Detailed Seismic Assessment

Waikari Memorial Hall

Prepared for Hurunui District Council

501917

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Quality Control Certificate

Eliot Sinclair & Partners Limited

eliotsinclair.co.nz

Action	Name	Signature	Date
Prepared by:	Simon Macdonald BSc (Hons), MEngNZ		1st February 2021
Reviewed by:	Harry Zhang BE(Hons), CPEng, CMEngNZ		1st February 2021
Status:	V1		
Release date:	01/02/2021		
Reference no:	501917		
Distributed to:	Hurunui District Council		

Limitations

This report has been prepared for Hurunui District Council *according to their instructions and for the particular objectives described in this report. The information contained in this report should not be used by anyone else or for any other purposes.*

Contents

Executive Summary

Background

Eliot Sinclair & Partners Limited (Eliot Sinclair) has been engaged by Hurunui District Council to undertake a Detailed Seismic Assessment (DSA) of the Memorial Hall building at Waikari, North Canterbury. This report has been prepared to summarise the seismic assessment and the associated results.

Building Description

The building is principally a single storey community hall with reinforced concrete walls to the main building and an unreinforced store room and ablutions extension to the west elevation. The building's floor is principally a raised timber floor with perimeter concrete foundation. The roof is comprised of lightweight steel corrugate cladding, supported on sarking with timber purlins then supported on timber trusses. The timber roof trusses span between the walls.

Assessed Seismic Rating

Based on the results of the seismic assessment, the building has a seismic rating of less than 20% of new building standard (NBS) for an importance level 2 building as defined by NZS1170.0:2002. The building is therefore categorized as a Grade E building following the New Zealand Society for Earthquake Engineering (NZSEE) grading scheme, refer Section 6 of this report. Grade E buildings represent a life safety risk to building occupants equivalent to 25 times greater than expected for a new building, indicating a Very High earthquake risk exposure.

A building with a seismc rating less than 34%NBS is considered to be an Earthquake-Prone Building in terms of the Earthquake-Prone Buildings Amendment Act 2016. The Waikari Memorial Hall building is therefore categorized as an Earthquake-Prone Building.

The seismic capacity of the building is limited by the in plane capacity of the roof diaphragm when taking the out of plane wall loading in the 'across' direction. We also note the cracking to the upper level of the western concrete wall as a limiting factor in it's current, damaged state.

Recommendations

a) Eliot Sinclair & Partners supports the recommendation of the NZSEE that it is desirable to seismically strengthen earthquake risk buildings to as near as reasonably practical to that of a new building; but, as a minimum, seismic improvements should achieve at least 67%NBS.

b) As requested by the client, we have prepared the 34%NBS seismic strengthening concept. Please refer to Appendix B.

c) This executive summary is a limited précis of our observations and conclusions. We recommend that this report is read in full. Where any question arises as to the scope or interpretation of the seismic assessment for this building Eliot Sinclair & Partners Ltd should be consulted.

1. Introduction

Eliot Sinclair & Partners Limited (Eliot Sinclair) has been engaged by Hurunui District Council to undertake a Detailed Seismic Assessment (DSA) of the Memorial Hall building located in Waikari, North Canterbury.

This DSA summarised in this report, has been undertaken generally in accordance with the EQ-Assess guidelines "The Seismic Assessment of Existing Buildings" issued July 2017.

The purpose of undertaking the DSA is to quantitatively establish the approximate ultimate seismic structural capacity of the existing building with a focus on life safety rather than damage avoidance.

1.1. Scope of Assessment

The scope of work undertaken by Eliot Sinclair includes:

a) Review of relevant information on the building which has been provided to Eliot Sinclair, including:

   i) Drawings, specifications and building reports obtained from the council's property file.

b) Undertake site inspections of the property for the purpose of identifying:

   i) The nature and general extent of earthquake damage to the building.

   ii) Other conditions that could impact on the seismic performance of the building.

c) Analyse the primary building structural systems based on the information gained from the review of the drawings and knowledge of the detailing used for structures of this era.

d) Quantitative evaluation of the capacity of the critical structural elements of the building and the seismic demands (internal forces and ductility) on these elements, as derived from the analytical models.

e) Produce a report summarising the findings of the DSA.

1.2. Limitations

a) This report has been prepared by Eliot Sinclair & Partners at the request of our Client and is exclusively for our Client's use for the purpose for which it is intended in accordance with the agreed scope of work. Eliot Sinclair & Partners accepts no responsibility or liability to any third party for any loss or damage whatsoever arising out of the use of or reliance on this report by that party or any party other than our Client.

b) The inspections of the building discussed in this report have been restricted to those required to assist in the structural assessment of the building structure for seismic loads only. This assessment does not consider gravity or wind loading or cover building services or fire safety systems, or the building finishes, glazing system or the weather tightness envelope.

c) Eliot Sinclair & Partners have not undertaken an assessment of the in-ceiling ducting, services and plant. We have also not checked whether tall or heavy furniture has been seismically restrained or not. These issues are outside the scope of this assessment but could be the subject of further investigation.

d) Unless otherwise noted within this report, no geotechnical, subsurface or slope stability assessments have been undertaken.

e) Eliot Sinclair & Partners is not able to give any warranty or guarantee that all possible damage, defects, conditions or qualities have been identified. The work done by Eliot Sinclair & Partners and the advice given is therefore on a reasonable endeavours basis.

f) The assessment is based on various assumptions as outlined in Section 4 of this report.

g) Eliot Sinclair & Partners has not considered any environmental matters and accepts no liability, whether in contract, tort, or otherwise for any environmental issues.

h) The basis of Eliot Sinclair & Partners advice and our responsibility to our Client is set out above and in the terms of engagement with our Client.

2. Property Description

2.1. Site Description

The site is located in Waikari Township. The site has a mild slope down towards the north.

Figure 1. Aerial Photo of the site. The building is located within the dashed red rectangle.

2.2. Building Description

The building is principally a single storey hall with reinforced concrete walls and an unreinforced block storage and ablutions extension to the west elevation.

The building's floor is a raised timber floor for the main hall with perimeter concrete foundation. The roof is comprised of lightweight steel corrugate cladding, supported on sarking with timber purlins on timber trusses.

The building is operated as a community hall with its maximum occupancy less than 300 persons and is therefore classified as importance level 2 in accordance with AS/NZS1170.0:2002.

2.3. Gravity Structure

Based the site inspection undertaken by Eliot Sinclair & Partners, the primary gravity load resisting system for the building comprises:

- **Roof:** Lightweight metal roofing supported on sarking on timber purlins and rafters spanning between walls.

- **Walls:** The external walls of the building comprise of reinforced concrete for the main hall, and unfilled blocks for the western storage room/ablution.
- **Foundations:** The main hall and entry structure have a raised timber floor. The northern cloakroom extension has a concrete slab on grade.

2.4. Seismic Lateral Structure

Based on a review of the available documentation in conjunction with site inspections undertaken by Eliot Sinclair & Partners, the primary lateral load resisting system for the building comprises:

- **Longitudinal Direction:** Generally, loads for roof and out-of-plane loaded walls are carried out to the in-plane concrete walls through the ceiling/roof diaphragm. All the in-plane loads from the walls are then transferred to the foundation system.
- **Transverse Direction:** Generally, loads for roof and out-of-plane loaded walls are carried out to the walls through the ceiling/roof diaphragm. All the in-plane loads from the walls are transferred to the foundation system.

2.5. Subsoil Description

No site specific geotechnical investigation has been carried out. We have reviewed the data available to us from geological mapping. The site situated on gravels but near the interface with mudstone/sandstone with an active faults approximately 100m to the north of the site.

3. Building Investigations

3.1. Document Review

The following documents were reviewed prior to undertaking site inspections to gain an understanding of the building design and construction to assist with locating areas of potential weakness:

i. Structural report, titled "Seismic Assessment of Waikari War Memorial Hall" from CPG dated May 2012.

ii. Structural report, titled "Detailed Engineering Evaluation, Waikari Memorial Hall", from Spiire dated 5^{th} November 2012.

3.2. Site Inspections

The building was inspected by Eliot Sinclair & Partners on the 15^{th} September 2020. The following summary defines the scope of the observations undertaken:

a) Visual observations of the building exterior wall elevations undertaken from ground level.

b) Visual observation of interior walls, floors and ceilings throughout the building. Wall, floor and ceiling linings were not specifically removed.

c) Visual observations of the paving and ground around the buildings for indication of ground movement, lateral spread and liquefaction.

d) Other than as noted above, no intrusive site investigations were undertaken.

3.3. Observations

We did not observe any seismic related damage during our site inspection.

Table 1 includes photos which record typical examples of condition observed to the building.

Photo 1 – View of front elevation

Photo 2 – View of rear elevation


Photo 3 – View to underside of main hall roof.


Photo 4 – View to inside of north elevation of main hall (timber internal wall).


Photo 5 – Crack identified to external of West elevation above west blockwork extension.


Photo 6 – Internal view of western blockwork extension.

Table 1: Photos

3.4. Structural investigations

We have carried out visual inspections to confirm the layout, dimensions and nature of construction of the building.

4. Detailed Seismic Assessment

4.1. Quantitative Assessment Methodology

The methodology adopted for the detailed seismic assessment of this building are generally as outlined in the EQ-Assess Guidelines.

Our methodology is briefly summarised below:

a) Review of drawings available to us, as outlined in Section 3.1 of this report, to identify the main structural elements and any apparent "structural weaknesses" that may significantly reduce the seismic performance of the building.

b) Visual inspection of key elements of the building.

c) Calculation of the expected seismic loads on the building following the current New Zealand loading standards (NZS1170).

d) Two-dimensional equivalent static analysis on the building structure in longitudinal and transverse directions.

e) Hand analysis of selected critical elements of the building to determine the likely failure mechanisms of these subassemblies, and the whole building.

f) Determination of the likely seismic capacity of the building compared with an equivalent new building at the site based on our inspections, any structural weaknesses identified, our calculations, and our engineering judgment.

4.2. Assessment Parameters

4.2.1. Material Design Standards

Various aspects of the following New Zealand Building Code compliance documents have been used in conjunction the EQ-Assess Guidelines to assist with the assessment of the seismic capacity of the building:

- New Zealand Loadings Standards - NZS1170(set)
- New Zealand Timber Structures Standard - NZS3603:1993
- New Zealand Timber Framed Buildings Standard – NZS3604:2011
- Design of Reinforced Concrete Masonry Structures – NZS4230:2004

4.2.2. Assessment Load Parameters

General

For the purposes of consideration of loading, this structure is Importance Level 2 in accordance with AS/NZS 1170.0:2002.

Permanent Loads

Building self-weight = calculated for each element

Imposed Loads

Roof = 0.25kPa, ψ_e = 0.0 - roof

Seismic Loads: Ultimate limit State

Site subsoil category = D – In accordance with EQ-Assess Guidelines.

Hazard Factor = 0.39 (Waikari)

Return Period Factor = 1.0 (1/500year earthquake)

Near fault factor = 1.0

Assumed structural ductility = assessed for each structural element as appropriate. Refer Table 2.

Structural Element	Structural Ductility	Reference
Unreinforced block walls	$\mu_p = 1.0$	EQ-Assess Guidance C8.8.5
Reinforced concrete walls	$\mu = 1.25$, $S_p = 0.925$	AS/NZS 3101:2006 & EQ Assess guidance C5.5

Timber roof	μ_p = 3.5, SP = 0.7	Conservative use of factors from EQ-Asses Guidance C9.4.2 and NZS3604:2011

Table 2. Assumed structural ductility

Exclusions

Other loadings, including wind, snow and serviceability limit state earthquake loads have not been considered as part of this seismic assessment.

Probable Material Strengths

In accordance with the EQ-Assess Guidelines, the seismic capacity of the existing building elements have been assessed using probable material strengths and reduced strength reduction factors. These are as follows:

- Timber – Materials as per SESOC EQ assessment guidance tables C9.2 and C9.3.
- Probable steel yield strength fy_{prob} = 1.08fy

  Reinforcing steel: fy_{prob} = 250MPa
- Concrete – 25MPa based on site observations.
- Probable masonry compressive strength

  Walls: $f'm_{prob}$ = 6.7MPa
- Material strength reduction factors

  Flexural capacity ϕ = 1.0

  Shear capacity ϕ = 0.85

General Assumptions

The results of the Detailed Seismic Assessment are reported as a %NBS. The %NBS value contains uncertainty due to the assumptions and simplifications which are made during the assessment. The primary assumptions include, but are not limited to:

- The existing construction information supplied is an accurate record of the building. The information used to undertake the seismic assessment is listed in Section 3.
- Simplifications made in the analysis, including boundary conditions such as foundation fixity.
- Assessments of material strengths based on limited drawings, specifications and site inspections.
- The normal variation in material properties which change from batch to batch.
- Approximations made in the assessment of the capacity of each element, especially when considering the post-yield behaviour.

4.3. Structural Weaknesses

A Structural Weakness is an aspect of the building structure and/or the foundation soils that score less than 100% New Building Standard (%NBS). The Detailed Seismic Assessment identified the following structural weaknesses in the building:

- Unreinforced block walls of western storeroom extension in out-of-plane bending.

- In plane shear of the concrete walls to the main building area.
- In plane bending capacity of the concrete frames to the easter supper room and kitchen areas.
- Out of plane capacity of concrete walls.
- Sarking ceiling diaphragms.

4.3.1. Critical Structural Weakness

The strength of the sarking to the end walls as they support the long walls in the across direction was determined as the Critical Structural Weakness (CSW) that is the lowest scoring structural weakness determined from the DSA.

4.3.2. Severe Structural Weaknesses

A Severe Structural Weakness (SSW) is a defined structural weakness that is potentially associated with catastrophic collapse and for which the capacity may not be reliably assessed based on current knowledge. Aspects that must be assessed as SSWs in a DSA have been predetermined and are listed in Section C1.5.3 of the EQ Assess guidelines. We have determined that none of the potential SSWs listed in C1.5.3 apply to this building.

5. Seismic Assessment Results

The results of the Detailed Seismic Assessment are summarised in Table 3. Note that the values given represent the worst performing elements in the building, as these effectively define the building's capacity. Other elements within the building may have significantly greater capacity when compared with the governing elements.

Structural Element	Load Direction	%NBS	Comments
Main Hall. Concrete walls in-plane shear.	Along	<33% in current damaged state (40% once repaired).	Walls assessed in accordance with Section 'C5' of NZSEE EQ-Assess guidance.
Main Hall. Concrete walls in-plane shear.	Across	40%	Walls assessed in accordance with Section 'C5' of NZSEE EQ-Assess guidance.
Main Hall. Sarking roof diaphragm.	Along	40%	Assessed in accordance with Section 'C9' of NZSEE EQ-Assess guidance.
Main Hall. Sarking roof diaphragm.	Across	<20%	Assessed in accordance with Section 'C9' of NZSEE EQ-Assess guidance.
Eastern extensions. Concrete frames.	Along & across	34%	Assessed in accordance with Section 'C5' of NZSEE EQ-Assess guidance.
Western Storage room. Unreinforced block walls.	Along & across	<33% in current damaged state (35% once repaired)	Reported at current damaged state. Greater figure once repaired. Out-of-plane bending assessed in accordance with Section 'C8' of NZSEE EQ-Assess guidance.
Foundation/Supporting soils.	Along & Across	Not Assessed	Foundation bearing is unlikely to govern building capacity. Investigation may be required if strengthening is to be further investigated.

Table 3. Seismic Capacity of Primary Structural Elements (%NBS)

Table 3 indicates that the overall seismic rating for the Waikari Memorial Hall is less than 20% NBS for an importance level 2 building as defined by the New Zealand Standard – Structural Design Actions AS/NZS1170.0:2002.

The seismic rating of the Memorial Hall Building is governed by the in plane capacity of the roof diaphragm when taking the out of plane wall loading in the 'across' direction.

6. Seismic Grades & Relative Risk

For this assessment, the building's earthquake resistance is expressed as a "Percentage of New Building Standard" (%NBS). The %NBS seismic rating is intended to provide a measure of the ultimate seismic structural capacity of a building relative to the minimum that would meet the current New Zealand Building Code requirements for a new building constructed on the same site

The following table by NZSEE provides the basis of a proposed grading system for existing buildings, as one way of interpreting the %NBS seismic rating. Table 4 taken from the EQ-Assess Guidelines provides the basis of a generally accepted grading system for existing buildings, as one way of interpreting the %NBS seismic rating.

Percentage of New Building Standard (%NBS)	Alpha rating	Approximate risk relative to a new building	Life-safety Risk Description
>100	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 or Medium risk
34-66	C	5-10 times greater	Medium risk
20-33	D	10-25 times greater	High risk
<20	E	25 times greater	Very High risk

Table 4: Relative Earthquake Risk

Table 4 shows that occupants of an Earthquake Prone building (%NBS less than 33%, Grade D and E) are exposed to up to more than 25 times the risk during an earthquake than that of occupants of a similar new building. For buildings that are potentially Medium Risk (67%>%NBS>34%), the risk is 5 to 10 times greater than that of an equivalent new building. Broad descriptions of the life-safety risk can be assigned to these building grades accordingly.

The New Zealand Society for Earthquake Engineering (which provides authoritative advice to the legislation makers, and should be considered to represent the consensus view of New Zealand structural engineers) classifies a building as achieving *building structural performance/greater than 34%NBS but less than 67%NBS as "Moderate Risk" and having "Acceptable legally. Improvement recommended"*

Based on the results of the seismic assessment, the Memorial Hall Building is categorized as a Grade E building following the NZSEE grading scheme. Grade E buildings represent a risk to building occupants equivalent to 25 times that expected for a new building, indicating a Very High earthquake risk exposure.

A building with a seismic rating less than 34%NBS is considered to be an Earthquake-Prone Building in terms of the Earthquake-Prone Buildings Amendment Act 2016 and a building rating less than 67%NBS as an Earthquake Risk Building by the New Zealand Society of Earthquake Engineering. The Waikari Memorial Hall Building is therefore categorized as an Earthquake-Prone Building.

7. Conclusions

a) Based on the seismic assessment, the Waikari Memorial Hall Building has a seismic rating of <20 %NBS for an importance level 2 building as defined by NZS1170.0:2002 in its current damaged state.

b) Based on this seismic rating, the Waikari Memorial Hall Building is categorized as a Grade E building following the NZSEE grading scheme. The building is therefore considered to be Earthquake Prone in it's current damged state.

c) Grade E buildings represent a risk to building occupants equivalent to 25 times that expected for a new building, indicating a Very High earthquake risk exposure.

d) The seismic rating for the building is governed by the in plane capacity of the roof diaphragm when taking the out of plane wall loading in the 'across' direction.

e) The decision for continued occupancy of the building remains with the owner and/or tenant of the building.

f) Eliot Sinclair & Partners supports the recommendation of the NZSEE that it is desirable to seismically strengthen earthquake risk buildings to as near as reasonably practical to that of a new building but, as a minimum, seismic improvements should achieve at least 67%NBS.

g) As requested by the client, we have prepared the 34%NBS seismic strengthening concept. Please refer to Appendix B.

h) Site specific geotechnical investigation has not been undertaken as part of this DSA as we do not consider the performance of the foundation to be the critical aspect governing the seismic capacity of the building. However, if seismic strengthening is to be undertaken, then site specific geotechnical testing may be required.

Appendix A. DSA Summary Sheets

1. Building Information	
Building Name/ Description	The Memorial Hall Building in Waikari, North Canterbury is principally a single storey community hall. The hall has raised timber floors while the northern cloakroom area has a concrete floor slab with perimeter concrete foundation beams.
Street Address	99 Princes Road, Waikari, North Canterbury
Territorial Authority	Hurunui District Council
No. of Storeys	1
Area of Typical Floor (approx.)	420m^2
Year of Design (approx.)	The main hall was originally constructed circa to 1950.
NZ Standards designed to	
Structural System including Foundations	The main hall is principally concrete framed. The hall has a raised timber floor with perimeter concrete foundation beams.
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 geohazards	Active Fault 100m to the North.
Previous strengthening and/ or significant alteration	The main hall was originally constructed circa 1950.
Heritage Issues/ Status	None Known.
Other Relevant Information	

2. Assessment Information	
Consulting Practice	Eliot Sinclair & Partners
CPEng Responsible, including: • Name • CPEng number • A statement of suitable skills and experience in the seismic assessment of existing buildings[1]	Quan Zhang BEng (Hons), CMEngNZ, CPENG (1012386) Practice Field is Structural Engineering with experience in seismic assessment and recent training on the SESOC/NZSEE/MBIE assessment procedures.
Documentation reviewed, including: • date/ version of drawings/ calculations[2] • previous seismic assessments	CPG report dated May 2012. Spiire report dated November 2012.
Geotechnical Report(s)	None noted.
Date(s) Building Inspected and extent of inspection	Visual inspection only.
Description of any structural testing undertaken and results summary	None taken.
Previous Assessment Reports	CPR report dated May 2012. Spiire report dated November 2012.
Other Relevant Information	-

[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

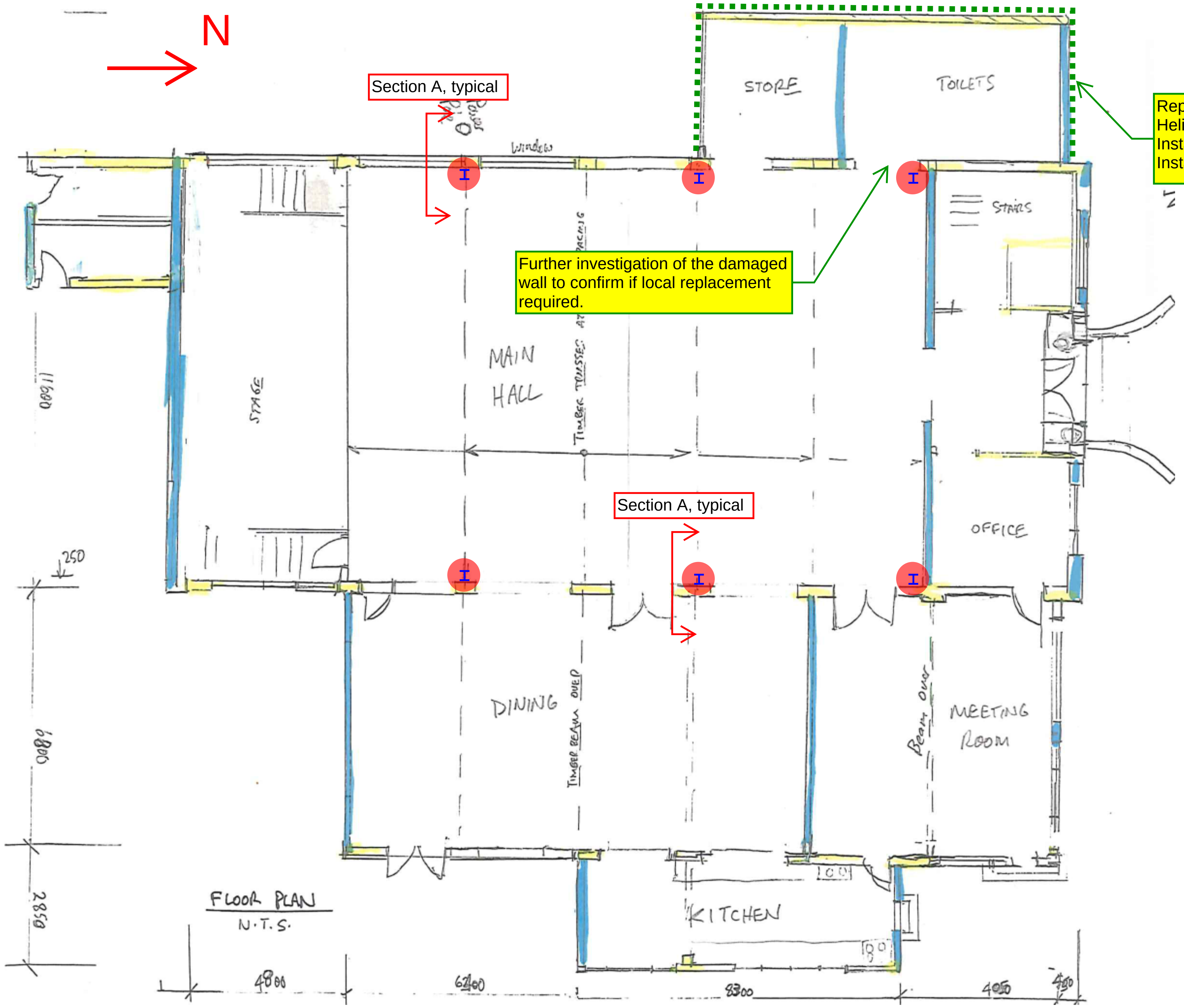
[2] Or justification of assumptions if no drawings were able to be obtained

3. Summary of Engineering Assessment Methodology and Key Parameters Used	
Occupancy Type(s) and Importance Level	Community Hall with less than 300 occupancy – Importance level 2
Site Subsoil Class	For assessing the out-of-plane bending strength for the Unreinforced block walls, use 'D' in accordance with EQ-assess guidance C8 For other structural elements, conservatively assumed as 'D' in accordance with NZS1170.5.
For an ISA:	
Summary of how Part B was applied, including: • Key parameters such as μ, S_p and F factors • Any supplementary specific calculations	N/A
For a DSA:	
Summary of how Part C was applied, including: • the analysis methodology(s) used from C2 • other sections of Part C applied	Elastic, force based procedure. C5, C8, and C9.
Other Relevant Information	-

4. Assessment Outcomes		
Assessment Status (Draft or Final)	Final	
Assessed *%NBS* Rating	<20 %NBS	
Seismic Grade and Relative Risk (from Table A3.1)	Grade E – 25 times greater than of a new building.	
For an ISA:		
Describe the Potential Critical Structural Weaknesses	N/A	
Does the result reflect the building's expected behaviour, or is more information/ analysis required?	N/A	
If the results of this ISA are being used for earthquake prone decision purposes, and elements rating <34*%NBS* have been identified:	**Engineering Statement of Structural Weaknesses and Location** -	***Mode of Failure and Physical Consequence* Statement(s)** -
For a DSA:		
Comment on the nature of Secondary Structural and Non-structural elements/ parts identified and assessed	N/A – Simple structure with analysis of relevant primary structure only.	
Describe the Governing Critical Structural Weakness	The in plane capacity of the roof diaphragm when taking the out of plane wall loading in the 'across' direction.	
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** - Refer to DSA report.	***Mode of Failure and Physical Consequence* Statement(s)** - Refer to DSA report.
Recommendations (*optional for EPB purposes*)	Refer to DSA report	

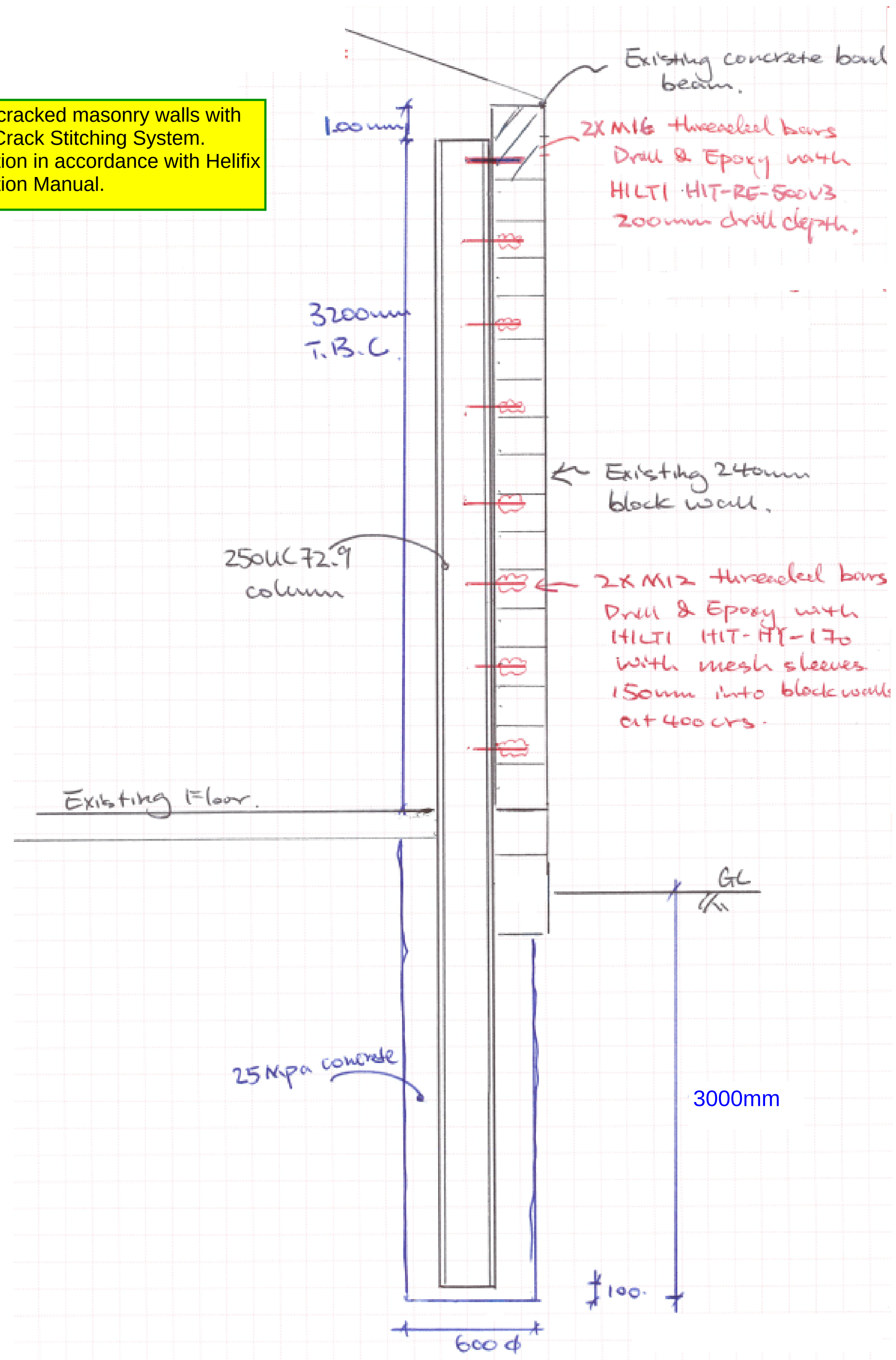
[3] If a building comprises a shared structural form or shares structural elements with other adjacent titles, information about the extent to which the low scoring elements affect, or do not affect the structure.

Appendix B. 34%NBS Seismic Strengthening Concept



Ground Floor Plan

Not To Scale



Section A

TYPICAL

Key:

- 3m deep, 600mm diameter concrete pile, 25Mpa concrete.
- 250UC72.9, new full height column. Embedded into concrete pile

PRELIMINARY

Rev.	Description	Drawn	Date
A	Preliminary		01/02/21

Surveyed:	-
Survey Date:	-
Coord System:	-
Calibration:	-
Origin of Levels:	-
Datum:	-

	Name	Date
Designed	-	-
Drawn	-	-
Drg. Chk	-	-
Proj. Mgr	-	-
Design Review	-	-
Approved	-	-

Client	Project Title	Project No.
Hurunui District Council	Waikari Memorial Hall	501917
	Drawing Title: Concept Strengthening to 34%NBS	**Set No.:** S1 · **Sht No.:** 1
	Scales: Not To Scale	**Rev.:** A

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Original A3 size mm 0 10 30 50 100 150 200 300

Plotted: Aug.10, 2020 at 4:10p.m. from C:\Users\nms\Desktop\A3_blank.dwg by NMS

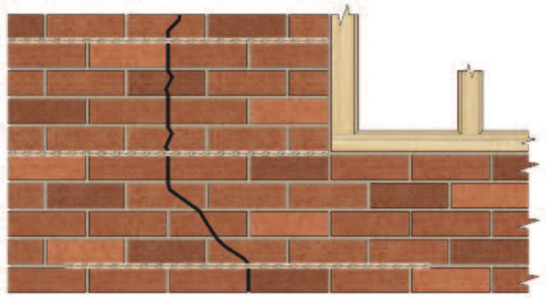
HELIFIX
SUSTAINABLE STRUCTURAL SOLUTIONS

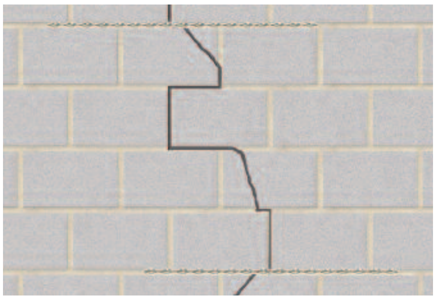
Crack Stitching

A reliable and cost-effective means of repairing and stabilising cracked masonry

Applications

- Rapid and permanent solution to cracked masonry
- Suitable for all forms of masonry structure





Features

- Fully concealed, non-disruptive repair solution
- More reliable than crack injection methods
- HeliBond cementitious grout is injectable and rapidly produces high compressive strength
- HeliBars and HeliBond grout combine to create excellent tensile strength within the masonry
- No additional stresses are introduced during installation
- Masonry remains flexible enough to accommodate normal building movement
- Tensile loads are redistributed
- Reduces likelihood of further cracking nearby
- Avoids costly and disruptive taking down and rebuilding

HeliBar is inserted into HeliBond grout within a cut slot

Over 50 standard repair specifications are available online, covering all common structural faults.
Relevant Repair Details: CS01 to CS03

Scan the QR Code for full Product Information, Case Studies and downloadable Repair Details

Installation Procedures

1. HeliBar to be long enough to extend a minimum of 500mm either side of the crack or 500mm beyond the outer cracks if two or more adjacent cracks are being stitched using one rod.
2. Where a crack is less than 500mm from the end of a wall or an opening, the HeliBar is to be continued for at least 200mm around the corner and bonded into the adjoining wall or bent back and fixed into the reveal, avoiding any DPC.
3. For solid masonry in excess of 230mm thick and in a cavity wall where both leaves are cracked, the wall must be crack stitched on both sides.
4. If there is render, this thickness must be added to the depth of slot. Crack stitching must be installed in the masonry and never in the render.
5. Ensure the masonry is well wetted or primed to prevent premature drying of the HeliBond due to rapid de-watering, especially in hot conditions. Ideally additional wetting of the slot should be carried out 1 to 2 minutes prior to injecting the HeliBond grout.
6. Do not use HeliBond when the air temperature is +4°C and falling or apply over ice. In all instances the slot must be thoroughly damp or primed prior to injection of the HeliBond grout.

1. Rake out or cut slots into the horizontal mortar beds, a minimum of 500mm either side of the crack

2. Clean out slots and flush with clean water and thoroughly soak the substrate within the slot

3. Using the Helifix Pointing Gun, inject a bead of HeliBond along the back of the slot

4. Using a finger trowel, or similar, push one HeliBar into the grout to obtain good coverage

5. Insert a further bead of HeliBond over the exposed HeliBar, finishing 10 – 15mm from the face, and 'iron' firmly into the slot using the HeliBar Finger Trowel

6. Re-point the mortar bed and make good the vertical crack with CrackBond TE

Slot Depth and Spacing

	Single leaf	Solid/multi-leaf masonry		
		Up to 110mm	110mm to 230mm	Over 230mm
Depth of slot	25 – 35mm		25 – 40 mm	25 – 40mm On both sides
Vertical Spacing	Every 4 courses (approx. 340mm)			

Technical Specifications

Material:	Austenitic stainless steel Grade 316 as standard (Grade 304 also available)
Diameter:	6mm as standard
Tensile strength (6mm HeliBar):	9.5 kN
0.2% Proof stress (6mm HeliBar):	840 MPa
Length:	To extend 500mm either side of the crack or outer cracks, if more than one
Standard lengths:	1m or 7m as standard. May be cut to length on site
Height of slot:	Full height of mortar bed or approx. 10mm if cut through the masonry unit
Bonding agent:	HeliBond cementitious grout. 1 x 3ltr HeliBond = approx. 10 linear metres of crack stitching
RECOMMENDED TOOLING	
For cutting slots:	Chisel, mortar saw or angle grinder with dust guard and vacuum
For mixing HeliBond grout:	3-jaw-chuck drill with mixing paddle
For injection of HeliBond into slots:	Helifix Pointing Gun CS with mortar nozzle
For smoothing pointing:	Standard finger trowel

HELIFIX
SUSTAINABLE STRUCTURAL SOLUTIONS

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