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Toilet – Rimu Park  
PRK 1645 BLDG 001  
Detailed Engineering Evaluation  
Qualitative Report  
Version Final

Buchanans Rd



**Toilet – Rimu Park  
PRK 1645 BLDG 001**

Detailed Engineering Evaluation  
Qualitative Report  
Version Final

Buchanans Rd

Christchurch City Council

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**Date**  
17<sup>th</sup> May 2013



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# Qualitative Report Summary

**Toilet – Rimu Park**

**PRK 1645 BLDG 001**

**Detailed Engineering Evaluation**

**Qualitative Report - SUMMARY**

**Version Final**

**Buchanans Road**

## **Background**

This is a summary of the Qualitative report for the building structure, and is based in part on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011, visual inspections on 20<sup>th</sup> September 2012.

## **Building Description**

The single storey building is formed by partial fill concrete masonry walls either 90 or 190 mm thick. The walls support flat and mono-pitched timber frame roof sections, clad with profiled metal sheets. The floor is a concrete ground slab and is likely supported by strip foundations.

## **Key Damage Observed**

No damage was observed that is expected to hinder the seismic capacity of the building.

## **Critical Structural Weaknesses**

The following potential critical structural weaknesses have been identified in the structure.

- ▶ Vertical Irregularity 42%

## **Indicative Building Strength (from IEP and CSW assessment)**

Based on the information available, and using the NZSEE Initial Evaluation Procedure, the original capacity of the building has been assessed to be in the order of 42% NBS and post-earthquake capacity also in the order of 42% NBS. The buildings post-earthquake capacity excluding critical structural weaknesses is in the order of 59% NBS.

The building has been assessed to have a seismic capacity in the order of 42% NBS and is therefore potentially Earthquake Risk.

## **Recommendations**

CCC are not required to undertake a detailed seismic assessment, however due to the relatively low score, GHD recommend a detailed seismic assessment is carried out.



## 1. Background

GHD has been engaged by the Christchurch City Council (CCC) to undertake a detailed engineering evaluation of the Toilet at Rimu Park.

This report is a Qualitative Assessment of the building structure, and is based in part on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011.

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).

At the time of this report, no intrusive site investigation, detailed analysis, or modelling of the building structure had been carried out. Construction drawings were made available, and these have been considered in our evaluation of the building. The building description below is based on a review of the drawings and our visual inspections.



## 2. 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.

### 2.1 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



## **2.2 Building Act**

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

### **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).

### **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.

#### **2.2.1 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.

### **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.

### **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.

### **Section 131 – Earthquake Prone Building Policy**

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





## 2.3 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;
- ▶ 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.

## 2.4 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:

- ▶ Hazard Factor increased from 0.22 to 0.3 (36% increase in the basic seismic design load)
- ▶ 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.



### 3. 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 1 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 1 NZSEE Risk Classifications Extracted from table 2.2 of the NZSEE 2006 AISPBE**

Table 1 compares the percentage NBS to the relative risk of the building failing in a seismic event with a 10% risk of exceedance in 50 years (i.e. 0.2% in the next year). It is noted that the current seismic risk in Christchurch results in a 6% risk of exceedance in the next year.



<b>Percentage of New Building Standard (%NBS)</b>	<b>Relative Risk (Approximate)</b>
>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

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

## 4. Building Description

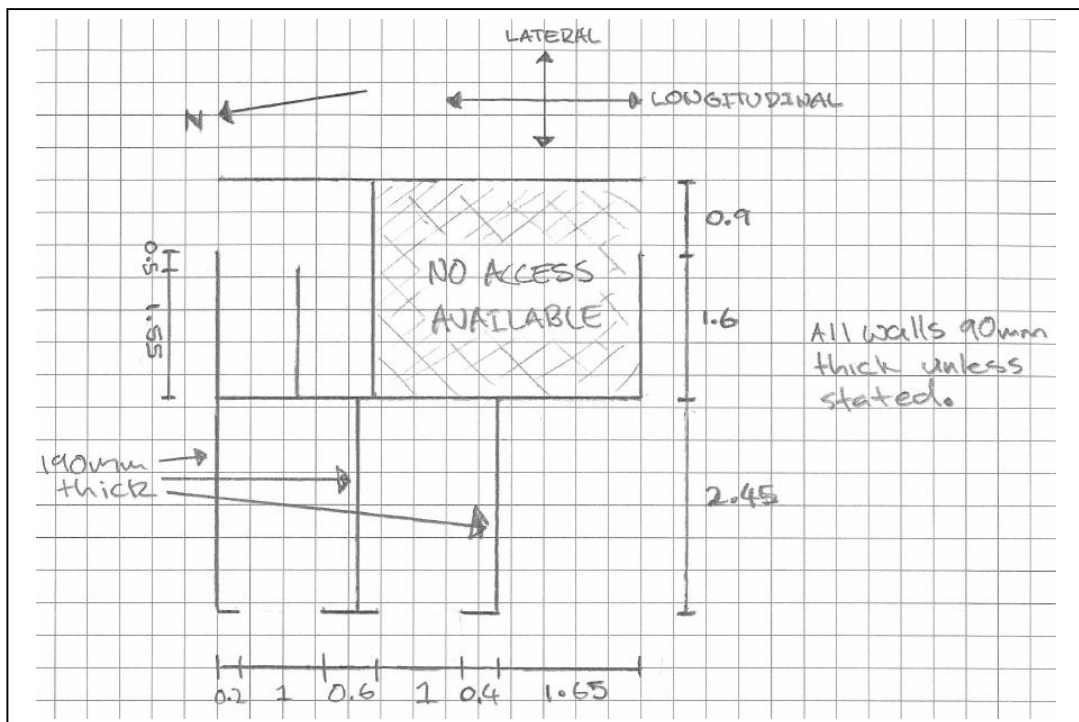
### 4.1 General

The Toilet is located in Rimu Park off Buchanans Road in Yaldhurst. The date of construction for the Toilet is unknown however it is assumed to be during the 1980's. There are construction joints throughout the building which signifies the later additions to the original structure.

The building is irregular in shape and covers an area of approximately 20m<sup>2</sup>. The eastern half of the building has a mono-pitch roof which slopes upward to 2.8 m on its eastern edge. The profiled metal sheet cladding in the mono-pitch section is supported by timber purlins spanning the buildings longitudinal direction and timber rafters spanning in the transverse direction. The remaining roof section is flat. The profiled metal sheet cladding in the flat section is supported by timber ceiling joists spanning in the transverse direction. Both sections of the timber framed roof then transfer the lateral loads into the concrete masonry walls.

The partial filled concrete masonry walls form the perimeter of the building and also provide the internal partitions; the layout can be seen in Figure 2. The walls are assumed to be partially filled and reinforced.

It is assumed the walls are found on concrete strip foundations which lie beneath the concrete masonry walls.



**Figure 2 Plan Sketch Showing Key Structural Elements**

The Toilet is relatively isolated with the nearest building being approximately 20 meters to the south. There are no waterways located nearby.

No plans were made available.



## **4.2 Gravity Load Resisting System**

Gravity loads are resisted by load bearing concrete masonry walls. Both timber roof sections span between the walls to support self-weight and other gravity loads. The concrete masonry walls transfer the gravity loads to the concrete strip footings and subsequently the ground beneath.

Internal gravity loads are transferred directly into the concrete floor slab which distributes the loads directly into the ground beneath.

## **4.3 Lateral Load Resisting System**

Lateral load resisting systems in the longitudinal and transverse direction are similar; however, the mono-pitch and flat sections of the building will behave slightly differently.

The flat section's ceiling and roof will provide nominal diaphragm action to carry the lateral loads to the in-plane concrete masonry walls. The panel action provided by the in-plane walls will transfer the lateral loads directly into the foundations and to the ground beneath.

The sloping roof section will provide little diaphragm action as the roof structure requires the need for timber studs to connect the roof to the top of the concrete masonry walls. This effectively acts as an unrestrained edge.



## 5. Assessment

An inspection of the building was undertaken on the 20<sup>th</sup> of September 2012. Both the interior and exterior of the building were inspected. The main structural components of the roof of the building were all able to be viewed. The buildings foundations were not able to be as these were below ground level. No access was available to the room in the buildings south-eastern corner and consequently, this could not be inspected.

The inspection consisted of scrutinising the building to determine the structural systems and likely behaviour of the building during an earthquake. The site was assessed for damage, including examination of the ground conditions, checking for damage in areas where damage would be expected for the type of structure and noting general damage observed throughout the building in both structural and non-structural elements.

The %NBS score determined for this building has been based on the IEP procedure described by the NZSEE and based on the information obtained from a visual observation of the building.

### 5.1 Damage Assessment

#### 5.1.1 Surrounding Buildings

No damage was noted to any of the surrounding buildings.

#### 5.1.2 Residual Displacements and General Observations

No residual displacements of the structure were noticed during our inspection of the building.

Cracking was noted at construction joints in the concrete masonry walls.

#### 5.1.3 Floor Level Survey

No level or verticality surveys have been undertaken for this building at this stage as indicated by Christchurch City Council guidelines.

#### 5.1.4 Ground Damage

There was no evidence of ground damage on the property or surrounding neighbours land.

### 5.2 IEP Damage Assessment

The damage identified has not reduced the overall lateral load resistance of the building. Therefore for the purposes of the IEP assessment of the building and the determination of the overall strength score, the effects of this damage on the performance of the building has not reduced the overall strength of the building.



### **5.3 Geotechnical Assessment**

A desktop report was not undertaken because no evidence of liquefaction or lateral spreading was clearly visible in the aerial photography taken following the September 2010, February 2011, June 2011 or December 2011 earthquakes.

A soil class of D (in accordance with NZS 1170.5:2004) should be adopted for the site due to the following reasons:

- No evidence of liquefaction following earthquakes;
- Anticipated depth to bedrock in excess of 100m.



## 6. Critical Structural Weakness

### 6.1 Short Columns

No short columns are present in the structure.

### 6.2 Lift Shaft

The building does not contain a lift shaft.

### 6.3 Roof

The roof is expected to provide nominal diaphragm action to the structure.

### 6.4 Staircases

The building does not contain a staircase.

### 6.5 Site Characteristics

Liquefaction or lateral spreading was absent from post-earthquake photographs, hence the 'site characteristics' were given an 'insignificant' potential in accordance with the NZSEE guidelines.

### 6.6 Vertical irregularity

The timber studs above the concrete masonry wall in the buildings eastern face will provide no lateral restraint out of plane. This results in the roof providing no restraint to the top edge of the wall and the wall not being adequately braced out of plane. This problem has been considered as a 'significant' vertical irregularity.





## 7. Initial Capacity Assessment

### 7.1 % NBS Assessment

The building has had its capacity assessed using the Initial Evaluation Procedure based on the information available. The buildings capacity excluding critical structural weaknesses are expressed as a percentage of new building standard (%NBS) and are in the order of that shown below in Table 2. These capacities are subject to confirmation by a more detailed quantitative analysis.

<u>Item</u>	<u>%NBS</u>
Building excluding CSW's	59
Vertical Irregularity	42

**Table 2 Indicative Building and Critical Structural Weaknesses Capacities based on the NZSEE Initial Evaluation Procedure**

Following an IEP assessment, the building has been assessed as achieving 42% New Building Standard (NBS). Under the New Zealand Society for Earthquake Engineering (NZSEE) guidelines the building is considered Earthquake Risk as it achieves greater than 33% and less than 67% NBS. This score has not been adjusted when considering damage to the structure as all damage observed was relatively minor and considered unlikely to adversely affect the load carrying capacity of the structural systems.

### 7.2 Seismic Parameters

The seismic design parameters based on current design requirements from NZS 1170:2002 and the NZBC clause B1 for this building are:

- Site soil class: D, NZS 1170.5:2004, Clause 3.1.3, Soft Soil
- Site hazard factor,  $Z = 0.3$ , NZBC, Clause B1 Structure, Amendment 11 effective from 1 August 2011
- Return period factor  $R_u = 1.0$ , NZS 1170.5:2004, Table 3.5, Importance level 2 structure with a 50 year design life.

An increased Z factor of 0.3 for Christchurch has been used in line with requirements from the Department of Building and Housing resulting in a reduced % NBS score.

### 7.3 Expected Structural Ductility Factor

A structural ductility factor of 1.25 has been assumed based on the structural system observed and the date of construction.

### 7.4 Discussion of Results

The results obtained from the initial IEP assessment are consistent with those expected for a building of this age and construction type. Although the original buildings original construction date is unknown, the building and was likely constructed during the 1980's and designed to the loading standard current at the time, NZS 4203:1976. The design loads used in accordance with this standard are likely to have



been less than those required by the current loading standard. When combined with the increase in the hazard factor for Christchurch to 0.3, it would be expected that the building would not achieve 100% NBS. Due to the age of the building and the Critical Structural Weakness it is reasonable to expect the building to be classified as potentially Earthquake Risk.



## 8. Conclusions & Recommendations

The building has been assessed to have a seismic capacity in the order of 42% NBS and is therefore potentially Earthquake Risk.

The only damage noted in the building was cracking between construction joints in the walls. This is damage that would not compromise the load resisting capacity of the existing structural systems. Because the building has achieved between 33% and 67% NBS following an initial IEP assessment, no further assessment is required by Christchurch City Council to comply with the building act. However, due to the relatively low score, GHD recommend a detailed seismic assessment is carried out.



## 9. Limitations

### 9.1 General

This report has been prepared subject to the following limitations:

- ▶ No intrusive structural investigations have been undertaken.
- ▶ No intrusive geotechnical investigations have been undertaken.
- ▶ Visual inspections of the foundations were unable to be completed.
- ▶ Visual inspections of the southeast interior were not undertaken as access was restricted.
- ▶ No level or verticality surveys have been undertaken.
- ▶ No material testing has been undertaken.
- ▶ No calculations, other than those included as part of the IEP in the CERA Building Evaluation Report, have been undertaken. No modelling of the building for structural analysis purposes has been performed.

It is noted that this report has been prepared at the request of Christchurch City Council and is intended to be used for their purposes only. GHD accepts no responsibility for any other party or person who relies on the information contained in this report. A specific limitations section.

### 9.2 Geotechnical Limitations

This report presents the results of a geotechnical appraisal prepared for the purpose of this commission, and prepared solely for the use of Christchurch City Council and their advisors. The data and advice provided herein relate only to the project and structures described herein and must be reviewed by a competent geotechnical engineer before being used for any other purpose. GHD Limited (GHD) accepts no responsibility for other use of the data.

The advice tendered in this report is based on a visual geotechnical appraisal. No subsurface investigations have been conducted. An assessment of the topographical land features have been made based on this information. It is emphasised that Geotechnical conditions may vary substantially across the site from where observations have been made. Subsurface conditions, including groundwater levels can change in a limited distance or time. In evaluation of this report cognisance should be taken of the limitations of this type of investigation.

An understanding of the geotechnical site conditions depends on the integration of many pieces of information, some regional, some site specific, some structure specific and some experienced based. Hence this report should not be altered, amended or abbreviated, issued in part and issued incomplete in any way without prior checking and approval by GHD. GHD accepts no responsibility for any circumstances, which arise from the issue of the report, which have been modified in any way as outlined above.



Appendix A  
Photographs

**Photograph 1 Western elevation.**



**Photograph 2 Eastern elevation showing timber stud over concrete masonry wall.**





**Photograph 3 View of the toilet block from the north.**



**Photograph 4 Southern elevation**



**Photograph 5 Mono-pitch roof structure.**



**Photograph 6 Cracking at construction joint.**





**Photograph 7 Cracking at construction joint 2.**



**Photograph 8 Concrete floor slab.**





Appendix B  
CERA Building Evaluation Form

Detailed Engineering Evaluation Summary Data

V1.11

Location		
Building Name:	Toilet - Rimu Park	
Building Address:	Unit No:	Street
Legal Description:	Cnr Buchanans Rd & West Coast Rd	
	Pt RES 321 (RM 84)	
	Degrees	Min Sec
GPS south:	43	30 41.00
GPS east:	172	28 38.00
Building Unique Identifier (CCC):	PRK 1645 BLDG 001	
Reviewer:	Stephen Lee	
CPEng No:	1006840	
Company:	GHD	
Company project number:		
Company phone number:	04 472 0799	
Date of submission:	17/05/2012	
Inspection Date:	20/09/2012	
Revision:	Final	
Is there a full report with this summary?	yes	

Site		
Site slope:	flat	Max retaining height (m):
Soil type:	mixed	Soil Profile (if available):
Site Class (to NZS1170.5):	D	If Ground improvement on site, describe:
Proximity to waterway (m, if <100m):		Approx site elevation (m):
Proximity to clifftop (m, if < 100m):		
Proximity to cliff base (m,if <100m):		

Building		
No. of storeys above ground:		single storey = 1
Ground floor split?	yes	Ground floor elevation (Absolute) (m):
Storeys below ground:		Ground floor elevation above ground (m):
Foundation type:	strip footings	if Foundation type is other, describe:
Building height (m):	2.80	height from ground to level of uppermost seismic mass (for IEP only) (m):
Floor footprint area (approx):		Date of design:
Age of Building (years):		1976-1992
Strengthening present?	no	If so, when (year)?
Use (ground floor):	public	And what load level (%g)?
Use (upper floors):		Brief strengthening description:
Use notes (if required):	Toilet	
Importance level (to NZS1170.5):	IL2	

Gravity Structure		
Gravity System:	load bearing walls	rafter type, purlin type and cladding
Roof:	timber framed	slab thickness (mm)
Floors:	concrete flat slab	overall depth (mm)
Beams:	precast concrete	
Columns:		thickness (mm)
Walls:	partially filled concrete masonry	90

Lateral load resisting structure		
Lateral system along:	partially filled CMU	Note: Define along and across in detailed report!
Ductility assumed, $\mu$ :	1.25	note total length of wall at ground (m):

Period along:  #### enter height above at H31  
 Total deflection (ULS) (mm):   
 maximum interstorey deflection (ULS) (mm):

estimate or calculation?   
 estimate or calculation?   
 estimate or calculation?

Lateral system across:   
 Ductility assumed, μ:   
 Period across:  #### enter height above at H31  
 Total deflection (ULS) (mm):   
 maximum interstorey deflection (ULS) (mm):

note total length of wall at ground (m):   
 estimate or calculation?   
 estimate or calculation?   
 estimate or calculation?

**Separations:**

north (mm):   
 east (mm):   
 south (mm):   
 west (mm):

leave blank if not relevant

**Non-structural elements**

Stairs:   
 Wall cladding:   
 Roof Cladding:   
 Glazing:   
 Ceilings:   
 Services(list):

describe:

**Available documentation**

Architectural   
 Structural   
 Mechanical   
 Electrical   
 Geotech report

original designer name/date:   
 original designer name/date:   
 original designer name/date:   
 original designer name/date:   
 original designer name/date:

**Damage**

Site:  
 (refer DEE Table 4-2)

Site performance:   
 Settlement:   
 Differential settlement:   
 Liquefaction:   
 Lateral Spread:   
 Differential lateral spread:   
 Ground cracks:   
 Damage to area:

Describe damage:   
 notes (if applicable):   
 notes (if applicable):   
 notes (if applicable):   
 notes (if applicable):   
 notes (if applicable):   
 notes (if applicable):

**Building:**

Current Placard Status:

Along

Damage ratio:   
 Describe (summary):

Describe how damage ratio arrived at:

Across

Damage ratio:   
 Describe (summary):

$$Damage\_Ratio = \frac{(\% NBS(before) - \% NBS(after))}{\% NBS(before)}$$

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 e'quakes:	<input type="text" value="42%"/>	42% %NBS from IEP below	If IEP not used, please detail assessment methodology:	<input type="text"/>
	Assessed %NBS after e'quakes:	<input type="text" value="42%"/>			
Across	Assessed %NBS before e'quakes:	<input type="text" value="42%"/>	42% %NBS from IEP below		
	Assessed %NBS after e'quakes:	<input type="text" value="42%"/>			

**IEP** **Use of this method is not mandatory - more detailed analysis may give a different answer, which would take precedence. Do not fill in fields if not using IEP.**

Period of design of building (from above): 1976-1992 h<sub>n</sub> from above: m

Seismic Zone, if designed between 1965 and 1992:  not required for this age of building   
not required for this age of building

	along	across
Period (from above):	0.4	0.4
(%NBS) <sub>nom</sub> from Fig 3.3:	<input type="text" value="16.5%"/>	<input type="text" value="16.5%"/>

Note:1 for specifically design public buildings, to the code of the day: pre-1965 = 1.25; 1965-1976, Zone A = 1.33; 1965-1976, Zone B = 1.2; all else 1.0

Note 2: for RC buildings designed between 1976-1984, use 1.2

Note 3: for buildngs designed prior to 1935 use 0.8, except in Wellington (1.0)

	along	across
<b>Final (%NBS)<sub>nom</sub>:</b>	<input type="text" value="17%"/>	<input type="text" value="17%"/>

**2.2 Near Fault Scaling Factor** Near Fault scaling factor, from NZS1170.5, cl 3.1.6:

	along	across
Near Fault scaling factor (1/N(T,D), <b>Factor A:</b>	<input type="text" value="1"/>	<input type="text" value="1"/>

**2.3 Hazard Scaling Factor** Hazard factor Z for site from AS1170.5, Table 3.3:

	Z <sub>1992</sub> , from NZS4203:1992	<input type="text" value="0.8"/>
Hazard scaling factor, <b>Factor B:</b>	<input type="text" value="3.33333333"/>	

**2.4 Return Period Scaling Factor** Building Importance level (from above):

Return Period Scaling factor from Table 3.1, <b>Factor C:</b>	<input type="text" value="1.00"/>
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<b>2.5 Ductility Scaling Factor</b>	Assessed ductility (less than max in Table 3.2)	along	1.25	across	1.25
	Ductility scaling factor: =1 from 1976 onwards; or = $k_{\mu}$ , if pre-1976, from Table 3.3:		1.00		1.00

Ductility Scaling Factor, **Factor D:** 1.00 1.00

**2.6 Structural Performance Scaling Factor:** Sp: 0.925 0.925

Structural Performance Scaling Factor **Factor E:** 1.081081081 1.081081081

**2.7 Baseline %NBS,  $(NBS\%)_b = (\%NBS)_{nom} \times A \times B \times C \times D \times E$**  %NBS: 59% 59%

Global Critical Structural Weaknesses: (refer to NZSEE IEP Table 3.4)

**3.1. Plan Irregularity, factor A:** insignificant 1

**3.2. Vertical irregularity, Factor B:** significant 0.7

**3.3. Short columns, Factor C:** insignificant 1

**3.4. Pounding potential**  
 Pounding effect D1, from Table to right 1.0  
 Height Difference effect D2, from Table to right 1.0

Therefore, Factor D: 1

**3.5. Site Characteristics** insignificant 1

Table for selection of D1	Severe	Significant	Insignificant/none
	Separation	0<sep<.005H	.005<sep<.01H
Alignment of floors within 20% of H	<b>0.7</b>	<b>0.8</b>	<b>1</b>
Alignment of floors not within 20% of H	<b>0.4</b>	<b>0.7</b>	<b>0.8</b>

Table for Selection of D2	Severe	Significant	Insignificant/none
	Separation	0<sep<.005H	.005<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

<b>3.6. Other factors, Factor F</b>	For $\leq 3$ storeys, max value =2.5, otherwise max value =1.5, no minimum	Along	1.0	Across	1.0
	Rationale for choice of F factor, if not 1		1		1

Detail Critical Structural Weaknesses: (refer to DEE Procedure section 6)

List any:  Refer also section 6.3.1 of DEE for discussion of F factor modification for other critical structural weaknesses

**3.7. Overall Performance Achievement ratio (PAR)** 0.70 0.70

**4.3 PAR x (%NBS)<sub>b</sub>:** PAR x Baseline %NBS: 42% 42%

**4.4 Percentage New Building Standard (%NBS), (before)** 42%

Official Use only:

Accepted By:   
 Date:





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**Document Status**

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