PO Box 1117
Wellington 6140, NZ
Tel: +64 4 939 9295
Email: admin@novaredesign.com
Website: www.novaredesign.com

Date: 11 November 2022

Novare Project No. 3321

Jacob Corlett
Greater Wellington Regional Council
100 Cuba Street, Te Aro
Wellington 6011

Dear Jacob,

INITIAL SEISMIC ASSESSMENT OF WATERLOO RAIL STATION UP-MAIN AMENITIES BUILDING

We have now completed an Initial Seismic Assessment (ISA) of Waterloo Rail Station Up-Main Amenities Building, Waterloo, Lower Hutt 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 July 2017. The assessment was carried out after completing a site visit on October 4, 2022, as well as a high-level review of the original drawings where available.

1 Executive Summary

Waterloo Rail Station Up-Main Amenities Building has an overall potential earthquake rating of ***85%NBS (IL2)***, which corresponds to a **Grade A** building when considered as an Importance Level 2 (IL2) building. This is above the threshold for earthquake-prone buildings (*34%NBS)* and above the threshold for earthquake-risk buildings (*67%NBS)*.

The ISA is considered to provide a relatively quick, high-level and qualitative measure of the building's seismic performance. A more reliable result will be obtained by a Detailed Seismic Assessment (DSA). A DSA could find structural weaknesses not identified from the IEP.

2 Introduction

2.1 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 2010/2011. 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 (<33%NBS), or having a lower *%NBS* score, which subsequent detailed investigation may indicate is less than the actual performance. However, there will be exceptions, particularly when potential critical structural weaknesses are present that have not been recognized from the level of investigation employed in the IEP.

PO Box 1117
Wellington 6140, NZ
Tel: +64 4 939 9295
Email: admin@novaredesign.com
Website: www.novaredesign.com

- 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 standards 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 behavior 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 item such as ceilings, plant, services or general glazing that are not considered to present a significant life safety hazard.

Experience to date is that an 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 indicative 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.

2.2 Basis for the Assessment

The information we have used for our IEP assessment includes:

- A site visit was performed on 04/10/2022, which included an inspection of the exterior of the entire complex and viewing of the interior of the building, however, it should be noted the structure was considerably covered by the existing interior fitout.
- A high-level review of the available documentation for the property. This included structural and architectural drawings including the adjoining canopy roof, although, not included in the IEP.
- Assessment of the geotechnical conditions was based on a geotechnical report by GHD July 2018 and the soil was identified as class D.

2.3 Building Description

Waterloo Rail Station Up-Main Amenities Building, Lower Hutt is a two-storey steel frame structure designed in 1987. The structure is rectangular in shape and is adjoined to the main station canopy structure at roof level.

The foundation is constructed of piles with reinforced concrete ground beams to support the hollowcore units with a topping slab and reinforcing mesh at the ground floor level. At the first-floor level the floor is built from lightweight timber construction. At roof level there is lightweight profile roofing supported on a lattice roof structure which is integrated with the canopy for the main station.

PO Box 1117
Wellington 6140, NZ
Tel: +64 4 939 9295
Email: admin@novaredesign.com
Website: www.novaredesign.com

In each orthogonal direction the lateral resisting load path is steel frame. This is a flexible structural system and is expected to be capable of undergoing reasonable displacements induced by the canopy. Note that to fully understand the level of displacements, would be beyond the scope of the IEP as it would require an analysis in accordance with Part C4 of the MBIE guidance documents which would include the soil structure interaction of the piles within the ground.

The soil class has been estimated as Class D (Deep soil) based on the GHD Geotechnical Report.

3 IEP Assessment Results

Our IEP assessment for Waterloo Rail Station Up-Main Amenities Building indicates the building can achieve ***85%NBS (IL2)*** in the longitudinal direction and **85%NBS (IL2)** in the transverse direction. The IEP assessment of this building therefore indicates an overall earthquake rating of ***85%NBS (IL2)***, corresponding to a 'Grade A' building as defined by the NZSEE building grading scheme. This is above *34%NBS* (one of the tests the TA will apply to determine the building's earthquake-prone building status), 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 below. Refer also to the attached IEP assessment.

Table 1: IEP Assessment Results for Waterloo Rail Station Up-Main Amenities Building

IEP Item	Assumption	Justification
Date of Building Design	Post-1981	Latest available drawings for the facility are dated 1987
Subsoil Type	Class D	Based on a recent geotechnical report by GHD.
Building Importance Level	IL2	Building is a normal structure that does not come under the occupancy and use categories for Importance Levels 1,3 or 4.
Ductility of Structure	$\mu = 1.25$	Low ductility selected due to the unknown performance to the cantilever columns of the integrated canopy of the main station.
Plan Irregularity Factor, A	1.0	Building itself is regular in plan.
Vertical Irregularity Factor, B	1.0	Building is two-storey and has no vertical irregularity.
Short Columns Factor, C	1.0	Flexible steel frame without short columns.
Pounding Factor, D	1.0	Evidence of thought put into sliding supports at the pump station.
Site Characteristics Factor, E	1.0	Site characteristics are unlikely to affect life-safety.
Other Factors, F	1.5	A Factor of 1.5 has been chosen because the ductility used for the assessment is considered low for steel moment frames. The low ductility factor was selected because of the uncertainty relating to the ground movement of the piles of the cantilever concrete columns.

PO Box 1117
Wellington 6140, NZ
Tel: +64 4 939 9295
Email: admin@novaredesign.com
Website: www.novaredesign.com

4 IEP Grades and Relative Risk

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.

Table 2: Relative Earthquake Risk

Percentage of New Building Standard *(%NBS)*	Alpha rating	Approx. risk relative to a new building	Life-safety risk description
>100	A+	Less than or comparable to	Low risk
80-100	A	1-2 times greater	Low risk
67-79	B	2-5 times greater	Low to Medium risk
34-66	C	5-10 times greater	Medium risk
20 to <34	D	10-25 times greater	High risk
<20	E	25 times greater	Very high risk

Waterloo Rail Station Up-Main Amenities Building has been classified by the IEP as Grade A, **Low** risk to life-safety.

The NZSEE (Which provides authoritative advice to the legislation makers, and should be considered to represent the consensus view of New Zealand structural engineers) classifies a building achieving greater than *67%NBS* as "low or medium risk" and having "acceptable (improvement may be desirable)" building structural performance.

PO Box 1117
Wellington 6140, NZ
Tel: +64 4 939 9295
Email: admin@novaredesign.com
Website: www.novaredesign.com

5 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, as specified by NZS 4219:2009 “The Seismic Performance of Engineering Systems in Buildings”.

An assessment has not been made of the bracing of the ceilings, in-ceiling ducting, services and plant or contents. We have also not checked whether or not tall or heavy furniture has been seismically restrained. These issues are outside the scope of this initial assessment but could be the subjects of another investigation. As a high level note during the interior inspection it was noted that the entrance had a glass feature wall with considerable mass that could be a hazard due to its expected brittle behavior.

During the exterior inspection it was noted that the facades are glass which could result in a broken glass hazard around the perimeter of the building during the egress stage of a seismic event.

PO Box 1117
Wellington 6140, NZ
Tel: +64 4 939 9295
Email: admin@novaredesign.com
Website: www.novaredesign.com

6 Conclusion

Our ISA assessment for Waterloo Rail Station Up-Main Amenities Building indicates that the building has an overall score of ***85%NBS (IL2)***, which corresponds to a **Grade A** building, as defined in the NZSEE building grading scheme. This is **above** the threshold for earthquake-prone buildings (*34%NBS)* and **above** the threshold for earthquake-risk buildings (*67%NBS)* as defined 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 DSA. This would also investigate other potential structural issues that may not have been identified in the Initial Seismic Assessment.

However, a DSA would require the inclusion of the main station canopy structure in order to adequately ascertain the displacements. We would be required to work in close collaboration with a geotechnical engineer to assess the soil structure interaction to Part C4 of the MBIE guidance documents as well as the Parts associated with the various structural materials.

A DSA would also investigate other potential structural issues that may not have been identified 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 me if you would like clarification of any aspect of this letter.

Yours faithfully,

s7(2)(a)

s7(2)(a)

CPEng. No: Out of scope

Encl: IEP Assessment (Waterloo Rail Station Up-Main Amenities Building).

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:	Cambridge Terrace	Job No.:	3321
AKA:	Waterloo Rail Station	By:	IM
Name of building:	Up-Main Amenities Building	Date:	11/11/2022
City:	Waterloo, Lower Hutt	Revision No.:	0

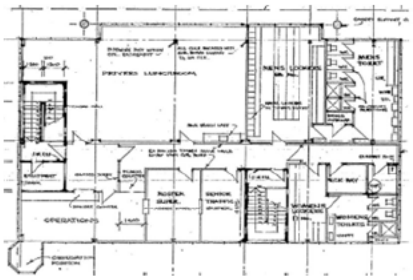
Table IEP-1 Initial Evaluation Procedure Step 1

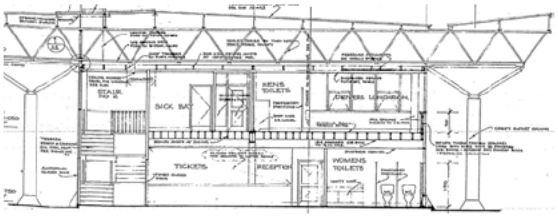
Step 1 - General Information

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)

For the Amenities building the structural system is shown on the drawings to be moment connections in the longitudinal direction along the centre frame on grid A2 with the columns cantilevering from the fist floor level. In the transverse direction it appears to be steelwork by portal action at each end of the building, although, the drawings are not conclusive. The ground floor is a suspended hollowcore floor with a mesh topping, it does not appear to be far from the ground and should be locked in place around the platform (little drift expected at this level). The first floor appears to be lightweight timber. The roof is a lattice of structural steelwork with a lightweight covering. The integral canopy roof is supported by cantilever columns, piles caps and piles.

1.4 Note information sources Tick as appropriate

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

Geotechnical report by GHD

Street Number & Name:	Cambridge Terrace	Job No.:	3321
AKA:	Waterloo Rail Station	By:	IM
Name of building:	Up-Main Amenities Building	Date:	11/11/2022
City:	Waterloo, 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	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 :	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: Steel moment frames in both directions		
h_n =	6	6 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):	○	○
Where h_n = height in metres from the base of the structure to the uppermost seismic weight or mass.	T: 0.54	0.54
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: 0.20	0.20
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	$(\%NBS)_{nom}$ 20%	20%

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.*

0 Page 3

Street Number & Name:	Cambridge Terrace	Job No.:	3321
AKA:	Waterloo Rail Station	By:	IM
Name of building:	Up-Main Amenities Building	Date:	11/11/2022
City:	Waterloo, 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:	2.50	2.50

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.)

	Longitudinal	Transverse
I =	1	1

b) Design Risk Factor, R_o (set to 1.0 if other than 1976-2004, or not known)

	Longitudinal	Transverse
	Category 4	Category 4
R_o =	1	1

c) Return Period Factor, R (from NZS1170.0:2004 Building Importance Level)

	Longitudinal	Transverse
Choose Importance Level	○ 1 ◉ 2 ○ 3 ○ 4	○ 1 ◉ 2 ○ 3 ○ 4
R =	1.0	1.0

d) Factor G = IR_o/R

	Longitudinal	Transverse
Factor G:	1.00	1.00

2.5 Ductility Scaling Factor, Factor H

a) Available Displacement Ductility Within Existing Structure

Comment:
Structural steel moment frames and cantilever reinforced concrete columns should have some ductility.

	Longitudinal	Transverse
μ =	1.25	1.25

b) Factor H

		k_μ Longitudinal	k_μ Transverse
For pre 1976 (maximum of 2)	=	1.19	1.19
For 1976 onwards	=	1	1
Factor H:		1.00	1.00

(where k_μ 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)

	Longitudinal	Transverse
Tick if light timber-framed construction in this direction	☐	☐
S_p =	0.93	0.93

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

	Longitudinal	Transverse
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)

	Longitudinal	Transverse
	55%	55%

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.*

0 Page 4

Street Number & Name:	Cambridge Terrace	Job No.:	3321
AKA:	Waterloo Rail Station	By:	IM
Name of building:	Up-Main Amenities Building	Date:	11/11/2022
City:	Waterloo, 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

The building is a very regular rectange. Both the building and the canopy are similar heights and are expected to be similarly flexible.

3.2 Vertical Irregularity

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

No significant irregularity observed

3.3 Short Columns

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

No significant short columns observed

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

Canopy sliding support at pumping stations column was designed. Full details not provided.

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

Unlikely to affect life safety performance, structural type is flexible enough to cope with some differential settlement.

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 1.5

Record rationale for choice of Factor F:

A Factor of 1.5 has been chosen because the ductility used for the assessment is considered low for steel moment frames. The low ductility factor was selected because of the uncertainty relating to the ground movement of the piles of the cantilever concrete columns.

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

PAR

Longitudinal 1.50

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.*

Street Number & Name:	Cambridge Terrace	Job No.:	3321
AKA:	Waterloo Rail Station	By:	IM
Name of building:	Up-Main Amenities Building	Date:	11/11/2022
City:	Waterloo, 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)

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

The building is a very regular rectange. Both the building and the canopy are similar heights and are expected to be similarly flexible.

3.2 Vertical Irregularity

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

No significant irregularity observed

3.3 Short Columns

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

No significant short columns observed

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

Floors align, height difference <1 storey

b) Factor D2: - Height Difference Effect

Factor D2 For Transverse Direction: 1.0

Table for Selection of Factor D2	Severe 0<Sep<.005H	Significant .005<Sep<.01H	Insignificant 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

Unlikely to affect life safety performance, structural type is flexible enough to cope with some differential settlement.

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: 1.50

Record rationale for choice of Factor F:

A Factor of 1.5 has been chosen because the ductility used for the assessment is considered low for steel moment frames. The low ductility factor was selected because of the uncertainty relating to the ground movement of the piles of the cantilever concrete columns.

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

PAR — Transverse: 1.50

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.*

0 Page 6

Street Number & Name:	Cambridge Terrace	Job No.:	3321
AKA:	Waterloo Rail Station	By:	IM
Name of building:	Up-Main Amenities Building	Date:	11/11/2022
City:	Waterloo, Lower Hutt	Revision No.:	0

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)	55%	55%
4.2	Performance Achievement Ratio (PAR) (from Table IEP - 2)	1.50	1.50
4.3	PAR x Baseline $(\%NBS)_b$	85%	85%
4.4	Percentage New Building Standard *(%NBS)* - Seismic Rating (Use lower of two values from Step 4.3)		85%

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)

Seismic rating for this building should be considered to be indicative only. The rating of the building using an IEP is strongly influenced by the era of design (1987). A DSA would also investigate other potential structural issues that may not have been identified in the Initial Seismic Assessment.

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

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.*

Street Number & Name:	Cambridge Terrace	Job No.:	3321
AKA:	Waterloo Rail Station	By:	IM
Name of building:	Up-Main Amenities Building	Date:	11/11/2022
City:	Waterloo, Lower Hutt	Revision No.:	0

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	1
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 s7(2)(a) **Signature**

Name

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.*

0

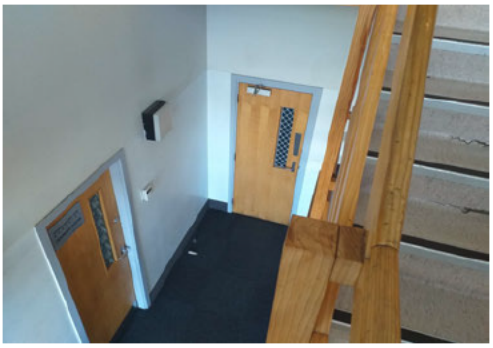
Page 1a

Street Number & Name:	Cambridge Terrace	Job No.:	3321
AKA:	Waterloo Rail Station	By:	IM
Name of building:	Up-Main Amenities Building	Date:	11/11/2022
City:	Waterloo, 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.*