Report

IEP Assessment

Arawa Street, 1135, Rotorua

Initial Evaluation Procedure

Job No: 45251

Date: 6 Sep 12

1.0 INTRODUCTION

Babbage Consultants Ltd has been commissioned by the building owner, Allan Webster, to prepare an IEP report for the building on the above site. The Initial Evaluation Procedure (IEP) is based on recommendations of NZSEE (2006) and intended to be a visual screening without structural analysis of the building.

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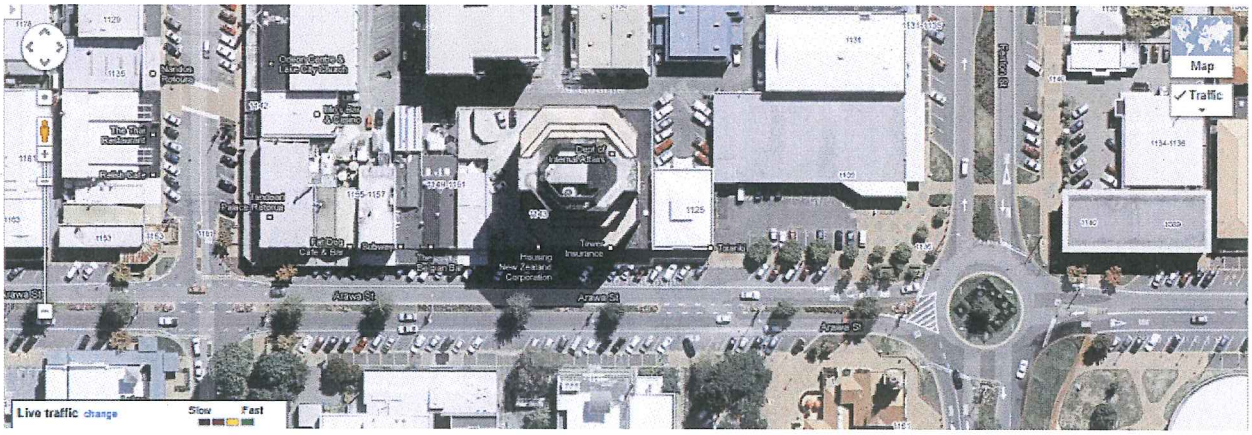
This report is the result of a desk top study of the record drawings. No site visit nor geotechnical investigation were completed as per the owner's request.

2.0 BUILDING CONSTUCTION & BACKGROUND

The building is located 1135 Arawa Street, Rotorua.



Site Plan

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Babbage Consultants Limited
Level 4, 68 Beach Road, Auckland 1010
PO Box 2027, Shortland Street,
Auckland 1140, New Zealand
T 09 379 9980 F 09 377 1170
E admin@babbage.co.nz www.babbage.co.nz

No geotechnical investigation has been carried out. Conservatively a soil classification D, soft rock, has been assumed. There are known geothermal activities within 500m of the site.

Council record drawings were obtained. The structural design was completed by Kelly Brown and Spurr in 1987.

The structure has two concrete shear walls parallel to Arawa Street on grid 5 and 7. These are central to building floor mass. Perpendicular to Arawa Street there are two shear walls on grid D and J on the outside of the building. The walls form a structure with a regular plan.

Other gravity load structures comprise 700 diameter concrete columns with precast shell beams supporting insitu concrete floor slabs.

The building is supported on a series of 300 diameter concrete piles.

3.0 DISCUSSION

The IEP is designed as a qualitative process involving considerable knowledge of earthquake behaviour of buildings and judgment as to key attributes and their effect on performance.

Based on NZSEE guidelines (*Assessment and Improvement of the Structural Performance of Buildings in Earthquake, June 2006*), some thresholds have been introduced to determine the percentage of new building standard (%NBS), as outlined below:

- A %NBS of 33 or less means that the building is assessed as potentially earthquake prone and more detailed evaluation is required.
- A %NBS of greater than 33 and less than 67% means that the building is regarded as outside of the requirements of the Act and is a potential earthquake risk.
- A %NBS of 67 or greater means that the building is not considered a significant earthquake risk.

Notes on the building IEP evaluations are presented below:

This IEP evaluation was carried out by a desk top study of the record drawings available from Council. No site inspection was carried out.

The drawings indicate a robust structure with shear walls providing lateral stability. The basic Baseline %NBS is 113%. There are no critical structural weaknesses due to plan or vertical regularity or separation from other buildings. However, pending any geotechnical investigation, we have included a downgrade factor of 0.7 for site characteristics due to known geothermal activity in the area. The net result is a building with a %NBS of 79%. This is considered a Seismic Grade B between 80 and 67%NBS.

4.0 CONCLUSIONS

The building is assessed as 79% NBS which gives a Seismic Grade B which is between 80 and 67%NBS.

5.0 DISCLAIMER

This IEP assessment is applicable for the information identified in the assessment. The %NBS quoted is a function of the New Building Standard applicable at the time the assessment was carried out and on the interpretation of the assessor. The assessed value is a course screen to prioritise the relative risk of buildings and is largely qualitative and subject to assumptions set out in the NZSEE methodology. The value could increase or reduce as additional information becomes available. The assessment should not be used for any other purpose.

This report is prepared by:

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Don Silvester
BE, ME, MIPENZ, CPEng

Senior Structural Engineer
Babbage Consultants Limited

This report is reviewed by:

.....

Victor Lam
BE, ME, PhD, MIPENZ, CPEng, IntPE

Principal (Structural)
Babbage Consultants Limited

Table IEP-1: Initial Evaluation Procedure - Step 2

Initial Evaluation Procedure Step 2

(Refer Table IEP-1 for Step 1; Table IEP-3 for Step 3; Table IEP-4 for Steps 4, 5 and 6)

Building Name:	**Ref:**
Location: 1135 Arawa Street, Rotorua	**By:**
Direction Considered: a) Longitudinal b) Transverse (Choose worst case if clear at start. Complete IEP-2 and IEP-3 for each if in doubt)	**Date:**

Step 2 Determination of $(\%NBS)_b$

2.1 Determine nominal (%NBS) = $(\%NBS)_{norm}$

a. Date of Design and Seismic Zone

			tick as appropriate	
Pre 1935			☐	See also notes 1, 3
1935 - 1965			☐	
1965 - 1976	Seismic Zone	A	☐	
		B	☐	
		C	☐	
1976 - 1992	Seismic Zone	A	☐	See also note 2
		B	☐	
		C	✓	
1992 - 2004			☐	

b. Soil Type

From NZS1170.5:2004, Cl 3.1.3	A or B Rock	☐
	C Shallow Soil	☐
	D Soft Rock	✓
	E Very Soft Soil	☐
From NZS4203:1992, Cl 4.6.2.2	a) Rigid	☐
(for 1992 to 2004 only and only if known)	b) Intermediate	☐

c. Estimate Period, T 1.15 seconds

Can use the following:

$T = 0.09h_n^{0.75}$	for moment resisting concrete frames
$T = 0.14h_n^{0.75}$	for moment resisting steel frames
$T = 0.08h_n^{0.75}$	for eccentrically braced steel frames
$T = 0.06h_n^{0.75}$	for all other frame structures
$T = 0.09h_n^{0.75}/A_c^{0.5}$	for concrete shear walls
$T \leq 0.4$ sec	for masonry shear walls

where h_n = Height in m from the base of the structure to the uppermost seismic weight or mass

A_ℓ = Cross-sectional shear area of shear wall in the first storey of the building, in m^2

$\ell_{w\ell}$ = Length of shear wall in the first storey in the direction parallel to the applied forces, in m

$A_c = \sum A_\ell(0.2 + L_{w\ell}/h_n)^2$

with restrictions that $\ell_{w\ell}/h_n$ shall not exceed 0.9

d. $(\%NBS)_{norm}$ determined from Figure 3.3 19 $(\%NBS)_{norm}$

Table IEP-2 Initial Evaluation Procedure - Step 2 continued

... 2.1 Determine nominal (%NBS) = (%NBS) $_{norm}$

Note 1: For buildings designed prior to 1965 and known to be designed as public buildings in accordance with the code of the time, multiply (%NBS) $_{norm}$ *by:* 1

1.25

For buildings designed 1965 - 1976 and known to be designed as public buildings in accordance with the code of the time, multiply (%NBS) $_{norm}$ *by:*

Zone A 1.33

Zone B 1.2

Note 2: For reinforced concrete buildings designed between 1976 - 1984 multiply (%NBS) $_{norm}$ *by:* 1

1.2

Note 3: For buildings designed prior to 1935 multiply (%NBS)norm by: 0.8 1

except for Wellington where the factor may be taken as 1

19 $(\%NBS)_{norm}$

2.2 Near Fault Scaling Factor, Factor A

If T ≤ 1.5 sec, Factor A = 1

a. *Near Fault Factor, N(T,D)* 1
(from NZS11170.5:2004, Cl 3.1.5)

b. *Near Fault Scaling Factor =1/N(T,D)* **Factor A** 1

2.3 Hazard Scaling Factor, Factor B

a. *Hazard Factor, Z, for site* 0.24
(from NZS1170.5:2004, Table 3.3)

b. *Hazard Scaling Factor*
for pre 1992 = 1/Z
for 1992 onwards = Z_{1992}/Z **Factor B** 4.17
(where Z_{1992} is the NZS4203:1992 Zone Factor from accompanying Figure 3.5(b))

2.4 Return Period Scaling Factor, Factor C

a. *Building Importance Level* 2
(from NZS1170.0:2004, Table 3.1 and 3.2)

b. *Return Period Scaling Factor from accompanying Table 3.1* **Factor C** 1

2.5 Ductility Scaling Factor, Factor D

a. *Assessed Ductility of Existing Structure, μ*
(shall be less than maximum given in accompanying Table 3.2)

2

b. *Ductility Scaling Factor*
for pre 1976 = k_μ
for 1976 onwards = 1
(where k_μ is NZS1170.5:204 Ductility Factor, from accompanying Table 3.3)

Factor D 1

2.6 Structural Performance Scaling Factor, Factor E

a. *Structural Performance Factor* S_p
from accompanying Figure 3.4

0.7

b. *Structural Performance Scaling Factor= 1/*S_p

Factor E 1.43

2.7 Baseline %NBS for Building, (%NBS) $_b$
(equals $(\%NBS)_{norm}$ x A x B x C x D x E)

113.10

Table IEP-2: Initial Evaluation Procedure - Step 3

Initial Evaluation Procedure Step 3

(Refer Table IEP-1 for Step 1; Table IEP-3 for Step 3; Table IEP-4 for Steps 4, 5 and 6)

Building Name:	**Ref:**
Location: 1135 Arawa Street, Rotorua	**By:**
Direction Considered: a) Longitudinal b) Transverse (Choose worst case if clear at start. Complete IEP-2 and IEP-3 for each if in doubt)	**Date:**

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

(Refer Appendix B - Section B3.2)

Critical Structural Weakness	*Building Score*	*Effect of Structural Performance* (Choose a value - do not interpolate)		
		Severe	Significant	Insignificant
3.1 Plan Irregularity				
Effect on Structural Performance				
	Factor A 1	0.4 max	0.7	1
Comment				
3.2 Vertical Irregularity				
Effect on Structural Performance				
	Factor B 1	0.4 max	0.7	1
Comment				
3.3 Short Columns				
Effect on Structural Performance				
	Factor C 1	0.4 max	0.7	1
Comment				

3.4 Pounding Potential

(Estimate D1 and D2 and set D = the lower of the two, or = 1, if no potential for pounding)

a. *Factor D1: Pounding Effect*

Select appropriate value from Table

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

Table for Selection of Factor D1

	Severe	Significant	Insignificant
Separation	0 < Sep < 0.005H	0.005 Sep < 0.01H	Sep > 0.01H
Alignment of Floors within 20% of Storey Height	0.7	0.8	1
Alignment of Floors not within 20% of Storey Height	0.4	0.7	0.8

Factor D1 1

Table IEP-2: Initial Evaluation Procedure - Step 3

Initial Evaluation Procedure Step 3

(Refer Table IEP-1 for Step 1; Table IEP-3 for Step 3; Table IEP-4 for Steps 4, 5 and 6)

Building Name:	**Ref:**
Location: 1135 Arawa Street, Rotorua	**By:**
Direction Considered: a) Longitudinal b) Transverse (Choose worst case if clear at start. Complete IEP-2 and IEP-3 for each if in doubt)	**Date:**

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

(Refer Appendix B - Section B3.2)

Critical Structural Weakness	*Building Score*	*Effect of Structural Performance* (Choose a value - do not interpolate)		
		Severe	Significant	Insignificant
3.1 Plan Irregularity				
Effect on Structural Performance				
	Factor A 1	0.4 max	0.7	1
Comment				
3.2 Vertical Irregularity				
Effect on Structural Performance				
	Factor B 1	0.4 max	0.7	1
Comment				
3.3 Short Columns				
Effect on Structural Performance				
	Factor C 1	0.4 max	0.7	1
Comment				

3.4 Pounding Potential

(Estimate D1 and D2 and set D = the lower of the two, or = 1, if no potential for pounding)

a. *Factor D1: Pounding Effect*

Select appropriate value from Table

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

Table for Selection of Factor D1

	Severe	Significant	Insignificant
Separation	0 < Sep < 0.005H	0.005 Sep < 0.01H	Sep > 0.01H
Alignment of Floors within 20% of Storey Height	0.7	0.8	1
Alignment of Floors not within 20% of Storey Height	0.4	0.7	0.8

Factor D1 1

b. Factor D2: Height Difference Effect

Select appropriate value from Table

Table for Selection of Factor D2

	Severe 0 < Sep < 0.005H	Significant 0.005 Sep < 0.01H	Insignificant Sep > 0.01H
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 D2 1

Factor D 1 (Set D = lesser of D1 and D2, or set D = 1.0 if no prospect of pounding)

3.5 Site Characteristics

(Stability, landslide threat, liquefaction, etc)

Possible geothermal activity

Building Score

Effect of Structural Performance

(Choose a value - do not interpolate)

Effect on structural performance

	Building Score	Severe	Significant	Insignificant
Factor E	0.7	0.5 max	0.7	1

Critical Structural Weakness

3.6 Other Factors

Factor F 1 For ≤ 3 storeys - maximum value 2.5, otherwise - maximum value 1.5. No minimum

3.7 Performance Achievement Ratio (PAR) 0.70

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

Table IEP-4: Initial Evaluation Procedure - Steps 4, 5 and 6

Initial Evaluation Procedure Steps 4, 5 and 6

(Refer Table IEP-1 for Step 1; Table IEP-2 for Step 2; Table IEP-3 for Step 3

Building Name:	**Ref:**
	By: DBS
Location: 1135 Arawa Street, Rotorua	**Date:** Sep-12

Step 4 Percentage of New Building Standard (%NBS)

	Longitudinal	Transverse
4.1 Assessed Baseline (%NBS) $_b$ from table (IEP - 1)	113.10	113.10
4.2 Performance Achievement Ratio (PAR) from table (IEP - 2)	0.70	0.70
4.3 PAR x Baseline(%NBS) $_b$	79.17	79.17
4.4 Percentage New Building Standard (%NBS) (use lower of two values from Step 3.3)		***79***

Step 5 Potentially Earthquake Prone?

(mark as appropriate)

%NBS > 33	YES
%NBS ≤ 33	NO

Step 6 Potentially Earthquake Risk?

(mark as appropriate)

%NBS > 67	NO
%NBS ≤ 67	YES

Step 7 Provisional Grading for Seismic Risk based on IEP

Seismic Grade B

Evaluation Confirmed by: _____ Signature

_____ Name

_____ CPEng. No

Relationship between Seismic Grade and %NBS

Grade	A+	A	B	C	D	E
%NBS	> 100	100 to 80	80 to 67	67 to 33	33 to 20	< 20