Petone Recreation Ground Grandstand
16 Udy Street, Petone

Initial Seismic Assessment

for
Hutt City Council

Project 9779

April 2020

9779
3 April 2020
Private Bag 31912
Lower Hutt 5040

Attention: Aaron Marsh

Dear Aaron,

Initial Seismic Assessment Report
Petone Recreation Ground Grandstand, 16 Udy Street, Petone

We have now completed an Initial Seismic Assessment (ISA) of the Petone Recreation Ground Grandstand at 16 Udy Street, Petone 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 completing a site visit on Thursday 12 March 2020.

Executive Summary

This building has been rated against the new building standard for a structure which is regarded as Importance Level 3 (IL3) in accordance with NZS1170.5:2004.

The assessed potential earthquake rating is 34%NBS (IL3) in both the longitudinal and transverse directions, which gives it a seismic 'Grade C'. Therefore, the potential status of the building in terms of life-safety is Earthquake Risk and not Earthquake Prone.

A "Severe Structural Weakness" (SSW) is a structural weakness for which rupture would lead to a catastrophic collapse. No Severe Structural Weaknesses have been identified.

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

Hutt City Council has engaged Sawrey Consulting Engineers Ltd (SCEL) to carry out an Initial Seismic Assessment (ISA) of the Petone Recreation Ground Grandstand located at 16 Udy Street, Petone, Lower Hutt. 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 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 building was constructed for Petone Borough Council in 1939. Roof bracing was added in 1979. The building was strengthened to 34%NBS (IL3) in 2015 (design carried out in 2014).

- Subsoil class D has been used based on GNS Science's Lower Hutt Valley Site Subsoil Class Map and geotechnical desktop study by Coffey Geotechnics in 2014.

- The period has been determined as being less than 0.40 seconds, based on calculations carried out for DSA in 2014.

- A Hazard Scaling Factor of Z = 0.4 has been used based on the location of the site in the Hutt Valley, south of Taita Gorge.

- The building has been assumed to have an Importance Level 3 (structures that as a whole may contain people in crowds).

- A ductility factor of μ = 1.5 has been assumed based on insitu reinforced concrete, blockwork and brick structure.

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

Table 1: IEP Assumptions

IEP Item	Assumption	Justification
Date of Building Design	1939 (Strengthening 2014)	This is the date on the drawings
Soil Type	D	GNS Science's Lower Hutt Valley Site Subsoil Class Map and Coffey Geotechnics geotechnical desktop study.
Building Importance Level	3	AS/NZS1170.0
Ductility of Structure	1.5	Insitu reinforced concrete, blockwork and brick structure.
Plan Irregularity Factor, A	1.0	Insignificant. Taken into account in 2014 assessment and strengthening.
Vertical Irregularity Factor, B	1.0	Insignificant. Taken into account in 2014 assessment and strengthening.
Short Columns Factor, C	1.0	Insignificant. Taken into account in 2014 assessment and strengthening.
Pounding Factor, D	1.0	Insignificant
Site Characteristics	1.0	Insignificant – Greater Wellington GIS viewer indicates high liquefaction potential. However, geotechnical desktop study in 2014 indicates non-liquefiable crust which may limit differential settlement. Foundations consist of reinforced concrete pads, with grillage of foundation beams and slab, so well tied together. Therefore, should liquefaction occur, risk is considered low from a life-safety perspective.
Factor F	1.3	Building strengthened to 34%NBS for an IL3 building in 2014.

Building Description

The grandstand was constructed by Nicholls & Pearce in 1939 for the Petone Borough Council. Additional roof bracing was installed in 1979. No documentation was found for alterations to the changing rooms and facilities on the ground floor that appear to have been designed and built around the 1970s. The grandstand was strengthening to 34%NBS (IL3) in 2015 (design carried out in 2014).

The grandstand has a corrugated iron hip roof supported on steel angle trusses. These trusses are supported on the rear (west) wall and steel I section columns along the centre of the grandstand. The trusses cantilever approximately 7.5m from these columns over the front of the grandstand.

The bleachers on which the grandstand seating is located are insitu reinforced concrete supported by raking insitu reinforced concrete beams.

At ground floor level, exterior walls are mainly 230mm brick infill panels between columns and openings. From the level of the top of the ground floor door and window openings to the underside of the bleachers, the exterior walls are 203mm concrete reducing to 152mm concrete above the bleachers.

Internal walls at ground floor level are mainly 190mm blockwork terminating approximately 200mm below the ceiling. There are also some 220 and 152mm thick concrete walls and single skin brick walls full height.

Foundations consist of insitu reinforced concrete pads, foundation beams and slab.

The 2014-2015 strengthening work consisted of the following:

- West (rear) wall columns – Strengthened by adding additional reinforced concrete to the exterior face.
- Return walls above bleacher level each end – Strengthened by adding bolt-on vertical galvanised steel channels.
- Single skin brick wall between equipment room and SW changing room – Removed and replaced with a timber framed wall.
- Chimney – Removed cracked concrete section above roof level and replaced with a steel flue. Tied brick section within the first floor ceiling space to the concrete wall with steel straps.

The DSA carried out in 2014 and subsequent strengthening identified a number of structural elements in poor condition. This includes significant corrosion to the following areas:

- Steel Posts at the glass walls at the north and south ends of the grandstand.
- Reinforcement in the west wall where cracking and spalling of concrete is beginning to occur.
- Top reinforcement to the bleacher support beams especially at the lower ends.
- The base of a concrete column where concrete has spalled off exposing the north eastern reinforcing bar.

The 2014 assessment and strengthening design took into account the reduced strength due to corrosion where it was identified. Based on comparison of photographs taken in 2014 and now, the degree of corrosion does not appear to have changed significantly. The strengths used in the 2014 assessment and design are therefore expected to still be appropriate. However, without significant remedial work to reverse the effects of this corrosion and stop future corrosion it is likely that the building's strength will degrade to a point where the corrosion reduces the building's seismic strength to less than 34%NBS (IL3). The recommendation of structural inspections at 3 yearly intervals to monitor the corrosion and assess its effect on the building's likely seismic strength that was made with the 2014 strengthening design therefore still stands.

IEP Assessment Result

Our IEP assessment of this building indicates the building achieves 34%NBS (IL3) in both the longitudinal and transverse directions. The IEP assessment of this building therefore indicates an overall earthquake rating of 34%NBS (IL3), corresponding to a 'Grade C' building as defined by the New Zealand Society for Earthquake Engineering (NZSEE) building grading scheme. This is above the threshold for Earthquake Prone Buildings (34%NBS), but below 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 C' building and is therefore considered to be a medium 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.

Conclusion

Our ISA assessment for this building, carried out using the IEP indicates an overall score of 34%NBS (IL3), which corresponds to a ‘Grade C’ building, as defined by the NZSEE building grading scheme. This is above the threshold for Earthquake Prone Buildings (34%NBS), but below the threshold for Earthquake Risk Buildings (67%NBS) as recommended by the NZSEE.

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.

A geotechnical desktop study was carried out by Coffey Geotechnics in 2014. The report for this provided recommendations for further investigation which would provide more reliable estimates of the liquefaction risk of the site and expected liquefaction induced settlements.

A number of areas have significant corrosion to reinforcing steel and structural steel. It is recommended that structural inspections be carried out at 3 yearly intervals to monitor the corrosion and assess its effect on the building’s likely seismic strength. Remedial measures could be considered to slow down the corrosion process and possibly extend the life of the building.

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

SAWREY CONSULTING ENGINEERS LTD

[redacted]

Appendix A: ISA Technical Summary Report
Appendix B: IEP Form

Appendix A - ISA Technical Summary Report

1. Building Information	
Building Name/ Description	Petone Recreation Ground Grandstand
Street Address	16 Udy Street, Petone
Territorial Authority	Hutt City Council
No. of Storeys	3
Area of Typical Floor (approx.)	560m^2
Year of Design (approx.)	1939 (original construction) 2014 (strengthening to 34%NBS (IL3))
NZ Standards designed to	NZSS 95:1936 or NZSS 95:1939 (original design) AS/NZS 1170.5:2004 (34%NBS (IL3) strengthening design)
Structural System including Foundations	Corrugated iron roof supported on steel angle trusses. Trusses supported on the rear (west) wall and steel I section columns along the centre of the grandstand. Steel diagonal roof bracing. Reinforced concrete beams supporting bleachers. Reinforced concrete columns and higher level walls. Brick lower level exterior walls. Interior lower level walls mainly blockwork terminating approx. 200mm below ceiling. Some concrete and brick walls full height. Foundations consist of insitu reinforced concrete pads, foundation beams and slab.
Does the building comprise a shared structural form or shares structural elements with any other adjacent titles?	No
Key features of ground profile and identified geohazards	High liquefaction potential
Previous strengthening and/ or significant alteration	Strengthened to 34%NBS (IL3) in 2014.
Heritage Issues/ Status	None
Other Relevant Information	N/A

2. Assessment Information	
Consulting Practice	Sawrey Consulting Engineers Ltd
CPEng Responsible, including: • Name • CPEng number • A statement of suitable skills and experience in the seismic assessment of existing buildings [1]	[redacted]
Documentation reviewed, including: • date/ version of drawings/ calculations [2] • previous seismic assessments	• Structural drawings for original 1939 design • Structural drawings for 2014 strengthening design • 2014 DSA by Sawrey Consulting Engineers
Geotechnical Report(s)	2014 Geotechnical Desktop Study by Coffey Geotechnics
Date(s) Building Inspected and extent of inspection	Inspection of accessible exterior and interior parts of building completed on Thursday 12th March 2020
Description of any structural testing undertaken and results summary	None
Previous Assessment Reports	2014 DSA by Sawrey Consulting Engineers
Other Relevant Information	N/A

1 This should include reference to the engineer's Practice Field being in Structural Engineering, and commentary on experience in seismic assessment and recent relevant training

2 Or justification of assumptions if no drawings were able to be obtained

3. Summary of Engineering Assessment Methodology and Key Parameters Used	
Occupancy Type(s) and Importance Level	IL3
Site Subsoil Class	D
For an ISA:	
Summary of how Part B was applied, including: • Key parameters such as μ, S_p and F factors • Any supplementary specific calculations	• μ of 1.5 based on insitu reinforced concrete, blockwork and brick structure • S_p of 0.85 • F factor of 1.3 to account for fact that building was strengthened to 34%NBS for an IL3 building in 2014
For a DSA:	
Summary of how Part C was applied, including: • the analysis methodology(s) used from C2 • other sections of Part C applied	N/A
Other Relevant Information	N/A

4. Assessment Outcomes		
Assessment Status (Draft or Final)	Final	
Assessed *%NBS* Rating	34% NBS (IL3)	
Seismic Grade and Relative Risk (from Table A3.1)	C	
<u>For an ISA:</u>		
Describe the Potential Critical Structural Weaknesses	• Stairs at north and south ends of grandstand • Numerous exterior and interior walls • West wall columns • Bleacher beams • Roof trusses	
Does the result reflect the building's expected behaviour, or is more information/ analysis required?	Yes – the ISA is sufficient ~~Or~~ ~~No - a DSA is recommended~~ [3]	
If the results of this ISA are being used for earthquake prone decision purposes, <u>and</u> elements rating <34*%NBS* have been identified:	**Engineering Statement of Structural Weaknesses and Location** N/A	***Mode of Failure and Physical Consequence*** **Statement(s)** N/A
<u>For a DSA:</u>		
Comment on the nature of Secondary Structural and Non-structural elements/ parts identified and assessed	N/A	
Describe the Governing Critical Structural Weakness	N/A	
If the results of this DSA are being used for earthquake prone decision purposes, <u>and</u> elements rating <34*%NBS* have been identified (including Parts) [4]:	**Engineering Statement of Structural Weaknesses and Location** N/A	***Mode of Failure and Physical Consequence*** **Statement(s)** N/A
Recommendations (*optional for EPB purposes*)	A number of areas have significant corrosion to reinforcing steel and structural steel. It is recommended that structural inspections be carried out at 3 yearly intervals to monitor the corrosion and assess its effect on the building's likely seismic strength. Remedial measures could be considered to slow down the corrosion process and possibly extend the life of the building.	

3 Indicate what form should the DSA take/ what the specific areas to focus on are
4 If a building comprises a shared structural form or shares structural elements with other adjacent titles, information about the extent to which the low scoring elements affect, or do not affect the structure.

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:	**16 Udy Street**	**Job No.:**	**9779**
AKA:		**By:**	[redacted]
Name of building:	**Petone Recreation Ground Grandstand**	**Date:**	**30/03/2020**
City:	**Lower Hutt**	**Revision No.:**	**0**

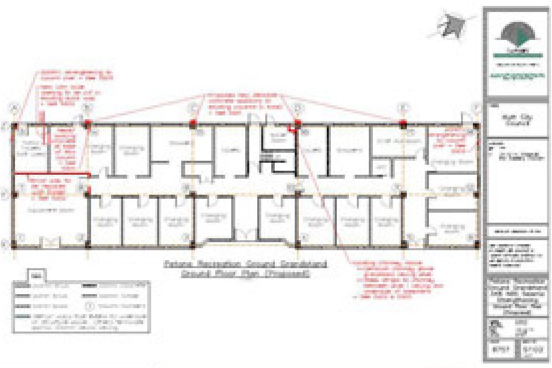
Table IEP-1 Initial Evaluation Procedure Step 1

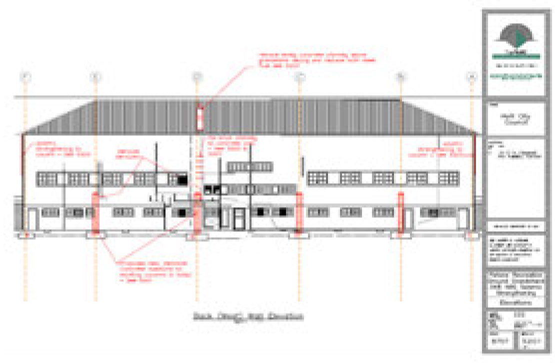
Step 1 - General Information

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)

The building was originally constructed in 1939. Roof bracing was added in 1979. The grandstand was strengthed to 34%NBS (IL3) in 2014.

The grandstand has a corrugated iron hip roof supported on steel angle trusses. These trusses are supported on the rear (west) wall and steel I section columns along the centre of the grandstand. The trusses cantilever approximately 7.5m from these columns over the front of the grandstand.

The bleachers on which the grandstand seating is located are insitu reinforced concrete supported by raking insitu reinforced concrete beams.

At ground floor level, exterior walls are mainly 230mm brick infill panels between columns and openings. From the level of the top of the ground floor door and window openings to the underside of the bleachers, the exterior walls are 203mm concrete reducing to 152mm concrete above the bleachers.

Internal walls at ground floor level are mainly 190mm blockwork terminating approximately 200mm below the ceiling. There are also some 220 and 152mm thick concrete walls and single skin brick walls full height.

1.4 Note information sources Tick as appropriate

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

Original structural drawings (difficult to read in places) and structural drawings for 2014 strengthening. 2014 DSA. 2014 Geotechnical Desktop Study.

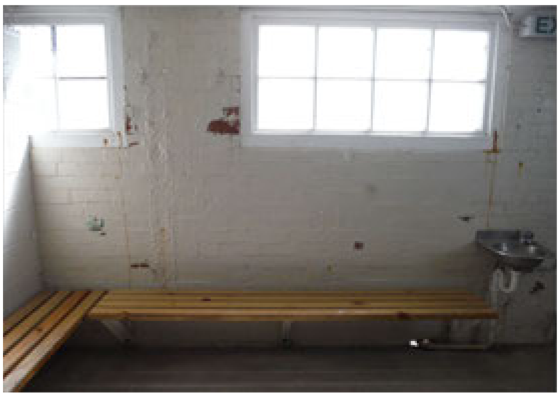
Initial Evaluation Procedure (IEP) Assessment - Completed for Hutt City Council Page 1a

Street Number & Name:	**16 Udy Street**	**Job No.:**	**9779**
AKA:		**By:**	[redacted]
Name of building:	**Petone Recreation Ground Grandstand**	**Date:**	**30/03/2020**
City:	**Lower Hutt**	**Revision No.:**	**0**

Table IEP-1a Additional Photos and Sketches

Add any additional photographs, notes or sketches required below:

Note: print this page separately



WARNING!! *This initial evaluation has been carried out solely as an initial seismic assessment of the building following the procedure set out "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 Hutt City Council

Street Number & Name:	**16 Udy Street**	**Job No.:**	9779
AKA:		**By:**	[redacted]
Name of building:	**Petone Recreation Ground Grandstand**	**Date:**	30/03/2020
City:	**Lower Hutt**	**Revision No.:**	**0**

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	34%	34%
If strengthened, enter original design date for information: 2014		
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:	**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*		
h_n =	13	13 m
A_c =	1.00	1.00 m^2
Moment Resisting Concrete Frames: $T = \max\{0.09h_n^{0.75}, 0.4\}$	○	○
Moment Resisting Steel Frames: $T = \max\{0.14h_n^{0.75}, 0.4\}$	○	○
Eccentrically Braced Steel Frames: $T = \max\{0.08h_n^{0.75}, 0.4\}$	○	○
All Other Frame Structures: $T = \max\{0.06h_n^{0.75}, 0.4\}$	○	○
Concrete Shear Walls: $T = \max\{0.09h_n^{0.75}/A_c^{0.5}, 0.4\}$	○	○
Masonry Shear Walls: $T \leq 0.4$sec	○	○
User Defined (input Period):	◉	◉
T:	0.40	0.40

Comment:

Period of building was calculated to be < 0.4s in 2014 DSA.

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:**	0.34	0.34
f) Factor B:	Determined from NZSEE Guidelines Figure 3A.1 using results (a) to (e) above	**Factor B:**	1.00	1.00
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)*$_{nom}$**	34%	34%

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

Street Number & Name:	16 Udy Street	Job No.:	9779
AKA:		By:	[redacted]
Name of building:	Petone Recreation Ground Grandstand	Date:	30/03/2020
City:	Lower Hutt	Revision No.:	0

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: Hutt Valley-south of Taita Gorge — **Refer right for user-defined locations**

Z =	0.4	(from NZS1170.5:2004, Table 3.3)
Z_{1992} =	1.2	(NZS4203:1992 Zone Factor from accompanying Figure 3.5(b))
Z_{2004} =	0.4	(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:	1.00	1.00

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*: ○ 1 ○ 2 ◉ 3 ○ 4 (Longitudinal); ○ 1 ○ 2 ◉ 3 ○ 4 (Transverse)

d) **Factor G** = IR_o/R

	Longitudinal	Transverse
I =	1	1
R_o =	1	1
R =	1.3	1.3
Factor G:	0.77	0.77

2.5 Ductility Scaling Factor, Factor H

a) **Available Displacement Ductility Within Existing Structure**

Comment: Insitu reinforced concrete, blockwork and brick structure.

b) **Factor H**

		Longitudinal	Transverse
μ =		1.50	1.50
		k_μ	k_μ
For pre 1976 (maximum of 2)	=	1.29	1.29
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
S_p =	0.85	0.85
Factor I:	1.00	1.00

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

	Longitudinal	Transverse
2.7 Baseline *%NBS* for Building, *(%NBS)*$_b$ (equals ***(%NBS)***$_{nom}$ **x E x F x G x H x I**)	26%	26%

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

Street Number & Name:	16 Udy Street	Job No.:	9779
AKA:		By:	[redacted]
Name of building:	Petone Recreation Ground Grandstand	Date:	30/03/2020
City:	Lower Hutt	Revision No.:	0

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

Taken into account in 2014 assessment and strengthening.

3.2 Vertical Irregularity

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

Taken into account in 2014 assessment and strengthening.

3.3 Short Columns

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

Taken into account in 2014 assessment and strengthening.

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

Geotechnical desktop study in 2014 indicates non-liquefiable crust which may limit differential settlement. Foundations well tied together. Therefore, risk is considered low from life-safety perspective.

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 1.3

Record rationale for choice of Factor F:

Building strengthened to 34%NBS for an IL3 building in 2014.

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

	PAR
Longitudinal	**1.30**

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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

3.2 Vertical Irregularity

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

Taken into account in 2014 assessment and strengthening.

3.3 Short Columns

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

Taken into account in 2014 assessment and strengthening.

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

Geotechnical desktop study in 2014 indicates non-liquefiable crust which may limit differential settlement. Foundations well tied together. Therefore, risk is considered low from life-safety perspective.

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 1.30

Record rationale for choice of Factor F:

Building strengthened to 34%NBS for an IL3 building in 2014.

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

PAR
Transverse **1.30**

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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)	26%	26%
4.2 Performance Achievement Ratio (PAR) (from Table IEP - 2)	1.30	1.30
4.3 PAR x Baseline *(%NBS)*$_b$	34%	34%
4.4 Percentage New Building Standard *(%NBS)* - Seismic Rating (Use lower of two values from Step 4.3)		34%

Step 5 - Is *%NBS* < 34? NO

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

Step 7 - Provisional Grading for Seismic Risk based on IEP

Seismic Grade C

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

Relationship between Grade and *%NBS* :

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

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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	3
8.2	Presence of heavy concrete floors and/or concrete roof? (Y/N)	Y

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 b [redacted]

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