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

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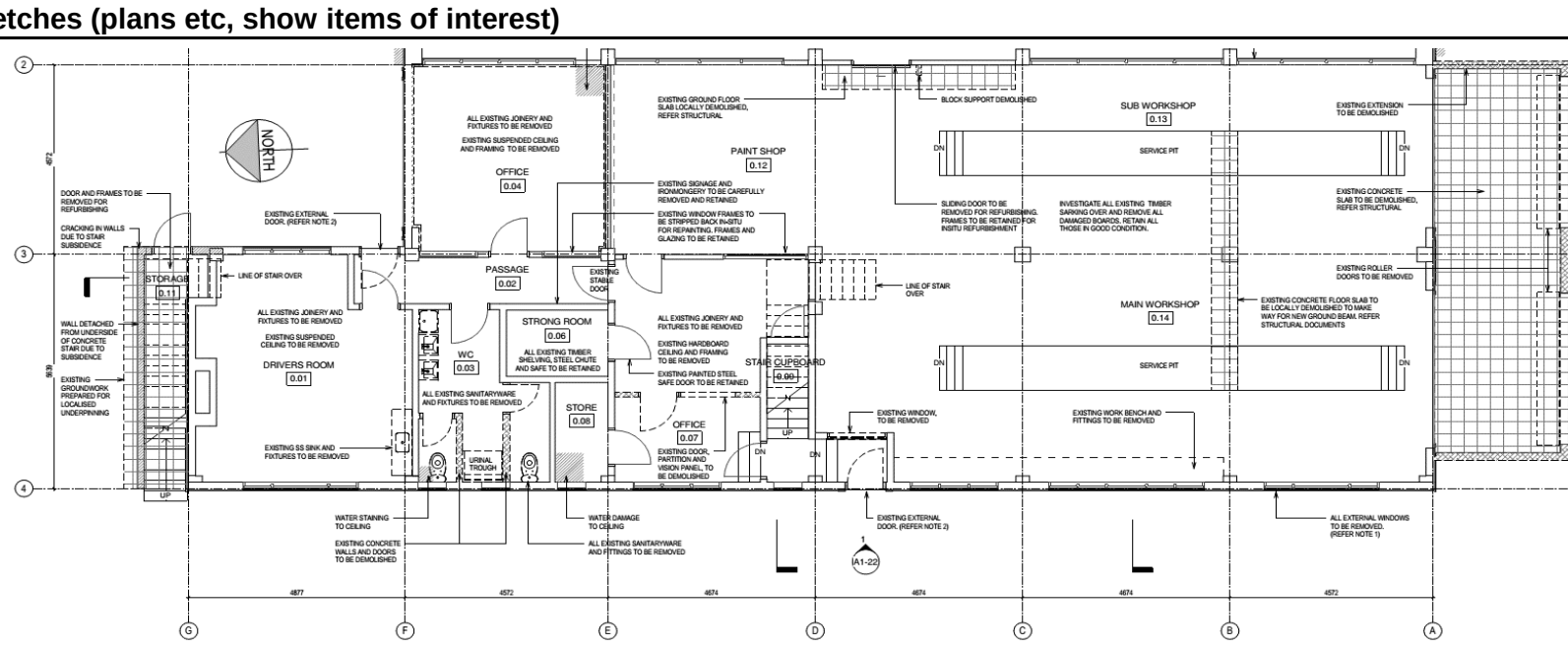
Street Number & Name:	**493 Muritia Road**	**Job No.:**	**5-C3957.00**
AKA:		**By:**	**GSF**
Name of building:	**Eastbourne Bus Barn**	**Date:**	**24/09/2019**
City:	**Eastbourne, Hutt City**	**Revision No.:**	**0**

Table IEP-1 Initial Evaluation Procedure Step 1

Step 1 - General Information

1.1 Photos (attach sufficient to describe building)

1.2 Sketches (plans etc, show items of interest)



EXISTING & DEMOLITION PLAN - LEVEL 0 - WEST

1.3 List relevant features (Note: only 10 lines of text will print in this box. If further text required use Page 1a)

Structure: Reinforced concrete walls and reinforced concrete frame, brick walls connected to new steel frames
Foundations: Reinforced concrete ground beams and slab on grade
Roof: Steel frame with new steel bracing and aLightweight timber frame with new Gib diaphragm

Subsoil: B Rock- based on geotechnical review during 2009

Construction Date: 1935 to 1940 - strengthened 2009 and 2010

1.4 Note information sources Tick as appropriate

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

Information Reviewed: 2009 construction drawings, design report and calculations

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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	67%	67%
If strengthened, enter original design date for information	1927	
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:	Public Buildings	Public Buildings
Seismic Zone:	**Not applicable**	**Not applicable**
c) Soil Type		
From NZS1170.5:2004, Cl 3.1.3 :	A or B Rock	A or B Rock
From NZS4203:1992, Cl 4.6.2.2 : (for 1992 to 2004 and only if known)	**Not applicable**	**Not applicable**
d) Estimate Period, *T*		
Comment:		
h_n =	8	8 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:** 0.43	0.43
e) Factor A: Strengthening factor determined using result from (a) above (set to 1.0 if not strengthened)	**Factor A:** 0.67	0.67
f) Factor B: Determined from NZSEE Guidelines Figure 3A.1 using results (a) to (e) above	**Factor B:** 0.05	0.05
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)*$_{nom}$** 3%	3%

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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 =	1.25	1.25

b) Design Risk Factor, R_o

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

	Longitudinal	Transverse
R_o =	1	1

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)

	Longitudinal	Transverse
R =	1.0	1.0

d) Factor G = IR_o/R

	Longitudinal	Transverse
Factor G:	1.25	1.25

2.5 Ductility Scaling Factor, Factor H

a) Available Displacement Ductility Within Existing Structure

Comment:
Strengthened RC walls in plane

	Longitudinal	Transverse
μ =	1.25	1.25

b) Factor H

		k_μ (Longitudinal)	k_μ (Transverse)
For pre 1976 (maximum of 2)	=	1.15	1.15
For 1976 onwards	=	1	1
Factor H:		1.15	1.15

(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)

Tick if light timber-framed construction in this direction ☐ (Longitudinal) ☐ (Transverse)

	Longitudinal	Transverse
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
12%	**12%**

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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)

a) Longitudinal Direction

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

3.1 Plan Irregularity

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

Comment: Nil

3.2 Vertical Irregularity

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

Comment: Nil

3.3 Short Columns

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

Comment: Nil

3.4 Pounding Potential

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

a) Factor D1: - Pounding Effect

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

Factor D1 For Longitudinal Direction: 1.0

Table for Selection of Factor D1	Severe	Significant	Insignificant
Separation	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Alignment of Floors within 20% of Storey Height	○ 1	○ 1	◉ 1
Alignment of Floors not within 20% of Storey Height	○ 0.4	○ 0.7	○ 0.8

Comment: Nil

b) Factor D2: - Height Difference Effect

Factor D2 For Longitudinal Direction: 1.0

Table for Selection of Factor D2	Severe	Significant	Insignificant
	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Height Difference > 4 Storeys	○ 0.4	○ 0.7	◉ 1
Height Difference 2 to 4 Storeys	○ 0.7	○ 0.9	○ 1
Height Difference < 2 Storeys	○ 1	○ 1	○ 1

Comment: Nil

Factor D 1.0

3.5 Site Characteristics - *Stability, landslide threat, liquefaction etc as it affects the structural performance from a life-safety perspective*

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

Comment: No impact on performance

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 2.5

Record rationale for choice of Factor F:

Comment: Generally reinforced concrete walls and frames, strengthened in 2009/2010 with design target of 67% NZS1170.5

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

PAR

Longitudinal **2.50**

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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

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

3.1 Plan Irregularity

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

Comment: Insignificant on performance

3.2 Vertical Irregularity

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

Comment: Nil

3.3 Short Columns

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

Comment: Nil

3.4 Pounding Potential

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

a) Factor D1: - Pounding Effect

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

Factor D1 For Transverse Direction: 1.0

Table for Selection of Factor D1	Severe	Significant	Insignificant
Separation	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Alignment of Floors within 20% of Storey Height	○ 1	○ 1	◉ 1
Alignment of Floors not within 20% of Storey Height	○ 0.4	○ 0.7	○ 0.8

Comment: Nil

b) Factor D2: - Height Difference Effect

Factor D2 For Transverse Direction: 1.0

Table for Selection of Factor D2	Severe	Significant	Insignificant
	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Height Difference > 4 Storeys	○ 0.4	○ 0.7	◉ 1
Height Difference 2 to 4 Storeys	○ 0.7	○ 0.9	○ 1
Height Difference < 2 Storeys	○ 1	○ 1	○ 1

Comment: Nil

Factor D 1.0

3.5 Site Characteristics - *Stability, landslide threat, liquefaction etc as it affects the structural performance from a life-safety perspective*

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

Comment: No impact on performance

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 2.50

Record rationale for choice of Factor F:

Comment: Generally reinforced concrete walls and frames, strengthened in 2009/2010 with design target of 67% NZS1170.5

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

PAR

Transverse **2.50**

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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)	12%	12%
4.2	**Performance Achievement Ratio (PAR)** (from Table IEP - 2)	2.50	2.50
4.3	**PAR x Baseline *(%NBS)*$_b$**	30%	30%
4.4	**Percentage New Building Standard *(%NBS)* - Seismic Rating** (Use lower of two values from Step 4.3)		30%

Step 5 - Is *%NBS* < 34? YES

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

Step 7 - Provisional Grading for Seismic Risk based on IEP

Seismic Grade D

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

Comment: Building Strengthened 2009 to 2010, design report indicate strengthening target 67% NZS 1170.5

Building rated **45-55%NBS IL2** based on a review of the strengthening design

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	2
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 by [redacted]

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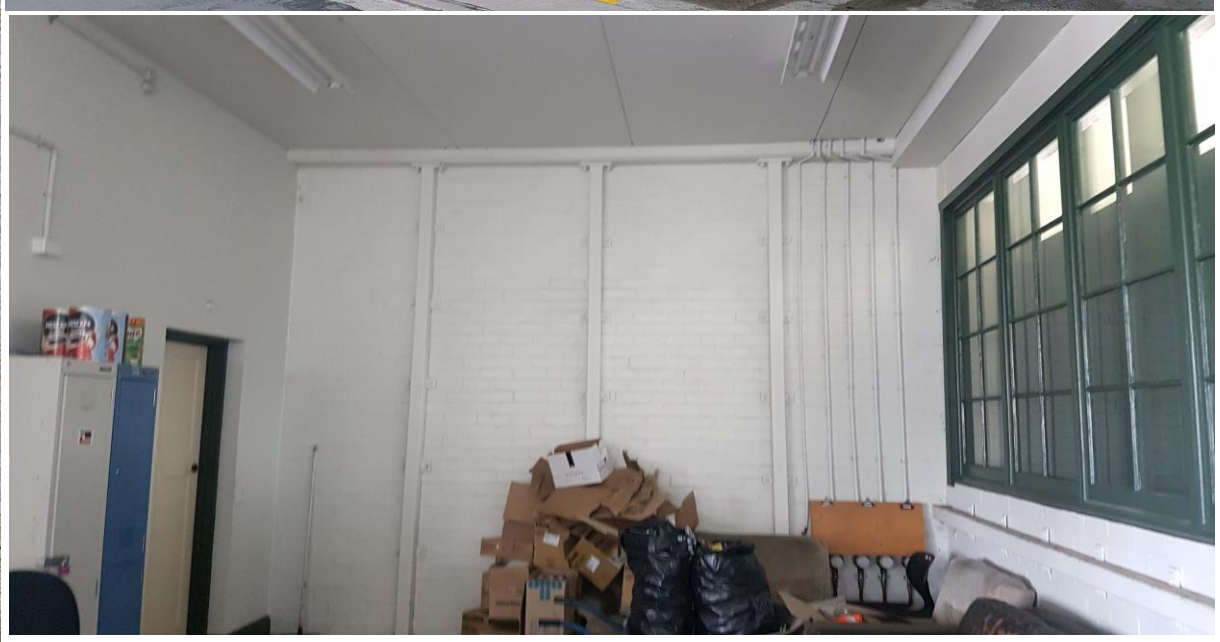
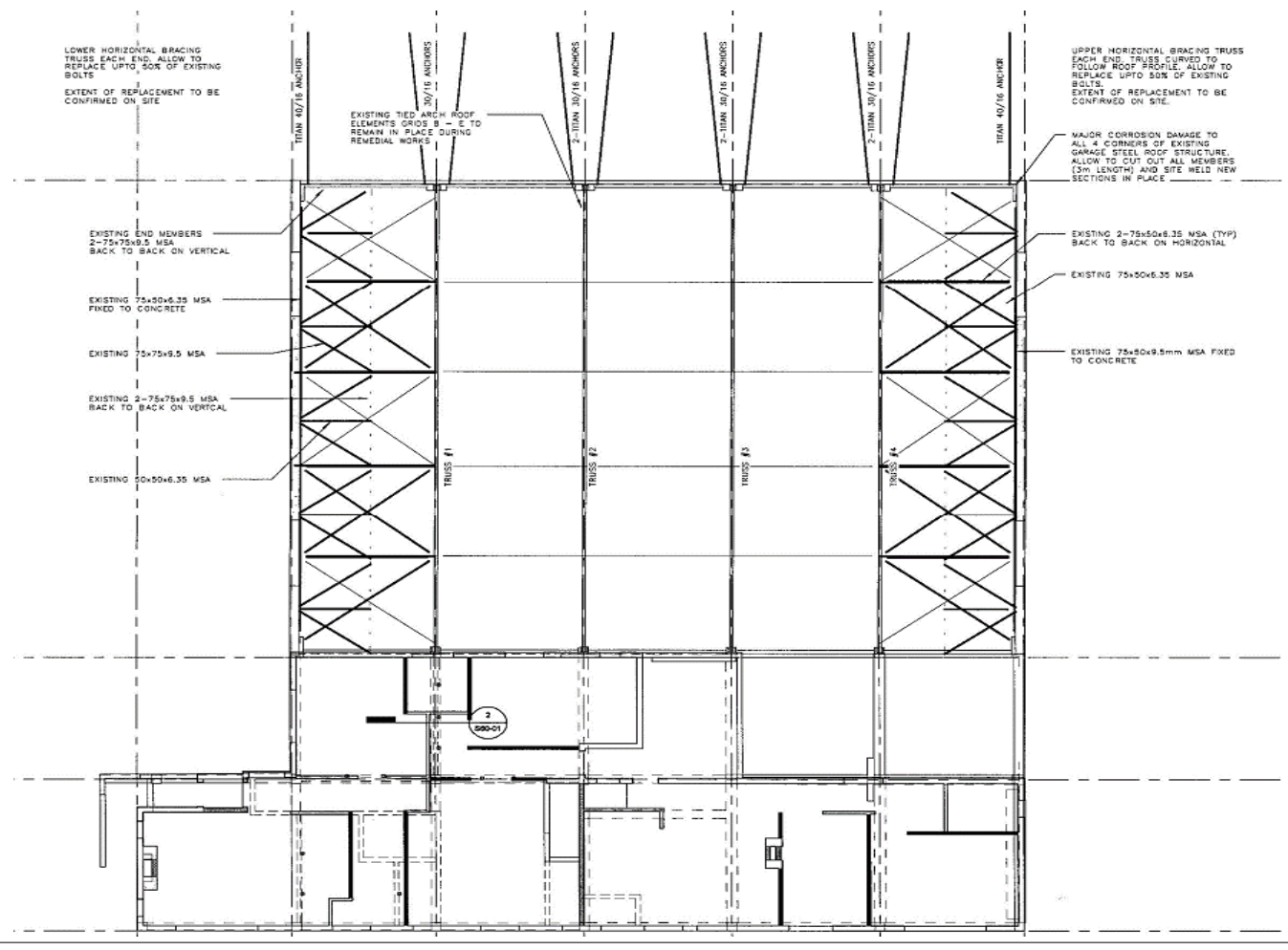
City:	**Eastbourne, Hutt City**	**Revision No.:**	**0**

Table IEP-1a Additional Photos and Sketches





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1. Building Information	
Building Name/ Description	Eastbourne Bus Barn
Street Address	493 Muritia Road, Eastbourne
Territorial Authority	Hutt City Council
No. of Storeys	1 and 2
Area of Typical Floor (approx.)	300 sqm
Year of Design (approx.)	1938 – opened 24 May 1939
NZ Standards designed to	NZS1170.5 – strengthening to 67% of the design code
Structural System including Foundations	Reinforced concrete walls and frames. Concrete slab on grade with foundation beams Two storey structure has new braceline roof diaphragms at the upper level Single level garage has a steel roof truss with new diagonal braced bays
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	Generally flat ground profile under the house, general site located an sloped ground with increasing slope toward SH2 to the south east, subsoil B
Previous strengthening and/ or significant alteration	2009/2010
Heritage Issues/ Status	Yes – NZHPT Cat 2 – 8th February 2006
Other Relevant Information	Strengthening details 2009 to 2010

2. Assessment Information	
Consulting Practice	[redacted]
CPEng Responsible, including: • Name • CPEng number • A statement of suitable skills and experience in the seismic assessment of existing buildings[1]	
Documentation reviewed, including: • date/ version of drawings/ calculations[2] • previous seismic assessments	2009 - Strengthening drawings – Structural and Architectural 2009 – Calculations package 2002 – Geotechnical Appraisal
Geotechnical Report(s)	NA – subsoil assumed based on 2002 Connell Wagner report
Date(s) Building Inspected and extent of inspection	24 September 2019
Description of any structural testing undertaken and results summary	None
Previous Assessment Reports	IEP - 2007
Other Relevant Information	Nil

[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	Importance Level 2
Site Subsoil Class	B based on 2002 geotechnical report by [redacted]
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	Ductility – 1.25 limited by capacity reinforced concrete walls Sp Factor – 0.93 F Factor – 2.5 both directions (maximum) based strengthening undertaken in 2009 and 2010. Target strengthening is 67% NBS IL2 NZS 1170.5
For a DSA:	
Summary of how Part C was applied, including: • the analysis methodology(s) used from C2 • other sections of Part C applied	NA
Other Relevant Information	NA

4. Assessment Outcomes		
Assessment Status (Draft or Final)	Final	
Assessed *%NBS* Rating	45-55%NBS IL2	
Seismic Grade and Relative Risk (from Table A3.1)	C Grade 5 to 10 times risk comparable to new building	
For an ISA:		
Describe the Potential Critical Structural Weaknesses	None identified	
Does the result reflect the building's expected behaviour, or is more information/ analysis required?	Yes – the ISA is sufficient	
If the results of this ISA are being used for earthquake prone decision purposes, and elements rating <34*%NBS* have been identified:	**Engineering Statement of Structural Weaknesses and Location** NA	***Mode of Failure and Physical Consequence* Statement(s)** NA
For a DSA:		
Comment on the nature of Secondary Structural and Non-structural elements/ parts identified and assessed		
Describe the Governing Critical Structural Weakness		
If the results of this DSA are being used for earthquake prone decision purposes, and elements rating <34*%NBS* have been identified (including Parts)[3]:	**Engineering Statement of Structural Weaknesses and Location**	***Mode of Failure and Physical Consequence* Statement(s)**
Recommendations (*optional for EPB purposes*)	No recommendations	

[3] 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.