the Ministry of Business, Innovation and Employment in accordance with the Building Act 2004. This ISA meets the requirements of an engineering assessment as prescribed in the EPB methodology.

Background to the IEP and Its Limitations

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

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

Characteristics and limitations of the IEP include:

- An IEP assessment is primarily concerned with life safety. It does not consider the susceptibility of the building to damage, and therefore to economic losses.
- It tends to be somewhat conservative, identifying some buildings as earthquake prone, or having a lower %NBS score, which subsequent detailed investigation may indicate is less than actual performance. However, there will be exceptions, particularly when potential critical structural weaknesses (CSWs) are present that have not been recognised from the level of investigation employed.
- An IEP can be undertaken with variable levels of available information: e.g. exterior only inspection, structural drawings available or not, interior inspection, etc. The more information available, the more representative the IEP result is likely to be. The IEP records the information that has formed the basis of the assessment and consideration of this is important when determining the likely reliability of the result.
- It is an initial, first-stage review. Buildings or specific issues which the IEP process flags as being problematic or as potentially critical structural weaknesses need further detailed

[redacted]

investigation and evaluation. A Detailed Seismic Assessment is recommended if the seismic status of a building is critical to any decision making.

- The IEP assumes that buildings have been designed and built in accordance with the building standard and good practice current at the time. In some instances, a building may include design features ahead of its time, leading to better than predicted performance. Conversely, some unidentified design or construction issues not picked up by the IEP process may result in the building performing not as well as predicted.
- It is a largely qualitative process and should be undertaken or overseen by an experienced engineer. It involves considerable knowledge of the earthquake behaviour of buildings, and judgement as to key attributes and their effect on building performance. Consequently, it is possible that the %NBS derived for a building by independent experienced engineers may differ.
- An IEP may over-penalise some apparently critical features which could have been satisfactorily taken into account in the design.
- An IEP does not take into account the seismic performance of non-structural items such as ceilings, plant, services or general glazing that are not considered to present a significant life safety hazard.

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

Basis for the Assessment

The information we have used for our IEP assessment includes:

The IEP has been based on a review of original architectural and structural drawings, a review of original specifications, and an inspection of both the interior and exterior on Monday 08 July 2019.

Shadow calculations have been carried out on the:
1. Reinforced concrete block partition walls under out-of-plane actions.
2. Reinforced concrete columns in the pool hall for bending and shear.

The following parameters have been used for the IEP and shadow calculations:
- 1984 Building
- Soil Class C
- Height of building, hn = 7.3m, and height of RC block wall, hi = 1m.
- Period, T <0.3 sec assumed.
- Near Fault Factor, N(T,D) = 1.0
- Hazard Scaling Factor, Z = 0.42 (Upper Hutt)
- Importance Level, IL = 3
- Ductility, μ=1.25 for shadow calculations and μ=2.0 for the IEP.
- Structural Performance Factor, SP = 0.925 for shadow calculations.
- Horizontal Earthquake Load on the Part, Fph = 1.440 Wp
- Horizontal design Action Coefficient, Cd(T1) = 1.04

[redacted]

Subsoil class C has been used, based on the Greater Wellington Regional Council Flex Map Viewer for earthquake shaking and correlations to *The Proceedings of the Ninth Pacific Conference on Earthquake Engineering,14-16 April, 2011, "NZS 1170.5:2004 site subsoil classification of Lower Hutt" D. Boon, N.D. Perrin, G.D. Dellow & R. Van Dissen.* The site is in a valley with hills nearby on both sides. GWRC mapping categorizes the site as low to moderate ground shaking and bordering the category of low earthquake shaking. This data indicates that the site is on the boundary of site subsoil class C "shallow soil" and site subsoil class B "rock".

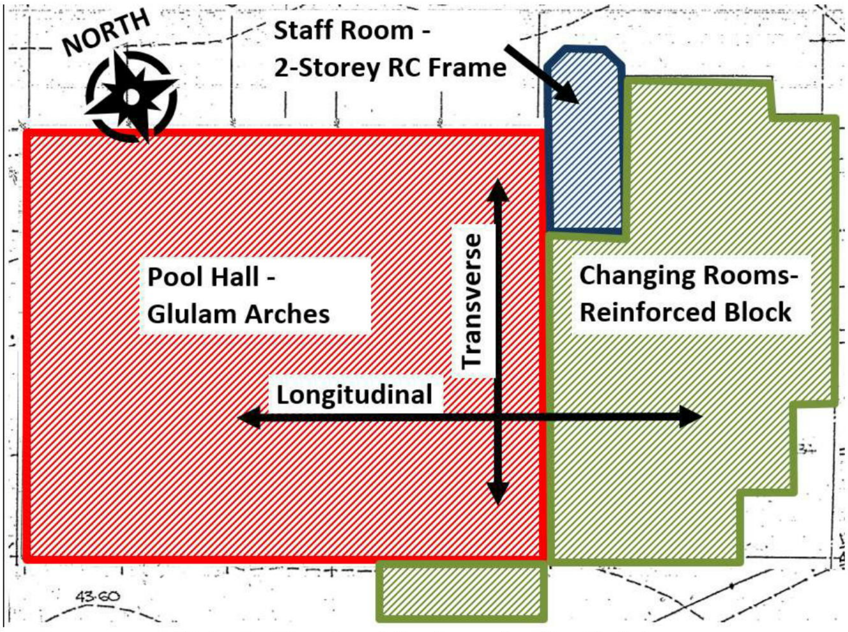


Plate 2. Structural Systems for the Building

The following adjustment factors have been used:

- Plan irregularity has been observed to be insignificant based on the building layout and mass distribution being close to symmetric and the lack of a rigid diaphragm. For longitudinal actions there are a series of struts and a pop-top roof in the pool hall which are off centre. Furthermore, the two storey area is positioned on one side of the building. For transverse actions almost one third of the building is significantly stiffer than the flexible glulam arches of the pool hall.
- Vertical irregularity has been observed to be insignificant based on the building being mostly single storey.
- Short columns have been analysed through shadow calculations and demonstrated to be insignificant. Calculations have been carried out on the column supporting the 'v' brace which demonstrate an assessment of >100%NBS (IL3) in bending and shear. By observation other pedestals to the glulam arches also appear to be >100%NBS (IL3).
- Other factors have utilized 1.0 based on the building being mostly single storey with a light roof, well maintained and the design has been well documented. Shadow calculations have been carried out on the reinforced concrete block partition walls for out of plane actions. The walls have an assessed capacity of >100%NBS (IL3). There is some plan irregularity.

A more reliable assessment might include a detailed seismic assessment of the glulam arches, reinforced concrete columns supporting the upstairs slab, connection between the timber arch structure and the block wall structure, torsion and accidental eccentricity, foundations etc.

The key assumptions made during our assessment are shown in Table 1 that follows.

[redacted]

Table 1: IEP Assumptions

IEP Item	Assumption	Justification
Date of Building Design	1984	Original Drawings
Soil Type	C	Greater Wellington Regional Council Flex map Viewer and correlations to the Proceedings of the Ninth Pacific Conference on Earthquake Engineering,14-16 April, 2011, "NZS 1170.5:2004 site subsoil classification of Lower Hutt" D. Boon, N.D. Perrin, G.D. Dellow & R. Van Dissen.
Building Importance Level	3	AS/NZS1170.0
Ductility of Structure	2 Transverse 2 Longitudinal	Reinforced concrete block walls, reinforced concrete columns, glulam arches.
Plan Irregularity Factor, A	Insignificant	*The Seismic Assessment of Existing Buildings -Technical Guidelines for Engineering Assessments*, August 2017, Part B, Appendix BA, Figure BA.5. Distributed lateral load resisting system and flexible diaphragm.
Vertical Irregularity Factor, B	Insignificant	*The Seismic Assessment of Existing Buildings-Technical Guidelines for Engineering Assessments*, August 2017, Part B, Appendix BA, Figure BA.5. Single storey therefore no vertical irregularity.
Short Columns Factor, C	Insignificant	Short reinforced concrete columns/pedestals at the base of each glulam arch. Shadow calculations assessment is >100%NBS (IL3)
Pounding Factor, D	Insignificant	There are no surrounding buildings or structures.
Site Characteristics	Insignificant	*The Seismic Assessment of Existing Buildings-Technical Guidelines for Engineering Assessments*, August 2017, Part B, section B4.2. Site is positioned in a valley away from slopes. Greater Wellington Regional Council Flex Map Viewer indicates low liquefaction potential.
Other Factors	1.0 Transverse 1.0 Longitudinal	The building is mostly single storey with a light roof, well maintained and the design has been well documented. Shadow calculations have been carried out on the reinforced concrete block partition walls for out of plane actions. The walls have an assessed capacity of >100%NBS (IL3). There is some plan irregularity.

[redacted]

Building Description

All dates and measurements in this description are for the purposes of carrying out an Initial Seismic Assessment, they are approximate and should not be relied upon for further assessment or design.

The original pool was designed by [redacted] circa 1984. The overall building plan area is 1,400 m2 and the height is 7.3m. The north and south external walls are mostly glazing. There are three general structural systems. Reinforced concrete (RC) moment frame, RC block and glulam timber arches.

Staff Room

The primary lateral load resisting system is reinforced concrete columns. The roof is corrugated metal on timber trusses. The plan area is 12m x 5m and the upstairs FFL is 2.6m high. The upstairs floor is RC rib and infill, and the RC stairs are orientated in the transverse direction. The ribs (longitudinal direction) are supported on RC beams (transverse direction) which are supported by 6-circular RC columns in the front and 4-RC block walls internally (2 in each direction).

Changing Rooms

The primary lateral load resisting system is RC block walls. Plan area is 19m x 28m. There is glazing along the ridge of the male changing rooms. Where there are ceiling linings they follow the roof pitch. Many of the block walls are partitions with timber jack framing on top to the underside of the roof. The external east wall is reinforced concrete block. The plant room contains building parts which are excluded from this Initial Seismic Assessment

Pool Hall

The primary lateral load resisting system are 3-pin Glulam Arches. The plan area is 34m x 28m. There is glazing along the ridge over the pool hall. The west external wall is timber framed. The south external wall has a pop-out RC block wall which is used as a weights and exercise area. There is a pair of struts configured in a 'V' shape positioned a third of the way along each transverse arch. The pairs of V struts and the arch legs are fixed to RC columns/ pedistals with cast-in steel brackets. There is circular ducting, lights and an extractor fan fixed to the roof structure. These parts are excluded from this Initial Seismic Assessment.

Plate 3. Glulam Arches on Reinforced Concrete Pedistals

[redacted]

IEP Assessment Result

Our IEP assessment of this building indicates the building can achieve 100%NBS (IL3) in the longitudinal direction and 100%NBS (IL3) in the transverse direction. The IEP assessment of this building therefore indicates an overall earthquake rating of 100%NBS (IL3), corresponding to a 'Grade A+' building as defined by the New Zealand Society for Earthquake Engineering (NZSEE) building grading scheme. This is above 34%NBS for earthquake prone and above the threshold for earthquake risk buildings (67%NBS) as recommended by the NZSEE.

The key assumptions made during our assessment are shown in Table 1 above. Refer also to the attached IEP assessment and ISA technical summary report.

IEP Grades and Relative Risk

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

Table 2 taken from the Technical Guidelines referred to earlier provides the basis for a proposed grading system for existing buildings, as one way of interpreting the %NBS earthquake rating.

This building has been classified by the IEP as a 'Grade *A+*' building and is therefore considered to be a low life-safety risk.

Table 2: Relative Earthquake Risk

Building Grade	Percentage of New Building Strength (*%NBS*)	Approx. Risk Relative to a New Building	Life-safety Risk Description
A+	>100	<1	low risk
A	80 to 100	1 to 2 times	low risk
B	67 to 79	2 to 5 times	low or medium risk
C	34 to 66	5 to 10 times	medium risk
D	20 to 33	10 to 25 times	high risk
E	<20	more than 25 times	very high risk

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

[redacted]

Conclusion

Our ISA assessment for this building, carried out using the IEP indicates an earthquake rating of 100%NBS (IL3), which corresponds to a 'Grade A+' building, as defined by the NZSEE building grading scheme. This is *above* the threshold for Earthquake Risk Buildings (67%NBS) as defined by the NZSEE and the New Zealand Building Code.

The ISA is considered to provide a relatively quick, high-level and qualitative measure of the building's performance. In order to confirm the seismic performance of this building with more reliability you may wish to request a Detailed Seismic Assessment (DSA).

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

We trust this letter and initial seismic assessment meets your current requirements. We would be pleased to discuss further with you any issues raised in this report. Please do not hesitate to contact us if you would like clarification of any aspect of this letter.

Yours faithfully

[redacted]

Prepared by:

[redacted]

Reviewer:

[redacted]

Appendix A – Engineering Assessment Technical Summary

Building Information	
Building Name/Description	Stokes Valley Swimming Pool including Spa, Sauna, Staff Room, Reception, Gym, etc.
Street Address	187 George Street
Territorial Authority	Hutt City Council
No. of Storeys	Two
Area of Typical Floor (approx.)	1400m^2
Year of Design (approx.)	1984 by [redacted]
NZ Standard Designed to	NZS 4203:1984 (1984). *General structural design and design loadings for buildings*, Standards Association of New Zealand, Wellington, NZ.
Structural System including Foundations	The front entry is two storey, with a 60m^2 rib and infill floor, circular RC columns at the front; and with RC masonry walls at the rear. A third of the building is single storey RC masonry with a corrugated metal roof. Two thirds of the building is single storey, 3-pin glulam arches on RC pedestals/short columns with a corrugated metal roof. Foundations are shallow pads, slab on grade and slab thickenings.
Key Features of Ground Profile and Identified Geohazards	Greater Wellington Regional Council hazard mapping indicates the liquefaction and slope failure hazard at the site is "low".
Previous Strengthening	None
Heritage Issues/Status	None
Other	N/A

Assessment Information	
Consulting Practice	[redacted]
CPEng Responsible	[redacted]
Date/Version of Drawings Reviewed	Structural Drawings: Approved for Construction Feb 1984 Job number 605306 rev A to rev F
Geotechnical Report(s)	None
Date Building Inspected	08 July 2019
Previous Assessment Reports	None
Other Relevant Information	None.

Summary of Engineering Assessment Methodology and Key Parameters Used	
Occupancy Type(s) and Importance Level	Swimming Pool, Spa, Sauna, Weights Area. Importance Level 3
Site Subsoil Class	C

Summary of Assessment Methodology Used	Initial Evaluation Procedure (IEP) in accordance with *The Seismic Assessment of Existing Buildings-Technical Guidelines for Engineering Assessments*, dated August 2017 (The Guidelines) Part B – Initial Seismic Assessment. Shadow calculations have been carried out in accordance with The Guidelines Part C5 – Concrete Buildings (November 2018), The Guidelines Part C8 - Unreinforced Masonry Buildings (July 2017), NZS 4230:2004 – Design of Reinforced Concrete Masonry Structures, AS/NZS 1170.0:2002 0 - Structural Design Actions, NZS3101:2006 – Concrete Structures Standard . Longitudinal actions are carried to the ground through a combination of RC masonry walls, RC columns and glulam arches on RC pedestals/ short columns. Transverse actions are carried to the ground through either RC masonry walls or glulam arches on RC pedestals/short columns. Shadow calculations have been carried out on RC masonry partition walls for out of plane actions, and on the RC pedestals/ short columns. The partition walls are not full height (2m tall) but have timber jack framing to the underside of the roof.
Other Relevant Information	N/A
Assessment Outcomes	
Assessment Status	Final
Assessed Seismic Rating	100%NBS (IL3)
Seismic Grade	A+
Describe the Governing Critical Structural Weakness and Likely Mode of Failure	Not observed.
Comment on Parts Identified and Assessed	Heavy cantilever partition walls are included in this assessment. Circular ducting, extractor fan, pop top roof, lights over the swimming pool have been excluded from this assessment and are a potential critical structural weakness. Plant inside the plant room are excluded from this initial seismic assessment.
Recommendations	Seismic assessment of building parts over the swimming pool would investigate other potential critical structural weaknesses. In order to confirm the seismic performance of this building with more reliability we would recommend a Detailed Seismic Assessment (DSA). A DSA would also investigate other potential weaknesses that may not have been considered in the initial seismic assessment.

Appendix B – Initial Evaluation Procedure (IEP)

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

WARNING!! *This initial evaluation has been carried out solely as an initial seismic assessment of the building following the procedure set out in the "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:	**187 George Street**	**Job No.:**	**9683**
AKA:	**Stokes Valley Swimming Pool**	**By:**	**ULM**
Name of building:		**Date:**	**2/05/2019**
City:	**Lower Hutt**	**Revision No.:**	**39999 v 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)

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)

All dates and measurements in this description are for the purposes of carrying out an Initial Seismic Assessment, they are approximate and should not be relied upon for further assessment or design. Designed by [redacted] circa 1984. The overall building plan area is 1,400 m2 and the height is 7.3m. The north and south external walls are mostly glazing. There are three general structural systems. Reinforced concrete moment frame, reinforced concrete block and glulam timber arches.

Staff Room The roof is corrugated metal on timber trusses. The plan area is 12mx 5m and the upstairs FFL is 2.6m high. The upstairs floor is RC rib and infill, and the stairs are RC orientated in the transverse direction. The ribs (longitudinal direction) are supported on RC beams (transverse direction) which are supported by 6-circular RC columns in the front and 4-RC block walls internally (2 in each direction).

Changing Rooms. The primary lateral load resisting system is RC block walls. Plan area is 19m x 28m. There is glazing along the ridge of the male changing rooms. Where there are ceiling linings they follow the roof pitch. Many of the block walls are partitions with timber jack framing on top to the underside of the roof. The external east wall is reinforced concrete block. The plant room contains building parts which are excluded from this Initial Seismic Assessment

Pool Hall. The primary lateral load resisting system are 3-pin Glulam Arches. The plan area is 34m x 28m. There is glazing along the ridge over the pool hall. The west external wall is timber framed. The south external wall has a pop-out RC block wall which is used as a weights and exercise area. There is a pair of struts configured in a 'V' shape positioned a third of the way along each transverse arch. The pairs of V struts and the arch legs are fixed to RC plinths/ columns with cast-in steel brackets. There is circular ducting, lights and an extractor fan fixed to the roof structure.

1.4 Note information sources Tick as appropriate

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

Inspection of interior & exterior. Original architectural and structural drawings (1984). Original specifications (1984).

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

Street Number & Name:	**187 George Street**	**Job No.:**	**9683**
AKA:	**Stokes Valley Swimming Pool**	**By:**	**ULM**
Name of building:		**Date:**	**2/05/2019**
City:	**Lower Hutt**	**Revision No.:**	**39999 v 1**

Table IEP-1a Additional Photos and Sketches

Add any additional photographs, notes or sketches required below:

Note: print this page separately

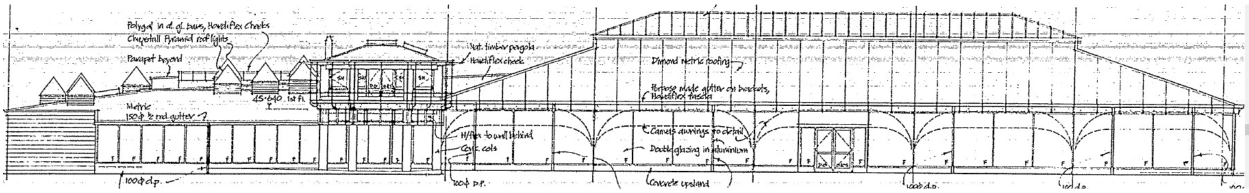


Fig1 - North elevation.

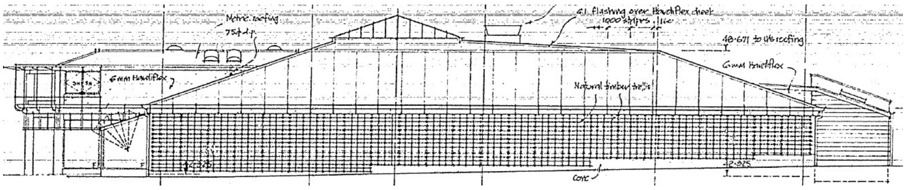
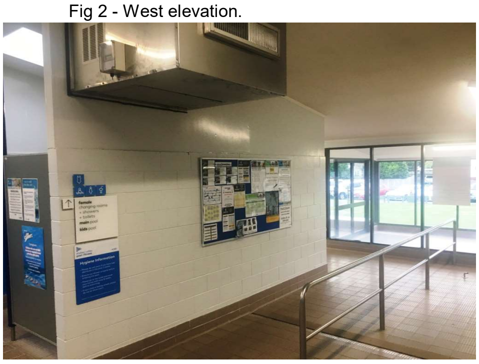


Fig 2 - West elevation.



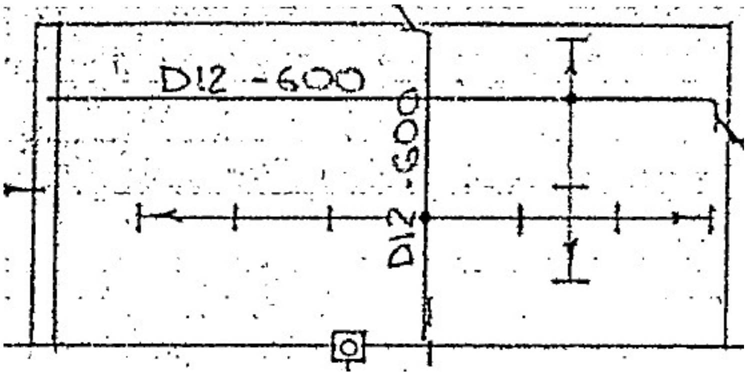


Fig 3 - Typical RC block partition wall.

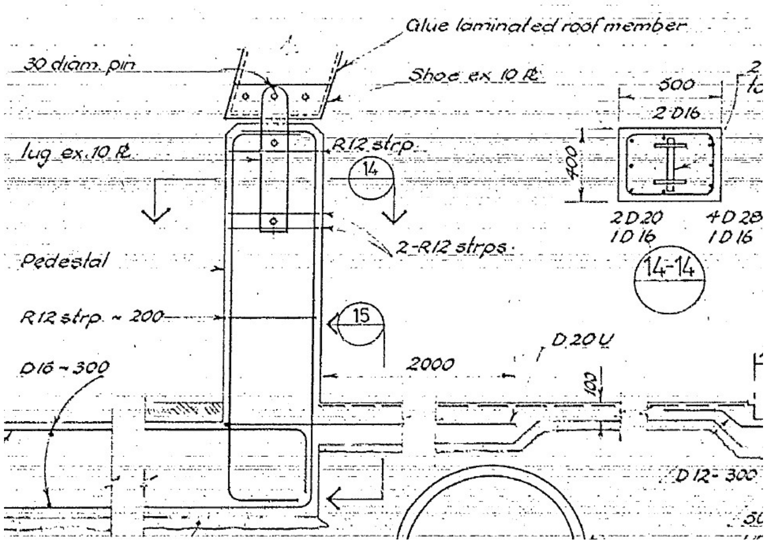


Fig 4 - Typical plinth/col pedestal for glulam arch.

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

Street Number & Name:	**187 George Street**	**Job No.:**	**9683**
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City:	**Lower Hutt**	**Revision No.:**	**39999 v 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:	**Not applicable**	**Not applicable**
Seismic Zone:	Zone A	Zone A
c) Soil Type		
From NZS1170.5:2004, Cl 3.1.3 :	C Shallow Soil	C Shallow Soil
From NZS4203:1992, Cl 4.6.2.2 : (for 1992 to 2004 and only if known)	**Not applicable**	**Not applicable**

d) Estimate Period, *T*

Comment:

Part single storey timber portal and part two storey reinforced concrete block walls. Therefore, short period.

		Longitudinal	Transverse
h_n =		7.3	7.3 m
A_c =		1.00	1.00 m²
Moment Resisting Concrete Frames:	$T = \max\{0.09h_n^{0.75}, 0.4\}$	○	○
Moment Resisting Steel Frames:	$T = \max\{0.14h_n^{0.75}, 0.4\}$	○	○
Eccentrically Braced Steel Frames:	$T = \max\{0.08h_n^{0.75}, 0.4\}$	○	○
All Other Frame Structures:	$T = \max\{0.06h_n^{0.75}, 0.4\}$	○	○
Concrete Shear Walls	$T = \max\{0.09h_n^{0.75}/A_c^{0.5}, 0.4\}$	○	○
Masonry Shear Walls:	$T \leq 0.4$sec	◉	◉
User Defined (input Period):		○	○
T:		0.40	0.40

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

			Longitudinal	Transverse
e) Factor A:	Strengthening factor determined using result from (a) above (set to 1.0 if not strengthened)	**Factor A:**	1.00	1.00
f) Factor B:	Determined from NZSEE Guidelines Figure 3A.1 using results (a) to (e) above	**Factor B:**	0.25	0.25
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:**	1.00	1.00
***(%NBS)* nom = AxBxCxD**		***(%NBS)* nom**	25%	25%

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City:	Lower Hutt	Revision No.:	39999 v 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: Upper Hutt — Refer right for user-defined locations

Z = 0.42 (from NZS1170.5:2004, Table 3.3)

Z_{1992} = 1.2 (NZS4203:1992 Zone Factor from accompanying Figure 3.5(b))

Z_{2004} = 0.42 (from NZS1170.5:2004, Table 3.3)

b) Factor F

For pre 1992 = $1/Z$

For 1992-2011 = Z_{1992}/Z

For post 2011 = Z_{2004}/Z

	Longitudinal	Transverse
Factor F:	2.38	2.38

2.4 Return Period Scaling Factor, Factor G

a) Design Importance Level, I

(Set to 1 if not known. For buildings designed prior to 1965 and known to be designed as a public building set to 1.25. For buildings designed 1965-1976 and known to be designed as a public building set to 1.33 for Zone A or 1.2 for Zone B. For 1976-1984 set I value.)

b) Design Risk Factor, R_o

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

c) Return Period Factor, R

(from NZS1170.0:2004 Building Importance Level)

Choose Importance Level

d) Factor G = IR_o/R

	Longitudinal	Transverse
I =	1	1
Category	Category 1	Category 1
R_o =	2	2
Importance Level	○ 1 ○ 2 ◉ 3 ○ 4	○ 1 ○ 2 ◉ 3 ○ 4
R =	1.3	1.3
Factor G:	1.54	1.54

2.5 Ductility Scaling Factor, Factor H

a) Available Displacement Ductility Within Existing Structure

Comment:

Timber portals. RC block walls. RC Frame.

	Longitudinal	Transverse
μ =	2.00	2.00

b) Factor H

		Longitudinal k_μ	Transverse k_μ
For pre 1976 (maximum of 2)	=	1.57	1.57
For 1976 onwards	=	1	1
Factor H:		1.00	1.00

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

2.6 Structural Performance Scaling Factor, Factor I

a) Structural Performance Factor, S_p

(from accompanying Figure 3.4)

Tick if light timber-framed construction in this direction

b) Structural Performance Scaling Factor = $1/S_p$

	Longitudinal	Transverse
Tick	☐	☐
S_p =	0.70	0.70
Factor I:	1.43	1.43

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)

	Longitudinal	Transverse
$(\%NBS)_b$	133%	133%

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

Street Number & Name:	187 George Street	Job No.:	9683
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Name of building:		Date:	2/05/2019
City:	Lower Hutt	Revision No.:	39999 v 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

none.

3.2 Vertical Irregularity

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

Mostly single storey.

3.3 Short Columns

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

Short RC columns at the base of each timber portal. Shadow calculations have been carried out on the column which supports the 'v' brace. This columns indicates >100%NBS (IL3). Othere columns appear >100% NBS (IL3) by observation.

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

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

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

Site is positioned in a valley away from slopes. GWRC flex map viewer indicates low liquefaction potential.

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:

Building is mostly single storey, well maintained and the design has been well documented. Shadow calculations have been carried out on the RC block partitions out-of-plane and the plinth/cols at the base of the arches. Insignificant plan irregularity introduced due to the pinned 'v' struts to arches being off-centre.

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

PAR — **Longitudinal** **1.00**

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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)

b) Transverse Direction

Factors

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

3.1 Plan Irregularity

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

Block wall area is more stiff than timber arch area but there appears to be no diaphragm. So use tributary widths.

3.2 Vertical Irregularity

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

Mostly single storey.

3.3 Short Columns

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

Short RC columns at the base of each timber portal. Shadow calculations have been carried out on the column which supports the 'v' brace. This columns indicates >100%NBS (IL3). Othere columns appear >100% NBS (IL3) by observation.

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

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

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

Site is positioned in a valley away from slopes. GWRC flex map viewer indicates low liquefaction potential.

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

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

Factor F 1.00

Record rationale for choice of Factor F:

Building is mostly single storey, well maintained and the design has been well documented. Shadow calculations have been carried out on the RC block partitions out-of-plane and the plinth/cols at the base of the arches. Insignificant plan irregularity introduced due to the pinned 'v' struts to arches being off-centre.

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

PAR

Transverse **1.00**

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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)*$_b$** (from Table IEP - 1)	133%	133%
4.2	**Performance Achievement Ratio (PAR)** (from Table IEP - 2)	1.00	1.00
4.3	**PAR x Baseline *(%NBS)*$_b$**	>100%	>100%
4.4	**Percentage New Building Standard *(%NBS)* - Seismic Rating** (Use lower of two values from Step 4.3)		>100%

Step 5 - Is *%NBS* < 34?

NO

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

NO

Step 7 - Provisional Grading for Seismic Risk based on IEP

Seismic Grade A+

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

Shadow calculations have been carried out on the RC block partions utilising the following parameters:

Part P2 & P3, Ductility 1.25, Soil Class C, Importance Level 3, Design Life 50 Yrs
Height of Building 7.3m, Height of Part 1m, Fph = 1.44 Wp

Shadow calculations have been carried out on the plinth/cols utilizsing the folowing parameters:

Groof 0.42kPa, Gglazing = 0.3 kPa, Earthquake combination facor for live roof load is 0
Ductility 1.25, Soil Class C, Importance Level 3, Design Life 50 Yrs, Cd = 1.04

Relationship between Grade and *%NBS* :

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

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Initial Evaluation Procedure (IEP) Assessment - Completed for Hutt City Council **Page 7**

Street Number & Name:	187 George Street	Job No.:	9683
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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 [redacted]

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