Council's buildings in High Street, Marton

Interim reports for Council's main building and the rural fire and workshop building are attached.

However, these refer to a consolidated report being prepared that incorporates the findings and costs associated with the structural adequacy in an earthquake event, health & safety, and ventilation findings of all the building". That phrase "all the buildings" was for six buildings –

1. The office complex, being –
    - main building
    - annex building (connected to main building via walkway)
    - assets building – currently housing the Assets team
    - rural fire and workshop building
2. The library building
3. The civil defence building

Yet to be confirmed

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Rangitikei District Council

Earthquake Performance Assessment / Council Offices - Main Building

Contents

1 Introduction

1.1 Report Structure

Rangitikei District Council (RDC) requested MWH to undertake an earthquake performance assessment of six council buildings, these include:

1. The office complex which consists of four buildings:
    a. Main building – currently housing reception and CEO offices.
    b. Annex building – connected to the main building via a walkway.
    c. Assets building – currently housing the Assets team
    d. Rural fire and workshop building.
2. The library building
3. The civil defense building

At the request of Council, an interim report was request to present the findings associated with the Main building located at the Council office complex. The report does not include the assessment of the Annex building which is linked to the main building by a timber framed corridor.

The final version of the report will be a consolidated report that incorporates the findings and costs associated with the structural adequacy in an earthquake event, health & safety, and ventilation findings of all the buildings. This report should be available in February 2008 once the analysis has been completed for all the buildings. This will allow for better decision making relating to the future of the office complex.

1.2 Current legislation

The Building Act 2004 has repealed the Building Act 1991 and introduced a number of changes one of which is to reduce the risk of death or injury that may result from the effects of a significant earthquake on buildings *that represent a higher than normal risk in earthquake.*

In relation to the above mentioned, the Building Act now focuses particularly on buildings of high risk. These buildings are referred in the legislation as *Earthquake Prone Buildings* hereafter referred to as EPB. To make these buildings deemed as earthquake prone safer to use in the future, the Building Act 2004 introduced provisions to improve the likelihood of existing buildings withstanding earthquakes

The expression EPB is now regarded as applying to any building (excluding some residential buildings) that is not capable of meeting the nominal performance objectives and requirements in relation to seismic strength of 33% of "New Building Standard" (NBS). 33% of NBS corresponds to approximately 20 times the risk of a building reaching a similar condition to that which a new building would reach in a full design earthquake.

Current legislation requires that buildings that are assessed as being earthquake prone under the Building Act be strengthened. It was made the responsibility of each individual Territorial Authority to develop their own formal policy on earthquake-prone buildings through consultation with building owners, consultants and the

public. Such policy was to addresses the identification process for earthquake prone buildings, a timetable for carrying out required strengthening works and specifies the required level of strengthening for EPBs.

1.3 Review of Rangitikei District Council Policy for Earthquake - Prone Buildings

The Rangitikei District Council has developed a policy for EPBs based on the provisions of the building act requirements.

The policy addresses the following issues:

- The approach that the Council will take in performing its functions under the Act;
- Council's priorities in performing those functions;
- How the policy will apply to heritage buildings.

The developed policy reflects the Council's desire to reduce the earthquake risk over time in a way that is socially and economically acceptable to its ratepayers and citizens, and which recognises the heritage value of its heritage stock and limited resources available to the Council.

1.3.1 Rangitikei District Council (RDC) Approach

The approach the Council will take (as identified in the policy) will be to:

- Review its building stock to identify buildings that fall within the scope of EPBs under the Building Act 2004.
- Assess broadly the performance of those buildings in relation to the new building standard and, in particular, to the standard defined for EPBs. This broad assessment will be done at the Council's cost, based on priorities.
- Determine and compile from this broad assessment a list of buildings that are earthquake-prone in terms of the Building Act 2004
- Advise owner(s) of these buildings of the results of the Council's broad assessment and invite them, within a limited time frame, to meet with and/or obtain further details from the Council on future requirements.
- Give written notices to all owner(s) of EPBs once the deadline for contacting Council has passed and, subject to the results of discussions, to carry out work to reduce or remove the danger or demolish the building within a specified timeframe.
- Allow owners a right of appeal as defined in the Building Act 2004, which can include applying for a determination under section 177.

1.3.2 Assessment Process

The process the Council will follow in identifying-earthquake prone buildings will be to:

- Undertake an initial desktop review of Council files to assess which buildings could be earthquake-prone (at Council cost).
- Follow this with a brief visual inspection of each building where necessary.
- Carry out an initial evaluation of performance in an earthquake based on information obtained by using the New Zealand Society of Earthquake Engineers (NZSEE) Initial Evaluation Method process (at councils cost).
- Require building owners to do a detailed assessment on buildings identified as earthquake-prone in the initial evaluation, unless otherwise agreed in discussion following the initial evaluation (at Owner cost).
- Assemble a list of earthquake-prone buildings according to the results of the assessments (at Councils cost).
- Categorise the earthquake-prone buildings according to use and importance as follows:

  -Buildings with special post-disaster functions as defined in AS/NZS 1170.0:2002, Importance Level 4.

  -Buildings that contain people in crowds or contents of high value to the community (including all Council-owned buildings) - not listed in 1 above as defined in AS/NZS 1170.0:2002, Importance Level 3.

  -Buildings with a heritage classification under the historic places act 1993.

1.3.3 Assessment criteria

The council will use the NZSEE recommendations as its preferred basis for defining technical requirements and criteria. These recommendations are designed to be used in conjunction with AS/NZS1170 Loadings Standard, NZS3101 Concrete Structures Standard, NZS3404 Steel Structures Standard and other materials standards.

The NZSEE document "Assessment and Improvement of the Structural Performance of Buildings in Earthquakes" which we will adopt for assessing the Council Offices Building, concentrates on matters relating to life safety; that is to say, performance at the ultimate limit state. MWH New Zealand Ltd emphasises, that the assessment procedure adopted is mainly concerned with the identification and elimination of possible undesirable collapse modes that could affect either part of a building or the entire structure. Damage to the building itself in an earthquake event is of secondary consideration. ***Earthquake prone buildings strengthened using the recommendations and procedures outlined by the NZSEE could be damaged beyond repair by a significant earthquake. It is therefore critical that Rangitikei DC acknowledges this fact and factors this into its decision making.***

1.3.4 Taking action on earthquake-prone buildings

Before exercising its powers under section 124 and 125 of the Act, the Council will seek, within a defined timeframe, to discuss options for action with owner(s) with a view to obtaining from the owner(s) a mutually acceptable approach for dealing with the danger, leading to receipt of a formal proposal from the owner(s) for strengthening or removal. In the event that discussions do not yield a mutually acceptable approach and proposal, the Council will serve a formal notice on the owner(s) to strengthen or demolish the building.

RDC requires buildings identified as earthquake-prone to be strengthened only to the minimum level of 33% NBS. NZSEE recommends strengthening to 67% NBS and RDC will encourage owners to upgrade to greater than the minimum.

1.3.5 Priorities

The Council has prioritised both the identification and the requirement to strengthen or demolish buildings as follows.

Figures that follow in brackets indicate the latest date for identification and notification and the maximum time for strengthening or demolition respectively. Times required for strengthening, or demolition, commence on the date of issue of formal notice. Specific times will be assigned for action according to assessment of structural performance and the value of concerns.

The order is as indicated below:

1. Buildings with special post-disaster functions as defined in *AS/NZS 1170.0:2002* Importance Level 4 (June 2008, 5 years).

2. Buildings that contain people in crowds or contents community as defined in AS/NZS 1170.0:2002, Importance Level 3 **including Council buildings** (June 2009, 10 years).

3. Buildings registered by the New Zealand Historic Places Trust under the Historic Places Act 1993 (June 2011, 15 years).

4. Buildings with an Importance Level of less than 3 as defined in AS/NZS1170.0:2002 (June 2011, 20 years).

The council Main Office Building is therefore required to be assessed by June 2009 and strengthened (if needed) within a maximum period of 10 years following identification and notification.

2 General Description of Building

The Council Offices main building was constructed in 1923 as a replacement to the original timber framed building (advised by RDC), refer to photos. It is mainly of brick wall construction and timber roof framing. The external walls are believed to be cavity wall construction. Foundations for the brick walls (internal and external)

are believed to be in the form of continuous concrete strips, we are uncertain at this stage if they are reinforced with steel bars or not. The internal flooring is timber with the timber sub floor framing supported on piles.

A brick parapet (which is an architectural feature) encompasses the roof all around the building. An annex building was later constructed (circa 1982) to increase the available office space. This building was linked to the original offices building by means of a timber framed corridor.

MWH NZ Ltd carried out a site inspection on 15 November to visually inspect the council buildings and to undertake a limited scope measure up of the council buildings at the High Street complex. The acquired dimensions for the main office building have been identified on the attached building plan.

At this stage for the purpose of this structural evaluation and due to lack of specific geotechnical ground information, we have assumed that the subsoil underlying the council buildings (High Street complex) are susceptible to liquefaction.

Soil liquefaction and related ground failures are associated with earthquakes. It refers to the loss of strength in saturated, cohesionless soils due to the build up of pore water pressures during dynamic loading. We recommend that a limited scope geotechnical investigation be undertaken at a later stage to verify ground conditions.

3 Outline of Evaluation Procedure Adopted

3.1 Building Act Definitions

The definition of an earthquake-prone building (EPB) is set out in Section 122 of the Building Act and in its associated Regulations.

Quoting from the Act;

122 Meaning of earthquake-prone building
(1) A building is earthquake prone for the purposes of this Act if, having regard to its condition and to the ground on which it is built, and because of its construction, the building –

(a) will have its ultimate capacity exceeded in a moderate earthquake (as defined in the regulations): and
(b) would be likely to collapse causing –

(i) injury or death to persons in the building or to persons on any other property; or
(ii) damage to any other property
(2) Subsection (1) does not apply to a building that is used wholly or mainly for residential purposes unless the building-
(a) comprises 2 or more storeys: and
(b) contains 3 or more household units.

And from the Regulations;

7. Earthquake-prone buildings: moderate earthquake defined-
For the purpose of section 122 (meaning of earthquake-prone building) of the Act, moderate earthquake means, in relation to a building, an earthquake that would generate shaking at the site of the building that is of the same duration as, but that is one-third as strong as, the earthquake shaking (determined by normal measures of acceleration, velocity, and displacement) that would be used to design a new building at that site.

It is worth mentioning that buildings that pass the one-third criterion, but which still represent a significant risk (below 67% NBS) require no action legally. However it is NZSEE view that any building below 67%NBS should be regarded as a questionable earthquake risk and therefore still an Earthquake Risk. In such a case it will be a client's preference as to strengthen a building or otherwise.

3.2 NZSEE Assessment Procedure

The structural evaluation process adopted for assessing EPBs (developed by NZSEE) comprises two stages as follows:

Initial Evaluation Process (IEP)
The initial evaluation procedure (IEP) is intended to be a coarse screening to identify potentially high risk (or earthquake-prone) buildings. The results obtained in the IEP may be used to:

- identify buildings that warrant a detailed assessment of their structural performance
- provide a preliminary score for a comparative risk grading of buildings
- provide a means of determining priorities for improvement of structural performance.

The objective of the IEP is to identify, with an acceptable level of confidence, all high risk buildings. At the same time the process must not catch an unacceptable number of buildings that would, on detailed evaluation be outside the high risk category.

Detailed Assessment of Earthquake Performance
The NZSEE assessment procedure states that where an initial evaluation indicates that the building is likely to be high risk (earthquake-prone), it is desirable that a detailed assessment is carried out as set out in NZSEE Guidelines. This will provide a more specific and convincing evaluation on which a final decision can be made on whether or not the building is to be classified as high risk.

4 Findings

Based on the IEP undertaken, we believe that the main council offices building is earthquake-prone failing the threshold Percentage of New Building Standard (%NBS) of 33 in both the longitudinal and transverse directions (refer to assessment calculations attached).

To this end we recommend that RDC undertakes the second stage detailed assessment which will identify to a higher degree of confidence the %NBS for the building in mention. Please note that the detailed assessment is intended to provide a means of more accurate evaluation of performance. It will allow us to look in more detail at

the characteristics of the building, its response to earthquake shaking, the demands it places on structural elements, and the capacity of such elements to meet those demands by maintaining structural integrity under imposed actions and displacements.

However MWH would like to point out that in order to undertake this assessment successfully more precise information regarding the building dimensions, building materials, condition of structural elements, structural design and ground conditions will need to be obtained or gathered.

5 Building Cost Estimates

RDC have requested that we undertake an evaluation of the indicative costs associated with:

- Constructing a new Council Offices Building, and
- Seismically improving the existing building to 33% NBS.

Due to the fact that neither an architectural layout / details for a new building have been developed nor that the required seismic strengthening of the building have yet been identified and designed, our cost estimates will be very indicative and perhaps to an accuracy of no more than +/- 35%.

Option A -New Building:
For this option, we have assumed the following:

1. New building to be single level
2. No foundation subsoil problems
3. Standard finishes
4. No unusual building shape
5. Minor local infrastructure upgrades only
6. Building footprint similar in size to existing office block (approximately 620m^2).
7. Construction is undertaken by 2009.
8. Estimate has been based on information outlined in Rawlinsons New Zealand Construction Handbook 2006 edition. A 2% costs inflation has been incorporated in the estimate.
9. Costs exclude
    - Land & demolition
    - Balconies, covered ways, access roads and parking areas
    - External services more than 3.0m from the outside face of the building
    - Data and telephone services
    - External works other than those immediately adjacent to the building
    - Loose Furniture, Fittings or Equipment
    - Professional fees, such as architect, engineer, quantity surveyor
    - Legal fees
    - Staff and furniture temporary or permanent relocation
    - Goods and Services Tax (GST)

Based on the above we estimate the cost associated with the construction of a new building to be in the region of $1.2m.

We estimate professional fees at this stage for this option (architect, structural eng., mechanical eng., electrical eng. and quantity surveyor) to be in the region of 15% of the total construction cost (excluding costs associated with any geotechnical investigation(s) and site survey), which equates to approximately $180,000.

The total estimated cost of replacement is therefore about $1,5m (excluding GST).

Option B -Seismic upgrade of existing building:
For this option we have assumed the following:

1. Minor foundation upgrades
2. Minimal demolition
3. Structural elements including roof timber framing in acceptable condition
4. Acceptable ground conditions / no major concerns with subsoil
5. Bracing walls with steel members as an acceptable seismic upgrade
6. Estimate has been based on information outlined in Rawlinsons New Zealand Construction Handbook 2006 edition. A 2% costs inflation has been incorporated in the estimate. Since the seismic upgrades have not yet been identified, we have assumed the rates for standard office building upgrades/renovation works.
7. Costs exclude:
    - Staff and furniture relocation during works
    - Architectural upgrades to building
    - Upgrade to services
    - Layout modifications
    - Major unforeseen structural problems with the existing structure
    - Professional fees, such as architect, engineer, quantity surveyor
    - Geotechnical investigation that may be needed to determine ground conditions
    - Goods and Services Tax (GST)

Based on the above we estimate the cost associated with seismically upgrading the existing main offices building to a nominal 33% NBS to be in the region of $265,000. It should be noted that upgrading the strength to greater than 33% NBS will most likely result in additional costs.

It should be noted that costs for strengthening the building exclude all upgrade costs associated with building improvements such as ventilation upgrades etc.

We estimate at this stage the structural engineering fees for the development of the seismic upgrade design (including the undertaking of the detailed assessment of the building structure which is critical for any upgrades design) to be in the region of $25,000 (plus GST) including the undertaking of a site survey but excluding any costs associated with obtaining documents, the undertaking of destructive / non-destructive investigative tests and a geotechnical investigation.

Allowing for unknowns and the undertaking of testing / investigative work, the estimate to strengthen the building to meet 33% NBS is around $350,000 (excluding GST).

6 Summary

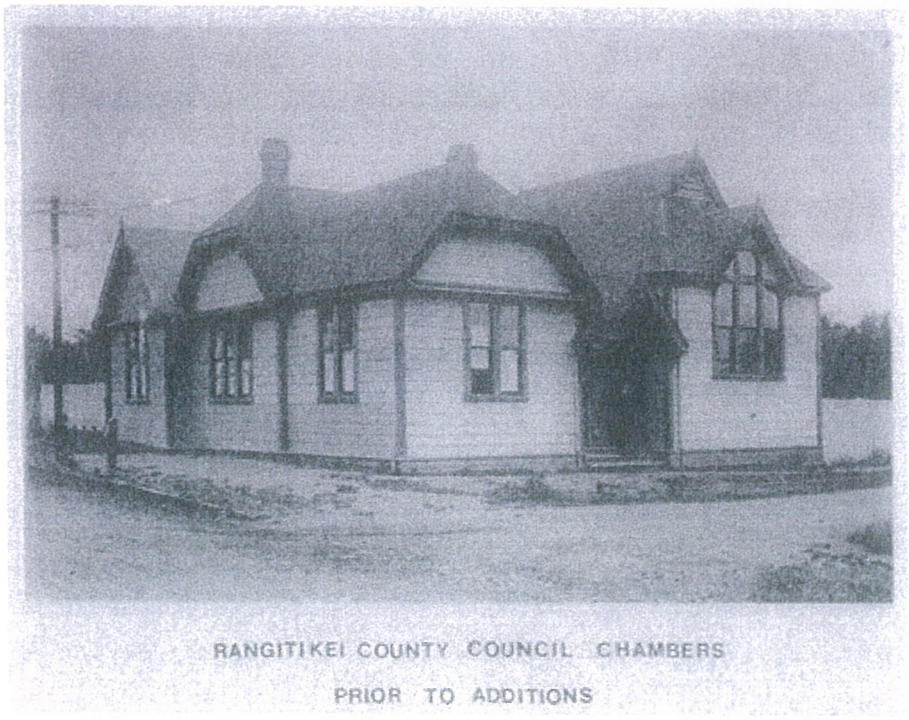
1. The Main office building was built in 1923 (An earthquake analysis for the Annex building that is connected to the main building will be done separately as it is a different structure built in 1982).
2. The Initial Evaluation Assessment has determined that the main office building is earthquake prone and does not meet the minimum legal requirement of having the seismic strength equivalent to 33% of a new building.
3. Section 122 of the Building Act and RDC's earthquake policy both only require the building to be upgraded to 33% of the new building standard (NBS). It should be noted that a building at 33% of the NBS has a risk of failure 20 times higher than a building constructed to full NBS.
4. Earthquake strengthening a building means that it has been strengthened to improve the risk of loss of life. It may be damaged beyond repair in a significant earthquake.
5. Strengthening the building to meet the 33% NBS is estimated to be $350,000 (excluding GST). The cost of strengthening the building excludes all upgrade costs such as improved functionality and ventilation.
6. An equivalent new 620m^2 fully serviced standard single storey office building would cost approximated $1,5m at a building rate of $2100/m^2 (excluding GST).

7 Recommendations

It is recommended that no decision be made on the future of the Main office building until the other three buildings on the office complex site have been evaluated for earthquake performance (initial assessment), health and safety aspects, ventilation, compliance with regulations and consent obligations if upgrades are to be made.

The target date for a consolidated report incorporating the above is the end of February 2008.

Appendix A Photos



Original Building That Was Demolished 1916 - 1923

Main Council Office Building Side View : Built 1923

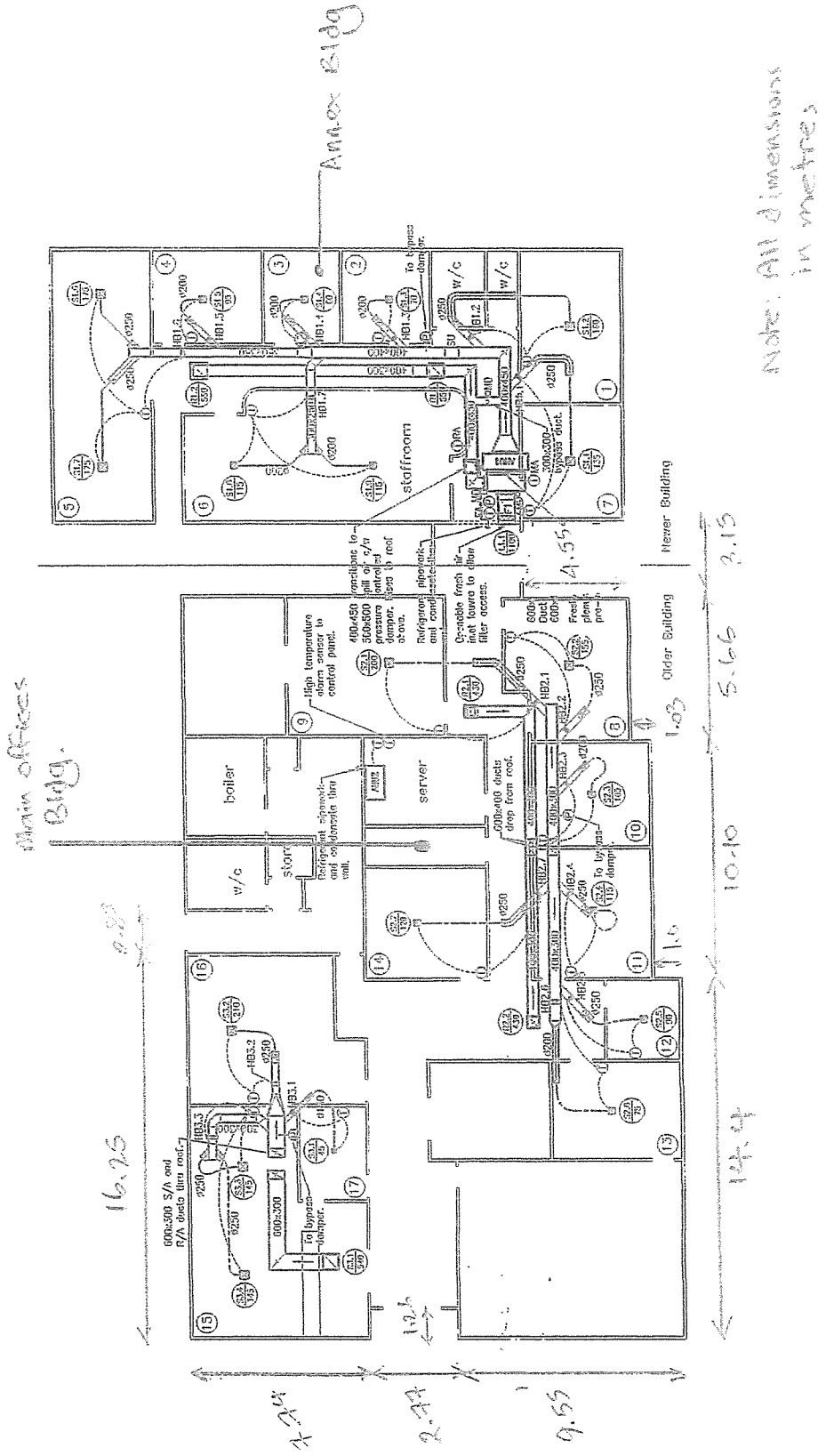
Main Council Office Building Front View

Main Council Office Building Link To Annex Building

Roof Parapet

Appendix B Measured Building Dimensions

6 Measured Building Dimensions



Appendix C Structural Evaluation Calculations

Table IEP-1: Initial Evaluation Procedure – Step 1 (Revision 1)

Table IEP-1 Initial Evaluation Procedure Step 1 Page 1....

(Refer Table IEP - 2 for Step 2; Table IEP - 3 for Step 3, Table IEP - 4 for Steps 4, 5 and 6)

Building Name	Rangitikei DC offices / main Building	Ref.	
Location	Marton	By	O. Hill
		Date	14/12/07

Step 1 - General Information

1.1 Photos (attach sufficient to describe building)

Refer to Report.

1.2 Sketch of building plan

Refer to report

1.3 List relevant features

- Constructed circa 1930 (as advised by RDC.
- Brick wall construction.
- Timber roof framing.

1.4 Note information sources

	tick as appropriate
Visual Inspection of Exterior	✓
Visual Inspection of Interior	✓
Drawings (note type)	Layout plan ✓
Specifications	X
Geotechical Reports	X
Other (list)	X

Longitudinal Direction

Table IEP-2: Initial Evaluation Procedure – Step 2

Table IEP-2 Initial Evaluation Procedure Step 2 Page 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	**By**
Direction Considered: a) Longitudinal ~~b) Transverse~~	
(Choose worse 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) = $(\%NBS)_{nom}$

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 Soil	✓
	E Very Soft Soil	
From NZS4203:1992, Cl 4.6.2.2 (for 1992 to 2004 only and only if known)	a) Rigid	
	b) Intermediate	

c) Estimate Period, T — 0.4 Seconds

Can use 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.

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

A_i = cross-sectional shear area of shear wall i in the first storey of the building, in m^2

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 l_{wi} / h_n shall not exceed 0.9

d) $(\%NBS)_{nom}$ determined from Figure 3.3 — 3.5 $(\%NBS)_{nom}$

Note 1: For buildings designed prior to 1965 and known to be designed as public buildings in accordance with the code of the time, multipy $(\%NBS)_{nom}$ by 1.25.
For buildings designed 1965 - 1976 and known to be designed as public buildings in accordance with the code of the time, multiply $(\%NBS)_{nom}$ by 1.33 - Zone A
1.2 - Zone B

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

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. — 2.8 — 2.8 $(\%NBS)_{nom}$

Continued over page

Table IEP-2: Initial Evaluation Procedure – Step 2 continued

Table IEP-2 Initial Evaluation Procedure Step 2 continued Page 3....

2.2 Near Fault Scaling Factor, Factor A

If $T \leq 1.5$sec, Factor A = 1

a) Near Fault Factor, *N(T,D)* (from NZS1170.5:2004, Cl 3.1.6) [1]

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) [0.3] (Marton)

b) Hazard Scaling Factor

For pre 1992 = 1/Z

For 1992 onwards = Z_{1992}/Z

(Where Z_{1992} is the NZS4203:1992 Zone Factor from accompanying Figure 3.5(b)) Factor B [3.33]

2.4 Return Period Scaling Factor, Factor C

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

b) Return Period Scaling Factor from accompanying Table 3.1 Factor C [1]

2.5 Ductility Scaling 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 NZS1170.5:2004 Ductility Factor, from accompanying Table 3.3) Factor D [1.57]

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 $(\%NSB)_{nom}$ x A x B x C x D x E)

[20.95] ≃ 21

Table IEP-3: Initial evaluation procedure – Step 3

Table IEP-3 Initial Evaluation Procedure Step 3 Page .....

(Refer Table IEP - 1 for Step 1; Table IEP - 2 for Step 2; Table IEP - 4 for Steps 4, 5 and 6)

Building Name
Location
Direction Considered: a) Longitudinal * ~~b) Transverse~~
(Choose worse case if clear at start. Complete IEP-2 and IEP-3 for each if in doubt)

Ref.
By O. Hill
Date 14/12/07

Step 3 - Assessment of Performance Achievement Ratio (PAR)

(Refer Appendix B - Section B3.2)

Critical Structural Weakness	Building Score	Effect on Structural Performance *(Choose a value - Do not interpolate)*		
		Severe	Significant	Insignificant
3.1 Plan Irregularity *Effect on Structural Performance*	Factor A 0.7	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 0.7	0.4 max	0.7	1
Comment				

3.4 Pounding Potential

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

Factor D1 1

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	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 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 *(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)*
Effect on Structural Performance

	Severe	Significant	Insignificant
Factor E 0.7	0.5 max	0.7	1

3.6 Other Factors

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

Record rationale for choice of Factor F:

.....

3.7 Performance Achievement Ratio (PAR) (equals A x B x C x D x E x F) 0.51

Transverse Direction

Table IEP-2: Initial Evaluation Procedure – Step 2

Table IEP-2 Initial Evaluation Procedure Step 2 Page 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	**By**
Direction Considered: a) Longitudinal b) Transverse *	
(Choose worse 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) = $(\%NBS)_{nom}$

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 Soil	✓
	E Very Soft Soil	
From NZS4203:1992, Cl 4.6.2.2 (for 1992 to 2004 only and only if known)	a) Rigid	
	b) Intermediate	

c) Estimate Period, T — 0.4 Seconds

Can use 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
$T = 0.05h_n^{0.75}$	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.

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

A_i = cross-sectional shear area of shear wall i in the first storey of the building, in m^2

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 L_{wi}/h_n shall not exceed 0.9

d) $(\%NBS)_{nom}$ determined from Figure 3.3 — 3.5 $(\%NBS)_{nom}$

Note 1: For buildings designed prior to 1965 and known to be designed as public buildings in accordance with the code of the time, multipy $(\%NBS)_{nom}$ by 1.25.
For buildings designed 1965 - 1976 and known to be designed as public buildings in accordance with the code of the time, multiply $(\%NBS)_{nom}$ by 1.33 - Zone A
1.2 - Zone B

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

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. — 2.8 — 2.8 $(\%NBS)_{nom}$

Continued over page

Table IEP-2: Initial Evaluation Procedure – Step 2 continued

Table IEP-2 Initial Evaluation Procedure Step 2 continued Page 3....

2.2 Near Fault Scaling Factor, Factor A

If $T \leq 1.5$sec, Factor A = 1

a) Near Fault Factor, $N(T,D)$ (from NZS1170.5:2004, Cl 3.1.6): 1

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): 0.3

b) Hazard Scaling Factor

For pre 1992 = $1/Z$

For 1992 onwards = Z_{1992}/Z

(Where Z_{1992} is the NZS4203:1992 Zone Factor from accompanying Figure 3.5(b)) Factor B: 3.33

2.4 Return Period Scaling Factor, Factor C

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

b) Return Period Scaling Factor from accompanying Table 3.1 Factor C: 1

2.5 Ductility Scaling 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 NZS1170.5:2004 Ductility Factor, from accompanying Table 3.3) Factor D: 1.57

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 $(\%NSB)_{nom}$ x A x B x C x D x E) 20.95 ≃ 21

Table IEP-3: Initial evaluation procedure – Step 3

Table IEP-3 Initial Evaluation Procedure Step 3 Page .....

(Refer Table IEP - 1 for Step 1; Table IEP - 2 for Step 2; Table IEP - 4 for Steps 4, 5 and 6)

Building Name — Ref.
Location — By
Direction Considered: a) Longitudinal b) Transverse
(Choose worse 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 on 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 =1.0 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 (eg with shear walls), the effect of pounding may be reduced by taking the co-efficient to the right of the value applicable to frame buildings.

Factor D1: 1

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	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 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 *(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)*

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

3.6 Other Factors

Factor F: 1.5 For ≤ 3 storeys - Maximum value 2.5, otherwise - Maximum value 1.5. No minimum.

Record rationale for choice of Factor F:

.....

3.7 Performance Achievement Ratio (PAR) (equals A x B x C x D x E x F) 1.05

Table IEP-4: Initial evaluation procedure – Steps 4, 5 and 6

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

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

Building Name Location	Rangitikei DC offices/main Building Marton	Ref. By Date	O.Hill 14/12/07

Step 4 - Percentage of New Building Standard (*%NBS*)

	Longitudinal	Transverse
4.1 Assessed Baseline (*%NBS*)$_b$ (from Table IEP - 1)	21	21
4.2 Performance Achievement Ratio (PAR) (from Table IEP - 2)	0.51	1.05
4.3 PAR x Baseline (*%NBS*)b	10.7	22.05
4.4 Percentage New Building Standard (*%NBS*) (Use lower of two values from Step 3.3)		10.7

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 Confirmed by... O.Hill ..... Signature

Owen Hill ..... Name

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