JOHN A CRABTREE ME, MIPENZ **CHARTERED ENGINEER** **CONSULTING ENGINEER** **PH (07) 549 3447** **FAX (07) 549 3438** **Mobile 021 438 750** **PO Box 172** **KATIKATI 3166**	**Job No** 12 18 30 **Project** St James Prebyterian Church IEP 76 Moresby Ave Waihi **Date** June 2012	**Sheet No** 1 **Description** IEP STEP 1

Project: **St James Presbyterian Church, 76 Moresby Ave, Waihi**

Initial Evaluation Procedure – Step 1, General Information

1.1 Photos of Exterior and Interior

Front Elevation – Moresby Avenue Frontage
Note Buttresses on corners. These do not contribute to lateral stability

Rear Elevation

North Elevation

South Elevation

Interior Nave View

View of Nave Ceiling – Note Timber Panelling and steel rod ties between walls

South Interior View along Transept

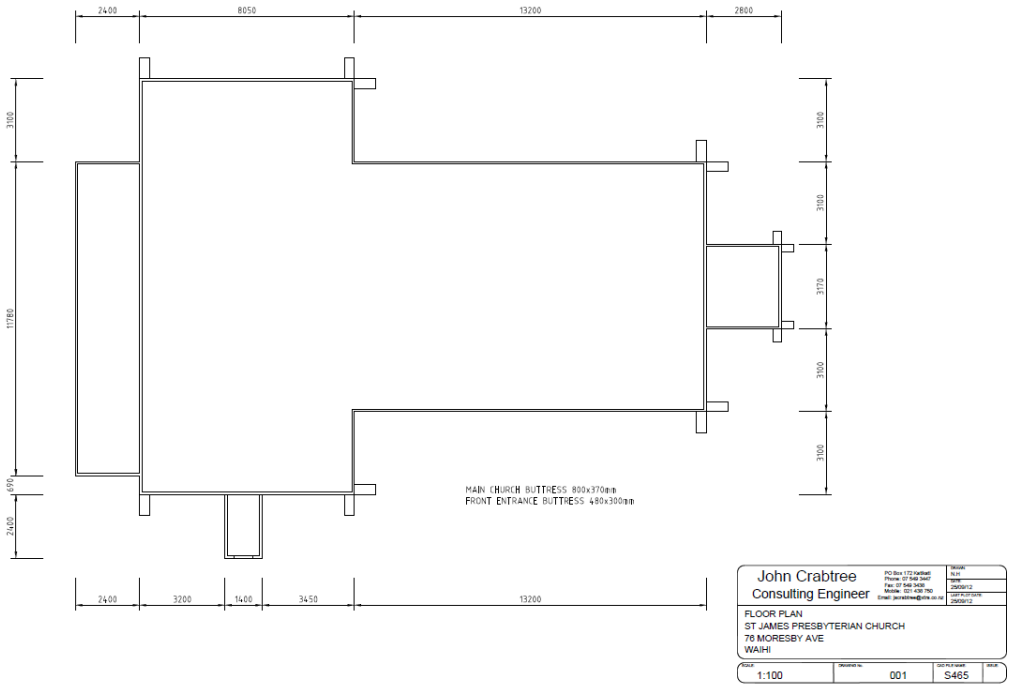
Transept Ceiling

Sub Floor Framing – Note absence of sub-floor bracing

Pile support under Buttress – this single pile is inadequate to support lateral loads

1.2 Plan of Building

Plans of the building structure were unable to be located and a floor plan has been prepared based on outside measurements taken during the walk over inspection completed on 6th September 2012.



Ground Floor Plan

A copy of the plan is appended to this report.

1.3 Features Relevant to Seismic Performance

Building records of the structure of the St James Presbyterian Church were unable to be located within Church records or Council property file records. However, information obtained from a search of the internet was obtained from the web page www.waymarking.com as follows

"*This Church was built in heart rimu timber with corrugated iron roof, was completed in 1905 and opened on 4th February 1906. The pointed arch windows, steep gabled roof, tall finial and buttresses all mark this as a fine example of Victoria Gothic architecture, it is a significant physical reminder of the gold boom days in Waihi and as a marker of over a century of Presbyterian worship in the town. Delays in commencing building caused the stacked timber to be weather marked. This can still be seen on the ceiling's match lining*."

Note that this information is not verified; however it gives an indication of the date of construction of the building.

The Church building structure comprises corrugated iron roofing on timber framing on timber framed walls on timber sub-floor framing on timber and concrete piles. The outside wall height from floor level to the roof/wall junction was measured as approximately 5 meters and the floor level varies from 600 to 800mm above the ground. The ridge is approximately 5 meters above the wall/roof junction and the roof has an approximate pitch of $47^{o.}$

The Church has seating for approximately 200 people and is regularly used with a congregation of up to 60 people.

Features relevant to seismic performance are as follows.

1. The timber panelling and roof support framing could be considered as a heavy roof structure.
2. The building is regular in plan with dimensions of 26.5m length and 15.5m width constructed in the typical cathedral cross configuration.
3. The building has constant height and shape with no vertical irregularity.
4. The building has no short columns.
5. It is unlikely that there is any frame action of the walls supporting the ceiling and roof structure.
6. The corner buttresses provide architectural features of the building but do not contribute any lateral support of the walls.
7. The absence of sub-floor bracing will cause lateral failure of the structure in the event of a seismic event.
8. The building is used for public purposes.

For the reasons outlined above, it is considered that a value of 0.75 should be applied as Factor F

1.4 Information Sources

Information for this report was obtained from the following sources

1. Walk over inspection of the building completed on 6th September 2012.
2. Overall measurements of the outside of the building taken during the walk over inspection.
3. A search of the internet as described above.

INITIAL EVALUATION PROCEDURE - STEP 2

Building Name : St James Presbyterian Church		Ref:	12 08 30
Building Location : 76 Moresby Ave, Waihi		CPEng Number:	2419
Direction Considered : Transverse		Date:	Sep 12

Step 2 Determination nominal (%NBS0 = $(\%NBS)_b$

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

(a) Date of Design & seismic Zone

Pre 1935			✓	
1935 - 1965				
1965 - 1976	Seismic Zone	A		Notes 1 & 3
		B		
		C		
1976 - 1992	Seismic Zone	A		Note 2
		B		
		C		
1992 - 2004				

(b) Soil Type

From NZS1170.5:2004 Cl 3.1.3	A or B Rock	
	C Shallow Rock	✓
	D Soft Rock	
	D Soft Soil	
	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

$T = 0.09h_n^{0.75}$	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	0.27	Seconds
$T = 0.09h_n^{0.75}A_c^{0.5}$	for concrtete shear walls		
$T = \leq 0.4$sec	for masonry shear walls		

Where hn = height in m from base of the structure to the uppermost seismic weight or mass

$A_c = \Sigma A_i(0.2 + L_{wi}/h_n)^2$

Ai = cross section shear wall area I in the first storey of the building in m2

L_{wi} = length of shear wall I in the first storey in the direction parallel to the applied forces in m

with the restriction that Lwi/hn shall not exceed 0.9

(d) $(\%NBS)_{nom}$ determined from Figure 3.3 2.5 $(\%NBS)_{nom}$

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 $(\%NBS)_{nom}$ by 1.25
For buildingd designed 1965 - 1976 and known to be designed as public buildings in accordance with the code of the time, multiply $(\%NBS)_{nom}$ by 1.33 - Zone A
1.2 - Zone B N/A

Note 2: For reinforced concrete buildings designed between 1976 - 84 multiply $(\%NBS)_{nom}$ by 1.2 N/A

Note 3: For buildings designed prior to 1935 multiply (%NBS)nom by 0.8 except for Wellington where the factor may be taken as 1 0.8 2 $(\%NBS)_{nom}$

INITIAL EVALUATION PROCEDURE - STEP 2 CONTINUED

Building Name :	St James Presbyterian Church	Ref:	12 08 30
Building Location :	76 Moresby Ave, Waihi	CPEng Number:	2419
Direction Considered :	Transverse	Date:	Sep 12

2.2 Near Fault Factor, Factor A
If T < 1.5 sec, Factor A = 1

a) Near Fault Factor N(T,D)
(from NZS1170.5 2004, Cl 3.1.6)

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
(from NZS1170.5 2004, Table 3.3) 0.18 (Waihi)

b) Hazard Scaling Factor

For pre 1992	=	1/Z	✓
1992 onwards	=	Z_{1992}/Z	

(Where Z_{1992} is the NZS4203 Zone Factor from accompanying Table 3.1) Factor B **5.56**

2.4 Return Period Scaling Factor, Factor C

a) Building Importance Level
(From NZS1170.0 2004, Table 3.1 & 3.2) 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 thn maximum given in accompanying Table 3.2)

b) Ductility Scaling Factor

For pre 1976	=	k_μ	✓
1976 onwards	=	1	

(Where k_μ is NZS1170.5 2004 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

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

2.7 Baseline %NBS for Building, $(\%NBS)_b$
(equals $(\%NBS)_{nom}$ x A x B x C x D x E) **11**

INITIAL EVALUATION PROCEDURE - STEP 2

Building Name :	St James Presbyterian Church	Ref:	12 08 30
Building Location :	76 Moresby Ave, Waihi	CPEng Number:	2419
Direction Considered :	Longitudinal	Date:	Sep 12

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

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		C		
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		B		
		C		
1992 - 2004				

(b) Soil Type

From NZS1170.5:2004 Cl 3.1.3	A or B Rock		
	C Shallow Rock	✓	
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	E Very Soft Soil		
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$T = \leq 0.4$sec	for masonry shear walls		

Where hn = height in m from base of the structure to the uppermost seismic weight or mass

$A_c = \Sigma A_i(0.2 + L_{wi}/h_n)^2$

Ai = cross section shear wall area I in the first storey of the building in m2

L_{wi} = length of shear wall I in the first storey in the direction parallel to the applied forces in m

with the restriction that Lwi/hn shall not exceed 0.9

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2 $(\%NBS)_{nom}$

INITIAL EVALUATION PROCEDURE - STEP 2 CONTINUED

Building Name :	St James Presbyterian Church	Ref:	12 08 30
Building Location :	76 Moresby Ave, Waihi	CPEng Number:	2419
Direction Considered :	Longitudinal	Date:	Sep 12

2.2 Near Fault Factor, Factor A
If T < 1.5 sec, Factor A = 1

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(from NZS1170.5 2004, Cl 3.1.6)

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a) Hazard Factor Z for site
(from NZS1170.5 2004, Table 3.3) 0.18 (Waihi)

b) Hazard Scaling Factor

For pre 1992 = 1/Z ✓
1992 onwards = Z_{1992}/Z

(Where Z_{1992} is the NZS4203 Zone Factor from accompanying Table 3.1) Factor B **5.56**

2.4 Return Period Scaling Factor, Factor C

a) Building Importance Level
(From NZS1170.0 2004, Table 3.1 & 3.2) 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 thn maximum given in accompanying Table 3.2)

b) Ductility Scaling Factor

For pre 1976 = k_μ
1976 onwards = 1 ✓

(Where k_μ is NZS1170.5 2004 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

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

2.7 Baseline %NBS for Building, $(\%NBS)_b$
(equals $(\%NBS)_{nom}$ x A x B x C x D x E) **11**

INITIAL EVALUATION PROCEDURE - STEP 3

Building Name :	St James Presbyterian Church	Ref:	12 08 30
Building Location :	76 Moresby Ave, Waihi	CPEng Number:	2419
Direction Considered :	Transverse	Date:	Sep 12

Step 3 Assessment of Performance Achievment Ratio (PAR)

Critical Structural Weakness		Building Score	Effect on Structural Performance (Choose a value - Do not interpolate)		
3.1 Plan Irregularity					
Effect on Structural Performance			Severe	Significant	Insignificant
	Factor A	1	0.4 max	0.7	1
Comment:	Building rectangular in plan				
3.2 Vertical Irregularity					
Effect on Structural Performance			Severe	Significant	Insignificant
	Factor B	1	0.4 max	0.7	1
Comment:	Building is single storey				
3.3 Short Columns					
Effect on Structural Performance			Severe	Significant	Insignificant
	Factor C	1	0.4 max	0.7	1
Comment:	Building has no short columns				

3.4 Pounding Potential

(Estimate D1 and D2 and set D = the lower of the two, or = 1.0 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.g. with shear walls), the effect of pounding may be reduced by taking the co-efficient to the right of the value applicable to to frame buildings.

Factor D1 1

Table for Selection of of Factor D1	Severe	Significant	Insignificant
Separation	0<sep<.005H	.005<Sep<.01H	Sep>.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

b) Factor D2 - Height Difference Effect

Select appropriate value from Table

Factor D2 1

Table for Selection of of Factor D2	Severe	Significant	Insignificant
Separation	0<sep<.005H	.005<Sep<.01H	Sep>.01H
Height Difference > 4 Storeys	0.7	0.8	1
Height Difference 2 to 4 Storeys	0.4	0.9	1
Height Difference < 2 Storeys	1	1	1

Factor D 1 ***(Set D = lesser of D1 and D2 or.. Set D =1 if no prospect of Pounding)***

3.5 Site Characteristics - *(Stability, landslide threat, liqefaction etc*)

Effect on Structural Performance			Severe	Significant	Insignificant
	Factor E	1	0.5 max	0.7	1

3.6 Other Factors

Factor F 0.75 **For <u>< 3</u> Storeys - Maximum value 2.5**
Otherwise - Maximum Value 1.5. No Minimum

Record Rationale for Choice of Factor F: Absence of sub-floor bracing and lateral support of long walls.

3.7 Performance Achievment Ration (PAR)
(equale A x B x C x D x E x F) 0.75

INITIAL EVALUATION PROCEDURE - STEP 3

Building Name :	St James Presbyterian Church	Ref:	12 08 30
Building Location :	76 Moresby Ave, Waihi	CPEng Number:	2419
Direction Considered :	Longitudinal	Date:	Sep 12

Step 3 Assessment of Performance Achievment Ratio (PAR)

Critical Structural Weakness		Building Score	Effect on Structural Performance (Choose a value - Do not interpolate)		
3.1 Plan Irregularity					
Effect on Structural Performance			Severe	Significant	Insignificant
	Factor A	1	0.4 max	0.7	1
Comment:	Building rectangular in plan				
3.2 Vertical Irregularity					
Effect on Structural Performance			Severe	Significant	Insignificant
	Factor B	1	0.4 max	0.7	1
Comment:	Building is single storey				
3.3 Short Columns					
Effect on Structural Performance			Severe	Significant	Insignificant
	Factor C	1	0.4 max	0.7	1
Comment:	Building has no short columns				

3.4 Pounding Potential

(Estimate D1 and D2 and set D = the lower of the two, or = 1.0 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.g. with shear walls), the effect of pounding may be reduced by taking the co-efficient to the right of the value applicable to to frame buildings.

Factor D1 1

Table for Selection of of Factor D1	Severe	Significant	Insignificant
Separation	0<sep<.005H	.005<Sep<.01H	Sep>.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

b) Factor D2 - Height Difference Effect

Select appropriate value from Table

Factor D2 1

Table for Selection of of Factor D2	Severe	Significant	Insignificant
Separation	0<sep<.005H	.005<Sep<.01H	Sep>.01H
Height Difference > 4 Storeys	0.7	0.8	1
Height Difference 2 to 4 Storeys	0.4	0.9	1
Height Difference < 2 Storeys	1	1	1

Factor D 1 ***(Set D = lesser of D1 and D2 or.. Set D =1 if no prospect of Pounding)***

3.5 Site Characteristics - *(Stability, landslide threat, liqefaction etc*)

Effect on Structural Performance			Severe	Significant	Insignificant
	Factor E	1	0.5 max	0.7	1

3.6 Other Factors

Factor F 0.75 **For <u>< 3</u> Storeys - Maximum value 2.5**
Otherwise - Maximum Value 1.5. No Minimum

Record Rationale for Choice of Factor F: Absence of sub-floor bracing and lateral support of long walls.

3.7 Performance Achievment Ration (PAR)
(equale A x B x C x D x E x F) 0.75

INITIAL EVALUATION PROCEDURE - STEP 4, 5, 6 & 7

Building Name : St James Presbyterian Church		Ref:	12 08 30
Building Location : 76 Moresby Ave, Waihi		CPEng Number:	2419
		Date:	Sep 12

Step 4 Percentage of New Building Standard (%NBS)

		Longitudinal	Transverse	
4.1 Assessed baseline (%NBS)b (From step 1)		11	11	
4.2 Performance Achievement Ratio (PAR) (From Step 2)		0.75	0.75	
4.3 PAR x Baseline (%NBS)b		8	8	
4.4 Percentage of New Building Standard (%NBS) (Use lower of two values from Step 3.3)			8	
Step 5 Potentially Earthquake Prone? (Mark as appropriate)	%NBS > 33		NO	
	%NBS ≤ 33		YES	✓
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**			E	

Evaluation Completed by:

Signature

John Crabtree — Name

2419 — 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