West Coast District Health Board

Te Poari Hauora a Rohe o Tai Poutini

Corporate Office
High Street, Greymouth

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3 July 2020

9(2)(a) [redacted]

RE Official information request WCDHB 9438

I refer to your email dated 23 June 2020 requesting the following information under the Official Information Act from West Coast DHB regarding Grey Base Acute and Community Mental Health facility. Specifically:

1. **Please can you also provide a copy of the new detailed seismic assessment.**

Please find attached as **Appendix 1** the Grey Base Hospital Acute and Community Mental Health Detailed Seismic Assessment dated 22 June 2020.

Please note we have redacted information pursuant to section 9(2)(a) of the Official Information Act i.e. *….to protect the privacy of natural persons, including those deceased".*

I trust that this satisfies your interest in this matter.

You may, under section 28(3) of the Official Information Act, seek a review of our decision to withhold information by the Ombudsman. Information about how to make a complaint is available at www.ombudsman.parliament.nz; or Freephone 0800 802 602.

Please note that this response, or an edited version of this response, may be published on the West Coast DHB website after your receipt of this response.

Yours sincerely

Carolyn Gullery
Executive Director
Planning, Funding & Decision Support

Grey Base Hospital Acute and Community Mental Health

Detailed Seismic Assessment

Project Number: 5-C4202.00
22 June 2020

CONFIDENTIAL

wsp

150 YEARS IN AOTEAROA

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Approved for release by

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Document History and Status

Revision	Date	Author	Reviewed by	Approved by	Status
1	30/04/2020	9(2)(a) [redacted]			Issued
2	22/06/2020				Issued

Revision Details

Revision	Details
1	Issued for client review
2	Added Section 3.4 for Site Investigations

Executive Summary

WSP has been engaged by the West Coast District Health Board to undertake a Detailed Seismic Assessment (DSA) of the Acute and Community Mental Health building at Grey Base Hospital in Greymouth. The purpose of this investigation was to establish the seismic performance of the structure in line with the current assessment guidelines.

This assessment follows the latest MBIE technical guidelines on seismic assessment of existing buildings (July 2017). The MBIE guidelines and the latest revision of its Chapter C5, 'Yellow Book' (November 2018) provides the current understanding of seismic assessments of existing concrete buildings and precast floor systems. It is used here to assess and report on the %NBS rating of the building.

The Grey Base Hospital Acute and Community Mental Health Services building is a two-storey reinforced concrete frame and wall building with internal timber framed upper floor walls and roof structure. Structural drawings indicate the building was constructed circa 1978.

The DSA assessment has found that the building is rated as 55%*NBS* (IL3) when assessed as an Importance Level 3 building with a design life of 50 years. The critical structural weakness was identified to be the capacity of the timber bracing walls on the upper level of the building.

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Disclaimers and Limitations

Limitation of Use

This detailed seismic assessment has been prepared by WSP exclusively for the West Coast District Health Board in relation to the detailed seismic assessment ('**Purpose**') and in accordance with our brief. WSP accepts no liability for any reliance on or use of this Report, in whole or in part, by any third party, for any purpose without prior confirmation of the use by WSP.

Historic and Client supplied data

In preparing the Report, WSP has relied upon data, surveys, analyses, designs, plans and other information provided by or on behalf of the Client. Except as otherwise stated in the 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 in relation to 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.

1 Introduction

1.1 Purpose

WSP has been engaged by the West Coast District Health Board to undertake a Detailed Seismic Assessment (DSA) of the Acute and Community Mental Health building at Grey Base Hospital in Greymouth. The purpose of this investigation was to establish the seismic performance of the structure in line with the current assessment guidelines. The following documents have been used to undertake this DSA:

- The Seismic Assessment of Existing Buildings: Technical Guidelines for Engineering Assessments, July 2017, Version 1 (excluding section C5).
- Section C5: Technical proposal to Revise the Engineering Assessment Guidelines, November 2018, Version 1A.

The Guidelines have been produced by New Zealand engineering technical societies in conjunction with the Ministry of Business, Innovation and Employment (MBIE) and the Earthquake Commission. These guidelines and the latest revision of its Chapter C5 'Yellow Book' (November 2018) provides the current understanding of seismic assessments of existing concrete buildings and precast floor systems in New Zealand.

These Guidelines came into force on 1 July 2017 and supersede the previous guidance published in 2006 by the New Zealand Society of Earthquake Engineering (NZSEE).

1.2 Scope

The scope of the detailed seismic assessment includes the following:

- A review of the original drawings and alterations carried out to the structure
- A review of previous assessments of the building
- An assessment using the latest guidelines as outlined above

2 Building Description

2.1 Primary Structural System

The Grey Base Hospital Acute and Community Mental Health Services building is a two-storey reinforced concrete frame and wall building with internal timber framed upper floor walls and roof structure. Structural drawings for the building are dated November 1977 and the building is believed to have been constructed circa 1978 to 1980. The layout of the timber walls in the upper level of the building was altered in November 2000.

Figure 1: Aerial image of the building

The foundations consist of a continuous strip foundation underneath the RC walls and individual pad footings underneath individual columns. Pad footings are linked together with concrete ground beams.

The structure consists of two-storey concrete shear walls around the perimeter with many openings. The internal structure of the lower level is made up of concrete columns and beams, which supports an insitu 140mm thick concrete slab at level 1. The internal structure of the upper level consists of timber framed gypsum bracing walls, supporting a light-weight roof. The roof structure consists of joists spanning between internal timber walls and external concrete walls. The roof is non-trafficable and accessible for maintenance purposes only.

The exterior cladding consists of 110mm thick brick veneer, supported on nibs cast in the concrete walls. The structural drawings indicate that the veneer contains galvanised horizontal and vertical reinforcement. Precast concrete fins are positioned at the vertical edges of all the upper floor windows for architectural purposes. These are dowelled into the concrete walls.

The building is also connected to the Physiotherapy/Laboratory Block with a linkage slab. There is a seismic gap of 25mm between the two structures.

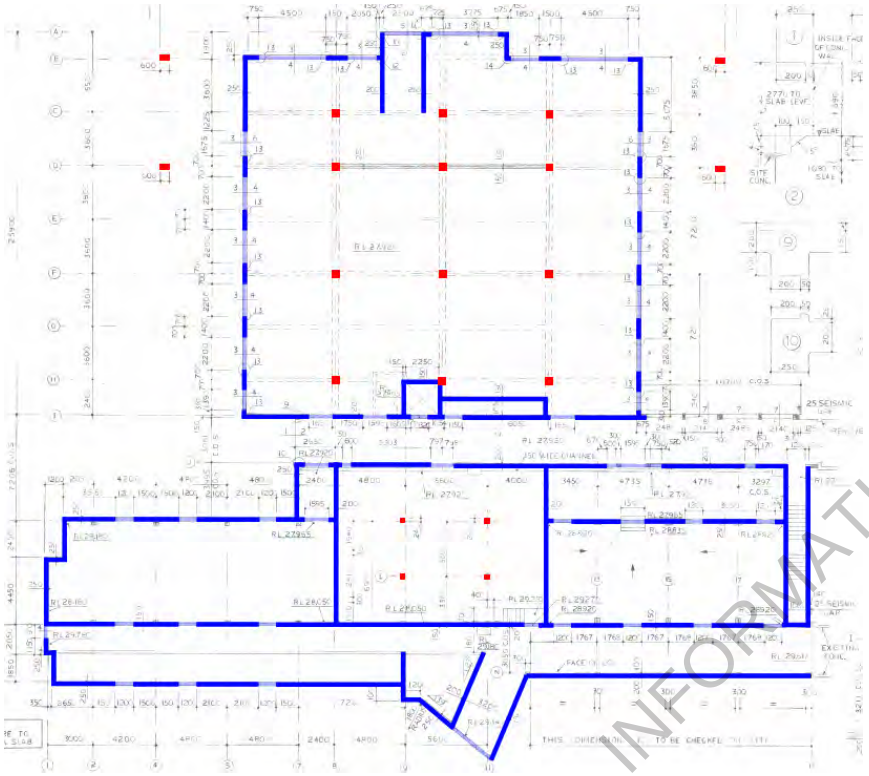

Figure 2: Lower level structural layout

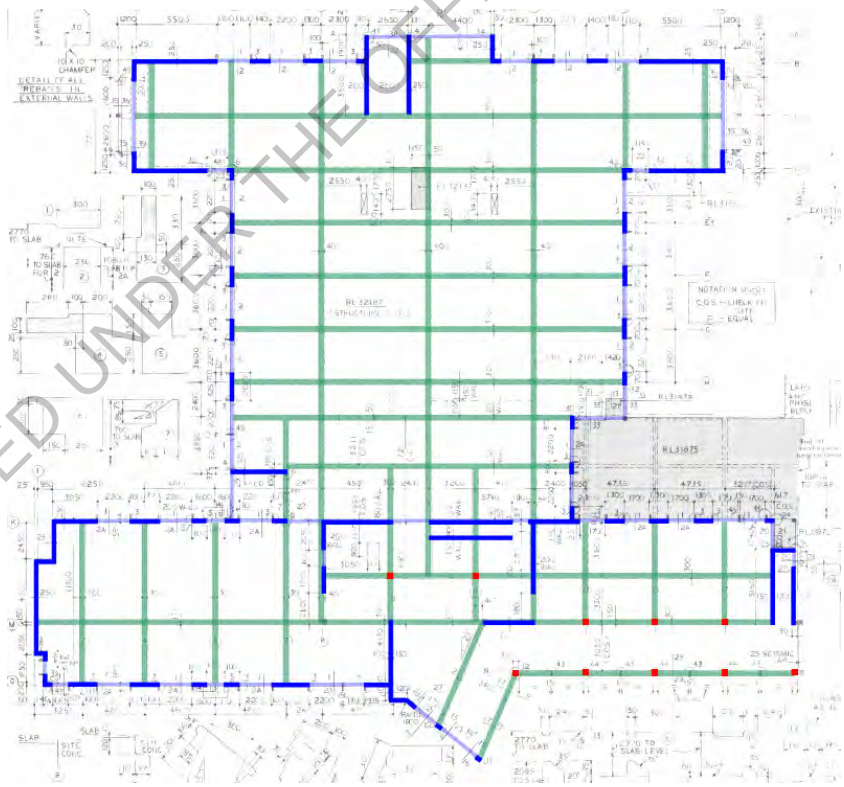

Figure 3: Upper level structural layout (not showing timber walls)

3 Sources of Building Data

The following documents and information were referred to for the assessment of the Acute and Community Mental Health building

3.1 Drawings

- Original structural drawings dated November 1977, by Bruce-Smith Chapman & Amos, Ref: C/421
- Structural alterations drawing of the upper level internal timber walls dated November 2000, by Montgomery Watson, sheet WD-A-402

3.2 Previous Assessments

- Detailed Engineering Evaluation – Acute & Community Mental Health Service by Opus International Consultants, September 2012, Ref: 6WCAN1.02
- Grey Base Hospital Geotechnical Assessment prepared by Tonkin & Taylor Ltd for Canterbury District Health Board, August 2012. T&T Ref: 53097

3.3 Site Geotechnical Information

The site subsoil class was taken as 'C' based on previous geotechnical assessment of a neighbouring building conducted by Tonkin & Taylor in 2012.

3.4 Site Investigations

As part of the previous DEE that was conducted in 2012, a site inspection consisting of visual and some intrusive investigations to confirm the construction of lined timber walls and scanning of some reinforced concrete elements to confirm bar locations was undertaken. The inspection also confirmed that there were no major variations from the plans provided.

No investigations have been undertaken as part of this assessment. However, we believe that the information is still relevant and there are no significant changes since this investigation was undertaken.

4 Assessment Criteria

4.1 Material Properties

The following material strengths have been adopted for the assessment, sourced from the drawings and the revised section C5 of the guidelines (Yellow Book):

Table 1: Material properties

Material	Nominal Strength	Probable Strength
Concrete	20 MPa (default)	30 MPa
Grade 275 reinforcing steel	275 MPa	324 MPa
Grade 380 reinforcing steel	380 MPa	455 MPa

4.2 Seismic Loading

4.2.1 Design Life

The structure has been assessed for seismic actions based on an assumed future design life of 50 years.

4.2.2 Importance Level

The seismic loading specified in NZS 1170.5:2004 is a function of Importance Level (IL) of the facility in accordance with AS/NZS 1170.0:2004. The Acute and Community Mental Health building is classified as 'Importance Level 3' to Table 3.2 of AS/NZS 1170.0.

4.2.3 Seismic Loading Parameters

The seismic loading spectrum was determined using the parameters below as per NZS 1170.5.

Table 2: Seismic loading parameters

Parameter	Value	Remarks
Site Subsoil Class	C	Shallow soil
Site Hazard Factor 'Z'	0.37	Hazard factor for Greymouth
R_u (ULS)	1.3	Importance Level 3
N(T,D)	1.0	Near fault factor

4.3 Analysis Methodology

An elastic, force-based, equivalent static analysis was conducted in accordance with section C2.3.1 of the Guidelines. Additionally, a displacement-based assessment was conducted on the upper level of the building in accordance with section C2.4.2 of the Guidelines, to provide greater understanding of the displacement response at this level. This is discussed further in section 4.3.2.

4.3.1 Modelling

ETABS building design software (V17) was used to assess the building response. Axial, bending and shear demands at ultimate limit state (ULS) were extracted from the model and compared with section capacities to determine the percentage New Building Standard (%NBS). An image of the model used is shown in Figure 4.

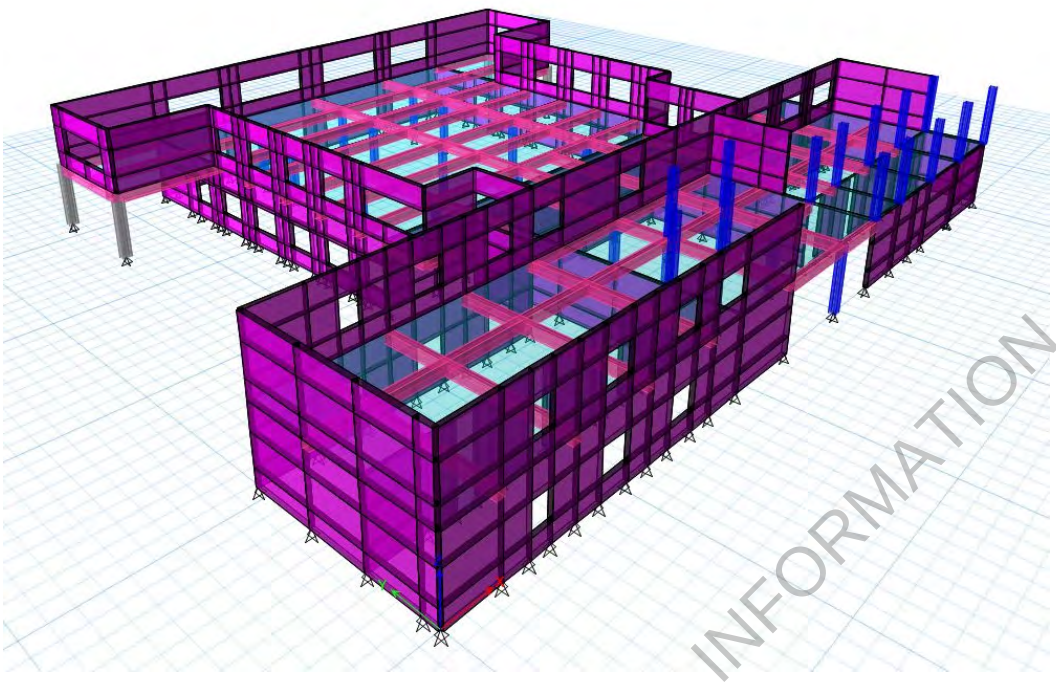

Figure 4: ETABs model of structural system

4.3.1 Frames

Flexural and shear capacity of beams and columns was checked along with the resulting displacement against the C5 Yellow Book. The failure hierarchy of the moment resisting reinforced concrete frames was determined by calculating the relative capacities of the beams and columns and comparing them with demands.

4.3.2 Timber Bracing Walls

In order to determine the realistic seismic performance for the upper storey timber bracing walls, both a force-based and displacement-based approach were used to ascertain their response.

A simple lateral mechanism analysis (SLaMA) was done for a worst-case strip of the upper level. This was to determine the expected mixed system response of the bracing walls and concrete perimeter walls working out of plane.

5 Detailed Seismic Assessment Results

5.1 Summary of Results

Table 3 below summarizes the findings of the DSA and rating of the building in terms of percentage New Building Standard, %*NBS*.

Table 3: %NBS ratings for assessed structural elements

Individual Structural Element	%NBS Score (IL3)	Critical Issues/Remarks
Concrete Walls	100%	As per previous assessment, the large volume of walls reduces the expected demands on the walls and adds redundancy to the system
Concrete Beams	100%	The beams are laid out with a close grid spacing and supported by an insitu concrete floor
Concrete Columns	100%	The columns in the building are protected by the walls in the building which minimises the expected drift in the building
Timber Bracing Walls	55%	The capacity of the bracing walls is limited to the hold-down capacity and nailing pattern of the walls
Level 1 Concrete Floor	100%	The floor diaphragm is considered not critical due to its substantial and robust insitu construction
Brick Veneer Cladding (Non-Structural Element)	Non Structural Item	The brick veneer is a non-structural cladding element. An inspection in 2012 found that in a few isolated areas at lower ground level there is a gap between the wall and the indicating potential movement.

The Acute and Community Mental Health building is rated as 55%*NBS* (IL3).

The critical structural element of the structure was identified to be the bracing capacity of the upper level internal timber bracing walls.

The timber framed bracing walls transfer the lateral load from the roof to the ground floor diaphragm in both directions. The capacity of the bracing walls is limited due to the uncertainty in the hold-down capacity and nailing pattern of the walls.

5.2 Analysis Summary

A summary of the key assessment outcomes from the DSA is presented below.

5.2.1 Building Response

The lateral deflection of the structure under the design seismic event was found to be minimal due to the large volume of walls around the full perimeter. The deflections are less than the 25mm gap provided to the neighbouring building. Therefore, pounding is not expected, however, the deflection profile of the neighbouring building is unknown. The fundamental period of the building was found to be 0.05 seconds, which demonstrates the rigidity of the structure.

5.2.2 Concrete Walls

The perimeter of the building consists of reinforced concrete walls for the lower and upper levels. The walls are detailed as 250mm thick doubly reinforced concrete behaving as piers and spandrels due to the large number of openings. The walls were found to have sufficient capacity to satisfy the expected lateral demands, utilising nominal ductility. The concrete walls are well connected into the system at the roof diaphragm level as is shown below of the timber beam connection to concrete.

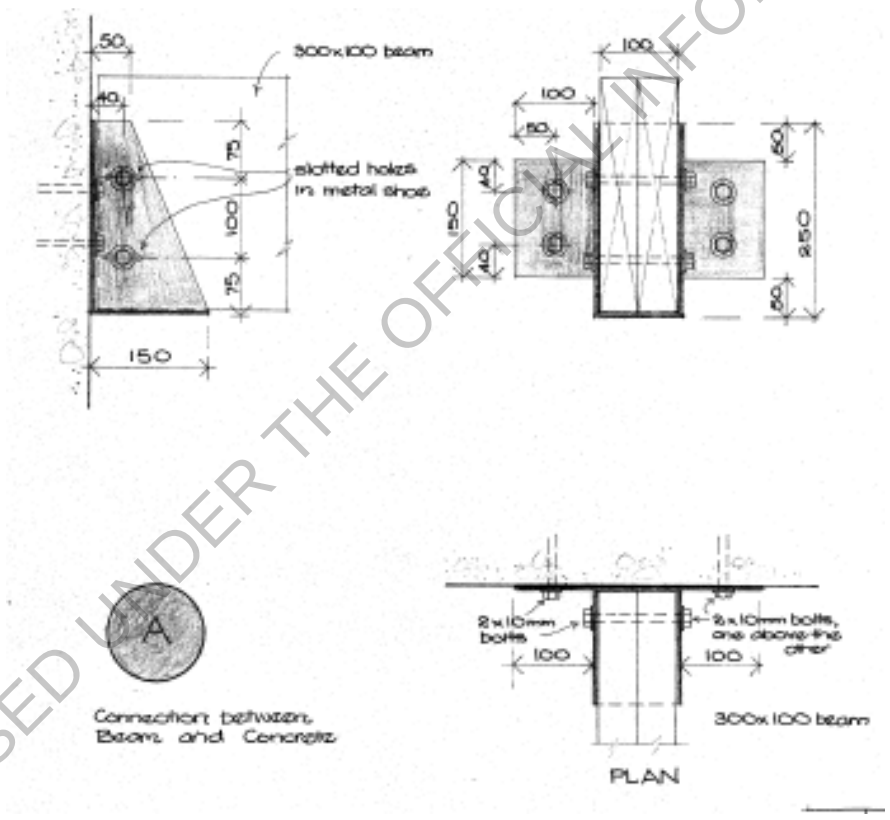

Figure 5: Connection between timber roof diaphragm and concrete walls

5.2.3 Concrete Frames

Due to the large number of walls present in the structure, the concrete frames at the lower level are protected from drifts and demands. Therefore, the columns and beams are 100%*NBS* (IL3).

5.2.4 Timber Bracing Walls

The upper level of the building was originally constructed with timber bracing walls forming the lateral load resisting system. Alterations were carried out to the layout of the upper level in 2000. Figure 6 shows the layout of the timber walls, with red indicating original walls and blue showing the additional walls from the alterations.

Figure 6: Timber bracing wall layout in the upper level

The original walls were designated as bracing elements in the construction drawings. However, the detailing of these elements is not entirely clear from the drawings.

The alterations removed a small portion of existing walls and more than doubled the length of wall provided in each direction. There is approximately 150m of timber wall in each direction on the upper level and the alterations detailed that all the walls were to be lined with 9.5mm Gib and designed to NZS 3604 requirements.

The bracing capacity per metre of wall is limited by the hold-down fixing at the base. Intrusive investigations in 2012 found the base plate fixing to be shot fired nails, which is an acceptable method as per the GIB Ezybrace system. Based on this, the bracing capacity was taken as 60BU/m, which then reduced by the appropriate factor due to the 2.7m stud height.

The force-based approach to assessing the walls considered the weight supported by the timber walls and ignored the concrete perimeter walls contribution and weight. Using a ductility factor of μ=3 and a structural performance factor of S_p=0.7, the timber walls had a minimum rating of 55% NBS (IL3) in the critical direction.

In order to determine the combined response of the timber walls acting in conjunction with the concrete perimeter walls, a SLaMA assessment was undertaken to verify this result. This looked at a critical tributary strip of the upper level of the structure.

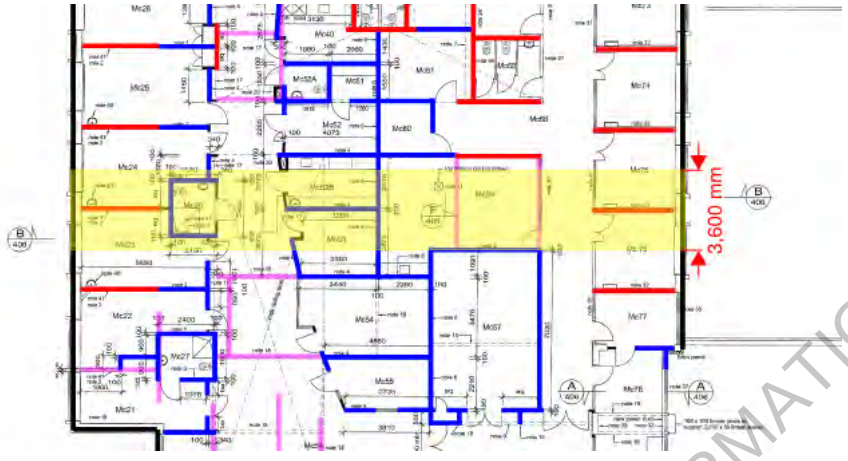

Figure 7: Strip of upper level assessed

The predicted acceleration-displacement responses of the concrete walls and timber walls are shown below. When plotted with the ADRS curve the resulting rating is slightly higher, at 60%NBS (IL3), than the force based assessment when comparing the capacity to the ULS elastic ADRS curve.

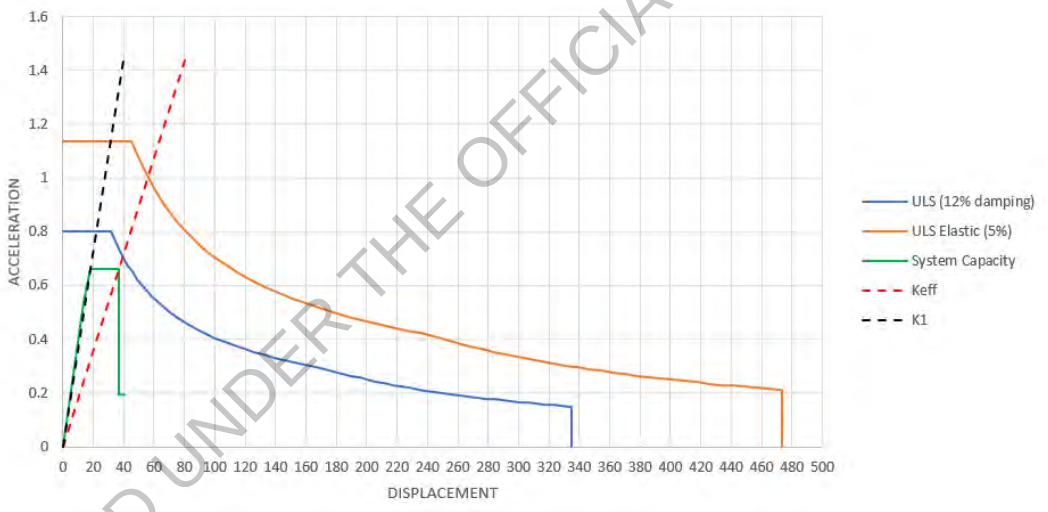

Figure 8: Combined system acceleration-displacement curve

5.2.5 Diaphragms

The level 1 diaphragm of the structure is a 140mm thick cast-insitu reinforced concrete floor. The floor plan layout is regular and uniform. Therefore, the diaphragm is expected to perform satisfactorily as a rigid element.

The roof diaphragm of the building is lightweight timber construction, with joists spanning between internal timber walls and external concrete walls. The roof is considered to act as a flexible diaphragm that distributes load to the timber and concrete walls according to their tributary areas.

5.2.6 Non – Structural Brick Veneer Cladding

The building has brick veneer cladding which is tied to the building with wire ties at every fourth course and additional vertical D10 bars.

A visual inspection in 2012 identified a few areas of the external brick veneer at lower ground level that appeared to have some minor movement or separation from the building.

The cause of the apparent movement and the condition of the ties in these locations should be investigated further.

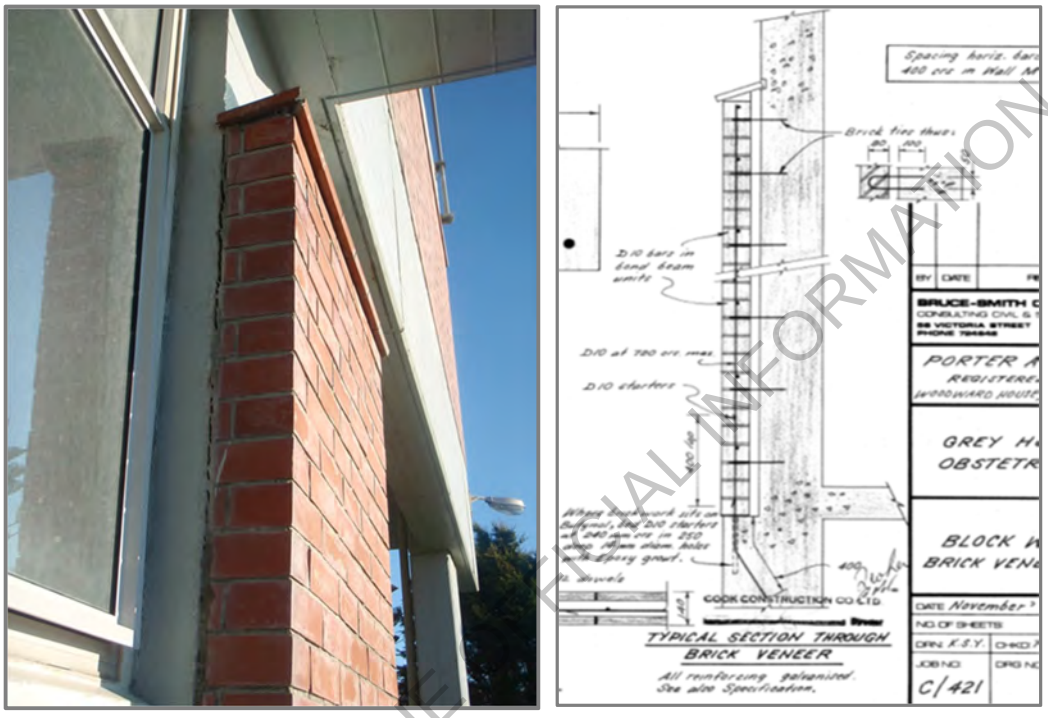

Figure 9: Gap between concrete pier and the brick veneer cladding– Lower Ground Level

6 Conclusions and Recommendations

The detailed seismic assessment has determined the rating of the Acute and Community Mental Health building at Grey Base Hospital in Greymouth is 55%NBS (IL3).

This equates to a medium risk building in accordance with the Guidelines.

The critical structural weakness of the primary structure was identified to be the bracing capacity of the upper level internal timber stud walls. The concrete substructure and other structural elements of the building had a rating of 100%NBS (IL3).

The bracing capacities of the timber framed bracing walls are limited due to the uncertainty in the hold-down capacity and nailing pattern of the GIB lined walls.

In order to achieve a seismic rating greater than 67%*NBS* (IL3), it is recommended to reline a selected amount of wall area with a material that contains a larger bracing capacity such as GIB Braceline and/or plywood.

Higher capacity hold-down fixings to the concrete floor would also be required for selected walls.

The previous 2012 investigation noted some possible movement in a few isolated areas of the brick veneer cladding on the lower ground floor. Further investigation is recommended to determine the condition of the brick veneer ties to the supporting structure in the locations where there is apparent movement.

Appendix A
DSA Assessment Summary Table

1. Building Information	
Building Name/ Description	Grey Base Acute and Community Mental Health building
Street Address	71 Water Walk Road, Greymouth, West Coast
Territorial Authority	Grey District Council
No. of Storeys	2
Area of Typical Floor (approx.)	1500 m2
Year of Design (approx.)	1978
NZ Standards designed to	-
Structural System including Foundations	Foundations are concrete strip under the walls with interconnected pads under the columns. Insitu reinforced concrete wall and frame structure for the lower level. Perimeter reinforced concrete walls with timber bracing walls and a light-weight timber roof for the upper level.
Does the building comprise a shared structural form or shares structural elements with any other adjacent titles?	There is a 35 mm seismic gap to a neighbouring building
Key features of ground profile and identified geohazards	-
Previous strengthening and/ or significant alteration	Alterations carried out in 2000, significant changes to the layout of the timber walls on the upper level, resulting in more walls than prior
Heritage Issues/ Status	-
Other Relevant Information	-

2. Assessment Information	
Consulting Practice	WSP
CPEng Responsible, including: • Name • CPEng number • A statement of suitable skills and experience in the seismic assessment of existing buildings[1]	9(2)(a) [redacted] Technical Principal/Structural Group Manager 9(2)(a) [redacted] 9(2) [redacted] is a Technical Principal with 25 years of consulting engineering experience and design management with an associated depth and breadth of technical skills across a wide range of engineering projects. He has undertaken numerous design and seismic structural assessments of multi-storey buildings, which forms part of his practice area. He is a Chartered Professional Engineer and a Fellow of Engineering New Zealand, Civil and Structural.
Documentation reviewed, including: • date/ version of drawings/ calculations[2] • previous seismic assessments	• Original structural drawings dated November 1977, completed by Bruce-Smith Chapman & Amos, Ref C/421 • Structural alterations drawing of the upper level internal timber walls dated November 2000, completed by Montgomery Watson, sheet WD-A-402 • Detailed Engineering Evaluation – Acute & Community Mental Health Service by Opus International Consultants, September 2012, Ref. 6WCAN1.02
Geotechnical Report(s)	• Grey Base Hospital Geotechnical Assessment prepared by Tonkin & Taylor Ltd for Canterbury District Health Board, August 2012. T&T Ref: 53097
Date(s) Building Inspected and extent of inspection	The building was inspected in 2012 as part of the Detailed Engineering Evaluation, which was completed by Opus. As part of the current assessment, the site visit records, photos, mark-ups, and comments were reviewed and considered
Description of any structural testing undertaken and results summary	-
Previous Assessment Reports	• Detailed Engineering Evaluation – Acute & Community Mental Health Service by Opus International Consultants, September 2012, Ref. 6WCAN1.02
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	Hospital and office space. Considered Importance Level 3
Site Subsoil Class	Subsoil Class C – NZS1170.5
<u>For a DSA:</u>	
Summary of how Part C was applied, including: • the analysis methodology(s) used from C2 • other sections of Part C applied	An elastic force-based equivalent static analysis was conducted in accordance with Section C2.3.1 of the Guidelines. A 3D ETABs model was created to assess the building response. A modified SLaMA was carried out for a section of the upper level to determine the mixed response system response of the timber bracing walls with the concrete perimeter walls acting out of plane.
Other Relevant Information	-

4. Assessment Outcomes		
Assessment Status (Draft or Final)	FINAL	
Assessed %*NBS* Rating	55%*NBS* (IL3)	
Seismic Grade and Relative Risk (from Table A3.1)	C, Medium Risk	
<u>For a DSA:</u>		
Comment on the nature of Secondary Structural and Non-structural elements/ parts identified and assessed	The stairs are cast-insitu, fixed at both ends, however, are protected from demands due to the large number of walls. The frame elements of the structure are also protected from large demands due to the walls. The brick veneer elements were assessed by inspection.	
Describe the Governing Critical Structural Weakness	The critical structural weakness of the structure was identified to be the bracing capacity of the upper level internal timber stud walls	
If the results of this DSA are being used for earthquake prone decision purposes, <u>and</u> elements rating <34%*NBS* have been identified (including Parts)[3]:	**Engineering Statement of Structural Weaknesses and Location** Timber bracing walls and concrete piers out-of-plane failure on the upper level of the building	***Mode of Failure and Physical Consequence* Statement(s)** Loss of lateral load resisting system on the upper level. Partial collapse of roof, falling brick and/or concrete elements from 2-storey height
Recommendations (*optional for EPB purposes*)	-	

[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.