Rangitikei District Council

DETAILED SEISMIC ASSESSMENT

CIVIL DEFENCE BUILDING
46 HIGH STREET, MARTON

15 FEBRUARY 2022

CONFIDENTIAL

Question today
Imagine tomorrow
Create for the future

DETAILED SEISMIC ASSESSMENT

CIVIL DEFENCE BUILDING
46 HIGH STREET, MARTON

WSP
Level 2
49 Victoria Avenue
Palmerston North, New Zealand
+64 6 350 2506
wsp.com/nz

REV	DATE	DETAILS
DRAFT	03/12/2021	For client information and comment
FINAL	15/02/2022	Updated %NBS scores

	NAME	DATE	SIGNATURE
Prepared by:	André Ferreira	29 November 2021	
Reviewed by:	Rudi van Schalkwyk	03 December 2021	
Approved by:	Robert Jeans	03 December 2021	

TABLE OF CONTENTS

EXECUTIVE SUMMARY

WSP has been engaged by *Rangitikei District City Council* (*RDC*) to complete a Detailed Seismic Assessment (DSA) of the "*Civil Defence Building*" building at 46 High Street, Marton. Our assessment has been completed in accordance with the MBIE document "*The Seismic Assessment of Existing Buildings – Technical Guidelines of Engineering Assessments*", July 2017 (the 'Red Book').

The DSA has been instructed following the requirement of RDC to have detailed seismic assessments undertaken of council operated buildings, as to comply with current building codes and standards.

The *Civil Defence Building* has two areas comprising of a workshop and housing area for emergency vehicles, while the other serves as an office and document storage area providing ancillary support to the surrounding Admin, Finance and Assets Buildings located at 46 High Street, Marton.

It is our understating that the *Civil Defence Building* is currently serving as an Emergency Operations Centre (EOC) and is therefore considered to be an Importance Level 4 **(IL4)** structure, in accordance with the joint Australian/New Zealand standard Structural Design Actions Part 0, AS/NZS 1170.0:2002. It has hence been assessed for actions from a seismic event causing 1-in-2500 year (ULS) ground shaking.

The design and construction date of the building is unknown however it is estimated that construction took place circa 1952. Previous records indicate that the current storage/archive area was added in 1982 with an approximate floor plan area of 11 m x 4.32m. It is a single-storey building constructed from reinforced concrete (RC) walls, supporting a timber trussed roof (with lightweight steel sheeting). The RC walls and internal floor (slab on ground) is supported on concrete strip footings.

The results of the DSA find the building's *Earthquake Rating* to be **27%*NBS* (IL4)** when assessed in accordance with the Guidelines. Therefore, this is a **grade D building** following the New Zealand Society for Earthquake Engineering (NZSEE) grading scheme. **Grade D** buildings represent a risk to occupants 25 times greater than expected for a new building, indicating a **high life-safety risk** exposure.

A building with an *Earthquake Rating* less than 34%NBS when assessed in accordance with the Seismic Assessment Guidelines (the 'Red book') fulfils one of the requirements for the Territorial Authority to consider it to be an Earthquake-Prone Building (EPB) in terms of the Building Act 2004. A building rating less than 67%NBS is considered as an Earthquake-risk Building by the NZSEE. The act requires all seismic strengthening work to be completed within 7.5 years for EPB rated buildings and 15 years for buildings rated above the EPB threshold. The priority classification of the Civil Defence Building is to the discretion of the Territorial Authority.

The assessment identified the following structural weaknesses in the building:

Structural Component/System	Seismic Score (%NBS – IL4)	Structural Weakness Type	Mode of Failure
Building Lateral Drift (SLS)	71%		Deflection limit
Grid A Footing	70%	SW	Flexural capacity
Grid D Footing	77%	SW	Soil bearing capacity
Grid G Footing	95%	SW	Soil bearing capacity
Grid 5 Footing	80%	SW	Flexural capacity
Grid A RC Wall (out-of-plane)	100%		
Grid A RC Wall (out-of-plane)	100%		
Grid D RC Wall (out-of-plane)	100%		
Grid D RC Wall (out-of-plane)	74%	SW	Flexural capacity (horizontal)
Grid E RC Wall (out-of-plane)	100%		
Grid E RC Wall (out-of-plane)	100%		
Grid F Masonry Wall (out-of-plane)	27%	CSW	Flexural capacity (vertical)
Grid G Masonry Wall (out-of-plane)	39%	SW	Flexural capacity (vertical)
Grid G Masonry Wall (out-of-plane)	47%	SW	Flexural capacity (horizontal)
Grid G RC Wall (out-of-plane)	100%		
Grid 4 RC Beam (EQx - vertical)	100%		
Grid 4 RC Beam (EQx - horizontal)	100%		
Grid 4 RC Beam (EQy - horizontal)	100%		
Gantry Beam (EQx - out-of-plane)	100%		
Gantry Beam (EQy - out-of-plane)	77%	SW	Flexural capacity

***Highlighted values indicate final scores adjusted after completion of rebar scanning.*

<u>Based on the outcomes of our assessment, we recommend strengthening the building to achieve a seismic rating 67%*NBS* (IL4).</u>

The assessment shows that the performance of the building is limited by the out-of-plane flexural capacity of the masonry wall in the storage/archive area. In terms of strengthening, the score can be significantly improved by installing transom beams. It is however left to the discretion of the client to decide if strengthening of the elements are required. Additionally, the critical structural weakness (CSW) listed above is not considered to inform the overall performance rating of the primary lateral and gravity load resisting system, because it is an infrequently accessed part of the building.

A technical summary of the DSA is presented in Appendix A.

1 PROJECT BACKGROUND

1.1 INTRODUCTION

WSP has been engaged by *Rangitikei District Council* (RDC) to complete a Detailed Seismic Assessment (DSA) of the "*Civil Defence Building*" at 46 High Street, Marton. This report summarises the inputs, methodology and findings of the assessment.

The DSA has been instructed following RDC's requirement to have detailed seismic assessments undertaken of council operated buildings, so as to comply with current building codes and standards.

1.2 DSA SCOPE AND PURPOSE

A DSA is one of two forms of *Engineering Assessment* (the other being an ISA) permitted by the Earthquake Prone Building Methodology of the Ministry of Business, Innovation and Employment to determine a building's *Earthquake Rating* (see Section 1.3) as part of the system for managing earthquake earthquake-prone buildings.

In July 2017 the latest revision of the "The Seismic Assessment of Existing Buildings – Technical Guidelines for Engineering Assessments" was issued. This is a document managed jointly by the Ministry of Business, Innovation and Employment, the Earthquake Commission, the New Zealand Society for Earthquake Engineering, the New Zealand Structural Engineering Society and the New Zealand Geotechnical Society. The part of the technical guidelines covering concrete buildings is Section C5. This section is also known to the industry as the "C5 Red Book".

In November 2018 an updated revision to the technical guidelines Section C5 was issued. This is known to the industry as the revised guidelines or the "C5 Yellow Book". The C5 Yellow Book included substantial updates to the main body of the guidelines for the assessment of the primary structure for concrete buildings and included updates to several of the appendices, including the precast floor section (now appendix C5E), of the guidelines. The updates to the guidelines included lessons learned from the recent University research and the 2016 Kaikoura Earthquake as well as findings from the MBIE "Statistics House" Investigation.

A DSA aims to achieve an understanding of the likely behaviour of a building in earthquakes by:

- Quantifying the strength and deformation capacities of the various structural elements, and;
- Checking the building's structural integrity against the loads/deformations (demands) that would be used for the design of a similar building on the same site, to the latest building codes and standards.

A building with an *Earthquake Rating* less than 34%NBS fulfils one of the requirements for the Territorial Authority to consider it to be an Earthquake-Prone Building (EPB) in terms of the Building Act 2004. For concrete buildings, the C5 Red Book must be utilised when determining the earthquake-prone status. A building rating less than 67%NBS is considered as an Earthquake-risk Building by the New Zealand Society of Earthquake Engineering (NZSEE).

Table 1 shows the grading system developed by the NZSEE for communicating the relative risk of a building compared to a that of a similar new building on the same site, based on the *Earthquake Rating* determined by a DSA.

Table 1: NZSEE grading system and relative risk description.

Percentage of New Building Standard (*%NBS*)	Alpha rating	Approx. risk relative to a new building	Life-safety risk description
>100 A+	A+	Less than or comparable to	Low risk
80-100	A	1-2 times greater	Low risk
67-79	B	2-5 times greater	Low to Medium risk
34-66	C	5-10 times greater	Medium risk
20 to <34	D	10-25 times greater	High risk
<20	E	25 times greater	Very high risk

1.3 %NBS CALCULATION

The *%NBS Earthquake Rating* for a building is found by a DSA from the following equation:

%NBS = Ultimate capacity (seismic) x 100% / ULS seismic demand

The Ultimate capacity (seismic) of a building is taken as the minimum of:

- The probable capacity of the primary lateral structure of the building, including the impact of geotechnical issues, or;
- The probable capacity of structural elements, the failure of which could lead to a significant life safety hazard, or;
- The capacity of any Severe Structural Weaknesses (refer Section 1.4), or;
- The probable capacity of Secondary Structure and Non-Structural (SSNS) elements.

The items above are only considered should failure result in a significant life safety hazard. This is generally considered as failures that would result in collapse of all or part of a building and that would reasonably affect a number of people.

1.4 STRUCTURAL WEAKNESSES

A structural weakness (SW) is an aspect of the building structure and/or the foundation soils that scores below 100%*NBS* and the failure of which would be considered a significant life safety hazard.

The critical structural weakness (CSW) is the lowest scoring SW of a building. The %*NBS* of the CSW will be the %*NBS* of the building.

Severe structural weaknesses (SSW's) are a predefined list of SW's in the Guidelines that are not readily amenable to reliable assessment using usual methods. The Guidelines require the calculated probable capacity of these elements/systems to be halved.

2 SOURCES OF BUILDING DATA

The following documents and information were used in the assessment of the Assets Building.

2.1 DRAWING, CALCULATIONS & REPORTS

<u>Drawings:</u>

- Rangitikei County Council: Worksop extensions (12/2/1982); plan 1 of 4
- Rangitikei County Council: Worksop extensions (12/2/1982); plan 2 of 4
- Rangitikei County Council: Worksop extensions (12/2/1982); plan 3 of 4
- Rangitikei County Council: Worksop extensions (12/2/1982); plan 4 of 4

<u>Reports:</u>

- RDC Building Assessments: Earthquake, Fire & Ventilation: MWH Report no. Z1504404 *dated* 26 February 2008

2.2 SITE GEOTECHNICAL INFORMATION

a) Site sub-soil Class

In the absence of a geotechnical report, conservatively a classification of site subsoil class D has been assumed, and a natural site period of 0.4 seconds has been used to develop a spectral response curve for this site in Marton.

b) Liquefaction

No known faults are mapped within 10 km of the site and the site is assumed to have a 'low' liquefaction induced ground damage potential. [*Data based on page 8 of "Update of hazard Information for 2015 Lifelines Risk & Responsibilities Report" published by GNS Science in the "GNS Science Consultancy Report 2016/40 May 2016"*]

c) Soil bearing capacity

Bearing capacity has been assumed to have 'Good ground' conditions to NZS:3604.

d) Bounding properties

The building does not have any other immediate buildings adjacent to it.

3 SITE AND BUILDING DECRIPTION

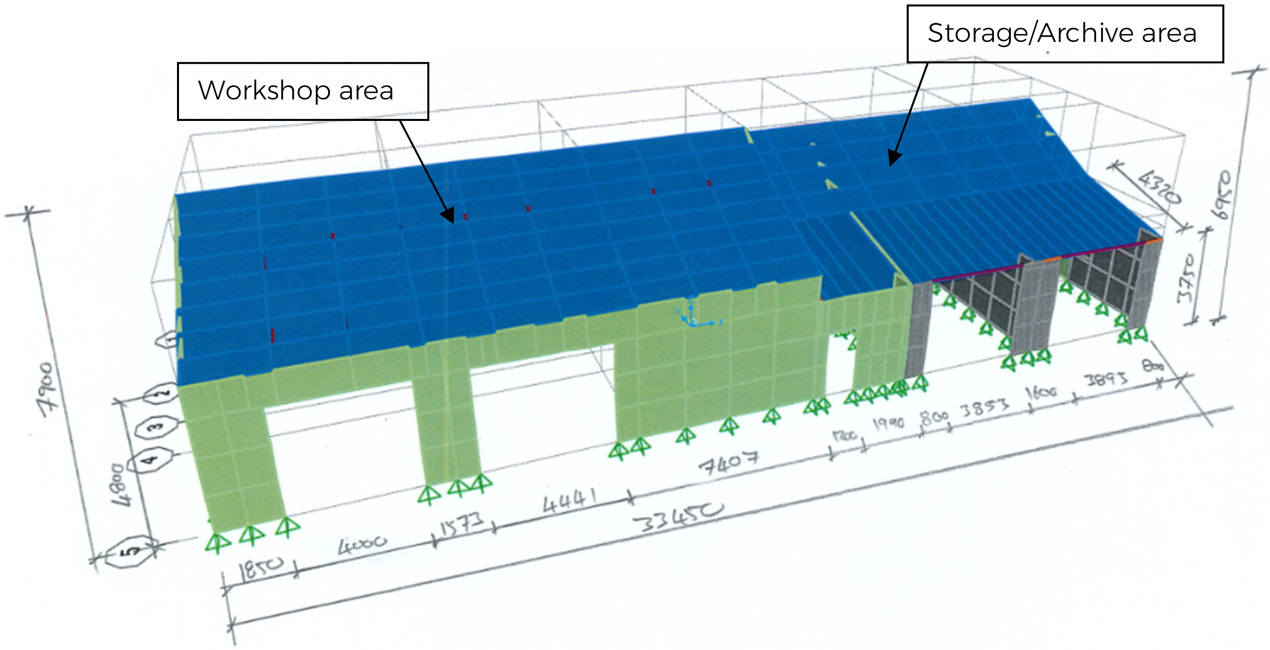
3.1 SITE

The building is located at 46 High Street, Marton.

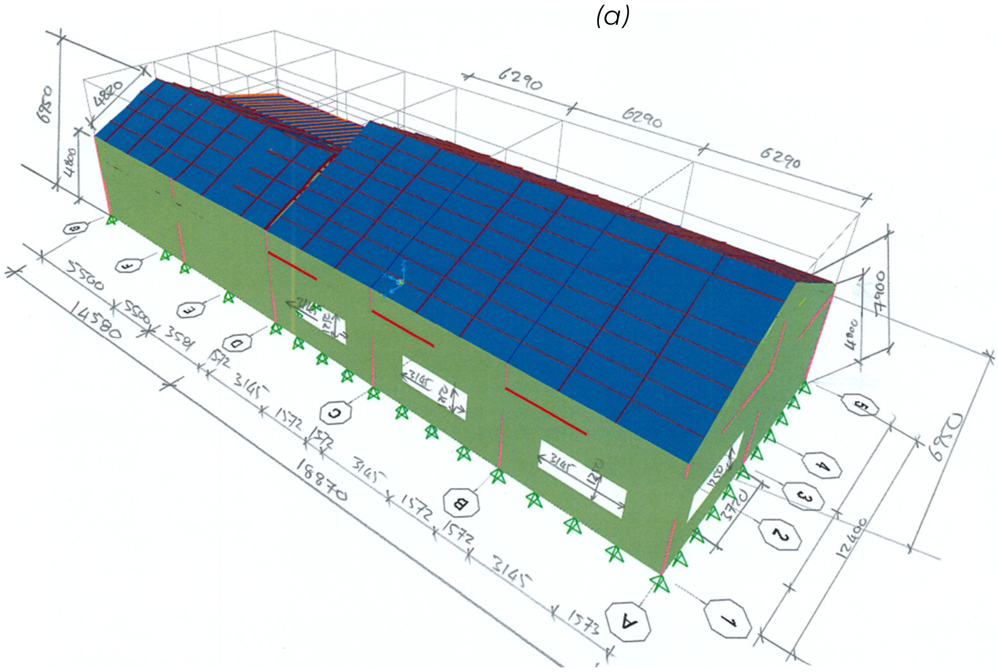
Figure 1: Site layout

3.2 BUIILDING SIZE AND USAGE

The building is approximately 33.45m long and 12.4 m wide. The floor areas of the building are provisioned as per the following: workshop floor area of 234 m^2; 40 m^2 office area and 136 m^2 storage/archive area; with a total ground floor area of 410 m^2. Additionally, the mezzanine floor in the archive area is approximately 89 m^2. Currently the workshop is used for keeping emergency vehicles locked behind closed doors, while the storage area/archive area is used for keeping hardcopy documents and files. At present, the mezzanine floor is not used for storage, but potentially may be used for storage in the future.



(a)



(b)

Figure 2: Building Layout: (a) Front Elevation & (b) Back Elevation

Original construction drawings were not available, however the following observations were made:

- From the 1982 alterations drawing set, RC walls are indicated as 150 mm thick; and concrete floor assumed to be 150 mm thick with nominal mesh 665 reinforcement.
- A gantry crane and trolley was observed, assuming occasional use.
- Masonry walls located in the archive/storage area are 190 mm thick reinforced with D12@600 crs – Vertically; and D12@800 crs – Horizontally.
- Foundation ground beam is 500 x 500 mm, reinforced with 2D12's Top and Bottom and D12 stirrups @ 250 mm crs.

3.3 PHOTOGRAPHIC DETAIL

The following photos present the exterior and interior aspects of the building.

Figure 3: Workshop - Front elevation

Figure 4: Building usage areas

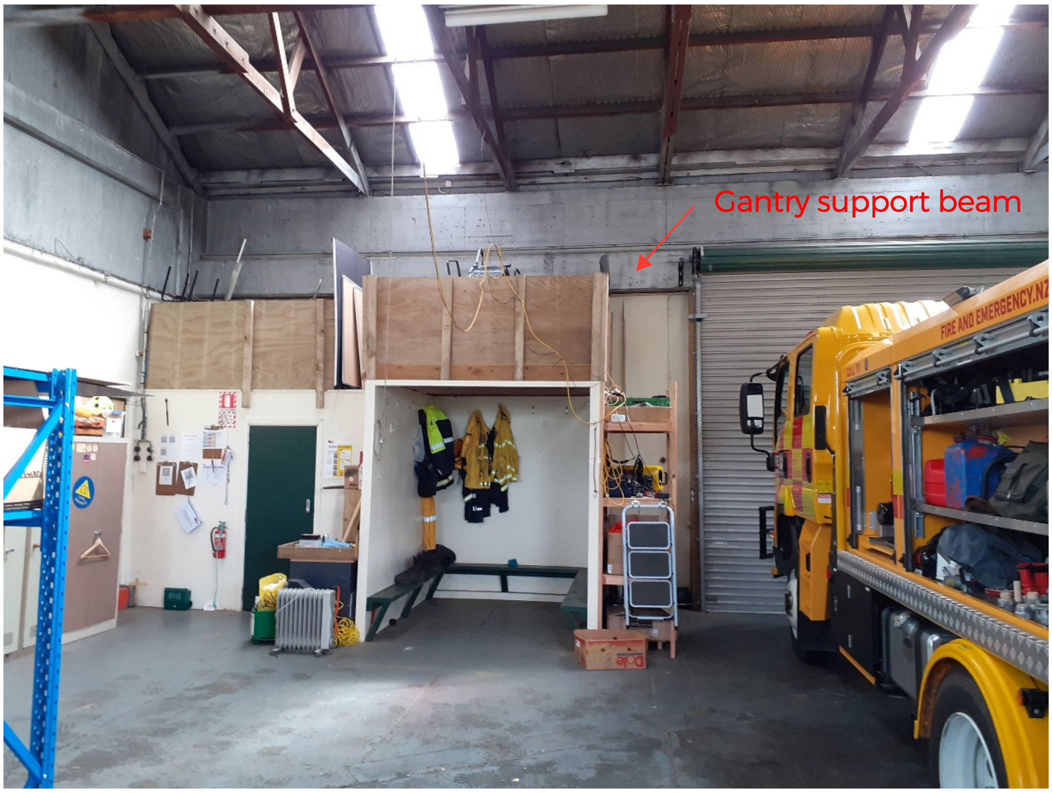


Figure 5: Workshop internal area - front wall elevation

Figure 6: Workshop internal area - back wall elevation

Figure 7: Workshop gantry

Figure 8: Workshop roof trusses

Figure 9: Archive area

Figure 10: Storage area – front wall elevation

Figure 11: Mezzanine floor

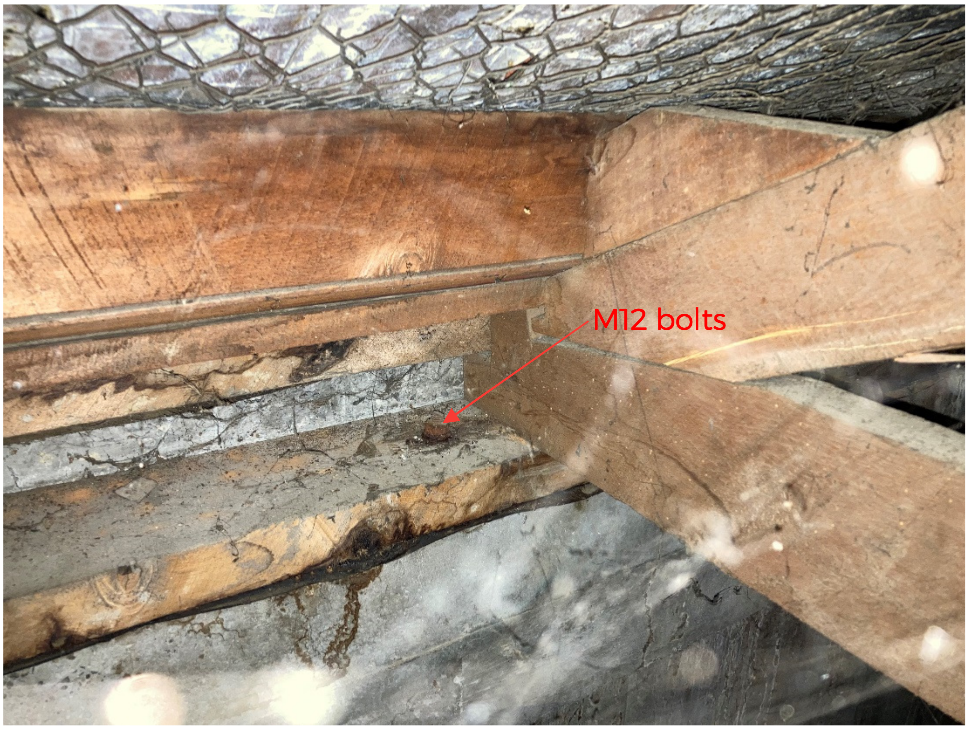


Figure 12: Timber truss connection to RC wall above mezz. floor

Figure 13: Mezzanine floor – 250UB31.4 with 200x50mm floor joists @ 300mm crs

3.4 STRUCTURAL SYSTEMS

Roof:

Timber roof trusses (and 2 steel roof trusses in the workshop area) are supported on the 150 mm thick RC walls. No ceiling bracing/diaphragm is present, however the roof system may be considered as a flexible diaphragm as commonly encountered in low-rise buildings like the Civil Defence Building. The RC walls are considered to be a stiff box-section and therefore it is considered that the RC walls provide sufficient robustness/stiffness against lateral movement of the roof.

RC Walls:

~~Reinforcement layouts/drawings of the RC walls were not available. The 150 mm thick RC walls are assumed to be singly reinforced and reinforcement quantities in the walls assumed to meet the minimum reinforcement values based on a previous version of the concrete code (NZS 3101:1995).~~

~~Though this code is considered “modern” when compared to the building code used in the 1950’s, it provides a more accurate reflection of the %NBS scores derived from the use of these steel areas in flexural and shear calculations. The assumed reinforcement quantities are D10@300 mm crs – vertical and D12@300 mm crs – horizontal.~~

~~**It is recommended that, in order to verify %NBS scores for wall flexural and shear capacities, rebar scanning be undertaken.**~~

Rebar scanning confirmed walls to be 170mm thick. Vertical reinforcement to each face of the wall is R16@300 mm crs with R12@300 mm crs horizontal bars (each face).

Foundations:

RC walls are cast monolithically with 150mm thick floor on perimeter footings with dimensions of 500x500mm and reinforced with 2D12 top and bottom and D12 stirrups@250 mm crs.

4 ASSESSMENT INPUTS

4.1 MATERIAL PROPERTIES

Lower bound material properties have been assumed and are presented below.

Table 4-1: Probable strength parameters for concrete

Description	Values
Foundation Concrete compressive strength, f'_c	30 MPa
Walls Concrete compressive strength, f'_c	40 MPa

Table 4-2: Probable material strength for timber

Description	Values
Radiate pine (m/c ≤: 16%):	
Bending	24.4 MPa
Compression parallel to grain	24.2 MPa
Compression perpendicular to grain	8.9 MPa
Tension parallel to grain	12.2 MPa

Table 4-3: Probable material strength for masonry

Description	Values
Compressive strength, f'_m	12 MPa
Modulus of Elasticity, E'_m	10800 MPa

Table 4-4: Probable material strength for steel reinforcement

Description	Values
Mesh Yield strength (pre-1960's), f'_y	284 MPa
Rebar Yield strength (pre-1960's), f'_y	338 MPa
Rebar Yield strength (post-1970's), f'_y	275 MPa
Modulus of Elasticity, E	200x10^3 MPa
Strain at tensile capacity	0.1

Table 4-5: Probable material strength for steel plate

Description	Values
Yield strength, f'_y	275 MPa
Modulus of Elasticity, E	200x10^3 MPa

4.2 SEISMIC LOADING

In accordance with the Guidelines, the building has been subject to Ultimate Limit State (ULS) seismic demands that would be used to design a similar new building on the same site.

The current usage of the building means it is Importance Level 4 in accordance with the joint Australian/New Zealand standard Structural Design Actions Part 0, AS/NZS 1170.0:2002. A new building on this site would typically have a design life of 50 years.

The design life and importance level mean ULS demands results from a seismic event causing 1-in-2500 year ground shaking.

The seismic loading parameters for the assessment are presented in Table 4-6.

Table 4-6: Seismic loading parameters

Parameter	Value	Remarks
Site sub-soil category	D	Assumed
Site hazard factor, Z	0.30	Marton
Return period factor, R_u	1.8	1-in-2500 year ground shaking
Near fault factor, N(T,D)	1.0	APE > 1/250
Site period	0.4 sec	
Ductility factor, μ	1.25	
Structural performance factor, S_p	0.925	
Annual probability of exceedance	1/2500	ULS

4.3 ANALYSIS METHDOLOGY

An analysis model of the single storey building was created and analysed using SAP2000 v23.1.0 using a force-based approach (equivalent static method). The automated lateral (seismic) load pattern utilizes seismic parameters based on NZS1170.5 (2004). Orthogonal directions (EQx & EQy) were analysed with 10% diaphragm eccentricity ratio and 30% orthogonal load combination concurrency.

Due to the site soil conditions (class D), SAP2000 recommends using a period of 0.6 seconds to obtain reasonable analysis output results. Base shear results of the automated equivalent static force analysis were compared to hand calculated base shear values and found to be within an acceptable range of each other.

Shell elements with corresponding material properties and thicknesses were used to depict structural walls, while beams and columns were modelled using frame elements. A non-linear analysis was performed for the seismic load combinations, however this analysis type is primarily used to take into account second-order effects such as P-Δ interaction. The overall structural behaviour of the building is still limited to an elastic response as it is unlikely to achieve any non-linear material response. This is due to the inherent stiffness of the walls and lack of ductility considerations throughout the building's construction details.

The building's seismic performance was assessed in accordance with the appropriate analysis procedures stipulated in Part C2 and in accordance with the material properties stipulated in Part C5.

5 ASSESSMENT RESULTS

5.1 TABULATED FINDINGS

Table 5.1 lists the %NBS rating for all structural elements assessed.

Table 5.1: Assessment results for individual components and/or systems (IL4).

Structural Component/System	Seismic Score (%NBS – IL4)	Structural Weakness Type	Mode of Failure
Building Lateral Drift (ULS)	100%		
Building Lateral Drift (SLS)	71%		Deflection limit
Grid A Footing	68%	SW	Soil bearing capacity
Grid A RC Wall	100%		
Grid D Footing	77%	SW	Soil bearing capacity
Grid D RC Wall	100%		
Grid E Footing	100%		
Grid E RC Wall	100%		
Grid F Footing	100%		
Grid F Masonry Wall	100%		
Grid G Footing	95%	SW	Soil bearing capacity
Grid G RC Wall	100%		
Grid 1 Footing	100%		
Grid 1 RC Wall	100%		
Grid 5 Footing	80%	SW	Flexural capacity
Grid 5 RC Wall	100%		
Grid A RC Wall (out-of-plane)			
Flexure (vertical)	100%		
Flexure (horizontal)	100%		
Grid D RC Wall (out-of-plane)			
Flexure (vertical)	100%		
Flexure (horizontal)	74%	SW	Flexural capacity (horizontal)
Grid E RC Wall (out-of-plane)			
Flexure (vertical)	100%		
Flexure (horizontal)	100%		
Grid F Masonry Wall (out-of-plane)			
Flexure (vertical)	27%	CSW	Flexural capacity (vertical)
Flexure (horizontal)	100%		
Grid G Masonry Wall (out-of-plane)			
Flexure (vertical)	39%	SW	Flexural capacity (vertical)
Flexure (horizontal)	47%	SW	Flexural capacity (horizontal)

Grid G RC Wall (out-of-plane)			
Flexure (vertical)	100%		
Flexure (horizontal)	100%		
Grid 4 RC Beam (out-of-plane)			
Flexure (EQx - vertical)	100%		
Flexure (EQy – vertical)	100%		
Flexure (EQx -horizontal)	100%		
Flexure (EQy - horizontal)	100%		
Gantry RC Beams (out-of-plane)			
Flexure (EQx)	100%		
Flexure (EQy)	77%	SW	Flexural capacity
RC Walls Shear (out-of-plane)	100%		
Timber Trusses	100%		
Steel Trusses	100%		

****Highlighted values indicate final scores adjusted after completion of rebar scanning.*

Table 5.2: Assessment results for individual components and/or systems based on IL3.

Structural Component/System	Seismic Score (%NBS – IL3)	Structural Weakness Type	Mode of Failure
Building Lateral Drift (SLS)	100%		
Grid D RC Wall (out-of-plane)	100%		
Grid F Masonry Wall (out-of-plane)	45%	SW	Flexural capacity (vertical)

5.2 COMMENTARY ON SEISMIC RISKS

The results of the DSA find the building's *Earthquake Rating* to be **27%*NBS* (IL4)**. Therefore, this is a **grade D building** following the NZSEE grading scheme.

NZSEE guidelines state the relative risk of a grade D building compared to that of a similar new building on the same site is **10-25 times**. This indicates a **High life-safety risk exposure**.

The assessment shows that the governing performance rating comes as a result of the out-of-plane flexural capacity of the masonry wall along gridline F being exceeded. ~~It can be seen from the tabulated results above that various other walls have their flexural capacities exceeded. This trend is symptomatic of the building's current assumed reinforcement details (except in the case of the masonry walls where the reinforcement is known). As noted previously in the report, actual reinforcement quantities in the RC walls are unknown and have therefore been assumed on a reasonable basis. It is recommended that rebar scanning be performed to establish the actual reinforcement content in the walls.~~

Additionally, on request by Rangitikei District Council, the building was re-assessed using IL3 criteria. The results are presented in Table 5.2.

Indicated in Table 5.2 are %NBS scores of the typically lowest scoring elements presented in Table 5.1. It can be seen that lateral drifts significantly improve as can be expected for SLS lateral drift limits using IL3 parameters. The %NBS scores for the flexural capacities of the masonry walls do not significantly improve.

5.3 RECOMMENDATIONS

Strengthening of the walls to achieve minimum 67%NBS is recommended~~. Rebar scanning of the reinforced concrete walls should also be undertaken to determine actual reinforcement quantities in the wall and thereby ascertain the true %NBS score.~~

Strengthening of the masonry wall to 67%NBS can easily be achieved with available retrofit options. It should be noted that the masonry walls are located in the storage/archive area where people do not tend to congregate. These walls are unlikely to fail catastrophically and would instead exhibit signs of cracking should it be subjected to heavy ground shaking. Therefore, the likelihood of these walls causing serious injury to persons or death is very low.

Optionally, if the IL4 status is replaced with IL2, the expected building performance assessed as IL2 should improve the %NBS score.

6 SEISMIC RETROFIT OPTIONS

6.1 GENERAL APPROACH

Seismic retrofit options for the structural weaknesses identified in the report are described below. Minimal strengthening would be required to achieve 67%NBS –options include, but are not limited to the following:

Masonry Walls:

- Install steel transom beams (typically PFC section) along length of walls that tie back into return walls

~~**Reinforced Concrete Walls~~:

- ~~Install fibre-reinforced-polymer (FRP) to affected area, or~~
- ~~Install steel transom beams (typically PFC section)~~

~~**Reinforced Concrete Gantry Beams~~:

- ~~Install fibre-reinforced-polymer (FRP) to affected area, or~~
- ~~Install steel transom beams (typically PFC section)~~

~~***NOTE: reinforcement scanning to be confirmed with rebar scanning areas to inform extent of strengthening required.*~~

***NOTE: reinforcement confirmed with rebar scanning and %NBS score adjusted accordingly as per this revised report.*

7 LIMITATIONS

This report ('Report') has been prepared by WSP New Zealand Limited ('WSP') exclusively for Rangitikei District Council ('Client') in relation to conducting a Detailed Seismic Assessment ('Purpose') and in accordance with the Short Form Agreement with PNCC dated **13 September 2021**. ('Agreement'). The findings in this Report are based on and are subject to the assumptions specified in the Report and that of WSP's Offer of Services dated **31 August 2021**. WSP accepts no liability whatsoever for any use or reliance on this Report, in whole or in part, for any purpose other than the Purpose or for any use or reliance on this Report by any third party.

In preparing this Report, WSP has relied upon data, surveys, analyses, designs, plans and other information ('Client Data') provided by or on behalf of the Client. Except as otherwise stated in this Report, WSP has not verified the accuracy or completeness of the Client Data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in this Report are based in whole or part on the Client Data, those conclusions are contingent upon the accuracy and completeness of the Client Data. WSP will not be liable for any incorrect conclusions or findings in the Report should any Client Data be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP.

APPENDIX A – TECHNICAL SUMMARY

1. Building Information	
Building Name/ Description	RDC Civil Defence Building
Street Address	46 High Street Road, Marton
Territorial Authority	Rangitikei District Council
No. of Storeys	1
Area of Typical Floor (approx.)	±410m²
Year of Design (approx.)	Original construction, circa 1950's; Alterations, circa 1982.
NZ Standards designed to	Unknown
Structural System including Foundations	Lightweight timber truss roof (considered as flexible ceiling diaphragm) on 150 mm thk RC walls supported on 500x500 mm perimeter concrete footing.
Does the building comprise a shared structural form or shares structural elements with any other adjacent titles?	No
Key features of ground profile and identified geo-hazards	Level ground. No hazards.
Previous strengthening and/ or significant alteration	No previous strengthening. Alterations carried out in 1982 – extension of storage area by adding masonry walls and timber mezzanine floor with lightweight lean-to roof.
Heritage Issues/ Status	None.
Other Relevant Information	n/a

<table>
<tr><th colspan="2">2. Assessment Information</th></tr>
<tr><td>Consulting Practice</td><td>WSP New Zealand Ltd.</td></tr>
<tr><td>CPEng Responsible, including:
• Name
• CPEng number
• A statement of suitable skills and experience in the seismic assessment of existing buildings[1]</td><td>Rudi van Schalkwyk (CPEng 1166463) - Senior Structural Engineer.

Rudi has 14 years of combined consulting and construction experience and have designed a range of structures across multiple occupancies. He has undertaken numerous detailed seismic assessments across a wide range of engineering projects.</td></tr>
<tr><td>Documentation reviewed, including:
• date/ version of drawings/ calculations[2]
• previous seismic assessments</td><td><u>Drawings:</u>
— Rangitikei County Council: Worksop extensions (12/2/1982); plan 1 of 4
— Rangitikei County Council: Worksop extensions (12/2/1982); plan 2 of 4
— Rangitikei County Council: Worksop extensions (12/2/1982); plan 3 of 4
— Rangitikei County Council: Worksop extensions (12/2/1982); plan 4 of 4
<u>Reports:</u>
— RDC Building Assessments: Earthquake, Fire & Ventilation: MWH Report no. Z1504404 dated 26 February 2008</td></tr>
<tr><td>Geotechnical Report(s)</td><td>None</td></tr>
<tr><td>Date(s) Building Inspected and extent of inspection</td><td>03 November 2021: Visual inspection of building (internal and external).</td></tr>
<tr><td>Description of any structural testing undertaken and results summary</td><td>None</td></tr>
<tr><td>Previous Assessment Reports</td><td>RDC Building Assessments: Earthquake, Fire & Ventilation: MWH Report no. Z1504404 dated 26 February 2008</td></tr>
<tr><td>Other Relevant Information</td><td>n/a</td></tr>
</table>

[1] This should include reference to the engineer's Practice Field being in Structural Engineering, and commentary on experience in seismic assessment and recent relevant training

[2] Or justification of assumptions if no drawings were able to be obtained

3. Summary of Engineering Assessment Methodology and Key Parameters Used	
Occupancy Type(s) and Importance Level	Workshop and storage/archive area. Importance level 4 Approximately 6 persons
Site Subsoil Class	D
Summary of how Part C was applied, including: • the analysis methodology(s) used from C2 • other sections of Part C applied	- Force-based assessment following the equivalent static analysis for the primary lateral structure per Part C2 of the guidelines. - Part C5: Concrete Buildings
Other Relevant Information	n/a

4. Assessment Outcomes	
Assessment Status (Draft or Final)	Final
Assessed %*NBS* Rating	27 %NBS (IL4)
Seismic Grade and Relative Risk (from Table A3.1)	Grade D building compared to that of a similar new building on the same site is 10-25 times. This indicates a high life-safety risk exposure.
Comment on the nature of Secondary Structural and Non-structural elements/ parts identified and assessed	n/a
Describe the Governing Critical Structural Weakness	Out-of-of-plane flexural capacity of reinforced masonry wall
If the results of this DSA are being used for earthquake prone decision purposes, and elements rating <34%NBS have been identified (including Parts)[3]:	**Engineering Statement of Structural Weaknesses and Location** • ~~Flexural capacity of reinforced concrete (RC) and masonry walls exceeded.~~ • Flexural capacity of reinforced concrete (RC) beams exceeded.
Recommendations	As per the purpose of this DSA and described in this report: • Strengthening of the walls and beams to achieve a recommended minimum 67%NBS

[3] If a building comprises a shared structural form or shares structural elements with other adjacent titles, information about the extent to which the low scoring elements affect, or do not affect the structure.