DETAILED SEISMIC ASSESSMENT

Of Primary Structure

Wairarapa Hospital

For Wairarapa District Health Board

LGE Consulting
Structural & Civil Engineers
Consulting Structural & Civil Engineers
425 Queen St, PO Box 2113, Kuripuni, Masterton 5842
Phone (06) 377 2541, Email office@lgeconsulting.co.nz

Report

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Of Primary Structure

Wairarapa Hospital

Prepared For

Wairarapa District Health Board

Date –	22.05.2018
Project no -	1418
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Prepared by

Michelle Grant

CPEng 1012598

Reviewed By

Stefan Lanser

CPEng 232488

REPORT ISSUE REGISTER

Date	Revision No.	Issue
23/04/2018	1	Draft for comment
22/05/2018	2	Final Issue

1. EXECUTIVE SUMMARY

1.1. Background

A seismic review of the Wairarapa Hospital primary structure has been completed at the request of Brian Freeman on behalf of the Wairarapa District Health Board. The Wairarapa Hospital building referred to in this report is the main hospital structure fronting Te Ore Ore Road, Masterton, refer to Figure 1 for extent of building.

1.2. Basis for Assessment

The following information was used to complete this assessment;

- Structural Drawings dated 15/12/2005.
- Architectural Drawings up to Revision E dated 13/02/2006.
- Contract Notes from the design engineer with additional details and record of two site visits.
- Site inspections completed on 11th November, 4th December 2017, 14th, 20th and 23rd February 2018, 12th and 19th March 2018 and 9th, 10th, 12th and 16th April 2018.
- Extract of the structural calculations (4 pages) from the original design.

1.3. Description of the Building

The building is a multi-wing single storey building. It has the following features;

- The building was constructed in 2006.
- It is a single storey timber framed building with slab on grade foundations.
- It is currently used as a Hospital building, ie Importance Level 4 building.
- The primary structural system is typically timber mono-slope trusses over lined timber framed walls. Resistance to earthquake loads is generally by specifically designed engineered roof bracing elements to connect the roof and out-of-plane walls to the in-plane timber bracing walls.
- Different structural systems form the entry canopy, service area, ambulance bay, walkways, cafeteria and other peripheral structures.
- There are no known previous assessment of, nor seismic improvements to the building.
- The building appears to have been designed to AS/NZS1170, however only a partial set of calculations were available for review.
- The limited calculations available from the original design indicate that the designers adopted a soil class of C. The site sub-soils are classed as Soil Class D per GNS report '*Sub-soil class determination using surface wave techniques in the Wellington region', dated 2016*.

1.4. Seismic Review Process

A final Detailed Seismic Assessment has not been completed at this stage. This was because a DSA requires knowledge of the as-built structure. Although structural and architectural plans are available, we are not satisfied that these plans can be relied on to provide an accurate representation of the as-built structure. This is because spot check inspections completed throughout the building highlighted repeated elements that were not in accordance with the available plans.

Notwithstanding this, we have completed a review of the load paths and configuration, as well as spot checks on key detailing which may affect the seismic capacity of the building.

Over most of the Hospital, the main issue is the engineered bracing connections between the roof, out-of-plane walls and the in-plane bracing walls. The following issues were noted during our review;

- Some engineered details could not be built in accordance with the plans, usually due to a clash with another structural element or building service.
- Structural bracing elements that were either cut or missing.
- Structural bracing elements built in the roof space and not connected to a wall underneath.
- Apparent lack of engineered load path for seismic loads of some peripheral structures.

The above noted items mean that when the building is subject to seismic loads, it will rely in areas, on secondary load paths which are difficult to quantify. A reliance on secondary load paths comes with an implication that disproportionate damage may occur as sufficient movement will be required to engage the secondary elements.

1.5. Assessed Earthquake Rating

Based on the light weight nature of the structure and the identified potential failure mechanisms, it is unlikely that the main Hospital primary structure would be potentially earthquake prone, ie the seismic rating will be greater than 34%NBS(IL4)

However, the main Hospital structure does not comply with the strength or serviceability requirements for an Importance Level 4 building, ie it will be less than 100%NBS(IL4).

This also means that parts of the Hospital may not remain operational after a 1 in 500 year earthquake.

Further assessment is required on the peripheral structural elements to determine their seismic rating, it is possible that some of these elements may be earthquake prone due to the lack of a defined robust engineered load path.

1.6. Recommended Next Steps

Commission a seismic strengthening investigation with a scope to provide improvements to the structure. The improvements should focus on achieving the performance requirements for an Importance Level 4 building.

This should be achieved broadly by the following;

1. Identify priority areas and therefore the order of review

   And, for each area;
2. Complete a detailed as-built review.
3. Prepare high level scheme drawings with constructible details of how to improve the wing.
4. Co-ordinate requirements for construction with the securing of installed services (refer to report from Clendon Burns and Park Ltd).
5. Prepare building consent construction documents.
6. Carry out improvement works.

2. MAIN REPORT

2.1. Introduction

A seismic review of the Wairarapa Hospital building has been completed.

The scope of this review is to provide an indication of the seismic compliance of the Wairarapa Hospital building. To complete this we have reviewed the load paths and the building configuration, as well as key structural detailing which may affect the seismic capacity of the building. We have also completed multiple site inspections across the structure. This review includes collating existing documentation for the original build, including sourcing design and build records where able.

The review was completed in accordance with the industry standard "Guidelines for Assessment and improvement of the Structural Performance of Buildings in Earthquakes" issued July 2017.

2.2. Limitations

This report has been prepared solely for Wairarapa District Health Board. Any reliance on this report by third party members is at their own risk.

Our observations are based on a drawing review and site inspections and include limited calculations on specific items only. We have not reviewed secondary structural/non-structural elements. Our review is limited to the primary structure.

Our professional services are performed using a degree of care and skill normally exercised, under similar circumstances, by reputable consultants practicing in this field at this time. No other warranty, expressed or implied, is made as to the professional advice provided in this report.

2.3. Documentation Review

To complete this review, we requested a copy of the building consent file from the Masterton District Council. The file information available at the time of writing this report was incomplete. For a project of this nature, we would usually expect the following;

- Structural Drawings
- Architectural Drawings
- Full set of design calculations
- PS1 Producer Statement – Design from the design engineer
- Peer review correspondence (if a peer review was carried out)
- Construction monitoring records
- PS4 Producer Statement – Certification from the construction monitoring engineer

However, we were unable to locate all of the above items from the Masterton District Council records. The Council file has a tender set of architectural and structural documents, including plans and specifications. Note that these documents have since been superseded by changes to the building layout.

A request was made to the builder for any possible records they may have held. The builders were able to provide a For Construction set of structural and architectural plans, showing significant changes from the Tender/Consent set. The builders were also able to provide a partial set of calculations (4 pages only), and Contract Advice notices from the structural engineer. The Contract Advice notices included design clarification details, additional structural details not shown on the plans, as well as records from two site inspections during the build.

A PS1 Producer Statement has since been provided from the DHBs own internal records.

Based on this, the following is noted;

- It does not appear that a peer review of the Hospital design was completed at the time of consent.
- The records show that only two site visits were completed by a structural engineer during the build process, which took place over 2 years (January 2005 to March 2006).

2.4. Description of the Building

The building is a multi-wing single storey building. There are multiple roof configurations and structural types which make up the building, as indicated on the marked up floor plan below;

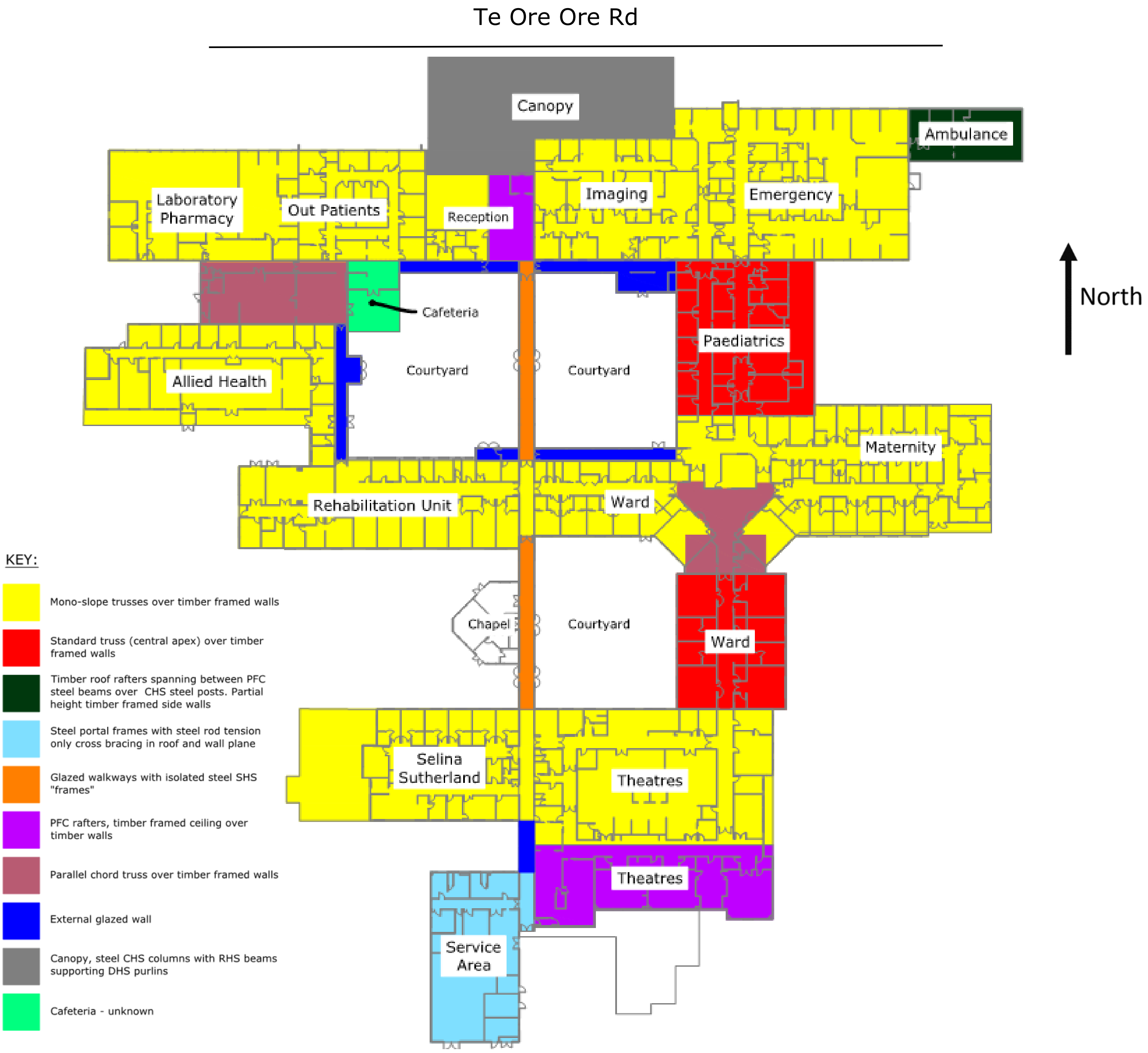


Figure 1 - Floor Plan showing different structural types

Each area indicated on the floor plan is described briefly. A full structural description of each area including a discussion on the lateral load path is included in Appendix A.

2.4.1. Timber Framed Buildings

The structural form over most of the Hospital is light timber framed walls with timber trusses over. In a typical timber framed building, seismic loads are resisted by the in-plane walls. Roof space braces and a ceiling is used to transfer roof and out-of-plane wall loads to the in-plane walls, ie the top of the roof is tied to the ceiling by some braces, and the ceiling forms the 'lid' on the box. This is illustrated in figure 2,3 and 4 below;

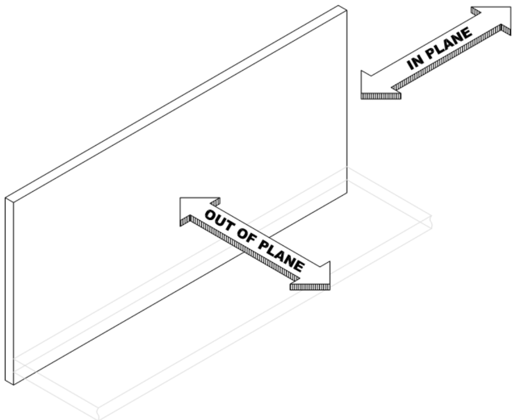


Figure 2 – Illustrating 'In-plane' versus 'Out-of-plane'

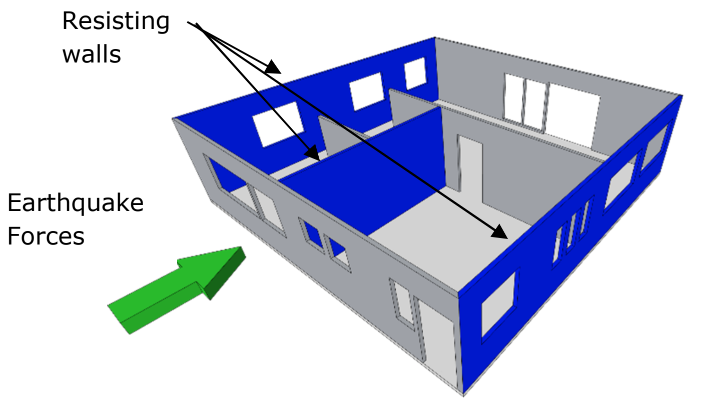


Figure 3a-Earthquake forces on one direction – in-plane walls are blue, out-of-plane walls are grey

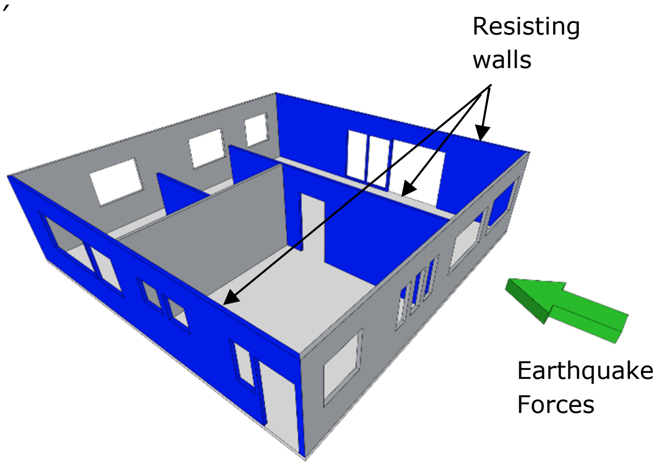


Figure 3b-Earthquake forces in other direction – in-plane walls are blue, out-of-plane walls are grey

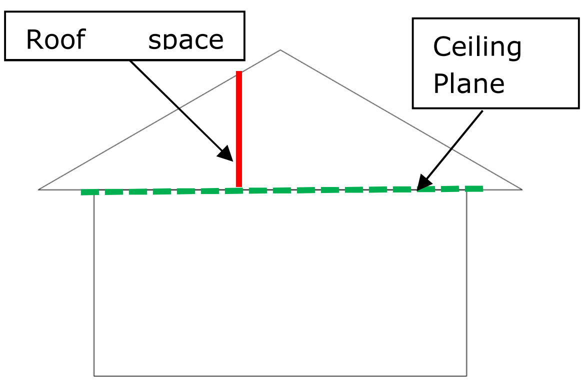


Figure 4 – Roof space braces to connect the roof to the walls

For the Hospital building, there is no structural ceiling present. A structural ceiling is typically framed with timber members and lined with plasterboard or plywood (see Figure 5 below).

Instead, a suspended ceiling was installed. A suspended ceiling is a ceiling made up of separate tiles supported on a steel grid which is hung from the trusses (see Figure 6 below). This ceiling element was chosen presumably to accommodate the large amount of services running in the roof space. Suspended ceilings do not provide structural bracing.

Figure 5a - Framing to accommodate new ceiling

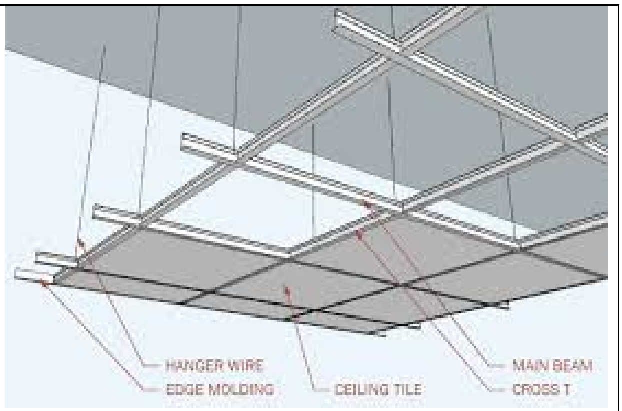


Figure 6a - Diagramatic of a suspended ceiling

Figure 5b - Ceiling with lining fixed in place

Figure 6b - Suspended ceiling being installed

As there was no ceiling 'lid' on the Hospital, specifically engineered elements were designed and installed. These engineering elements were intended to brace the roof and out-of-plane walls and then transfer the loads to the in-plane walls. These elements include;

- Roof space braces in the form of vertical bracing straps
- Discreet sections of plywood ceiling diaphragms
- Roof plane strap bracing
- Ceiling plane strap bracing

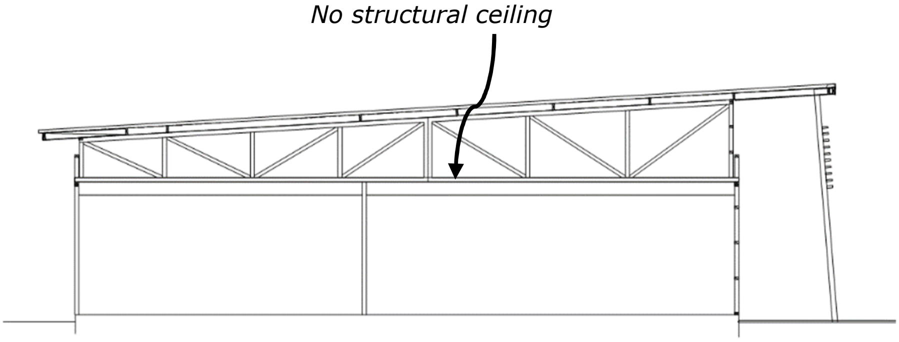
Each Hospital area is discussed in more detail below, and expanded upon further in Appendix A.

2.4.2. Description of Hospital Areas

Main Hospital typology

Includes the laboratory, Outpatients, Imaging, Emergency, Allied Health, Rehabilitation, Wards, Maternity and Theatre Wings

The building is timber framed, with walls lined in a combination of plasterboard and triboard linings. The roof is formed with timber purlins oriented east-west and spanning between mono-slope timber trusses.

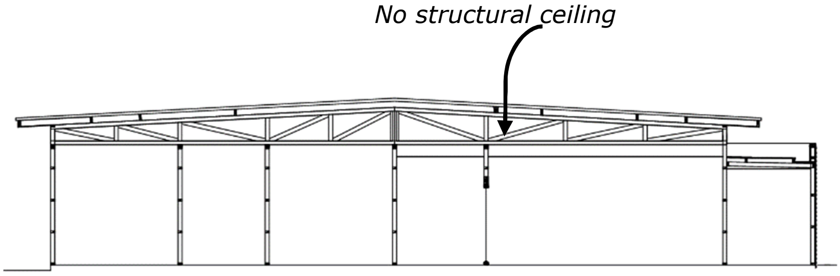


Typical Cross Section

There is a suspended ceiling throughout the building, and therefore the roof and out-of-plane walls are braced via engineered elements. The roof is lightweight corrugated iron, and the external walls are clad in a combination of titan board and weatherboard.

Paediatric & Ward

The building is timber framed, with walls lined in a combination of plasterboard and triboard linings. The roof is formed with timber purlins running north-south and spanning between common timber trusses

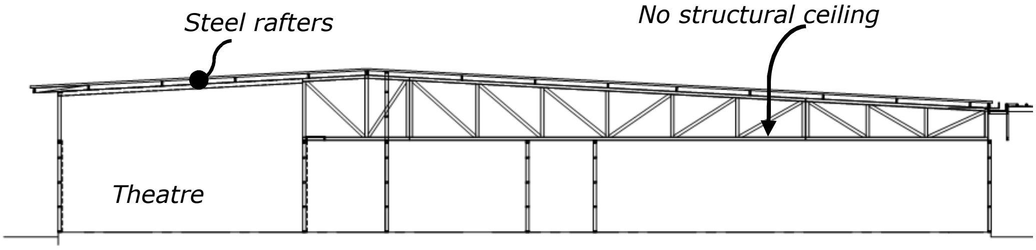


Paediatrics/Ward Cross Section

There is a suspended ceiling throughout the building. The roof is lightweight corrugated iron, and the walls are clad in a combination of titan board and weatherboard.

Theatres

The theatre roof is different from the rest of the building. Over the theatre there are large structural steel elements to suspend the necessary services. To allow space for these services, there are no trusses over the theatre, and the roof is supported on steel rafters.



Theatres Cross Section

Entrance Canopy

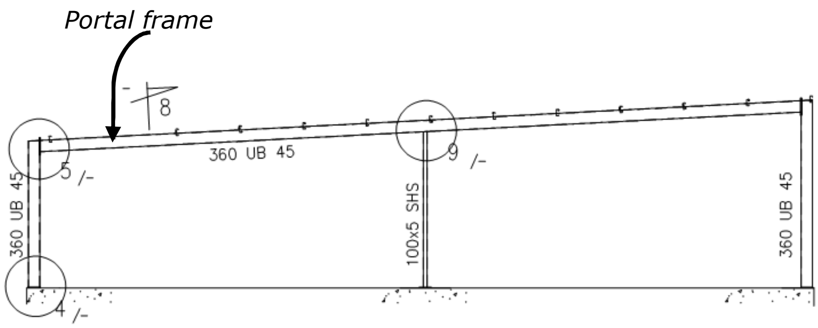
The canopy is formed with structural steel Circular Hollow Section (CHS) columns which support structural steel beams. Galvanised steel DHS purlins run parallel to the building, spanning between structural steel beams.

Ambulance Bay

The ambulance bay structure consists of steel CHS posts supporting steel parallel flange channel (PFC) beams over. The roof is formed by timber rafters spanning between the PFC beams.

The structural details for the ambulance bay were not included in the original drawing set. The details were issued in a Contract Advice notice to the contractor at a later date.

Service Area



The service area is formed with three steel portal frames over the plant room. There is tension only rod bracing in the plane of the roof. In this bay there is also tension only rod bracing in the end walls.

Walkway between Wards

The corridor is formed with glazed wall elements supported by steel hollow section (SHS) frames at 3.9m centres. The roof is timber framed and ply lined, with a butynol layer providing water proofing.

External Glazed wall

At certain locations around the hospital, the external wall line consists entirely of glazing. At these locations there does not appear to be bracing wall elements. As there is no ceiling structure/diaphragm there is no defined primary load path to support the roof and walls under earthquake loading.

Cafeteria

The cafeteria is not shown on the structural or architectural plans available at the time of writing this report. The external walls of the cafeteria are all glazed, and there is no defined structural system to resist earthquake forces.

2.5.Structural Inspections Summary

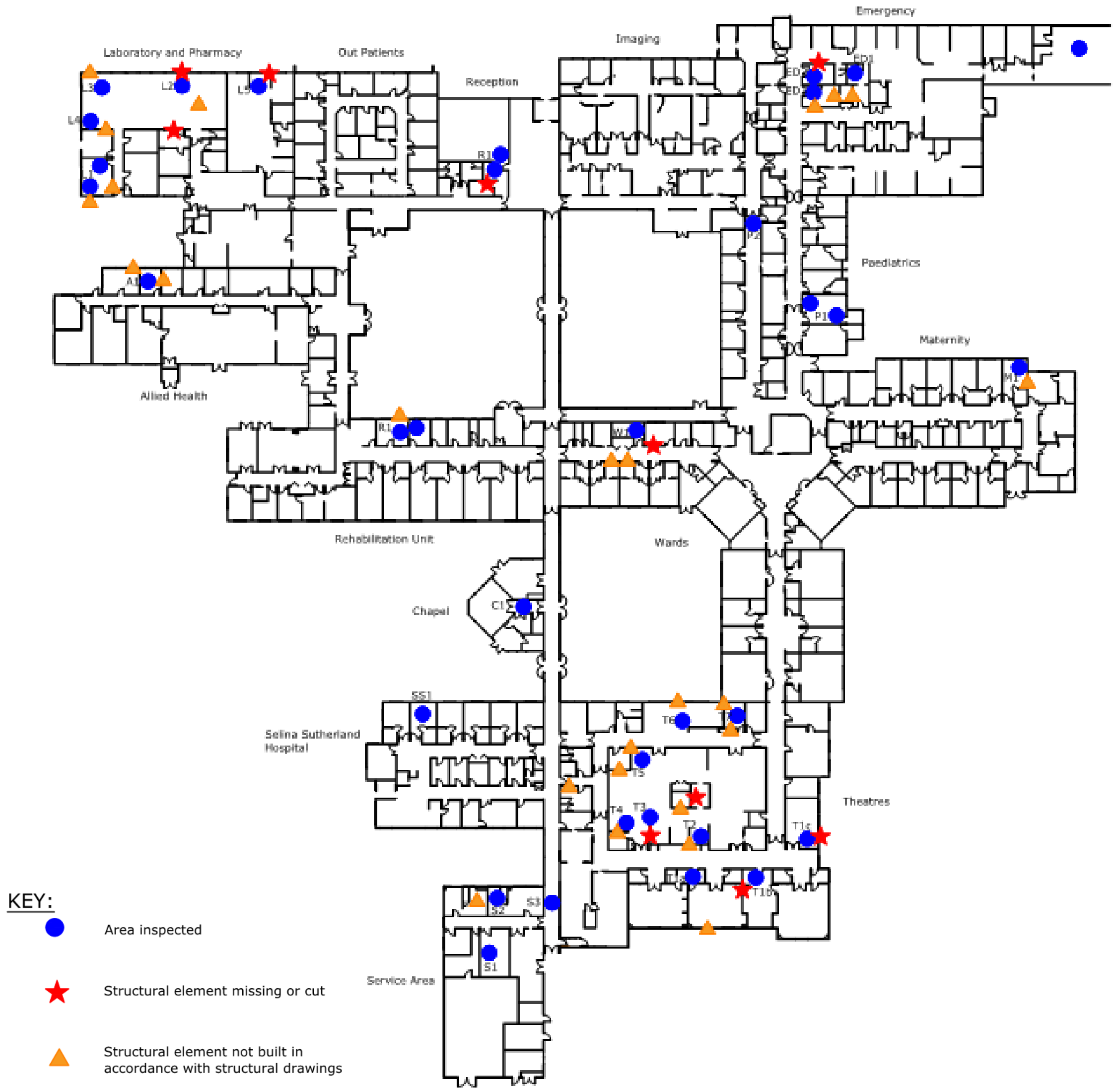


Figure 7 – Floor plan indicating areas inspected, inspections were in roof spaces and focused on roof space bracing, ceiling plane strap bracing and part ply ceiling diaphragm sections.

Full documentation of the structural inspections is included in Appendix B. The areas inspected are indicated by blue dots on the map above.

The following is a summary of the items noted:

- Inspections were completed at multiple locations across all wings of the building.
- At most locations there were specific engineer designed roof and ceiling bracing elements that were either cut or were not installed in accordance with the plans.
- Typical specific engineer designed roof and ceiling bracing elements could not be constructed in accordance with the plans at multiple locations. This was generally due to a clash with another architectural or structural element, for example, cross bracing cannot be installed in the same plane as external wall framing.

  At these locations, the typical details have generally still been installed, albeit offset from the specified location.
- The services area structural steel is markedly different from the structural plans

2.6. Review of Lateral Load Path

Based on a review of the structural plans, there are incomplete load paths present in some areas of the hospital. These affect the seismic compliance and will also affect the operational continuity of the building after a seismic event.

A detailed overview of each area of the building is included in Appendix A. This overview outlines the structural system and how it resists earthquake loads, as well as notes on the inspection of this area of the structure.

We were unable to locate structural details for some items, for example the Cafeteria and the Glazed Walkway steel frames.

2.7. Assessment Criteria

2.7.1. Loading Standard Overview

All structures built in New Zealand must comply with the requirements for the Ultimate Limit State (strength requirements) and the Serviceability Limit State (occupancy and use requirements). These terms are defined in the Loadings Standard AS/NZS1170, and replicated below.

> *<u>Serviceability limit state</u>*
>
> *This condition is reached when the structure undergoes damage that limits its intended use through deformation, vibratory response, degradation or other physical aspects under an earthquake of low intensity.*
>
> *<u>Ultimate limit state</u>*
>
> *In its application to earthquake-resistant design, the ultimate limit state is defined as being when the capacity of an element and/or the structure is reached, based on the design strength, strain, ductility and deformations limits that are specified for the ultimate limit state in this and appropriate material standards. The structure as a whole may have sustained significant structural damage but shall have reserve capacity to avoid structural collapse.*

All buildings in New Zealand are designed for earthquake loading, however the magnitude of the earthquake loading is not always the same. One of the factors that determines how much lateral (sideways) force we apply to a building is the return period factor, Ru, which is related to the "importance level" of a building. A rural farm building, for example, is classified as Importance Level 1, or IL1. A normal building is classified as having an importance level 2, or IL2. A hospital is classified Importance Level 4 (IL4). Table 2 shows the difference in the Ru factor between an IL2 (1.0) and IL4 building (1.8).

The magnitude of earthquake loading is expressed as an earthquake that is typically expected over a period of time. For example, an earthquake that occurs once every 25 years has relatively low levels of shaking and is quite common. An earthquake that occurs once every 500 years has a substantial level of earthquake shaking, while an earthquake that occurs once every 2500 years has a very high and intense level of earthquake shaking.

A normal building must be serviceable, ie able to be used after a 1 in 25 year earthquake. It must also meet the Ultimate limit State requirements in a 1 in 500 year earthquake.

A Hospital building designated as Importance Level 4 must be serviceable, ie able to be used after a 1 in 500 year earthquake, and must meet Ultimate limit State requirements in a 1 in 2500 year earthquake.

This is shown in the table below;

	Design Level Earthquake		Return period factor
	Serviceability Limit State	***Ultimate Limit State***	R_u
Normal building (IL2) (for comparison)	1 in 25 year earthquake	1 in 500 year earthquake	1.0
Hospital Building (IL4)	1 in 500 year earthquake	1 in 2500 year earthquake	1.8

Table 2 – Importance Level and earthquake return period

2.7.2. Serviceability Limit State

For a Hospital, the serviceability requirements are clearly outlined in the Loading Standard AS/NZS 1170 Clause 2.1.4.b(ii) which states that;

> *In a structure with a critical post-earthquake designation (i.e. importance level 4) all elements required to maintain those operations for which the structure is designated as critical, are to be maintained in an operational state or are to be returned to a fully operational state within an acceptable short timeframe (usually minutes to hours rather than days) after the SLS2 earthquake as defined in NZS 1170.5 clause 2.1.4.*

To put this in context, the Hospital building should be ***operational within minutes to hours*** after an earthquake that would exceed strength limits for a normal building.

The following structural damage may limit the functioning of the main hospital building. For a Hospital, none of this damage should be expected after a serviceability level (1 in 500 year) earthquake.

- Excessive movement between the roof and walls plane (ie at ceiling level) which will affect the suspended ceiling and services passing through this level
- Doors not opening/closing
- Glazing panels breaking
- Excessive movement of the external cladding leading to weather tightness issues

Note also that all services required for the Hospital to remain functional should not be compromised after a serviceability level earthquake.

2.7.3. Ultimate Limit State

After a ULS earthquake (ie 1 in 2500 year event), significant failure of the walls is expected, with major damage to wall linings being visible.

- Wall linings may pop off their framing
- Significant cracking to the wall linings
- Walls may lift and displace significant amounts
- Significant damage to ceiling structure and glazing

2.7.4. Assessment for Earthquake Prone Building purposes

The Ministry of Business, Innovation and Employment (MBIE) document "The Seismic Assessment of Existing Buildings: Technical Guidelines for Engineering Assessments July 2017" produced in accordance with Section 133AV of the Building Act 2004, sets out the methodology to assess existing buildings.

This document clearly outlines that the assessment of existing buildings is focussed on *life safety*. An element is only considered to be relevant to an assessment if its failure is likely to cause a Significant Life Safety Hazard.

There are two different forms of life safety hazard to consider; when the ultimate capacity of the building, a section of the building or a primary structural element is exceeded to the extent that a significant life safety issue arises, or when a falling secondary structural or non-structural (SSNS) building element poses a significant life safety hazard.

The Guidelines do recommend the following for an Importance Level 4 building;

Notwithstanding the focus on life safety, it is recommended that an IL4 building should either attain a 67%NBS (IL4) rating as a minimum and fully satisfy SLS2 requirements or be re-designated.

2.7.5. Summary of Assessment Criteria

Due to the secondary nature of some of the load paths present, the seismic rating of some components cannot be quantified, ie we are unable to assign a %NBS at this stage.

We have provided an indication of whether each component appears to comply with the Ultimate Limit State requirements. The following outlines what has been completed to inform this statement;

- For the main hospital structure, we have completed a bracing review of the in-plane walls in the following areas – Allied Health, Day Rehab, Maternity, Laboratory and Pharmacy, Outpatients, Paediatrics, Rehab and the Theatres.
- The seismic rating of the specific engineer designed roof space bracing and roof to wall connections is unable to be quantified at this stage. The spot check inspections completed highlighted multiple variances in how this has been constructed. Further inspections are needed to verify this load path.
- Calculations have been completed to review the service area portal frames and the tension only bracing system in this area.
- Some elements are listed as non-complying due to the lack of an identifiable engineered load path.

The SLS2 (serviceability limit state) assessment is a pass/fail assessment. This is based on whether the element is likely to ensure the building can remain operational.

2.8. Assessment Results

This assessment has been completed based on the structural plans with information provided by the site inspections. A summary review of each component of the building is included in Appendix A. The following table outlines key aspects for each component.

Building Component			Compliance	
Items Identified	**Issue**	**Consequence**	**ULS criteria met**	**SLS2 criteria met**
Main Hospital structure				
Roof bracing and connection to walls parallel to trusses	Missing connections to walls, no account for diaphragm eccentricity	Excessive movement between roof and walls, differential deflections between individual trusses	No[1]	No[3,4]
Roof space bracing and connection to walls perpendicular to trusses	Missing connections, bracing offset from walls	Excessive movement between roof and walls	No[1]	No[3,4]
In-plane wall bracing capacity	Nil	n/a	Yes	Yes[2]
Paediatrics & General Ward				
Roof bracing and connection to walls parallel to trusses	No engineered load path to in-plane walls	Excessive movement between roof and walls to engage secondary load path	No[1]	No[4]
Roof space bracing and connection to walls perpendicular to trusses	No engineered load path to in-plane walls	Excessive movement between roof and walls to engage secondary load path	No[1]	No[4]
In-plane wall bracing capacity	Nil	n/a	Yes	Yes[2]
Ambulance Bay				
Bracing across the ambulance bay	Reliance on single bracing strap, no connection details	Excessive movement to engage secondary load path	No[1]	No[4]
Bracing along the ambulance bay	No defined bracing system	Excessive movement to engage secondary load path	No[1]	No[4]
Theatres				
Roof bracing and connection to walls parallel to trusses	Relies on load transfer to adjacent rafters, no connection to walls directly under	Excessive movement between roof and walls, likely to affect services over theatres	No[1]	No[3,4]
Roof bracing and connection to walls perpendicular to trusses	Missing load path from roof to ceiling level on external wall	Excessive movement to engage secondary load path	No[1]	No[3,4]
In-plane wall bracing capacity	Nil	n/a	Yes	Yes[2]

Notes:
1 – Calculations have not been completed at this stage, assessment re ULS criteria made based on high level review.
2 - No assessment has been made of the effect of differential stiffness due to the differing wall lengths.
3 – The SLS assessment is based on the construction noted during inspection, refer Appendix A and B
4 – The SLS assessment is based on the reliance of indirect load paths in this component

Building Component *(continued)*			**Complies?**	
Items Identified	**Issue**	**Consequence**	**ULS criteria met?**	**SLS2 criteria met?**
External Canopy				
Bracing along length of canopy	Eccentric connections to unconventional 'frames'	Failure of connection of strut elements	No[1]	No[4]
Bracing transverse	No defined bracing system	Potential loss of support for roof spanning between canopy and main building	No[1]	No[4]
Service Areas				
Portal frames over service area	No fly braces, knee joint stiffener offset	Lateral buckling of rafter segment	No	No
Cross bracing system	Eccentric connections to struts and bracing rods	Buckling of struts	No	No
Walkway between wards				
Bracing of the glazed walkways	No defined bracing system	Glazing breaking after excessive movement	No	No
Cafeteria				
No structural details available	No defined bracing system	Glazing breaking after excessive movement	No[1]	No
External Glazed Walls				
Bracing in-plane	No defined bracing system	Glazing breaking after excessive movement	No[1]	No

Table 3 – Assessment results

Notes:
1 – Calculations have not been completed at this stage, assessment re ULS criteria made based on high level review.
2 - No assessment has been made of the effect of differential stiffness due to the differing wall lengths.
3 – The SLS assessment is based on the construction noted during inspection, refer Appendix A and B
4 – The SLS assessment is based on the reliance of indirect load paths in this component

In summary,

- The Hospital building does not appear to comply with the Ultimate Limit State requirements for an Importance Level 4 building.
- Based on the light weight nature of the structure and the identified potential failure mechanisms, it is unlikely that the primary structure would be potentially earthquake prone.
- The Hospital building does not meet the requirements for SLS2, ie operational after a 1 in 500 year earthquake.

2.9.Conclusion and Recommendations

The Hospital building is an Importance Level 4 structure. This means the Hospital should be ***operational within minutes to hours*** of an earthquake that would render a normal building irreparably damaged.

The operation of the Hospital is reliant on both the building structure and the services being available for use. The following main points are noted based on the review completed;

- The Wairarapa Hospital building does not meet the serviceability criteria for an Importance Level 4 structure.
- While it is unlikely that the main Hospital structure is potentially Earthquake Prone, it does not comply with structural requirements, ie it is greater than 34%NBS(IL4) but less than 100%NBS(IL4).
- Further assessment is required on the peripheral structural elements to determine their seismic rating.
- More assessment is needed to clarify seismic performance and risk.

We recommend that the DHB commission a seismic strengthening investigation with a scope to provide improvements to the structure. The improvements should focus on achieving the performance requirements for an Importance Level 4 building.

While this should primarily focus on the main Hospital area, we recommend the entry canopy be given priority for further review also.

The further investigation for the main Hospital building should be achieved broadly by the following;

1. Identify priority areas and therefore the order of review

   For each area;
2. Complete a detailed as-built review
3. Prepare high level scheme drawings with constructible details of how to improve the wing
4. Co-ordinate requirements for construction with the securing of installed services (refer report by Clendon Burns and Park Ltd)
5. Prepare building consent construction documents
6. Carry out improvement works

This needs to be completed in conjunction with a full review of the services to the Hospital.

3. Technical Summary Sheet

The inclusion of the following summary sheet is a requirement of the assessment Guidelines.

Wairarapa Hospital DSA Draft

1. Building Information	
Building Name/ Description	Wairarapa Hospital
Street Address	Te Ore Ore Rd, Masterton
Territorial Authority	Masterton District Council
No. of Storeys	1
Area of Typical Floor (approx.)	
Year of Design (approx.)	2006
NZ Standards designed to	AS/NZS1170
Structural System including Foundations	Varies – main hospital is light timber framed with trusses over lined timber framed walls. Service area is steel portal frames with tension only bracing. The entrance canopy has steel CHS posts with steel roof framing.
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	The site sub-soils are classed as Soil Class D per GNS report 'Sub-soil class determination using surface wave techniques in the Wellington region', dated 2016.
Previous strengthening and/ or significant alteration	Nil
Heritage Issues/ Status	Nil
Other Relevant Information	Nil

2. Assessment Information	
Consulting Practice	LGE Consulting
CPEng Responsible, including: • Name • CPEng number • A statement of suitable skills and experience in the seismic assessment of existing buildings[1]	Michelle Grant CPEng# 1012598 Michelle has experience in seismic assessment of existing buildings, using force and displacement based methods. Michelle has attended MBIE/SESOC/NZSEE training on Initials Seismic Assessments, and Part C of the Guidelines.
Documentation reviewed, including: • date/ version of drawings/ calculations[2] • previous seismic assessments	Structural Plans Architectural plans 4 pages of calculations when designed Contract Advice notices
Geotechnical Report(s)	Nil
Date(s) Building Inspected and extent of inspection	Completed on 11th November and 4th December 2017, and 14th and 20th February, 12th and 16th March.
Description of any structural testing undertaken and results summary	Nil
Previous Assessment Reports	Nil
Other Relevant Information	Nil

[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	Importance Level 4
Site Subsoil Class	D
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	
For a DSA:	
Summary of how Part C was applied, including: • the analysis methodology(s) used from C2 • other sections of Part C applied	Areas of building assessed separately in both longitudinal and transverse directions: Main timber framed building C2 - Force based assessment criteria C9 – Assignment of bracing capacities Service area C2 - Force based assessment criteria C6 – Steel members
Other Relevant Information	NOTE – DSA needs to include other structural items, ie entrance canopy, cafeteria etc. However more intrusive site investigation is needed to confirm the structural form in these areas. This is therefore to be considered a partial DSA only.

<table>
<tr><th colspan="3">4. Assessment Outcomes</th></tr>
<tr><td>Assessment Status
(Draft or Final)</td><td colspan="2">Draft</td></tr>
<tr><td>Assessed %NBS Rating</td><td colspan="2">Not considered to be potentially earthquake prone, further investigation recommended.</td></tr>
<tr><td>Seismic Grade and Relative Risk (from Table A3.1)</td><td colspan="2"></td></tr>
<tr><td>For an ISA:</td><td colspan="2"></td></tr>
<tr><td>Describe the Potential Critical Structural Weaknesses</td><td colspan="2"></td></tr>
<tr><td>Does the result reflect the building's expected behaviour, or is more information/ analysis required?</td><td colspan="2"></td></tr>
<tr><td>If the results of this ISA are being used for earthquake prone decision purposes, <u>and</u> elements rating <34<i>%NBS</i> have been identified:</td><td>Engineering Statement of Structural Weaknesses and Location</td><td>Mode of Failure and Physical Consequence Statement(s)</td></tr>
<tr><td>For a DSA:</td><td colspan="2"></td></tr>
<tr><td>Comment on the nature of Secondary Structural and Non-structural elements/ parts identified and assessed</td><td colspan="2">Secondary structural elements critical – this is being reviewed by Clendon Burns and Park and is not a part of this review.</td></tr>
<tr><td>Describe the Governing Critical Structural Weakness</td><td colspan="2">Failure of the connection between the roof and the bracing walls.
Service area portals failure of the rafter segment in buckling.
Entrance canopy connection failure of the steel 'frames'</td></tr>
<tr><td>If the results of this DSA are being used for earthquake prone decision purposes, <u>and</u> elements rating <34<i>%NBS</i> have been identified (including Parts)[3]:</td><td>Engineering Statement of Structural Weaknesses and Location</td><td>Mode of Failure and Physical Consequence Statement(s)</td></tr>
<tr><td>Recommendations
(optional for EPB purposes)</td><td colspan="2">A full as-built review of the hospital needs to be completed, and all areas not currently assessed need to be reviewed.</td></tr>
</table>

[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.