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Jack Phillips

128 Main Street Gore

Detailed Seismic Assessment (DSA)

"Chartered Professionals"

GM DESIGNS LIMITED

Architecture - Structural & Environmental Engineering

Address:	**128 Main Street Gore** **(PT SEC 11 BLK VII GORE TOWN)**
Client:	**Jack Phillips**
GM Ref:	**J4726**
Date of Issue:	**31.05.13 (Rev0), 22.11.13 (Rev1)**
Revision:	**1**

Originator

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Final Review / Approval for Issue

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Executive Summary

The quantitative assessment completed for the building located at 128 Main Street, deems it as an earthquake risk in its current state. The building is expected to perform poorly in a design level earthquake. The result of 20%NBS is in terms of the expected performance of life safety in a 1 in 500 year design level earthquake. The %NBS is summarized in Table 5. The building is classified as a high risk building, which is currently not accepted legally under the current Building Act 2004. The NZSEE recommends strengthening of buildings to at least 67%.

Structural Assessment Summary Results		
System	**%NBS**	**Notes**
2 Storey URM wall	20	Out of plane failure of URM walls

Table 1 %NBS of building

The Gore District Council was scheduled to review the Earthquake Prone Buildings Policy in May 2011 but this has been deferred until the Royal Commission of Enquiry to the Christchurch Earthquakes completes its report and recommendations to the Government. To date, there has not been another policy released and approved through parliament. The NZSEE define an earthquake prone building as on that meets 33% or less of the current building code. This building is therefore considered to be earthquake prone.

This is below the 34% threshold which defines a building as an earthquake risk by the New Zealand Society of Earthquake Engineers. Investigation design work has been completed to present a possible solution to withstand a code earthquake but it reflects costs of additional capital investment many times more than what can be recovered from any possible future rentals as the building format stands at present, this is due to the non-commercial shape and lack of lateral structural mechanisms present in the current building and hence there is no viable option to move forward with this building as it stands.

It is our recommendation that the building is demolished immediately as it poses a high degree of risk of collapse in earthquake event tremor and can be defined as an earthquake prone building within the building act (see below) due to any earthquake event. The building could become and deemed dangerous if by way of any strong winds or further weathering to the parapets or other bricks became dislodged and they then could pose a risk to members of the public at large when passing this building.

Table of Contents

1. Introduction

1.1. Background

Jack Phillips has engaged GM Designs to provide a Detailed Seismic Assessment (herein referred to as DSA) assessment of the property located at 128 Main Street Gore. GM Designs staff members, Graeme McMillan (CPEng), Paul McKay and Michael Sheridan conducted various structural inspections dating from early 2011.

1.2. Scope of a Detailed Seismic Assessment Report

The structural assessment of the building involved a Detailed Seismic Assessment (herein referred to a DSA). This was necessary due to the current building owner seeking structural advise on whether a high %NBS could be achieved at an economically viable construction cost.

This DSA evaluation report will indicate the current strength of the building in terms of current code requirements and determine if strengthening work or further investigation of potential structural weaknesses are required. The building strength is expressed as a percentage of New Building Standards.

The DSA evaluation of the building in terms of lateral load capacity has been undertaken using the New Zealand Society for Earthquake Engineering (NZSEE) document *Assessment and Improvement of the Structural Performance of Buildings for Earthquakes, June 2006*. A previous IEP report has been attached in Appendix B, which presents a %NBS of 18% for the structure. The IEP is superseded by this DSA.

The DSA procedure as set out by the NZSEE gives an approximate overall building strength in terms of current building code requirements.

1.3. Objective of a Detailed Seismic Assessment Report

This detailed engineering evaluation involves a review of the building's design, from this information we hope to gain a better understanding on the seismic performance in future earthquakes events.

1.4. General Building Description

A general description of the building is shown in Table 2.

Current Tenants:	Vacant
Address:	128 Main Street Gore
Legal description:	PT SEC 11 BLK VII GORE TOWN
Building use:	Vacant – Previously used as Beauty Salon
Number of storeys:	2
Roof construction:	Lightweight roof
Wall construction:	Unreinforced Masonry
1st Floor construction:	1st storey floor is timber with T&G flooring
Subfloor construction:	Timber subfloor on piles
Year built:	Estimated 1900-1910

Approximate floor area:	~105m² / floor
Building Importance:	2 (1170.0:2004 Table 2.)

Table 2 General Building Layout

2. Earthquake Resistance Standards

The assessment of a buildings earthquake resistance is compared with the current New Zealand Building Code requirements for a newly constructed building. The loadings used in the analysis are in accordance with the current earthquake loading standards, NZS 1170.2004 – Section 5.

The design timeline for the building is shown in Table 3.

Building:	**Design Code:**	**Plan Area (m²)**
128 Main Street, Gore	Pre 1935 – No Seismic design (except for buildings in Wellington)	105 / floor

Table 3 Building Design Timeline

The earthquake risk for existing buildings, in terms of NBS%, which has been proposed by the New Zealand Society for Earthquake Engineering in 2006 (referred here-in as NZSEE) is displayed in Figure 2.

Description	Grade	Risk	%NBS	Existing Building Structural Performance
Low Risk Building	A or B	Low	Above 67	Acceptable (improvement may be desirable)
Moderate Risk Building	B or C	Moderate	34 to 66	Acceptable legally. Improvement recommended
High Risk Building	D or E	High	33 or lower	Unacceptable (Improvement required under Act)

Improvement of Structural Performance	
Legal Requirement	NZSEE Recommendation
The Building Act sets no required level of structural improvement (unless change in use) This is for each TA to decide. Improvement is not limited to 34%NBS.	100%NBS desirable. Improvement should achieve at least 67%NBS
	Not recommended. Acceptable only in exceptional circumstances
Unacceptable	Unacceptable

Figure 2 NZSEE Risk Classifications Extracted from Table 2.2 of the NZSEE 2006 AISPBE Guidelines

3. Structural Systems

3.1. Location and Description

The two storey building is primarily constructed of URM. The irregular arrangements of interior walls on the first floor are mostly URM and some lightweight partition walls also exist. The building has had interior alterations since first constructed but no lateral earthquake resistance mechanisms have been constructed.

3.2. Walkthrough Inspection / Discussion

The building does not contain any lateral restraint mechanisms which would be adequate to resist a code earthquake event. The irregular shape of the structure would induce higher stresses in the areas of irregularity (at the acute corners) which would cause difficulty in restraining walls. This could possibly result in out of plane failure of various elements. A change in section is shown in Figure 1. A floor / roof diaphragm is the most economical way in which URM walls can be restrained from falling out of plane (outwards). It is therefore crucial to have regular ties at regular centres around the perimeter of the building. This becomes a difficult process when there are large windows and a change in plan regularity.

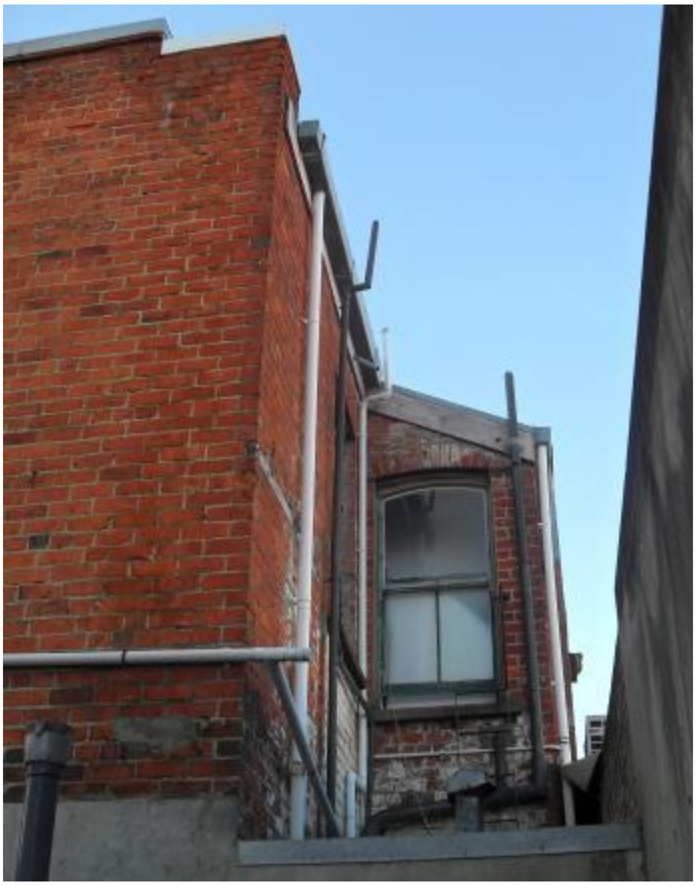

Figure 1 Change in shape of URM

There has been extensive damage to the brickwork throughout as can be seen in Figure 2. There are no ties from the brickwork into the timber floor which increases the slenderness of the wall which increase the likely out of plane collapse.

Figure 2 URM wall – No ties at floor or roof level

The parapet and front façade are unrestrained which poses an immediate risk of collapse onto the street front though lateral loading situations. The taller and thicker the parapet the higher the period, therefore, a larger displacement demand would occur due to the thickness of this ornate façade. Cantilevered parapets are also likely to fail in shear at the parapet base especially if a damp proof course (DPC) membrane has been used at the parapet base. This is shown in Figure 3.

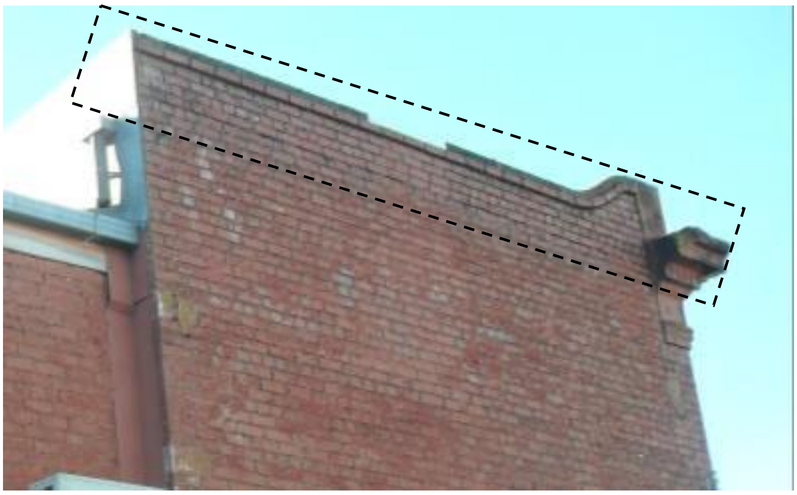

Figure 3 URM unrestrained damaged parapet

The verandah has deteriorated since its initial construction. The 'hauches' shown in Figure 4 had to be removed as they became loose and the bolt fixings had completed rusted through. These haunches weighed approximately 50kg each and would cause irreplaceable damage if they were to fall and had to be removed. The bottoms of the posts supporting the verandah have been covered by the overlaid tarmacadam which has prevented drainage out the bottom as originally designed. This has caused the posts to rust and are beyond repair in places.

Figure 4 Haunches have been removed

Further site photos are shown in Appendix A.

3.3. Heritage Classification and Issues

This building is not listed by the New Zealand Historic Places Trust, however is listed within the GDC historic register contained in the district plan.

4. Geotechnical Investigation

No specific geotechnical investigation has been undertaken by this office. A desk study has been undertaken by this office to assess the soil type, Southland District Council released a report in 2006 "*Southland District Lifelines Study*" which indicated the soil type to be soil type D.

5. Detailed Seismic Assessment

5.1. Overview

The detailed seismic assessment has been based on the NZSEE 2006 [1] guidelines for the "*Assessment and Improvement of the Structural Performance of Buildings in Earthquakes*" together with the "*Guidance on Detailed Engineering Evaluation of Earthquake Affected Nonresidential Buildings in Canterbury, Part 2 Evaluation Procedure*" [4] draft document prepared by the Engineering Advisory Group on 19 July 2011, and the SESOC guidelines "*Practice Note – Design of Conventional Structural Systems Following Canterbury Earthquakes*" [2] issued on 21 December 2011.

5.2. Critical Structural Weaknesses

There is moderate aesthetic earthquake damage on the exterior of the structure. Any settlement issues on site were not addressed in this report, no noticeable settlement was noticed onsite.

Various critical structural weakness (referred herein as a CSW) have been identified for the structure;

5.3. Displacement / Force Controlled CSW

- Out of plane failure of URM walls/parapets,
- Inplane failure of URM,
- Hinging of lower columns.

5.4. Quantitative Assessment Methodology

The quantitative methodology assessment for the structure is described below.

- Further analyses of the suitability of structural members were analysed using spreadsheet calculation.
- Analysis was carried out using NZS1170:2004 – 5, section 8 using a hazard site factor of 0.18, and in accordance with NZSEE publications listed above. This analysis was used to establish the actions on the structural elements.
- The building was assessed as importance level 2 from NZS 1170:2004 – Section 0.
- The demand to capacity ratios for each component in question was determined from the structural analysis, thus presenting a %NBS.

5.5. Limitations and Assumptions in Results

The analysis and assessment is based on the structure to be in an undamaged state. As a result the current capacity of the structure may be lower than stated. The values used in the analysis may contain some uncertainty due to the many assumptions and simplifications which are made during the assessment, including;

- Assessments of material strengths are based upon site inspections.
- Approximations are made on the ultimate capacity of each element.
- Various simplifications are made in the analysis, including boundary conditions such as foundation and element fixity.

No information was provided about the current foundations on site or no detailed soil investigation was carried out. As a result, this should be carried out on site to ensure the foundation base is adequate.

5.6. Seismic Loading

The seismic weight of the building includes the weight of the floors, roof and other non-structural components, and half the weight of the walls and columns (at ground level), is calculated referring to the structural calculations and current loading standards, NZS1170.5;2004.

5.7. Quantitative Assessment

A summary of the structural performance of the building is displayed in the table below. Please note the values that are highlighted are critical structural weakness and collapse hazard, as they define the buildings capacity. The ductility factor (μ) used in the building is 1.25, which is due to the limitations of the buildings which is defined in "assessment of improvement of a buildings structural performance in an earthquake".

The % NBS for the critical components for the two storey building which will form the lateral restraining system for the building are shown in Table 4.

Building			
Structural Element System	**Failure mode or description of limiting criteria based on force capacity of critical element.**	**Critical Structural Weakness and Collapse Hazard**	**% NBS based on calculated capacity**
Primary components at ground floor and upper level which will form the lateral retaining system.			
URM Walls	Out of plane failure of URM wall. Brittle failure expected.	Yes	20

Table 4 Summary of Critical Component for the building

6. Conclusion / Recommendation

The quantitative assessment completed for the building located at 128 Main Street, deems it as an earthquake risk in its current state. The building is expected to perform poorly in a design level earthquake. The result of 20%NBS is in terms of the expected performance of life safety in a 1 in 500 year design level earthquake. The %NBS is summarized in Table 5. The building is classified as a high risk building, which is currently not accepted legally under the current Building Act 2004. The NZSEE recommends strengthening of buildings to at least 67%.

Structural Assessment Summary Results		
System	**%NBS**	**Notes**
Building	20	Out of plane failure of URM walls

Table 5 %NBS of building

The Gore District Council was scheduled to review the Earthquake Prone Buildings Policy in May 2011 but this has been deferred until the Royal Commission of Enquiry to the Christchurch Earthquakes completes its report and recommendations to the Government. To date, there has not been another policy released and approved through parliament. The NZSEE define an earthquake prone building as on that meets 33% or less of the current building code. This building is therefore considered to be earthquake prone.

The building is being limited to a %NBS of 20% which is due to the out of plane capacity of the URM walls. The %NBS could be increased by installing external plates to the URM walls which would lock into the timber flooring. This would also have to be done at roof level. A diaphragm must be installed at both levels to ensure that the applied earthquake loading can be transferred into the external walls. Due to the irregular shape of the plan, this can distress at the corners which can cause ineffective load transfer and disproportionate failure. As a result this typical solution is not an adequate.

As previously discussed in Section 3.2, the heavy damaged parapet is unrestrained and likely to have large displacements in an earthquake. This could fall out of plane onto the street frontage which is likely to endanger the public safety.

This is below the 34% threshold which defines a building as an earthquake risk by the New Zealand Society of Earthquake Engineers. Investigation design work has been completed to present a possible solution to withstand a code earthquake but it reflects costs of additional capital investment many times more than what can be recovered from any possible future rentals as the building format stands at present, this is due to the non-commercial shape and lack of lateral structural mechanisms present in the current building and hence there is no viable option to move forward with this building as it stands.

It is our recommendation that the building is demolished immediately as it poses a high degree of risk of collapse in earthquake event tremor and can be defined as an earthquake prone building within the building act (see below) due to any earthquake event. The building could become and deemed dangerous if by way of any strong winds or further weathering to the parapets or other bricks became dislodged and they then could pose a risk to members of the public at large when passing this building.

Report issued as approved by:

Graeme McMillan
CPENG AFIM MIPENZ BE (HONS) RPEq

Limitation Statement

The sole purpose of this DSA report and the associated services performed by GM Designs Ltd. "GMDesigns" is to determine the structure %NBS based on GM Designs inspection(s) and checking of the property file information or information provided by the client. It also provides general recommendations on any immediate risks posed. The work is carried out in accordance with the scope of services set out in the contract between GM Designs and the Client. GM Designs has not considered the condition of any building services on the site.

This report has been prepared for the particular project described to us and its extent is limited to the scope of work agreed between the client and GM Designs Limited. No responsibilty is accepted by GM Designs for the accuracy of information provided by third parties and/or the use of any part of this report in any other context or for any other purposes.

This report has been prepared on behalf of, and for the exclusive use of, GM Designs Client, and is subject to, and issued in accordance with, the provisions of the contract between GM Designs and the Client. It is not possible to make a proper assessment of this report without a clear understanding of the terms of engagement under which it has been prepared, including the scope of the instructions and directions given to, and the assumptions made, by GM Designs. The report may not address issues which would need to be considered for another party if that party's particular circumstances, requirements and experience were known and, further, may make assumptions about matters of which a third party is not aware. No responsibility or liability to any third party is accepted for any loss or damage whatsoever arising out of the use of or reliance on this report by any third party.

Without limiting any of the above, in the event of any liability, GM Designs liability, whether under the law of contract, tort, statute, equity or otherwise, is limited as set out in the terms of the engagement with the Client. It is not within GM Designs scope or responsibility to identify the presence of asbestos, nor the responsibility of GM Designs to identify possible sources of asbestos. Therefore for any property pre-dating 1989, the presence of asbestos materials should be considered when costing remedial measures or possible demolition.

Appendix A- Pictures

The photos which were taken onsite in are shown in Appendix A.

Figure 5 Front view of building

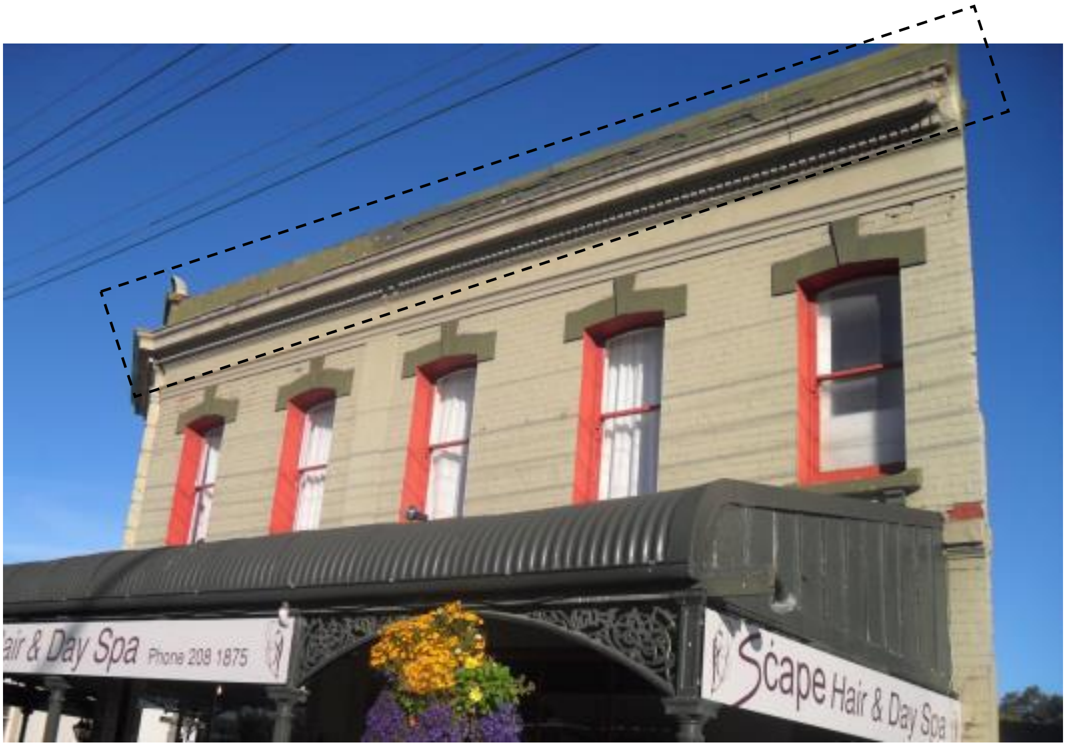

Figure 6 Damaged parapet

Figure 7 Damaged external URM wall

Figure 8 Damaged URM wall, various changes in shape of structure

Appendix B- IEP Summary

A summary of the initial IEP results are attached for information only. This is now superseded by this DSA report.

Initial Evaluation Procedure

Table IEP-1: Initial Evaluation Procedure - Step 1

Table IEP-1 Initial Evaluation Procedure Step 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	Scape	Ref #	4726
Location	128 Main Street Gore	Date	25/11/2013

Step 1 -General Information

1.1 Photos (attach sfficient to describe building)

See drawing S000-4726

1.2 Sketch of building Plan

See drawing S000-4726

1.3 List relevant features

See drawing S000-4726

1.4 Note information sources

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

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Initial Evaluation Procedure

Table IEP-2: Initial Evaluation Procedure - Step 2

Table IEP-2 Initial Evaluation Procedure Step 2

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

Building Name	Scape	Ref #	4726
Location	128 Main Street Gore	Date	25/11/2013

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

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

a) Date and Design of 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 NZS 1170.5:2004, Cl 3.1.3	A or B Rock	☐
	C Shallow Soil	☑
	D Soft Soil	☐
	E Very Soft Soil	☐
From NZS 4203:1992, Cl 4.6.2.2	a) Rigid	☐
(for 1992 to 2004 only and only if known)	b) Intermediate	☐

c) Estimate Period — **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
$T \leq 0.4sec$	for masonry shear walls

Where h_n = height in m from the base of the structure to the uppermost seismic mass

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

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 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 Fig 3.3 — **3.8** $(\%NBS)_{nom}$

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 — **1**

Note 2: For reinforced concrete buildings designed between 1976-84 multiply $(\%NBS)_{nom}$ by 1.2 — **1**

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**

3.04 $(\%NBS)_{nom}$

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Initial Evaluation Procedure

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

Table IEP-2 Initial Evaluation Procedure Step 2 Continued

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

If T ≤ 1.5sec, Factor A = 1

a) Near Fault Factor, N(T,D) — 1
(from NZS 1170.5:2004, Cl 3.1.6)

a) Near Fault Fscaling Factor = 1/N(T,D) — **Factor A** — 1

2.3 Hazard Scaling, Factor B

If T ≤ 1.5sec, Factor A = 1

a) Hazard Factor, Z, for site — 0.18
(from NZS 1170.5:2004, Table 3.3)

a) 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** — 5.56

2.4 Return Period Scaling Factor, Factor C

a) Building Importance Level — 2
(from NZS 1170.0:2004, Table 3.1 and 3.2)

a) Return Period Scaling Factor from accompanying Table 3.1 — **Factor C** — 1.00

2.5 Ductility Scaling Factor, D

a) Assessed Ductility of Existing Structure, μ — 1.25
(shall be less than maximum given in accompanying Table 3.2)

b) Ductility Scaling Factor
For pre 1976 = k_{u}
For 1976 onwards = 1
(Where ku is NZS1170.5:2004 Ductility Factor, from accompanying Table 3.3) — **Factor D** — 1.14

2.6 Structural Performance Scaling Factor, Factor E

a) Structural Performance Factor, Sp — 0.925
from accompanying Figure 3.4

a) Structural Performance Scaling Factor (1/Sp) — **Factor E** — 1.08

2.7 Baseline % NBS for building, $(\%NBS)_{b}$ — 20.81

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Initial Evaluation Procedure

Table IEP-3: Initial Evaluation Procedure - Step 3

Table IEP-2 Initial Evaluation Procedure Step 3

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

Building Name	Scape	Ref #	4726
Location	128 Main Street Gore	Date	25/11/2013

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)		
3.1 Plan Irregularity			Severe	Significant	Insignificant
Effect on Structural Performance	**Factor A**	1	0.4 max	0.7	1
Comment					
3.2 Vertical Irregularity			Severe	Significant	Insignificant
Effect on Structural Performance	**Factor B**	1	0.4 max	0.7	1
Comment					
3.3 Short Columns			Severe	Significant	Insignificant
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 = lower of the two, or 1 if no potential for pounding)

a) Factor D1: Pounding Potential

Note: Values given assume the building has a frame structure. For still 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
Seperation	0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Alignment of floors within 20% of storey height	0.7	0.8	1
Alignment of floors notwithin 20% of storey height	0.4	0.7	0.8

a) Factor D2: Height Difference Effect

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 1.00 (Lesser of D1 and D2 or set D=1 if no pounding potential)

			Severe	Significant	Insignificant
3.5 Site Characteristics (Stabilty, landslide threat, liquefaction etc.)					
Effect on Structural Performance	**Factor E**	1	0.4 max	0.7	1
Comment					

3.6 Site Characteristics (Stabilty, landslide threat, liquefaction etc.)

Effect on Structural Performance **Factor F** 1 (For ≤ 3 storeys-maximum value 2.5, otherwise-maximum value 1.5. No minimum)

Record rational for choice of Factor F:

3.7 Performance Achieved Ratio (PAR) 1

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Initial Evaluation Procedure

Table IEP-4: Initial Evaluation Procedure - Step 4

Table IEP-2 Initial Evaluation Procedure Steps 4, 5 and 6

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

Building Name	Scape	Ref #	4726
Location	128 Main Street Gore	Date	25/11/2013

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

	Longitudinal	Transverse
4.1 Assessed Baseline $(\%NBS)_b$ (from Table IEP - 1)	(Worst Case) 20.81	18.73
4.2 Performance Achieved Ratio (from Table IEP - 2)	1	1
4.2 PAR x Baseline $(\%NBS)_b$	20.81	18.73

Step 5 - Potentially Earthquake Prone

%NBS > 33	-
%NBS ≤ 33	Yes

Step 6 - Potentially Earthquake Risk?

%NBS ≥ 67	-
%NBS < 67	-

Step 7 - Provisional Grading for Seismic Risk based on IEP

Seismic Grade: D

Evaluation Carried out by: Michael Sheridan

Evaluation Confirmed by:

	[signature]	Signature
	Graeme Mc Millan	Name
	47102	CPEng. No

Relationship between Seismic Grade and %NBS

Grade:	A+	A	B	C	D	E
%NBS:	≥ 100	100-80	80-67	67-33	33-20	< 20

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Appendix C- GM Designs drawings

GM Designs drawing S000-4726.