

CHRISTCHURCH CITY COUNCIL
PRK_2231_BLDG_001 EQ2
Packe Reserve Shed
129 Packe Street, Edgeware



QUALITATIVE ASSESSMENT REPORT
FINAL

- Rev B
- 23 May 2013



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1. Executive Summary

1.1. Background

A qualitative assessment was carried out on the building located in Packe Reserve at 129 Packe Street, Edgware. The building is single storey and is currently utilised as a storage shed. It is believed to be constructed from lightweight timber framing. An aerial photograph illustrating this area is shown below in Figure 1. Detailed descriptions outlining the building's age and construction type is given in Section 5 of this report.



■ Figure 1 Aerial Photograph of the storage shed in Packe Reserve

The qualitative assessment includes a summary of the building damage as well as an initial assessment of the current seismic capacity compared with current seismic code loads using the Initial Evaluation Procedure (IEP).

This qualitative report for the building structure is based on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011 and a visual inspection on 18 September 2012.

1.2. Key Damage Observed

No external damage was observed during our site inspection.



1.3. Critical Structural Weaknesses

No potential critical structural weaknesses have been identified for this building.

1.4. Indicative Building Strength (from IEP and CSW assessment)

Based on the information available, and using the NZSEE Initial Evaluation Procedure, the buildings original capacity has been assessed to be in the order of 100% NBS. No damage was observed during the site investigation therefore the post earthquake capacity will not change as a result of earthquake damage.

The building has been assessed to have a seismic capacity greater than 67% NBS and is therefore not a potential earthquake risk.

1.5. Recommendations

It is recommended that:

- a) There is no damage to the building that would cause it to be unsafe to occupy.
- b) We consider that barriers around the building are not necessary.

2. Introduction

Sinclair Knight Merz was engaged by Christchurch City Council to prepare a qualitative assessment report for the building located in Packer Reserve at 129 Packer Street following the magnitude 6.3 earthquake which occurred in the afternoon of the 22nd of February 2011 and the subsequent aftershocks.

The qualitative assessment uses the methodology recommended in the Engineering Advisory Group draft document “Guidance on Detailed Engineering Evaluation of Earthquake affected Non-residential Buildings in Canterbury”, issued 19 July 2011. The qualitative assessment includes a summary of the building damage as well as an initial assessment of the likely current Seismic Capacity compared with current seismic code requirements.

A qualitative assessment involves inspections of the building and a desktop review of existing structural and geotechnical information, including existing drawings and calculations, if available.

The purpose of the assessment is to determine the likely building performance and damage patterns, to identify any potential critical structural weaknesses or collapse hazards, and to make an initial assessment of the likely building strength in terms of percentage of new building standard (%NBS).

This report describes the structural damage observed during our inspection and indicates suggested remediation measures. The inspection was undertaken from floor levels and was a visual inspection only. Our report reflects the situation at the time of the inspection and does not take account of changes caused by any events following our inspection. A full description of the basis on which we have undertaken our visual inspection is set out in Section 7.

The NZ Society for Earthquake Engineering (NZSEE) Initial Evaluation Procedure (IEP) was used to assess the likely performance of the building in a seismic event relative to the New Building Standard (NBS). 100% NBS is equivalent to the strength of a building that fully complies with current codes. This includes a recent increase of the Christchurch seismic hazard factor from 0.22 to 0.3¹.

At the time of this report, no intrusive site investigation, detailed analysis, or modelling of the building structure had been carried out. The building description below is based on our visual inspections.

¹ <http://www.dbh.govt.nz/seismicity-info>

3. Compliance

This section contains a brief summary of the requirements of the various statutes and authorities that control activities in relation to buildings in Christchurch at present.

3.1. Canterbury Earthquake Recovery Authority (CERA)

CERA was established on 28 March 2011 to take control of the recovery of Christchurch using powers established by the Canterbury Earthquake Recovery Act enacted on 18 April 2011. This act gives the Chief Executive Officer of CERA wide powers in relation to building safety, demolition and repair. Two relevant sections are:

Section 38 – Works

This section outlines a process in which the chief executive can give notice that a building is to be demolished and if the owner does not carry out the demolition, the chief executive can commission the demolition and recover the costs from the owner or by placing a charge on the owners' land.

Section 51 – Requiring Structural Survey

This section enables the chief executive to require a building owner, insurer or mortgagee carry out a full structural survey before the building is re-occupied.

We understand that CERA will require a detailed engineering evaluation to be carried out for all buildings (other than those exempt from the Earthquake Prone Building definition in the Building Act). It is anticipated that CERA will adopt the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011. This document sets out a methodology for both qualitative and quantitative assessments.

The qualitative assessment is a desk-top and site inspection assessment. It is based on a thorough visual inspection of the building coupled with a review of available documentation such as drawings and specifications. The quantitative assessment involves analytical calculation of the buildings strength and may require non-destructive or destructive material testing, geotechnical testing and intrusive investigation.

It is anticipated that factors determining the extent of evaluation and strengthening level required will include:

- The importance level and occupancy of the building
- The placard status and amount of damage
- The age and structural type of the building
- Consideration of any critical structural weaknesses

- The extent of any earthquake damage

3.2. Building Act

Several sections of the Building Act are relevant when considering structural requirements:

3.2.1. Section 112 – Alterations

This section requires that an existing building complies with the relevant sections of the Building Code to at least the extent that it did prior to any alteration. This effectively means that a building cannot be weakened as a result of an alteration (including partial demolition).

3.2.2. Section 115 – Change of Use

This section requires that the territorial authority (in this case Christchurch City Council (CCC)) be satisfied that the building with a new use complies with the relevant sections of the Building Code 'as near as is reasonably practicable'. Regarding seismic capacity 'as near as reasonably practicable' has previously been interpreted by CCC as achieving a minimum of 67%NBS however where practical achieving 100%NBS is desirable. The New Zealand Society for Earthquake Engineering (NZSEE) recommend a minimum of 67%NBS.

3.2.3. Section 121 – Dangerous Buildings

The definition of dangerous building in the Act was extended by the Canterbury Earthquake (Building Act) Order 2010, and it now defines a building as dangerous if:

- in the ordinary course of events (excluding the occurrence of an earthquake), the building is likely to cause injury or death or damage to other property; or
- in the event of fire, injury or death to any persons in the building or on other property is likely because of fire hazard or the occupancy of the building; or
- there is a risk that the building could collapse or otherwise cause injury or death as a result of earthquake shaking that is less than a 'moderate earthquake' (refer to Section 122 below); or
- there is a risk that that other property could collapse or otherwise cause injury or death; or
- a territorial authority has not been able to undertake an inspection to determine whether the building is dangerous.

3.2.4. Section 122 – Earthquake Prone Buildings

This section defines a building as earthquake prone if its ultimate capacity would be exceeded in a 'moderate earthquake' and it would be likely to collapse causing injury or death, or damage to other property. A moderate earthquake is defined by the building regulations as one that would generate ground shaking 33% of the shaking used to design an equivalent new building.

3.2.5. Section 124 – Powers of Territorial Authorities

This section gives the territorial authority the power to require strengthening work within specified timeframes or to close and prevent occupancy to any building defined as dangerous or earthquake prone.

3.2.6. Section 131 – Earthquake Prone Building Policy

This section requires the territorial authority to adopt a specific policy for earthquake prone, dangerous and insanitary buildings.

3.3. Christchurch City Council Policy

Christchurch City Council adopted their Earthquake Prone, Dangerous and Insanitary Building Policy in 2006. This policy was amended immediately following the Darfield Earthquake of the 4th September 2010.

The 2010 amendment includes the following:

- A process for identifying, categorising and prioritising Earthquake Prone Buildings, commencing on 1 July 2012;
- A strengthening target level of 67% of a new building for buildings that are Earthquake Prone. Council recognises that it may not be practicable for some repairs to meet that target. The council will work closely with building owners to achieve sensible, safe outcomes;
- A timeframe of 15-30 years for Earthquake Prone Buildings to be strengthened; and,
- Repair works for buildings damaged by earthquakes will be required to comply with the above.

The council has stated their willingness to consider retrofit proposals on a case by case basis, considering the economic impact of such a retrofit.

We anticipate that any building with a capacity of less than 33%NBS (including consideration of critical structural weaknesses) will need to be strengthened to a target of 67%NBS of new building standard as recommended by the Policy.

If strengthening works are undertaken, a building consent will be required. A requirement of the consent will require upgrade of the building to comply 'as near as is reasonably practicable' with:

- The accessibility requirements of the Building Code.
- The fire requirements of the Building Code. This is likely to require a fire report to be submitted with the building consent application.



3.4. Building Code

The building code outlines performance standards for buildings and the Building Act requires that all new buildings comply with this code. Compliance Documents published by The Department of Building and Housing can be used to demonstrate compliance with the Building Code.

After the February Earthquake, on 19 May 2011, Compliance Document B1: Structure was amended to include increased seismic design requirements for Canterbury as follows:

- a) Hazard Factor increased from 0.22 to 0.3 (36% increase in the basic seismic design load)
- b) Serviceability Return Period Factor increased from 0.25 to 0.33 (80% increase in the serviceability design loads when combined with the Hazard Factor increase)

The increase in the above factors has resulted in a reduction in the level of compliance of an existing building relative to a new building despite the capacity of the existing building not changing.

4. Earthquake Resistance Standards

For this assessment, the building's earthquake resistance is compared with the current New Zealand Building Code requirements for a new building constructed on the site. This is expressed as a percentage of new building standard (%NBS). The new building standard load requirements have been determined in accordance with the current earthquake loading standard (NZS 1170.5:2004 Structural design actions - Earthquake actions - New Zealand).

The likely capacity of this building has been derived in accordance with the New Zealand Society for Earthquake Engineering (NZSEE) guidelines 'Assessment and Improvement of the Structural Performance of Buildings in Earthquakes' (AISPBE), 2006. These guidelines provide an Initial Evaluation Procedure that assesses a buildings capacity based on a comparison of loading codes from when the building was designed and currently. It is a quick high-level procedure that can be used when undertaking a Qualitative analysis of a building. The guidelines also provide guidance on calculating a modified Ultimate Limit State capacity of the building which is much more accurate and can be used when undertaking a Quantitative analysis.

The New Zealand Society for Earthquake Engineering has proposed a way for classifying earthquake risk for existing buildings in terms of %NBS and this is shown in Figure 2 below.

Description	Grade	Risk	%NBS	Existing Building Structural Performance	Improvement of Structural Performance	
					Legal Requirement	NZSEE Recommendation
Low Risk Building	A or B	Low	Above 67	Acceptable (improvement may be desirable)	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
Moderate Risk Building	B or C	Moderate	34 to 66	Acceptable legally. Improvement recommended		Not recommended. Acceptable only in exceptional circumstances
High Risk Building	D or E	High	33 or lower	Unacceptable (Improvement	Unacceptable	Unacceptable

■ **Figure 2: NZSEE Risk Classifications Extracted from table 2.2 of the NZSEE 2006 AISPBE Guidelines**

Table 1 below provides an indication of the risk of failure for an existing building with a given percentage NBS, relative to the risk of failure for a new building that has been designed to meet current Building Code criteria (the annual probability of exceedance specified by current earthquake design standards for a building of 'normal' importance is 1/500, or 0.2% in the next year, which is equivalent to 10% probability of exceedance in the next 50 years).



■ **Table 1: %NBS compared to relative risk of failure**

Percentage of New Building Standard (%NBS)	Relative Risk (Approximate)
>100	<1 time
80-100	1-2 times
67-80	2-5 times
33-67	5-10 times
20-33	10-25 times
<20	>25 times

5. Building Details

5.1. Building description

The building is located in Packer Reserve at 129 Packer Street. There is only one building on this site. The building has one storey that is currently utilised as a storage shed. The building is believed to be constructed from lightweight timber-framing with lightweight corrugated steel cladding for the walls and roof. It has a timber particle-board floor supported on a steel frame that is anchored to concrete block footings, raising it 400mm off the ground. It is assumed the building was designed and constructed in the 1980's, allowing for the building to have been transported from another site, as the reserve was created in 1996.

Our evaluation was based on the external visual inspection carried out on 18 September 2012. Drawings were not available to verify the date of construction.

5.2. Gravity Load Resisting system

It appears that the gravity loads are taken by the timber framing in the walls with direct transfer into the steel framing and concrete block footings below.

5.3. Seismic Load Resisting system

Lateral loads acting across and along the building will be transferred through the timber framing in the walls and into the steel frame and concrete block footings.

Note that for this building the 'along direction' has been taken as east-west and the 'across direction' has been taken as north-south.

6. Damage Summary

SKM undertook an inspection on 18 September 2012. The following areas of damage were observed during the time of inspection:

General

- 1) No visual evidence of settlement was noted at this site, therefore a level survey is not required at this stage of assessment.

Building Damage

- 1) No earthquake-related damage was observed during our site inspection.
- 2) Gaps opening up between wall cladding elements. This is not believed to be earthquake-related damage.
- 3) Impact damage on gutter on the south side of the building. This is not believed to be earthquake-related damage.
- 4) Rusting of steel elements throughout the building. This is not earthquake-related damage.

Photos of the above damage can be found in Appendix 1 – Photos.

7. Initial Seismic Evaluation

7.1. The Initial Evaluation Procedure Process

This section covers the initial seismic evaluation of the building as detailed in the NZSEE 'Assessment and Improvement of the Structural Performance of Buildings in Earthquakes'. The IEP grades buildings according to their likely performance in a seismic event. The procedure is not yet recognised by the NZ Building Code but is widely used and recognised by the Christchurch City Council as the preferred method for preliminary seismic investigations of buildings².

The IEP is a coarse screening process designed to identify buildings that are likely to be earthquake prone. The IEP process ranks buildings according to how well they are likely to perform relative to a new building designed to current earthquake standards, as shown in Table 2. The building rank is indicated by the percent of the required New Building Standard (%NBS) strength that the building is considered to have. Earthquake prone buildings are defined as having less than 33% NBS strength which correlates to an increased risk of approximately 20 times that of 100% NBS³. Buildings that are identified to be earthquake prone are required by law to be followed up with a detailed assessment and strengthening work within 30 years of the owner being notified that the building is potentially earthquake prone⁴.

Table 2: IEP Risk classifications

Description	Grade	Risk	%NBS	Structural performance
Low risk building	A+	Low	> 100	Acceptable. Improvement may be desirable.
	A		100 to 80	
	B		80 to 67	
Moderate risk building	C	Moderate	67 to 33	Acceptable legally. Improvement recommended.
High risk building	D	High	33 to 20	Unacceptable. Improvement required.
	E		< 20	

The IEP is a simple desktop study that is useful for risk management. No detailed calculations are done and so it relies on an inspection of the building and its plans to identify the structural members and describe the likely performance of the building in a seismic event. A review of the

² <http://resources.ccc.govt.nz/files/EarthquakeProneDangerousAndInsanitaryBuildingsPolicy2010.pdf>

³ NZSEE 2006, *Assessment and Improvement of the Structural Performance of Buildings in Earthquakes*, p 2-2

⁴ <http://resources.ccc.govt.nz/files/EarthquakeProneDangerousAndInsanitaryBuildingsPolicy2010.pdf>



plans is also likely to identify any critical structural weaknesses. The IEP assumes that the building was properly designed and built according to the relevant codes at the time of construction. The IEP method rates buildings based on the code used at the time of construction and some more subjective parameters associated with how the building is detailed and so it is possible that %NBS derived from different engineers may differ.

This assessment describes only the likely seismic Ultimate Limit State (ULS) performance of the building. The ULS is the level of earthquake that can be resisted by the building without catastrophic failure. The IEP does not attempt to estimate Serviceability Limit State (SLS) performance of the building, or the level of earthquake that would start to cause damage to the building⁵. This assessment concentrates on matters relating to life safety as damage to the building is a secondary consideration. SLS performance of the building can be estimated by scaling the current code levels if required.

The NZ Building Code describes that the relevant codes for NBS are primarily:

- AS/NZS 1170 Structural Design Actions
- NZS 3101:2006 Concrete Structures Standard
- NZS 3404:1997 Steel Structures Standard

7.2. Available Information, Assumptions and Limitations

Following our inspection on 18 September, SKM carried out a preliminary structural review. The structural review was undertaken using the available information which was as follows:

- SKM site measurements and external inspection findings of the building. Please note no intrusive investigations were undertaken.
- There were no drawings available to carry out our review.

The following assumptions and design criteria were used in this assessment:

- Standard design assumptions for typical office and factory buildings as described in AS/NZS1170.0:2002
 - 50 year design life, which is the default NZ Building Code design life.
 - Structure Importance Level 1. This level of importance is described as 'low' with small or moderate consequence of failure.
 - Ductility level of 1.25 in both directions, based on our assessment and code requirements at the time of design.

⁵ NZSEE 2006, *Assessment and Improvement of the Structural Performance of Buildings in Earthquakes*, p2-9



- Site hazard factor, $Z = 0.3$, NZBC, Clause B1 Structure, Amendment 11 effective from 1 August 2011
- Seismic subsoil Class D (deep or soft soil) ground performance and properties, in accordance with NZS1170.5

This IEP was based on our external visual inspection of the building. Since it is not a full design and construction review, it has the following limitations:

- It is not likely to pick up on any original design or construction errors (if they exist)
- Other possible issues that could affect the performance of the building such as corrosion and modifications to the building will not be identified
- The IEP deals only with the structural aspects of the building. Other aspects such as building services are not covered.

7.3. Critical Structural Weaknesses

No critical structural weaknesses have been identified in this building.

7.4. Qualitative Assessment Results

The building has had its capacity assessed using the Initial Evaluation Procedure based on the information available. The buildings capacity is expressed as a percentage of new building standard (%NBS) and are in the order of that shown below in Table 3. This capacity is subject to confirmation by a quantitative analysis.

Table 3: Qualitative Assessment Summary

<u>Item</u>	<u>%NBS</u>
Likely Seismic Capacity of Building	>100

Our qualitative assessment found that the building is not likely to be classed as potentially earthquake prone and is probably a 'Low Risk Building' (capacity greater than 67% of NBS). The full IEP assessment form is detailed in Appendix 2 – IEP Reports.



8. Further Investigation

No further investigation is required at this stage as the likely seismic capacity of the building is greater than 67% NBS and no structural damage was observed.



9. Conclusion

A qualitative assessment was carried out on the building located in Packer Reserve at 129 Packer Street, Edgeware. The building has sustained no earthquake-related damage. The building has been assessed to have a seismic capacity in the order of 100% NBS and is therefore not a potential earthquake risk and is likely to be classified as a 'Low Risk Building' (capacity greater than 67% NBS).

No further investigation is recommended at this stage.

It is recommended that:

- a) There is no damage to the building that would cause it to be unsafe to occupy.
- b) We consider that barriers around the building are not necessary.



10. Limitation Statement

This report has been prepared on behalf of, and for the exclusive use of, SKM's client, and is subject to, and issued in accordance with, the provisions of the contract between SKM 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, SKM. 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, SKM's liability, whether under the law of contract, tort, statute, equity or otherwise, is limited in as set out in the terms of the engagement with the Client.

It is not within SKM's scope or responsibility to identify the presence of asbestos, nor the responsibility of SKM 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.

There is a risk of further movement and increased cracking due to subsequent aftershocks or settlement.

Should there be any further significant earthquake event, of a magnitude 5 or greater, it will be necessary to conduct a follow-up investigation, as the observations, conclusions and recommendations of this report may no longer apply. Earthquake of a lower magnitude may also cause damage, and SKM should be advised immediately if further damage is visible or suspected.

11. Appendix 1 – Photos



Photo 1: South elevation



Photo 2: East elevation

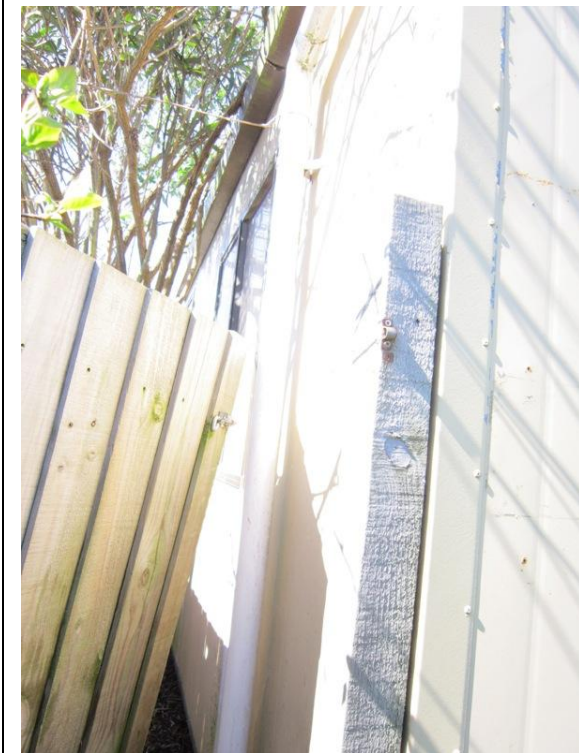


Photo 3: North elevation



Photo 4: West elevation



Photo 5: Impact damage on south gutter



Photo 6: Gaps opening up between wall cladding elements



Photo 7: Foundation system showing rust on steel beam (typical)



Photo 8: Profile of wall cladding



12. Appendix 2 – IEP Reports

Building Name:	Packe Reserve Shed	Ref.	ZB01276.194
Location:	129 Packe Street, Edgeware	By	WPK
		Date	19/09/2012

Step 1 - General Information

1.1 Photos (attach sufficient to describe building)



1.2 Sketch of building plan

1.3 List relevant features

The building in Packe Reserve at 129 Packe Street is one storey and is currently used as a storage shed. The building is assumed to have timber-framed walls and floor with metal sheeting as external wall cladding. The main lateral load-resisting system appears to be the timber framing in the walls. The roof is assumed to be timber-framed with metal sheeting as cladding. The building appears to be supported on steel framing bolted to concrete footings. The building is assumed to have been constructed in the 1980's. The Reserve was created in 1996, however the building could have existed before this and been transported from another site.

1.4 Note information sources

Tick as appropriate

- Visual Inspection of Exterior
- Visual Inspection of Interior
- Drawings (note type)
- Specifications
- Geotechnical Reports
- Other (list)

<input checked="" type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

Table IEP-2 Initial Evaluation Procedure – Step 2

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

Building Name:	Packe Reserve Shed	Ref.	ZB01276.194
Location:	129 Packe Street, Edgeware	By	WPK
Direction Considered:	Longitudinal & Transverse	Date	19/09/2012
(Choose worse case if clear at start. Complete IEP-2 and IEP-3 for each if in doubt)			

Step 2 - Determination of (%NBS)b
2.1 Determine nominal (%NBS) = (%NBS)nom

Pre 1935

1935-1965

1965-1976

Seismic Zone; A

B

C

1976-1992

Seismic Zone; A

B

C

1992-2004

<input type="radio"/>
<input type="radio"/>
<input type="radio"/>
<input type="radio"/>
<input type="radio"/>
<input type="radio"/>
<input checked="" type="radio"/>
<input type="radio"/>
<input type="radio"/>

See also notes 1, 3

See also note 2

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

<input type="radio"/>
<input type="radio"/>
<input checked="" type="radio"/>
<input type="radio"/>

From NZS4203:1992, Cl 4.6.2.2

(for 1992 to 2004 only and only if known)

a) Rigid

b) Intermediate

<input checked="" type="radio"/>
<input type="radio"/>

N-A

c) Estimate Period, T

building Ht = 2.5 meters

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

$$T \leq 0.4\text{sec}$$

for masonry shear walls

Longitudinal	Transverse
N/A	N/A
<input type="radio"/> MRCF	<input type="radio"/> MRCF
<input type="radio"/> MRSF	<input type="radio"/> MRSF
<input type="radio"/> EBSF	<input type="radio"/> EBSF
<input checked="" type="radio"/> Others	<input checked="" type="radio"/> Others
<input type="radio"/> CSW	<input type="radio"/> CSW
<input type="radio"/> MSW	<input type="radio"/> MSW

Ac = N/A m2

Where

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

$$A_c = \sum A_i(0.2 + Lw_i/h_n)^2$$

Ai = cross-sectional shear area of shear wall i in the first storey of the building, in m2

Lwi = 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

Longitudinal	Transverse
0.1	0.1

Seconds

d) (%NBS)nom determined from Figure 3.3
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.

No 1

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 or 1.2 - Zone B

No 1

Note 2: For reinforced concrete buildings designed between 1976 -1984 (%NBS)nom by 1.2

No 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.

No 1

Longitudinal	16.5	(%NBS)nom
Transverse	16.5	(%NBS)nom

Continued over page

Building Name:	Packe Reserve Shed	Ref.	ZB01276.194
Location:	129 Packe Street, Edgeware	By	WPK
Direction Considered:	Longitudinal & Transverse	Date	19/09/2012
(Choose worse case if clear at start. Complete IEP-2 and IEP-3 for each if in doubt)			

2.2 Near Fault Scaling Factor, Factor AIf $T < 1.5\text{sec}$, Factor A = 1a) 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	1.00
----------	------

2.3 Hazard Scaling Factor, Factor B

Select Location

Christchurch

a) Hazard Factor, Z , for site

(from NZS1170.5:2004, Table 3.3)

 $Z = 0.3$ $Z_{1992} = 0.8$

Auckland 0.6 Palm Nth 1.2

Wellington 1.2 Dunedin 0.6

Christchurch 0.8 Hamilton 0.67

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)

1

b) Return Period Scaling Factor from accompanying Table 3.1

Factor C	2.00
----------	------

2.5 Ductility Scaling Factor, Da) Assessed Ductility of Existing Structure, μ

(shall be less than maximum given in accompanying Table 3.2)

Longitudinal 1.25

 μ Maximum = 6

Transverse 1.25

 μ Maximum = 6

b) Ductility Scaling Factor

For pre 1976

= k_{μ}

For 1976 onwards

= 1

(where k_{μ} is NZS1170.5:2005 Ductility Factor, from accompanying Table 3.3)

Longitudinal	Factor D	1.00
Transverse	Factor D	1.00

2.6 Structural Performance Scaling Factor, Factor E

Select Material of Lateral Load Resisting System

Longitudinal

Timber

Transverse

Timber

a) Structural Performance Factor, S_p

from accompanying Figure 3.4

Longitudinal

 S_p

0.93

Transverse

 S_p

0.93

b) Structural Performance Scaling Factor

Longitudinal

 $1/S_p$

Factor E

1.08

Transverse

 $1/S_p$

Factor E

1.08

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

Longitudinal	118.9	(%NBS) _b
Transverse	118.9	(%NBS) _b

Table IEP-3 Initial Evaluation Procedure – Step 3

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

Building Name: <u>Packe Reserve Shed</u>	Ref. <u>ZB01276.194</u>
Location: <u>129 Packe Street, Edgware</u>	By <u>WPK</u>
Direction Considered: a) Longitudinal	Date <u>19/09/2012</u>
(Choose worse case if clear at start. Complete IEP-2 and IEP-3 for each if in doubt)	

Step 3 - Assessment of Performance Achievement Ratio (PAR)

(Refer Appendix B - Section B3.2)

Critical Structural Weakness**Effect on Structural Performance**

(Choose a value - Do not interpolate)

**Building
Score****3.1 Plan Irregularity**

Effect on Structural Performance

Comment

Severe	Significant	Insignificant
<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

Factor A **3.2 Vertical Irregularity**

Effect on Structural Performance

Comment

Severe	Significant	Insignificant
<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

Factor B **3.3 Short Columns**

Effect on Structural Performance

Comment

Severe	Significant	Insignificant
<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

Factor C **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 <input type="text" value="1"/>		
		Severe	Significant	Insignificant
Separation		0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Alignment of Floors within 20% of Storey Height		<input type="radio"/> 0.7	<input type="radio"/> 0.8	<input checked="" type="radio"/> 1
Alignment of Floors not within 20% of Storey Height		<input type="radio"/> 0.4	<input type="radio"/> 0.7	<input type="radio"/> 0.8

b) Factor D2: - Height Difference Effect

Select appropriate value from Table

		Factor D2 <input type="text" value="1"/>		
		Severe	Significant	Insignificant
Separation		0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Height Difference > 4 Storeys		<input type="radio"/> 0.4	<input type="radio"/> 0.7	<input type="radio"/> 1
Height Difference 2 to 4 Storeys		<input type="radio"/> 0.7	<input type="radio"/> 0.9	<input type="radio"/> 1
Height Difference < 2 Storeys		<input type="radio"/> 1	<input type="radio"/> 1	<input checked="" type="radio"/> 1

Factor D

(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
<input type="radio"/> 0.5	<input type="radio"/> 0.7	<input checked="" type="radio"/> 1

Factor E **3.6 Other Factors**

For < 3 storeys - Maximum value 2.5,

otherwise - Maximum value 1.5. No minimum.

Factor F

Record rationale for choice of Factor F:

Small scale lightweight building, unlikely to be governed by earthquake loading (increased F factor could be considered if necessary).

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

Building Name:	Packe Reserve Shed	Ref.	ZB01276.194
Location:	129 Packe Street, Edgeware	By	WPK
Direction Considered:	b) Transverse	Date	19/09/2012
(Choose worse case if clear at start. Complete IEP-2 and IEP-3 for each if in doubt)			

Step 3 - Assessment of Performance Achievement Ratio (PAR)

(Refer Appendix B - Section B3.2)

Critical Structural Weakness
Effect on Structural Performance
 (Choose a value - Do not interpolate)

Building Score
3.1 Plan Irregularity

Effect on Structural Performance

Comment

Severe	Significant	Insignificant
<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

Factor A **3.2 Vertical Irregularity**

Effect on Structural Performance

Comment

Severe	Significant	Insignificant
<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

Factor B **3.3 Short Columns**

Effect on Structural Performance

Comment

Severe	Significant	Insignificant
<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

Factor C **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
		0<Sep<.005H	.005<Sep<.01H	Sep>.01H
Separation				
Alignment of Floors within 20% of Storey Height		<input type="radio"/> 0.7	<input type="radio"/> 0.8	<input checked="" type="radio"/> 1
Alignment of Floors not within 20% of Storey Height		<input type="radio"/> 0.4	<input type="radio"/> 0.7	<input type="radio"/> 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		
Separation		0<Sep<.005H	.005<Sep<.01H	Sep>.01H		
Height Difference > 4 Storeys	<input type="radio"/>	0.4	<input type="radio"/>	0.7	<input type="radio"/>	1
Height Difference 2 to 4 Storeys	<input type="radio"/>	0.7	<input type="radio"/>	0.9	<input type="radio"/>	1
Height Difference < 2 Storeys	<input type="radio"/>	1	<input type="radio"/>	1	<input checked="" type="radio"/>	1

Factor D
 (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
<input type="radio"/> 0.5	<input type="radio"/> 0.7	<input checked="" type="radio"/> 1

Factor E **3.6 Other Factors**

For < 3 storeys - Maximum value 2.5,

otherwise - Maximum value 1.5. No minimum.

Factor F

Record rationale for choice of Factor F:

Small scale lightweight building, unlikely to be governed by earthquake loading (increased F factor could be considered if necessary).

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

Building Name:	Packe Reserve Shed	Ref.	ZB01276.194
Location:	129 Packe Street, Edgeware	By	WPK
Direction Considered:	Longitudinal & Transverse	Date	19/09/2012

(Choose worse case if clear at start. Complete IEP-2 and IEP-3 for each if in doubt)

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

	Longitudinal	Transverse
4.1 Assessed Baseline (%NBS)_b (from Table IEP - 1)	118	118
4.2 Performance Achievement Ratio (PAR) (from Table IEP - 2)	1.00	1.00
4.3 PAR x Baseline (%NBS)_b	118	118
4.4 Percentage New Building Standard (%NBS) (Use lower of two values from Step 4.3)		118

Step 5 - Potentially Earthquake Prone?

(Mark as appropriate)

%NBS ≤ 33

NO**Step 6 - Potentially Earthquake Risk?**

%NBS < 67

NO**Step 7 - Provisional Grading for Seismic Risk based on IEP**

Seismic Grade

A+

Evaluation Confirmed by



Signature

James Carter

Name

1017618

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



13. Appendix 3 – CERA Standardised Report Form

Location		Building Name: <input type="text" value="Packe Reserve Shed"/>		Reviewer: <input type="text" value="James Carter"/>	
		Unit No: <input type="text" value="Street"/>		CPEng No: <input type="text" value="1017618"/>	
Building Address: <input type="text" value="1291 Packe Street, Edgeware"/>				Company: <input type="text" value="SKM"/>	
Legal Description: <input type="text"/>				Company project number: <input type="text" value="ZB01276.194"/>	
				Company phone number: <input type="text" value="09 928 5500"/>	
		Degrees Min Sec		Date of submission: <input type="text" value="24-May"/>	
GPS south: <input type="text"/>		<input type="text"/>		Inspection Date: <input type="text" value="18/09/2012"/>	
GPS east: <input type="text"/>		<input type="text"/>		Revision: <input type="text" value="B"/>	
Building Unique Identifier (CCC): <input type="text" value="PRK 2231 BLDG 001"/>				Is there a full report with this summary? <input type="text" value="yes"/>	

Site		Site slope: <input type="text" value="flat"/>		Max retaining height (m): <input type="text" value="0.15"/>	
		Soil type: <input type="text"/>		Soil Profile (if available): <input type="text"/>	
Site Class (to NZS1170.5): <input type="text" value="D"/>				If Ground improvement on site, describe: <input type="text"/>	
Proximity to waterway (m, if <100m): <input type="text"/>				Approx site elevation (m): <input type="text"/>	
Proximity to cliff top (m, if < 100m): <input type="text"/>					
Proximity to cliff base (m, if <100m): <input type="text"/>					

Building		No. of storeys above ground: <input type="text" value="1"/>		single storey = 1	
Ground floor split?: <input type="text" value="no"/>				Ground floor elevation (Absolute) (m): <input type="text"/>	
Storeys below ground: <input type="text" value="0"/>				Ground floor elevation above ground (m): <input type="text"/>	
Foundation type: <input type="text" value="mat slab"/>				if Foundation type is other, describe: <input type="text"/>	
Building height (m): <input type="text" value="2.50"/>		height from ground to level of uppermost seismic mass (for IEP only) (m): <input type="text" value="2.9"/>		Date of design: <input type="text" value="1976-1992"/>	
Floor footprint area (approx): <input type="text" value="15"/>					
Age of Building (years): <input type="text" value="30"/>					
Strengthening present?: <input type="text" value="no"/>				If so, when (year)? <input type="text"/>	
Use (ground floor): <input type="text" value="recreational"/>				And what load level (%g)? <input type="text"/>	
Use (upper floors): <input type="text"/>				Brief strengthening description: <input type="text"/>	
Use notes (if required): <input type="text"/>					
Importance level (to NZS1170.5): <input type="text" value="IL1"/>					

Gravity Structure		Gravity System: <input type="text" value="frame system"/>		rafter type, purlin type and cladding: <input type="text"/>	
		Roof: <input type="text" value="timber framed"/>		joist depth and spacing (mm): <input type="text" value="Unknown (assumed)"/>	
		Floors: <input type="text" value="timber"/>		type: <input type="text" value="Timber (assumed)"/>	
		Beams: <input type="text" value="timber"/>		typical dimensions (mm x mm): <input type="text" value="Unknown (assumed)"/>	
		Columns: <input type="text" value="timber"/>			
		Walls: <input type="text" value="non-load bearing"/>			

Lateral load resisting structure		Lateral system along: <input type="text" value="lightweight timber framed walls"/>		Note: Define along and across in detailed report!	
Ductility assumed, μ : <input type="text" value="1.25"/>		0.00		note typical wall length (m): <input type="text" value="4.8"/>	
Period along: <input type="text" value="0.10"/>				estimate or calculation? <input type="text" value="estimated"/>	
Total deflection (ULS) (mm): <input type="text" value="10"/>				estimate or calculation? <input type="text" value="estimated"/>	
maximum interstorey deflection (ULS) (mm): <input type="text"/>				estimate or calculation? <input type="text" value="estimated"/>	
Lateral system across: <input type="text" value="lightweight timber framed walls"/>		0.00		note typical wall length (m): <input type="text" value="3"/>	
Ductility assumed, μ : <input type="text" value="1.25"/>				estimate or calculation? <input type="text" value="estimated"/>	
Period across: <input type="text" value="0.10"/>				estimate or calculation? <input type="text" value="estimated"/>	
Total deflection (ULS) (mm): <input type="text" value="10"/>				estimate or calculation? <input type="text" value="estimated"/>	
maximum interstorey deflection (ULS) (mm): <input type="text"/>				estimate or calculation? <input type="text" value="estimated"/>	

Separations:		north (mm): <input type="text"/>		leave blank if not relevant	
		east (mm): <input type="text"/>			
		south (mm): <input type="text"/>			
		west (mm): <input type="text"/>			

Non-structural elements		Stairs: <input type="text"/>		describe: <input type="text" value="Lightweight corrugated sheeting"/>	
		Wall cladding: <input type="text" value="profiled metal"/>		describe: <input type="text" value="Lightweight corrugated sheeting"/>	
		Roof Cladding: <input type="text" value="Metal"/>			
		Glazing: <input type="text" value="aluminium frames"/>			
		Ceilings: <input type="text"/>			
		Services(list): <input type="text"/>			

Available documentation		Architectural: <input type="text" value="none"/>		original designer name/date: <input type="text"/>	
		Structural: <input type="text" value="none"/>		original designer name/date: <input type="text"/>	
		Mechanical: <input type="text" value="none"/>		original designer name/date: <input type="text"/>	
		Electrical: <input type="text" value="none"/>		original designer name/date: <input type="text"/>	
		Geotech report: <input type="text" value="none"/>		original designer name/date: <input type="text"/>	

Damage		Site performance: <input type="text"/>		Describe damage: <input type="text" value="No damage observed"/>	
Site: (refer DEE Table 4-2)				notes (if applicable): <input type="text"/>	
Settlement: <input type="text" value="none observed"/>				notes (if applicable): <input type="text"/>	
Differential settlement: <input type="text" value="none observed"/>				notes (if applicable): <input type="text"/>	
Liquefaction: <input type="text" value="none apparent"/>				notes (if applicable): <input type="text"/>	
Lateral Spread: <input type="text" value="none apparent"/>				notes (if applicable): <input type="text"/>	
Differential lateral spread: <input type="text" value="none apparent"/>				notes (if applicable): <input type="text"/>	
Ground cracks: <input type="text" value="none apparent"/>				notes (if applicable): <input type="text"/>	
Damage to area: <input type="text" value="none apparent"/>				notes (if applicable): <input type="text"/>	

Building:		Current Placard Status: <input type="text" value="green"/>			
Along		Damage ratio: <input type="text" value="0%"/>		Describe how damage ratio arrived at: <input type="text" value="No damage observed during our site inspection."/>	
		Describe (summary): <input type="text" value="No damage observed"/>			
Across		Damage ratio: <input type="text" value="0%"/>		$Damage_Ratio = \frac{(\% NBS (before) - \% NBS (after))}{\% NBS (before)}$	
		Describe (summary): <input type="text" value="No damage observed"/>			
Diaphragms		Damage?: <input type="text" value="no"/>		Describe: <input type="text"/>	
CSWs:		Damage?: <input type="text" value="no"/>		Describe: <input type="text"/>	
Pounding:		Damage?: <input type="text" value="no"/>		Describe: <input type="text"/>	
Non-structural:		Damage?: <input type="text" value="no"/>		Describe: <input type="text"/>	

Recommendations		Level of repair/strengthening required: <input type="text" value="none"/>		Describe: <input type="text"/>	
		Building Consent required: <input type="text" value="no"/>		Describe: <input type="text"/>	
		Interim occupancy recommendations: <input type="text" value="full occupancy"/>		Describe: <input type="text"/>	
Along		Assessed %NBS before: <input type="text" value="100%"/>		%NBS from IEP below	
		Assessed %NBS after: <input type="text" value="100%"/>		If IEP not used, please detail assessment methodology: <input type="text" value="Qualitative Assessment carried out includes NZSEE IEP (refer to SKM report)."/>	
Across		Assessed %NBS before: <input type="text" value="100%"/>		%NBS from IEP below	
		Assessed %NBS after: <input type="text" value="100%"/>			