Report on Acute Services Buildings

Hawke's Bay Fallen Soldiers Memorial Hospital

Hawke's Bay District Health Board

Understanding the Current Seismic Risk Status of the Buildings

11 February 2022

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Contents

This report ('**Report**') has been prepared by WSP exclusively for Hawke's Bay District Health Board ('**Client**') in relation to reporting on Acute Services Buildings ('**Purpose**') and in accordance with the offer of service dated 14 September 2021. The findings in this Report are based on and are subject to the assumptions specified in the Report. WSP accepts no liability whatsoever for any reliance on or use of this Report, in whole or in part, for any use or purpose other than the Purpose or any use or reliance on the Report by any third party.

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Executive Summary

WSP was commissioned by HBDHB to respond to the "Brief for Further Engineering Input Required" prepared by Kestrel Group, dated 31 August 2021.

This brief was prepared to assist HBDHB with site-wide master planning to address clinical and operational requirements of the hospital and to meet the needs of the community. An indicative updated adjustment of previous seismic ratings of the nominated acute services buildings, with reference to anticipated code loading changes likely to follow forthcoming changes to the seismicity in the region was sought.

In taking in to account the forthcoming seismicity changes a significant increase in seismic loadings along the east coast of the North island are indicated due to its proximity to the Hikurangi subduction zone. While the values for Hastings are not yet established, there will likely be an increase on the current loading standard (NZS1170 Part 5) seismicity values.

To establish a consistent basis for reporting on the seismic status of the buildings for master planning purposes, the current assessment %NBS ratings were indicatively adjusted in proportion to the seismic demand corresponding to NZS 1170.5 seismicity loads**. This was carried out based on assessing the change in seismic demand input, and where possible considering key aspects of the building's response. It should be noted that the existing DSA's remain the current DSA's for the respective buildings and this exercise does not replace those assessments.** In this hypothetical exercise of what would be the effect of adjusting the %NBS by comparative seismic loadings, the assessments themselves, have not been revisited. The critical structural elements and likely behaviours were however reviewed in isolated instances as part of clarifying the current vulnerabilities.

The following documents were prepared for the master planning exercise:

1. A site plan of the nominated buildings.
2. A table of updated %NBS ratings for all nominated buildings adjusted to a common basis of IL4 and NZS 1170.5 loadings.
3. Clarification of the junctions and physical interfaces between nominated acute services buildings and comment on their likely response to earthquake events
4. Indicative categorisations of the expected performance of key non-structural elements in the critical services buildings
5. Qualitative comment on expected levels of overall damage to the key acute services buildings with a focus on behaviours in an earthquake with an expected recurrence of 1 in 500 years

A number of recommendations are made of items that can in the interim reduce currently identified risks for minimal resourcing. These include investigating the restraint of water tanks in Block AB, carrying out upgrading of inadequate roof bracing of the plant room of ICU, isolating the main stair of the two storey Laboratory Block, investigating in detail the restraint of equipment in the main Q HUB in the Physiotherapy Block, and continuing with the seismic upgrading works at AAU Block.

1 Introduction

1.1 Background

WSP was commissioned by HBDHB to respond to the "Brief for Further Engineering Input Required" prepared by Kestrel Group, dated 31 August 2021.

This brief was prepared to assist HBDHB with site-wide master planning to address clinical and operational requirements of the hospital and to meet the needs of the community. An Indicative adjustment of previous seismic ratings of the nominated acute services buildings, with reference to anticipated code loading changes likely to follow forthcoming changes to the seismicity in the region was sought.

In taking in to account the forthcoming seismicity changes a significant increase in seismic loadings along the east coast of the North island are indicated due to its proximity to the Hikurangi subduction zone. While the values for Hastings are not yet established, there will likely be an increase on the current loading standard (NZS1170 Part 5) seismicity values.

The key point for the Hawke's Bay Fallen Soldiers Memorial Hospital is that the 2012 site-specific (probabilistic) seismic hazard analysis (PSHA) undertaken by GNS Science and used for a number of Detailed Seismic Assessments (DSA's) and upgrade designs, has recently been shown to significantly understate the seismicity. This is due to the recent advances in the modelling of faults on which site-specific seismic hazard analyses are based on.

As part of the site-wide master planning there is a need to have a clearer picture of the current seismic risk status of the existing buildings on a consistent basis, with a key area of focus being the "Acute Services Buildings", as defined in Section 2. Further information in relation to non-structural elements of these buildings based on studies by WSP to date was also sought. Also sought was an understanding of how the individual buildings will physically interact with each other to help to increase the understanding of how the set of buildings are likely to respond individually and collectively to earthquake shaking.

While all IL4 buildings have had their current ratings updated to indicate the likely NZS1170.5 – based values, emphasis has been placed on the likely behaviours, in respect to life safety and continued functioning, of the buildings that accommodate the acute services response functions.

1.2 Scope

Key scope items are summarised as follows:

- Provide updated %New Building Standard (NBS) ratings for all assessed Importance Level 4 (IL4) buildings
- For the buildings making up the Acute Services Buildings:
    - Clarify the junctions and interfaces between all buildings
    - Provide indicative categorisations of the expected performance of key non-structural elements in the buildings
    - Provide qualitative commentary on expected levels of overall damage to buildings

1.3 Approach

To establish a consistent basis for reporting on the seismic status of the buildings for master planning purposes, the current assessment %NBS ratings were indicatively adjusted in proportion to the seismic demand corresponding to NZS 1170.5 seismicity loads.

This was carried out based on assessing the change in seismic demand input, and where possible considering key aspects of the building's response. It should be noted that the existing DSA's remain the current DSA's for the respective buildings and this exercise does not replace those assessments.

In this hypothetical exercise of what would be the effect of adjusting the %NBS by comparative seismic loadings, the assessments themselves, have not been revisited. The critical structural elements and likely behaviours were however reviewed in isolated instances as part of clarifying the current vulnerabilities.

The current "assessment guidelines" referred to in this document are the relevant parts of MBIE Technical Guidelines for Engineering Assessments (July 2017).

The following documents were prepared as part of this report to support a master planning exercise:

1. A site plan of the nominated buildings (Appendix A).
2. A table of updated %NBS ratings for all nominated buildings adjusted to a common basis of IL4 and NZS 1170.5 loadings (Appendix B).
3. Clarification of the junctions and physical interfaces between nominated acute services buildings and comment on their likely response to earthquake events (Appendix C)
4. Indicative categorisations of the expected performance of key non-structural elements in the critical services buildings (Appendix D)
5. Qualitative comment on expected levels of overall damage to the key acute services buildings with a focus on behaviours in an earthquake with an expected recurrence of 1 in 500 years (Appendix E)

These are discussed in detail in the below sections.

2 Site Plan

The site plan (Refer Figure 1) shows the location of the Acute Services Buildings and buildings identified as IL4 based on the draft guidance prepared by Kestrel Group for the Ministry of Health. (refer to Appendix A for a larger plan)

ACUTE SERVICES BUILDING DETAILS		
HBDHB BUILDING NO.	BUILDING NAME	SERVICES IN BUILDING
HA11	Hazardous Goods Store	Hazardous Goods Store
HA12	Chiller Building	Chiller Plant Room
HA13	Boiler House	Boiler house, Switchgear Room and Generator Buildings
HA15	Helicopter Hangar	Rescue Helicopter Hangar
HA20	Service Entry	Procurement Stores
HA23	Physiotherapy	Physiotherapy
HA25	Emergency Department	Emergency Department Entry
HA26	Laboratory	Laboratory
HA26a	Laboratory Extension	Radiology
HA27	Radiology Services	Radiology
HA27a	Radiology Services - Extension	Radiology
HA28	Special Care Baby Unit	Special Care Baby Unit
HA29	Wards Block	Wards Block
HA29a	Ata Rangi	Maternity Unit
HA29b	Waioha	Birthing Centre
HA30	Intensive Care Unit	Intensive Care Unit
HA31	General Medical Wards Access	General Medical Wards Access
HA32	General Medical Wards	General Medical Wards
HA32a	Pediatrics Ward	Pediatrics Ward
HA34	Pharmacy, Acute Assessment Unit	Pharmacy, Acute Assessment Unit
HA37	Theatre Block	Theatre Block

Figure 1. Site plan showing the location of IL4 and Acute Services Buildings

The following buildings have been defined as the 'acute services core': HA37 Theatre Block, HA27 Radiology, HA27a Radiology Extension, HA25 Emergency Department, HA30 ICU, HA26 Laboratory Block (2 storey), HA26a Laboratory Extension and HA28 SCBU.

These buildings were nominated from the Kestrel Group draft paper "Proposed Expansion of Importance Levels for Hospital Facilities", dated 8 September 2021. It includes inpatient wards buildings as IL4 and specialist functions or services. HA 04 Nga Rau Rakau Mental Health Unit (built 2016) could possibly be covered by its definition but was not included for this exercise.

It should be noted that most of the existing DSA's were commissioned on a department-by-department basis, whereas the Building Act describes buildings as separate structures. Thus, the names of some buildings have been changed from earlier assessments to comply with the Building Act definition particularly in the Laboratory/Radiology/Emergency Department locality.

The HA27 Radiology single storey building also includes much of the Emergency Department except for what is shown as HA25 Emergency Department Entry. Similarly, the HA26 Laboratory and HA26a, two storey buildings, include much of the Radiology Department on their ground floors.

3 Indicative Updated Seismic Ratings (%NBS)

The spreadsheet attached at Appendix B summarises the outcome of the desktop study which involves an update of the previously assessed seismic ratings (%NBS) of the Acute Services as Buildings.

This review constitutes a high-level, qualitative evaluation of change in seismic risk to inform decision-making at a point in time. As such they do not constitute a replacement of the current building DSA assessments, which remain unaltered.

Most of the buildings ratings were updated because they had previously been assessed or strengthened based on the PHSA report by GNS, dated September 2012, titled "Seismic Design Spectra and Geotechnical Hazard Summary for Hastings Hospital. The recommended ground acceleration coefficient in the 2012 PSHA report is lower than that prescribed in the Loadings Code (NZS1170.5).

Since the latest research on the Hikurangi subduction zone indicates an increase in the seismicity values for Hawke's Bay, it is deemed prudent for a consistent current comparison to update the assessed building ratings to the current NZS1170.5 as previously recommended by WSP.

In these cases, the %NBS has been updated by scaling down the assessed %NBS by the ratio of the seismic coefficients $Cd(T)_{NZS1170.5}$ and $Cd(T)_{PSHA}$. This method is simplistic and does not take into account non-linearity of structural response and therefore updated %NBS values may vary for some of the structures if a new quantitative DSA was completed.

The change from PSHA to NZS1170.5 loads as described above increases the loadings for the Ultimate Limit State earthquake by a factor of approximately 1.45 and therefore decreases the %NBS by approximately 45% for the short period buildings investigated. Further increases in seismicity can be anticipated with the revised National Seismic Hazard due later this year.

Buildings HA23 and HA32a have had their Importance Level categories adjusted from IL3 to IL4. This involves increased loadings by proportional additional factor of about 1.5.

HA25 (Emergency Department Entry) HA29a (Ata Rangi), HA32a (Paediatrics) and HA15 (Helicopter Services) have not had DSA's completed and have been assessed by IEP's, only. IEPs are qualitative assessments mostly based on year of construction and as such can be quite variable from DSA's for Ultimate Limit State assessments and do not accurately identify the continuous operation performance at Serviceability Limit State 2 (SLS2), as required for an IL4 building.

The summary of the indicative seismic ratings for ULS is presented in the spreadsheet attached at Appendix B. Note that the updated %NBS may vary for some of the buildings if a new quantitative DSA was completed for each building.

The following structures were reviewed in this study:

(1) HA 20 Service Entry
(2) HA 23 Physiotherapy
(3) HA 26 Laboratory (the two-storey block previously called Clinical Services Block)
(4) HA 26a Laboratory 1995 Extension
(5) HA 27 Radiology (the single storey block which includes the Emergency Department).
(6) HA25 Emergency Department Entry
(7) HA 27a Radiology 1995 extension
(8) HA 28 SCBU
(9) HA 30 ICU
(10) HA 34 AAU
(11) HA 37 Theatre Block

A further 10 nominated Importance Level 4 and 3 buildings were also similarly reviewed.

The below subsections describe some of the key building ratings in more detail.

It should be noted that older assessments did not specifically cover secondary structural and heavy non-structural elements and so such items that have been observed while on site visits have been noted.

3.1 HA30 ICU

HA30 ICU was assessed at about 100% IL4 (PSHA) for most elements apart from the load path restraining one side of the plant room located at ceiling height. A strengthening scheme of upgrading the roof framing intended to take these loadings would appear to be a relatively straight forward exercise that if carefully designed, could be constructed with the minimum of disruption. It is acknowledged there would need to be a "total project" consideration of a number of continued functioning issues prior to undertaking such strengthening.

3.2 HA28 SCBU

HA28 SCBU has its foundation columns as its critical elements. This building is part of the original 1980's Clinical Services Block but does not have nearby foundation bracing walls even if the ground floor slab is fully continuous over the original block. While an obvious strengthening concept would be the construction of bracing walls between the foundation columns, the location of the building being 'landlocked' by other buildings could prove a significant challenge to install. However, as explained later damage to the foundation system below ground is considered to not be as critical to life safety as the above ground structure.

3.3 The Ward Blocks (HA29 Block B, HA31 Block AB and HA32 Block A)

The Wards Blocks (HA29 Block B, HA31 Block AB and HA32 Block A) most recent assessments were carried out in 2010, based on non-linear time-history analyses. This very detailed model assessment methodology precedes the current assessment guidelines.

While the buildings were analysed for IL3 events, a summary report gives them assessments at 67%NBS IL4. It also anticipates significant spalling of concrete at IL3 or 67% IL4. It also notes the buildings could not be strengthened to fully comply with IL4.

If a medium to long-term future is seen for these buildings, a revised DSA should be carried out, with an initial review against the current assessment guidelines being the first step.

Block B is what is termed a "flat slab building". During the regional hospital project construction it was found that the cast-in-situ slabs had slightly sagged during the original construction which had been levelled by an asbestos compound. The asbestos was removed and replaced with light weight levelling compound. The sagging slabs were not known during the 2010 assessments and it is not known what effect that might have on the behaviour of the block.

3.4 HA27a Radiology Extension

HA27a Radiology Extension, a single storey building, was strengthened in 2019 to greater than 33% NBS IL4 (PSHA) in anticipation of the Radiology Project Upgrade project taking it to >67% IL4 (PSHA). The upgrade works carried out involved welding the connections of steel trusses to columns so they could act together as steel portals to supplement inadequately detailed cantilevered columns. Now, the next most critical elements are the truss end chords whose capacity would determine the building NBS.

3.5 HA25 Emergency Department Entry and HA29a Ata Rangi

HA25 Emergency Department Entry and HA29a Ata Rangi were found not to have been assessed and so as part of this exercise were assessed on the basis of IEP's. It should be noted that IEP assessments are heavily influenced by date of construction and an assessor judgement factor. Thus, they can vary considerably from follow up DSA's which would be more accurate.

3.6 HA34 AAU

HA34 AAU was classified as IL3 following discussions with the Hospital Emergency Response Management Team and based on emergency response planning. Thus, for this study of the standardised comparison with other buildings on the site, and the building has remained at IL3.

HA34 AAU was assessed part way through the project to expand Histology into the first floor of HA34. When its assessed condition was understood the first floor and services fixings were upgraded as a matter of urgency. Assessment and strengthening upgrading is currently being designed for the ground floor and basement. The ground floor bracing that was installed as part of the 1990's addition of the first storey is likely to be insufficient due to the capacity of their anchors drilled into concrete. A strengthening bracing system along the exterior walls has been proposed.

Being built over a former shingle pit which was backfilled with non-engineered fill has created a number of issues especially with the incomplete fixings of intended bracing foundation walls. A recent geotechnical study has noted the potential for deeper foundation material lenses to liquefy and has been subject to further study. A conclusion at this stage is that liquefaction effects could be mitigated within the designed additional foundation works.

3.7 HA23 Physiotherapy and HA32a Paediatrics

For this exercise Buildings HA23 and HA32a had their Importance Level categories adjusted from IL3 to IL4. This involved increased loadings by proportional factor of about 1.5 in addition to any increase for NZS 1170.5 loading.

Thus, for HA23 and HA32a the loadings used in the assessments have been increased by a factor of about 2.0 (or a reduction of the NBS by about 50%). It has resulted in these buildings being reduced to below 34%NBS (IL4). If the DSAs were to be revised in future, this is one of the criteria for a building being designated earthquake prone. However, based on the current seismic assessments as submitted to Hastings District Council, these buildings are not currently earthquake prone.

HA23 Physiotherapy was classified as IL3 based on the description of the building's main functions. However, during the Radiology upgrade design project it was learnt that a key piece of radiology equipment is proposed to be located within this building. Also, the non-structural elements study found the hospital's main IT Q HUB is located in this building. These factors would make assessment of this building at IL4, reasonable. As an alternative, the key equipment referred to could be relocated to an IL4 building and HA23 could continue to be considered at IL3.

4 Junctions between Nominated Acute Services Buildings

The data on the junctions between the nominated buildings is attached in Appendix C

This shows that the original 1980's HA26 Laboratory Block is surrounded by a 50mm seismic gap at first floor level (eaves level for adjacent buildings) located one half grid width outside the building framing plan. This gap was continued for most of the 1990's extensions to adjacent buildings including the first-floor slab of HA34 AAU. Subsequent DSA's have found the 50mm gap to be insufficient for the expected displacements of HA26.

HA32 Block A and HA29 Block B are noted in their respective DSA's as having 150mm seismic gaps with HA31 Block AB and this was confirmed by photo. Holmes Group, as part of its time-history assessments of the blocks carried out a study on the interactions between the buildings. It found pounding between A/AB and AB/B is unlikely during a 1/500 year (IL2/ IL4, SLS2) seismic event and a 1/1000 year (IL3) seismic event but likely for both locations a 1/2500 year (IL4) seismic event. Strengthening would be required to reduce such relative movements

The main corridor which is part of HA37 Theatre Block was found to have no seismic gap with HA28 SCBU, HA27a Radiology Extension and HA26a Laboratory Extension with the corridor walls effectively built into the framing of the respective buildings. This would affect the response of the corridor, where it is likely the weakest link (possibly the link corridors on the other side of the main corridor) would tend to absorb any out of phase movements. The net result is likely to be deflections of the ceiling framing leading to collapse of areas of light weight ceiling tiles.

4.1 Services Across Seismic Gaps

Intrusive investigations have found that services and ceilings crossing the seismic gaps have not been detailed for the differential movement expected across such gaps. This will likely lead to services and ceiling being damaged or failing during a seismic event. We therefore recommend as a minimum any critical services crossing seismic gaps to be assessed and remediated as soon possible.

4.2 Pounding

The analysis of the buildings shows that the 50mm seismic gap between HA26 and the surrounding buildings is insufficient and in a 500year seismic event the buildings are likely to collide. This is at IL4, SLS2 level of shaking. The effects of this are explained in detail below.

Pounding occurs when the gap between two buildings is not sufficient and during a seismic event the buildings collide causing a change in behaviour of the buildings and may result in significant damage. The quantification of the effects and damage due to pounding is very difficult and is associated with considerable uncertainty.

Pounding between buildings is more of a concern if one of the below situations is present:

1. Misaligned floors and column-to-floor pounding.
2. Aligned floors but with mass difference.
3. Aligned floors but with building height difference.

The seismic gap around the Laboratory Building (HA26) is 50mm which in an 500year seismic event will be exceeded and therefore pounding will occur. HA26 is a two-storey concrete framed building and is surrounded by predominately single storey concrete framed buildings which align with the first floor of HA26. Therefore, case 2 and 3 occur and pounding is likely to affect the performance of the buildings.

As per Part C of the MBIE Technical Guidelines for Engineering Assessments (July 2017), Appendix C2B (Section C2B.5.3) pounding is likely to cause up to a 75% increase is demand on the immediately adjacent second storey perimeter columns of HA26 and a 25% increase to the first-floor perimeter columns. The surrounding building column loads are expected to increase by approximately 20%.

However, in this case because the buildings are at or very close to their capacity at these displacements the additional loads from pounding do not significantly affect their %NBS ratings due to their capacity already being reached.

4.3 Ground Floor Slab Level

The ground floor slab level of the hospital is generally tied together between the buildings which makes the analysis very complex and therefore uncertain. This is further complicated because the ground floor is supported on a mixture of foundation systems including slab on grade, cantilevered columns, foundation blockwork walls, concrete foundation walls and concrete basement walls.

For the current assessments the foundations have been assessed as if they are not tied together. We believe this is a suitable method for assessment as this shows if there is enough strength

locally to resist the building loads from above. We can expect some re-distribution of load to occur, but note there are also some weak diaphragm and connection details of the floor to the foundation walls.

We expect the superstructure performance to govern failure and foundation damage associated with redistribution is likely to be a progressive failure mechanism that is unlikely to cause global failure of the structure above.

HA34 AAU and HA 23 Physiotherapy are connected at first floor/ single storey eaves level and proposed strengthening concept schemes involve creating an appropriate seismic gap between the buildings which was assumed completed in the DSA of both buildings.

5 Performance of Non-structural elements

The comments on the assessments of non-structural elements are based on the previous work by WSP which has been adapted to the format agreed for this report. One key difference is changing from assessing by compliance (as per FEMA 74) to assessing by rating categories.

Non-structural elements refer to the parts of the building that are not considered primary or secondary structure, but that are affected by structural loads, and in particular seismic loads. This includes restraint of the following in general terms:

- Cladding
- Partitions, including firewalls
- Ceilings
- Building service runs including fire sprinkler pipework
- Mechanical & electrical plant and equipment

This evaluation utilises Vulnerability Ratings which are described in terms of Continued Functionality (CF) under three criteria given below.

A. Element restraint

Rating	Category	Description
1	CF_{likely}	Appears well restrained, likely to enable continued functionality in major (~ 500 year) earthquake shaking
2	$CF_{uncertain}$	Some restraint (partial) but unlikely to be adequate in major earthquake shaking but likely to enable continued functionality in minor (~ 100 year) earthquake shaking
3	$CF_{unlikely}$	No restraint apparent, unlikely to enable continued functionality in minor earthquake shaking
NI	NI	No information currently available

B. Element movement capacity

Rating	Category	Description
1	CF_{likely}	Adequate movement available or not an issue, likely to enable continued functionality in major (~ 500 year) earthquake shaking

2	$CF_{uncertain}$	Some movement available but unlikely to be adequate in major earthquake shaking but likely to enable continued functionality in minor (~ 100 year) earthquake shaking
3	$CF_{unlikely}$	No ability to move apparent, unlikely to enable continued functionality in minor (~ 100 year) earthquake shaking
NI	NI	No information currently available

C. ***Internal capability of adequately restrained equipment to withstand shaking*** *(applies to specialised equipment)*

Rating	Category	Description
1	CF_{likely}	Equipment has seismic qualification (or is considered 'rugged' and qualification therefore unnecessary), likely to provide continued functionality in major (~ 500 year) earthquake shaking
2	$CF_{uncertain}$	Uncertain
3	$CF_{unlikely}$	Inadequate
NI	NI	No information currently available

WSP began its work by assessing main accessways, services hubs, main services distribution lines to buildings and have assessed services under HA27 Radiology. The data from these assessments have been summarised and adapted into the summary sheet using the ratings above. This information is generalised by type across the Acute Services Buildings.

In accordance with the current assessment guidelines, recent DSA's have also included general assessments of heavy non-structural elements in respective buildings as well as being tasked to comment on other non-structural elements that too have been incorporated into the spreadsheet at Appendix D.

It is noted that the assessment of these services is based on qualitative assessment of fixings based on visual inspection (photos) and available drawings. It therefore captures service restraint conditions in areas that are representative. No calculations have been carried out, and it does not constitute a review of Code compliance. It does not constitute an assessment of the resilience or redundancy designed into a given service system. We note that if there is a system with a single point of failure, it only takes failure of one fixing and/or joint to result in loss of service of that system.

The Acute Services buildings contain a very high number of non-structural elements in congested configurations that provide the many services that these specialist buildings require for continuing functioning. The comments on Appendix D are often are campus-wide for buildings of the same respective eras (mostly dating to the regional hospital upgrade). As a general comment, poor lateral restraint of non-structural components results in movement and where this is excessive, it causes damage. While this may not be a life-safety threat, it is likely to affect operational continuity.

The assessments at Appendix D have identified 3 elements (1 generic) with a rating of 3, using the criteria in the above tables, of which 1 would directly affect future continuity and 13 (12 generic) with a rating of 2 of which 8 could affect future continuity.

Generally, there appears to be gravity support only for non-structural elements. Major pipes and fire sprinkler systems span between buildings unrestrained. There are very few observed seismic restraints in the sub-floor and ceiling spaces. The sparse connections would not comply with the

current design codes. It was concluded there were no provisions for flexible or movement joints at inter-building locations.

All suspended ceilings inspected are light weight panels supported on a light-weight steel grid comprising inverted T sections supported by wire hangers or L framing fixed to ceiling edge walls. These ceilings have not been designed for seismic movement, in contrast to current light weight suspended ceilings. While the loss of tiles may be anticipated at locations of differential movements, they would not be considered to pose a life safety hazard. The framing would generally remain exposed and continue to support any light services elements such as air vents or small numbers of communications cabling.

HVAC units suspended in ceilings are generally supported by rod hangers at each corner anchored into the concrete slab or timber framing above. While not braced they would be anticipated to swing without collapsing provided the fixings are adequate but could interact with adjacent services ducts or pipes. This may affect operational continuity.

Suspended ductwork is generally supported by steel trapeze and end rods fixed above. With no sway braces these would be expected to swing without collapsing provided the fixings are adequate but could interact with adjacent services ducts or pipes.

Most buildings have plant rooms on mezzanine floors just above ceiling height. Most of the plant items are fixed in place but the capacity of the fixings could not be ascertained. So, most items would appear to be restrained to a certain extent by the fixings. At a few isolated locations restraint of some non-structural elements could not be located.

Pressure piping (gas) and other fluid piping generally is supported by rod hangers and restrained at regular intervals without sway braces. Such pipework could in a major event (a 500-year return period event or greater) tend to be damaged at rigid bends, penetrations and building joint locations.

Electrical and communications cables are generally tied together and attached to the underside of ductworks or laid directly on the suspended ceilings. Cable trays are in place in some locations and supported by rod hangers at regular spacing.

The main stair stringers of HA26 Laboratory Block are rigidly fixed to concrete slabs at half level landings. It has been recommended that above ground floor these stringers be isolated to allow differential movements of the landings (estimated up to 35 mm) without experiencing damage. A proposal was designed and is intended to be incorporated in the Radiology refurbishment project, which is currently on hold. It is recommended this isolation work proceeds to maintain this main egress stair in a major event.

The IT Q HUB in HA23 Physiotherapy is the main IT centre for the hospital. The plant and equipment were restrained to a certain extent post 2005 by what appears to be light weight steel framing. It seems to rely on the unbraced floating floor continuing to provide vertical support to the IT racks in a seismic event. Restraint of some of the plant cupboards could not be confirmed. A detailed assessment and if necessary, design of improved restraint is recommended.

The Radiology IT HUB appears to have items supported on a floating floor with no restraint. It is recommended such restraint be investigated and designed if required.

The identification assessment and upgrading of all non-structural elements in each building would be an extensive and very intrusive exercise. Thus, it is recommended that upgrading of non-structural elements be included as part of extensive building renovation projects. This could be augmented by a resilience assessment of the key services to identify single points of failure.

6 Qualitative Comments on Anticipated Levels of Overall Damage

The qualitative comments on anticipated levels of overall damage are a combination of all the above sections of work and were the result of a workshop of staff who have been involved in assessments, peer review of assessments and the design and peer review of designs of upgrades to these buildings.

Describing levels of damage to the nominated return period earthquakes with any certainty goes beyond the typical scope of seismic assessments. We have based our comments on the existing information and have made indications of the sorts of damage that may occur. They are qualitative comments only of what might happen based on the DSA reports and a high degree of judgement and could in no way be considered to be predictions.

The comments are contained on the spreadsheet at Appendix E.

The older DSA's did not pick up non-structural elements nor critical secondary structural and heavy non-structural elements. Thus, while we have noted a few items that we are aware of, such as the heavy water tanks at the top of HA 31 Block AB, we cannot guarantee that our comments cover all such elements.

The following secondary structural and heavy non-structural elements that have the potential for life injury and could affect continued functionality, were noted as requiring further investigation:

- The brick cladding of spandrel beams of Blocks A and B. While these appear to be mortared to the supporting reinforced concrete walls the potential for any of these elements to be displaced and drop onto buildings or walkways below
- Block B has exposed stone cladding which while appearing to be well fixed should also be investigated.

Noted comments on the more obvious non-structural elements that could have effects on life safety and continued functionality would be:

HA31 Block AB has significantly sized water header tanks in the upper floor. The potential for water damage to affect services, lifts, access would affect the continued functioning of Blocks AB, A and B. It is recommended that the restraint of these tanks be investigated, and any required upgrading be undertaken as a priority.

HA26 Laboratory main stair. This is the main egress from the first storey of the Laboratory Block and has its stringers cast and bolt fixed to the structure at half landing floor levels and so have no capacity for differential drifts of the landings. Depending on the drifts there is the potential for the stringers to buckle or lose their support, making the stair inoperable and limit the continued access to and from the Laboratory Department. A mitigating stringer movement isolation scheme has been designed for some time but is still waiting to be undertaken. It is included in the Radiology upgrade project which is currently on hold.

HA23 Physiotherapy Block's IT Q HUB is recommended for detailed assessment and additional bracing if found necessary.

HA34 AAU was assessed and strengthening designed for IL3, following consultation with the Hospital Health Emergency Response Management. The design of ground and foundation strengthening has identified issues due to potential liquefaction of sub foundation depth layers and has designed measures to mitigate potential effects.

The HA30 ICU DSA identified that part of the roof structure transfers from the elevated plant room to the side walls as critical and has provided a "relatively" straight forward roof bracing retrofit concept to mitigate this weakness. It is recommended that the potential to mitigate this weakness

ahead of any other required long-term strengthening, be investigated for a short-term return to upgrade the building's safety and potential functionality, noting it would also need to consider all consequential impacts during construction on current functioning of ICU and associated costs..

Recent assessment studies have shown how the site potentially could be affected by liquefaction of the thin layers of river-laid silts that lie below the near surface gravel bearing layers. There have been numerous geotechnical studies of the foundation materials at locations around the site that have acknowledged these layers but so far have concluded the net result from significant earthquakes is likely to be localised building settlements. Modern geotechnical investigation provides far more accurate detailed information on the likelihood and consequences of liquefaction with a greater degree of certainty.

Thus, it is recommended that as part of any long-term site wide master planning a site wide geotechnical investigation based on existing records, is undertaken to better understand any potential foundation issues of building (particularly multi-storey building) developments on the site.

7 Recommendations

It is usual that DSA reports contain recommendations for upgrading of buildings to greater than 67%NBS for a further 50-year life. While this still applies for the Acute Services Buildings it is acknowledged that this exercise is for the short term in order for long term site planning to be undertaken. For the purposes of this report, short term is understood to be up to 10 years from the time of writing.

When considering actions to be taken, the following aspects of risk, related to seismic should be noted. Risk is the likelihood of an event times the consequence. In terms of likelihood, the probability of exceedance is shown in Table 1 below for a 500 year return period event, when considering both 50 years, and 10 years.

Table 1. Probabilities of exceedance of a seismic event for various return periods and time periods.

	500-year return period		100year return period	
Time period considered	50 years	10 years	50 years	10 years
Probability of exceedance in a given time period	10%	2%	40%	10%

The other aspect of risk associated with a seismic event is the consequence. The information within this report provides an indication of consequence. Consequences of damage that would impact operation need to be considered by HBDHB. These may be such that the consequences drive decision-making more than the likelihood of such an event. A risk evaluation is not part of this report but forms an important part of any decision-making. We recommend such a risk evaluation be carried out.

The following recommendations are made of items that can in the interim reduce currently identified risks for minimal resourcing in a suggested order.

7.1 HA31 Block AB

This building has significantly sized water header tanks in its upper floor. It is unknown to what extent these tanks are restrained if at all. Without detailed assessment there could be the potential for the water contents to discharge during a major seismic event which would likely result in damage to the lifts and services in the building. This could affect the functioning of Blocks AB, A and B. It is recommended that the restraint of these tanks be investigated, and any required upgrading be undertaken as a priority.

7.2 HA30 ICU

It is recommended that a strengthening scheme to upgrade the roof framing to take seismic loadings from the weaker side of the elevated plant room be investigated for a short-term return that would improve the building's safety and potential continued functionality following a major seismic event noting it would also need to consider all consequential impacts on current functioning of ICU and associated costs.

7.3 HA26 Laboratory Block Main Stair

This stair is the main egress from the first storey of the Laboratory Block and has its supporting steel stringers fixed into the structure at half storey landings and so have no capacity to absorb differential drifts of the landings. A mitigating stringer movement isolation scheme has been designed for some time and has been included in Radiology upgrade project which is currently on hold. It is recommended this proceed as a separate project.

7.4 HA23 Physiotherapy Block IT Q HUB

The IT Q HUB in HA23 Physiotherapy is the main IT centre for the hospital and some of the equipment was braced to a certain extent post 2005. A detailed assessment and if necessary, design of improved restraint is recommended.

7.5 HA29 & HA32 Blocks B and A Masonry Cladding Fixings

It is recommended the fixings of the brick and stone claddings on these blocks be investigated and assessed.

7.6 HA34 AAU

It is recommended the design and upgrade of ground and foundation strengthening to HA34 AAU which includes seismic separation from HA23 continue in order to mitigate the effects of potential liquefaction of sub foundation depth layers that has been identified.

General Recommendations

7.7 DSA's

DSA's are recommended for HA25 Emergency Department Entry, HA29a Ata Rangi and HA32a Paediatrics.

7.8 Non-Structural Elements

The identification assessment and upgrading of all non-structural elements in each building would be an extensive and very intrusive exercise. Thus, it is recommended that upgrading of non-structural elements be included as part of extensive building renovation projects.

It is further recommended consideration be given to using the available assessment information for developing an upgrading of a critical service by critical service upgrade of the main piped networks from source to where they enter each acute services building, particularly around junctions and seismic joints between buildings.

7.9 Geotechnical Investigation

It is recommended that any long-term site wide planning exercise include geotechnical investigation based on existing records and current investigation techniques to better understand the potential for the liquefaction of already identified sub surface silt layers and its effects.

Appendix A

Acute Services Buildings Site Plan

SITE PLAN

SCALE 1:750 [A1], 1:1500 [A3]

ACUTE SERVICES BUILDING DETAILS		
HBDHB BUILDING NO.	BUILDING NAME	SERVICES IN BUILDING
HA11	Hazardous Goods Store	Hazardous Goods Store
HA12	Chiller Building	Chiller Plant Room
HA13	Boiler House	Boiler house, Switchgear Room and Generator Buildings
HA15	Helicopter Hangar	Rescue Helicopter Hangar
HA20	Service Entry	Procurement Stores
HA23	Physiotherapy	Physiotherapy
HA25	Emergency Department	Emergency Department Entry
HA26	Laboratory	Laboratory
HA26a	Laboratory Extension	Radiology
HA27	Radiology Services	Radiology
HA27a	Radiology Services - Extension	Radiology
HA28	Special Care Baby Unit	Special Care Baby Unit
HA29	Wards Block	Wards Block
HA29a	Ata Rangi	Maternity Unit
HA29b	Waioha	Birthing Centre
HA30	Intensive Care Unit	Intensive Care Unit
HA31	General Medical Wards Access	General Medical Wards Access
HA32	General Medical Wards	General Medical Wards
HA32a	Pediatrics Ward	Pediatrics Ward
HA34	Pharmacy, Acute Assessment Unit	Pharmacy, Acute Assessment Unit
HA37	Theatre Block	Theatre Block

1:100 @ A1
1:200 @ A3
0 2000 4000 6000 8000 10000 mm

REVISION	AMENDMENT	APPROVED	DATE
1	ISSUED FOR CLIENT USE	N.E	29/10/2021
2	UPDATING TABLE HEADING	N.E	08/11/2021

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STRUCTURES

SCALES: 1:750 [A1], 1:1500 [A3]
ORIGINAL SIZE: A1

DRAWN	DESIGNED	APPROVED
C.MURRAY	C.MURRAY	N.EVANS
DRAWING VERIFIED	DESIGN VERIFIED	APPROVED DATE
G.LI	G.LI	2021-10-29

ISSUED FOR CLIENT USE

PROJECT
HAWKES BAY DISTRICT HEALTH BOARD
398 OMAHU ROAD, HASTINGS
ACUTE SERVICES BUILDINGS

TITLE
SITE PLAN

WSP PROJECT NO. (SUB-PROJECT): 2-S5000.13
SHEET NO.: S01
REVISION: 2

Appendix B

Updated % NBS Ratings for Acute Services Buildings

HBDHB Acute Services Corridor Buildings and Designated IL4 Buildings

Seismic Update 5 November 2021

KEY:
Green - Low Risk
67%-100% of NBS

Blue - Low Medium Risk
50%-67% of NBS

Orange - Medium Risk
33%-50% of NBS

Red - High Risk
0%-33% of NBS

Rangi and HA32asss

Bldg. No.	Building Name	Services in Building	Date of Construction/ Major upgrade	No of Storeys (excl basement)	Previous Assessment Seismic Importance Level	Date of Previous Assessment	Consultant/ Upgrade Designer	Standard used for Assessment	Assessment Type *If other, use Comment field to specify*	Assessed NBS (%)	Updated Rating (X%NBS(ILY) to NZS1170.5: 2004	Heavy Parts to be Assessed	Identified Critical Structural Weakness (yes/no) *If yes, use Comment field to specify*	Drop Zone Issues Identified? (yes/no) *If yes, use Comment field to specify*	Comments	General Comment or Issues
HA37	Theatre Block	Surgical Services	1997	**1**	IL4	Jul-19	LHT	PSHA 2012	Detailed Seismic Assessment (DSA) & Interim Upgrade	15%	50% (IL4)	Assume coverd by upgrade	Yes	No	Construction underway	Seismic strengthening underway (2021) to achieve 70% IL4 of PSHA which is 50% IL4 of 1170.5
HA27	Radiology	Emergency Department/ Radiology Services	1980's	1	IL4	Jul-18	WSP	PSHA 2012	Detailed Seismic Assessment (DSA)	35%	30% (IL4)	No	Yes	No	RC column Flexural capacity in Y direction critical	Renovation Project on HOLD
HA27a	Radiology Extension	Radiology Services	1997	1	IL4	Jun-19	WSP	PSHA 2012	Detailed Seismic Assessment (DSA) & Interim Upgrade	34%	25% (IL4)	No	Yes	No	Columns & Trusse connections upgraded to >33% IL4 (PSHA) in anticipation of a major upgrade of Radiology & Laboratory. Roof truss chords now critical elements.	Renovation Project on HOLD Interim Works complete in 2020
HA25	Emergency Department	Emergency Department Entry	1980 & 1997	1	IL4	Oct-21	WSP	NZS 1170.5:2004	Initial Evaluation Process (IEP)	45%	45% (IL4)	No	No	No	No DSA although recommended. IEP used an F factor of 1.0 based on surrounding buildings	Interaction with adjacent buildings uncertain
HA30	ICU	Intensive Care Unit	1996	1	IL4	Jun-21	ACH	PSHA 2012	Detailed Seismic Assessment (DSA)	40%	25% (IL4)	No	No	No	Buckling of plant room steel transfer members critical. Could lead to potential failure of steel roof system.	Strengthening the plant room will signficantly increase the overall building rating.
HA26	Laboratory Block	Laboratory (upper floor) Radiology/ ED (ground floor)	1980's	2	IL4	Jun-13	WSP	PSHA 2012	Detailed Seismic Assessment (DSA)	65%	45% (IL4)	No	Yes	No	The flexural capacity of RC columns is critical.	Previously called Clinical Services Block for its DSA Designed interstorey isolation of main stairs yet to be undertaken.
HA26a	Laboratory Extension	Radiology (ground floor)	1997	1 (2 anticipated)	IL4	Jul-19	WSP	PSHA 2012	Detailed Seismic Assessment (DSA)	70%	50% (IL4)	No	No	No	DSA was undertaken as part of Radiology DSA.	Part of Radiology DSA (1997 Lab Extn.)
HA28	SCBU	Special Care Baby Unit	1980's	1	IL4	Jun-21	ACH	PSHA 2012	Detailed Seismic Assessment (DSA)	40%	30% (IL4)	No	No	No	Sub floor RC columns critical. No sub floor foundation walls in locality.	
HA23	Physiotherapy	Physiotherapy Orthopaedic	1980	1	IL3	Jun-21	WSP	PSHA 2012	Detailed Seismic Assessment (DSA)	40%	30% (IL4)	No	Yes	No	RC columns to ground floor critical. IT HUB bracing (post 2005) needs detailed assessment.	High Earthquake Risk. Upgrading to >67%NBS (IL4) would require foundation walls and bracing elements to ground floor and roof framing.
HA34	AAU	Pharmacy, Acute Assessment Unit (ground floor) Histology, Education Centre, Library (second floor)	1997	**2**	IL3	Jan-21	WSP	PSHA 2012	Detailed Seismic Assessment (DSA)	37%	33% (IL3)	No	Yes	No	This building was set at IL3 after consultation with Hospital Emergency Response Management. The upper storeys, added in 1995, were upgraded to>70% IL3 in 2018 (PSHA 2012), to accommodate the new Histology lab and retain a functioning AAU (ground floor). The 1995 installed braces to the ground floor would intially limit the rating. However, the original RC beam/column structure would be able to withstand the rating given. The partially designed upgrading of basement and ground floors consists of additional/upgraded foundation walls and external bracing frames and separation from HA23. Potential liquefaction effects are possible if basement works designed to mitigate worste effects do not occur.	Current rating from WSP from Stage 3 design works so far.

KEY:
Green - Low Risk
67%-100% of NBS
Blue - Low Medium Risk
50%-67% of NBS
Orange - Medium Risk
33%-50% of NBS
Red - High Risk
0%-33% of NBS

Bldg. No.	Building Name	Services in Building	Date of Construction/ Major upgrade	No of Storeys (excl basement)	Previous Assessment Seismic Importance Level	Date of Previous Assessment	Consultant/ Upgrade Designer	Standard used for Assessment	Assessment Type *If other, use Comment field to specify*	Assessed NBS (%)	Updated Rating (X%NBS(IL Y) to NZS1170.5: 2004	Heavy Parts to be Assessed	Identified Critical Structural Weakness (yes/no) *If yes, use Comment field to specify*	Drop Zone Issues Identified? (yes/no) *If yes, use Comment field to specify*	Comments	General Comment or Issues
HA29	B-Block	Wards Block	1960's	4	IL4	Mar-10	Holmes	NZS 1170.5:2004	Detailed Seismic Assessment (DSA)	67%	67% (IL4)	Fixing of brick cladding	No	Yes	DSA completed in 2010 based on time history analyses, before PSHA 2012 was completed. Potential drop zone of spalled concrete onto HA29a, HA29b and surrounds.	IEP 2013 (WSP) takes into account DSA 2010 (Holmes) and 2010 Strengthening works to IL3.Minor works recommended to achieve these rating undertaken in 2012. Notes the building could not be upgraded to 100% (IL4). Notes cracking/ spalling damage can be expected at lower seismic accelerations than for new structures. 1995 renovations found the original cast in situ suspended flat slabs had slight sags. Asbestos on floors removed. Asbestos on walls left undisturbed and sealed. West End stairs currently being inter-storey isolated.
HA29a	Ata Rangi	Maternity Unit	1960's	1	IL4	Oct-21	WSP	NZS 1170.5:2004	Initial Evaluation Process (IEP)	34%	34% (IL4)	No	No	No	No DSA. A DSA of this single storey RC wall building would very likely give about 45% NBS IL4 Common foundation but no link to Block B at eaves level	The 2010 DSA of B-Block did not consider Ata Rangi. The recent IEP considered the 2017 rennovations designed to IL3.
HA29b	Waioha	Birthing Unit	2016	1	IL4	Oct-21	WSP	NZS 1170.5:2004	New Built & Part Upgraded (IEP)	85%	85% (IL4)	No	No	No	Extension and roof over existing to NZS 1170.5 in 2016. No seismic gap to Block B	Nil
HA31	AB Block	General Medical Wards Access	1950's	6	IL4	Mar-10	Holmes	NZS 1170.5:2004	Detailed Seismic Assessment (DSA)	67%	67% (IL4)	Top Level water tanks	No	Yes	DSA completed in 2010, based on time history analyses before PSHA 2012 was completed. Lift equipment not commented on. Heavy header water tanks noted on 6th floor Potential drop of spalled concrete onto HA 29a	IEP 2013 (WSP) takes into account DSA 2010 (Holmes) and 2010 Strengthening works. Notes the building could not be upgraded to 100% (IL4). IEP 2017 (WSP). Note cracking/spalling damage (mostly to spandrel beams) can be expected at lower seismic accelerations than for new structures
HA32	A Block	General Medical Wards	1950's	5	IL4	Mar-10	Holmes	NZS 1170.5:2004	Detailed Seismic Assessment (DSA)	67%	67% (IL4)	Fixing of brick cladding	No	Yes	DSA completed in 2010, based on time history analyses before PSHA 2012 was completed. Potential drop zone of spalled concrete onto HA 32a and access areas	IEP 2013 (WSP) takes into account DSA 2010 (Holmes) and 2010 Strengthening works. Notes the building could not be upgraded to 100% (IL4). IEP 2017 IL3 Rating (WSP). Note cracking/ spalling damage can be expected at lower seismic accelerations than for new structures.
HA32a	Paediatrics	Paediatrics Ward	1970's	1	IL3	Oct-17	WSP		Initial Evaluation Process (IEP)	85%	60% (IL4)	No	No	No	No DSA	DSA recommended
HA20	Service Entry	Procurement stores	1997	1	IL3	Jun-21	WSP	PSHA 2012	Detailed Seismic Assessment (DSA)	45%	45% (IL3)	No	Yes	No	Transverse steel frames critical	Moderate Earthquake Risk. Limitations on the strength of existing elements would make strengthening to >67% (IL4) very difficult
HA12	Chiller Plant Room	Chiller and Services Plant Room	2013	1	IL4	Apr-17	LHT	NZS 1170.5:2004	Building Upgrade (IEP)	100%	100% (IL4)	No	No	No	Upgrade complete in 2013. Designer then not aware of PSHA 2012	Rating confirmed by designer in IEP review 2017 Upgrade completed 2013 to 100% of IL4
HA13	Former Boiler House	Boiler House, Switchgear Room and Generator buildings	2012	1	IL4	Oct-17	Holmes, Geoff Kell Consultants, LHT	NZS 1170.5:2004	Building Upgrade (IEP)	100%	100% (IL4)	No	No	No	No DSA. Holmes 2012 PS1 Boiler Bldg. Calculation confirm standard	Boiler Bldg. - Upgrade completed 2011 100% IL4 (Holmes) Switchgear Bldg. - Upgrade completed 2012 100% IL4 (Geoff Kell). Rating confirmed by switchgear designer in IEP 2017. Generator and Switchgear building - Refurb to commence in 2021 (Generator Room Project - LHT)
HA11	Dangerous Good Store	Hazardous Goods Store	2010	1	IL3	Nov-13	WSP	PSHA 2012	Building Upgrade (IEP)	76%	100% (IL 4)	No	No	No	No DSA Built complete in 2012 - before PSHA was produced PS1 and PS4 does not mention IL rating IEP 2013. IEP corrected in 2021 review	Constructed in 2011
HA15	Helicopter Service	Rescue Helicopter Hangar	2000	1	IL4	Nov-13	WSP	PSHA 2012	Initial Evaluation Process (IEP)	100%	67% (IL4)	No	No	No	No DSA An IL4 SLS assessment was recommended	Cross-bracing likely not ductile detailed.

Appendix C

Junctions between Nominated Acute Services Buildings

SITE PLAN

SCALE 1:750 [A1], 1:1500 [A3]

CRITICAL SERVICES BUILDING DETAILS		
HBDHB BUILDING NO.	BUILDING NAME	SERVICES IN BUILDING
HA11	Hazardous Goods Store	Hazardous Goods Store
HA12	Chiller Building	Chiller Plant Room
HA13	Boiler House	Boiler house, Switchgear Room and Generator Buildings
HA15	Helicopter Hangar	Rescue Helicopter Hangar
HA20	Service Entry	Procurement Stores
HA23	Physiotherapy	Physiotherapy
HA25	Emergency Department	Emergency Department Entry
HA26	Laboratory	Laboratory
HA26a	Laboratory Extension	Radiology
HA27	Radiology Services	Radiology
HA27a	Radiology Services - Extension	Radiology
HA28	Special Care Baby Unit	Special Care Baby Unit
HA29	Wards Block	Wards Block
HA29a	Ata Rangi	Maternity Unit
HA29b	Waioha	Birthing Centre
HA30	Intensive Care Unit	Intensive Care Unit
HA31	General Medical Wards Access	General Medical Wards Access
HA32	General Medical Wards	General Medical Wards
HA32a	Pediatrics Ward	Pediatrics Ward
HA34	Pharmacy, Acute Assessment Unit	Pharmacy, Acute Assessment Unit
HA37	Theatre Block	Theatre Block

300 mm 200 100 50 0 10 mm

1:100 @ A1
1:200 @ A3
0 2000 4000 6000 8000 10000 mm

REVISION	AMENDMENT	APPROVED	DATE
1	ISSUED FOR CLIENT USE	N.E	10/12/2021

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Napier 4142
New Zealand

STRUCTURES

SCALES: 1:750 [A1], 1:1500 [A3]
ORIGINAL SIZE: A1

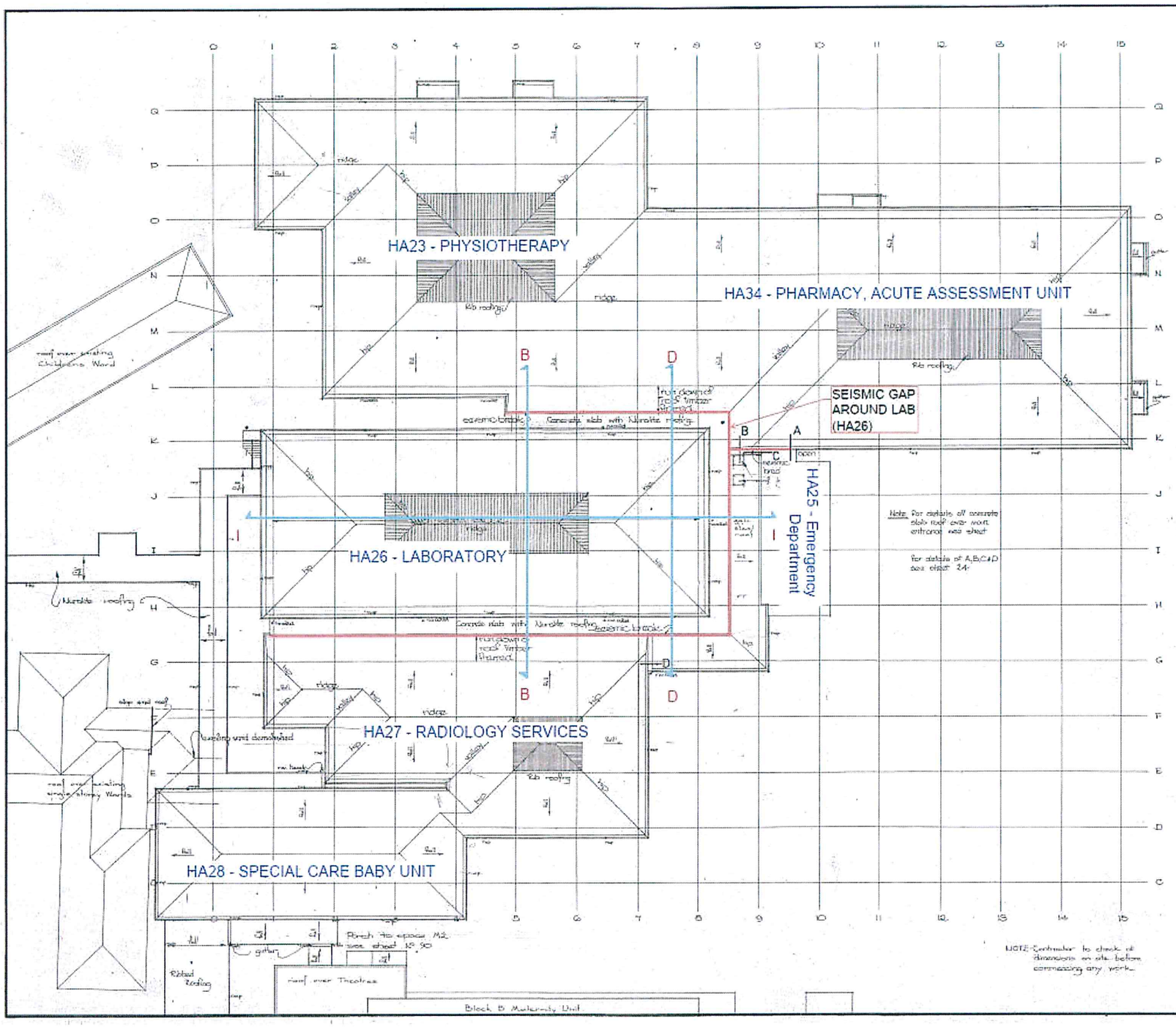
DRAWN	DESIGNED	APPROVED
G.LI	G.LI	N.EVANS
DRAWING VERIFIED	DESIGN VERIFIED	APPROVED DATE
S.MCCONWAY	S.MCCONWAY	2021-12-10

ISSUED FOR CLIENT USE

PROJECT
HAWKES BAY DISTRICT HEALTH BOARD
398 OMAHU ROAD, HASTINGS
ACUTE SERVICES BUILDINGS

TITLE
SITE PLAN

WSP PROJECT NO. (SUB-PROJECT): 2-S5000.13
SHEET NO.: S01
REVISION: 1



THE HAWKES BAY HOSPITAL BOARD

MEMORIAL HOSPITAL HASTINGS

BLOCK 'CH' CLINICAL SERVICES

KEY PLAN

KINGSFORD, SMITH, NORWELL & PARTNERS
DAVIES, PHILLIPS, CHAPEL & PARTNERS
ARCHITECTS & CONSULTING ENGINEERS
QUEEN STREET HASTINGS

STRUCTURAL CONSULTANTS
EDWARDS CLENDON & PTNRS
MECHANICAL CONSULTANTS
SANDERS JOHNSON SMITH LTD
ELECTRICAL CONSULTANTS
W.H.PITT & ASSOCIATES
QUANTITY SURVEYORS
POWRIE WRIGHT & COMPANY

TRUE NORTH	ELEVATIONAL	DATE

INDICATIONS	AMENDMENTS

ARCHITECTURAL WORKING DRAWINGS

ALL BLOCKS

ROOF PLAN

FILE NO.	SHEET NO.	SCALES
1064	5	1:200

1:100 @ A1
1:200 @ A3
0 2000 4000 6000 8000 10000 mm

REVISION	AMENDMENT	APPROVED	DATE
1	ISSUED FOR CLIENT USE	N.E	10/12/2021

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STRUCTURES

SCALES
1:750 [A1], 1:1500 [A3]

ORIGINAL SIZE
A1

DRAWN	DESIGNED	APPROVED
G.LI	G.LI	N.EVANS

DRAWING VERIFIED	DESIGN VERIFIED	APPROVED DATE
S.MCCONWAY	S.MCCONWAY	2021-12-10

ISSUED FOR CLIENT USE

PROJECT
HAWKES BAY DISTRICT HEALTH BOARD
398 OMAHU ROAD, HASTINGS
ACUTE SERVICES BUILDINGS

TITLE
ROOF PLAN AT CLINICAL SERVICES BUILDINGS

WSP PROJECT NO. (SUB-PROJECT)	SHEET NO.	REVISION
2-S5000.13	S02	1

Original sheet size A1 (841x594) Plot Date 2021-11-05 at 10:21:49 AM \\corp.pbwan.net\ANZ\ProjectsNZ\2s\2-S5000.13 Acute Services Buildings, Structural Eng\Home\01_Proj_Mgmt\Task 1 Site Plan\CAD\(X) Other Category\+AutoCAD\2-S5000.13 (1).dwg S01(1)

SEISMIC GAP AROUND LAB (HA26)

THE HAWKES BAY HOSPITAL BOARD

MEMORIAL HOSPITAL
HASTINGS

BLOCK 'CH'
CLINICAL SERVICES

KEY PLAN

UNSWORTH SANDS NORWELL & PARTNERS
ARCHITECTS & CONSULTING ENGINEERS
QUEEN STREET HASTINGS

STRUCTURAL CONSULTANTS
EDWARDS CLENDON & PENRS
MECHANICAL CONSULTANTS
SANDERS JOHNSON SMITH LTD
ELECTRICAL CONSULTANTS
W.H.PITT & ASSOCIATES
QUANTITY SURVEYORS
POWRE WRIGHT & COMPANY

TRUE NORTH	ELEVATIONAL	DATE

INDICATIONS	AMENDMENTS
2 hr Fire wall	
1 hr Fire wall	

ARCHITECTURAL
WORKING DRAWINGS

BLOCK L

1st FLOOR PLAN

FILE NO.	SHEET NO.	SCALES
1064	11R	1:100

1st FLOOR PLAN
(Laboratory)

1:100 @ A1
1:200 @ A3
0 2000 4000 6000 8000 10000 mm

REVISION	AMENDMENT	APPROVED	DATE
1	ISSUED FOR CLIENT USE	N.E	10/12/2021

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STRUCTURES

SCALES
1:750 [A1], 1:1500 [A3]

ORIGINAL SIZE
A1

DRAWN	DESIGNED	APPROVED
G.LI	G.LI	N.EVANS

DRAWING VERIFIED	DESIGN VERIFIED	APPROVED DATE
S.MCCONWAY	S.MCCONWAY	2021-12-10

ISSUED FOR CLIENT USE

PROJECT
HAWKES BAY DISTRICT HEALTH BOARD
398 OMAHU ROAD, HASTINGS
ACUTE SERVICES BUILDINGS

TITLE
FIRST FLOOR PLAN AT LABORATORY (HA26)

WSP PROJECT NO. (SUB-PROJECT)	SHEET NO.	REVISION
2-S5000.13	S03	1

Original sheet size A1 (841x594) Plot Date 2021-11-05 at 10:21:49 AM \\corp.pbwan.net\ANZ\ProjectsNZ\2s\2-S5000.13 Acute Services Buildings, Structural Eng\Home\01_Proj_Mgmt\Task 1 Site Plan\CAD\(X) Other Category\+AutoCAD\2-S5000.13 (1).dwg S01(1)

NO SEISMIC GAP AT GROUND FLOOR LEVEL (HA26)

THE HAWKES BAY HOSPITAL BOARD

MEMORIAL HOSPITAL HASTINGS

BLOCK 'CH' CLINICAL SERVICES

KEY PLAN

KINGSFORD, SANDS, NORWELL & PARTNERS
ARCHITECTS & CONSULTING ENGINEERS
QUEEN STREET HASTINGS

STRUCTURAL CONSULTANTS
EDWARDS CLENDON & PTNRS
MECHANICAL CONSULTANTS
SANDERS JOHNSON SMITH LTD
ELECTRICAL CONSULTANTS
W.H.PITT & ASSOCIATES
QUANTITY SURVEYORS
POWRIE WRIGHT & COMPANY

TRUE NORTH	ELEVATIONAL	DATE
		9/12/21

INDICATIONS	AMENDMENTS
	Condition 1

ARCHITECTURAL WORKING DRAWINGS

ALL BLOCKS

GROUND FLOOR LAYOUT PLAN

FILE NO.	SHEET NO.	SCALES
1064	4R	1:200

1:100 @ A1
1:200 @ A3
0 2000 4000 6000 8000 10000 mm

REVISION	AMENDMENT	APPROVED	DATE
1	ISSUED FOR CLIENT USE	N.E	10/12/2021

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New Zealand

STRUCTURES

SCALES	ORIGINAL SIZE
1:750 [A1], 1:1500 [A3]	A1

DRAWN	DESIGNED	APPROVED
G.LI	G.LI	N.EVANS

DRAWING VERIFIED	DESIGN VERIFIED	APPROVED DATE
S.MCCONWAY	S.MCCONWAY	2021-12-10

ISSUED FOR CLIENT USE

PROJECT
HAWKES BAY DISTRICT HEALTH BOARD
398 OMAHU ROAD, HASTINGS
ACUTE SERVICES BUILDINGS

TITLE
GROUND FLOOR PLAN AT LABORATORY(HA26)

WSP PROJECT NO. (SUB-PROJECT)	SHEET NO.	REVISION
2-S5000.13	S04	1

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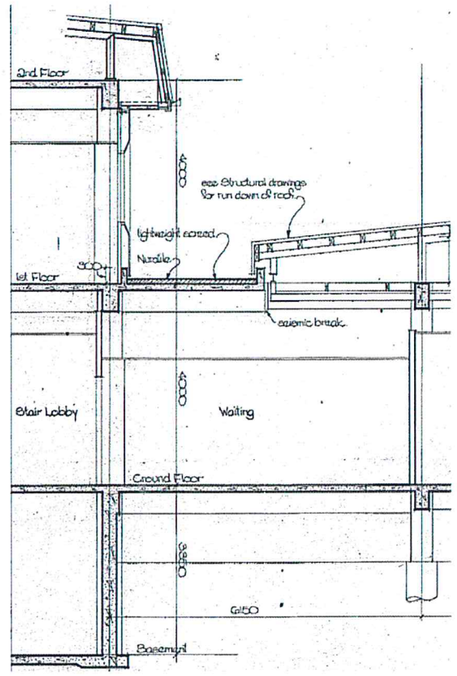
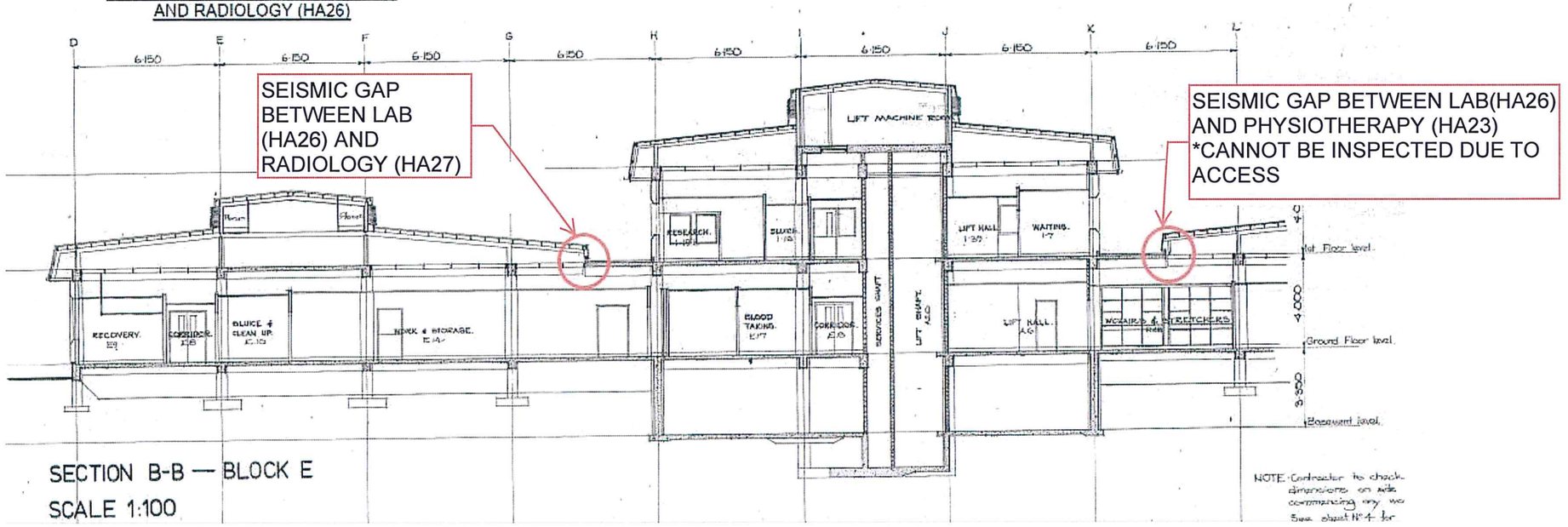
SEISMIC GAP BETWEEN LAB (HA27) AND RADIOLOGY (HA26)



ARCHITECTURAL DETAIL AT SEISMIC GAP



SECTION B-B — BLOCK E

SCALE 1:100

1:100 @ A1
1:200 @ A3
0 2000 4000 6000 8000 10000 mm

REVISION	AMENDMENT	APPROVED	DATE
1	ISSUED FOR CLIENT USE	N.E	10/12/2021

HAWKE'S BAY District Health Board Whakawāteatia

wsp
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Private Bag 6019
Napier 4142
New Zealand

STRUCTURES

SCALES
1:750 [A1], 1:1500 [A3]

ORIGINAL SIZE
A1

DRAWN	DESIGNED	APPROVED
G.LI	G.LI	N.EVANS
DRAWING VERIFIED	DESIGN VERIFIED	APPROVED DATE
S.MCCONWAY	S.MCCONWAY	2021-12-10

ISSUED FOR CLIENT USE

PROJECT
HAWKES BAY DISTRICT HEALTH BOARD
398 OMAHU ROAD, HASTINGS
ACUTE SERVICES BUILDINGS

TITLE
CROSS SECTION B-B

WSP PROJECT NO. (SUB-PROJECT)	SHEET NO.	REVISION
2-S5000.13	S05	1

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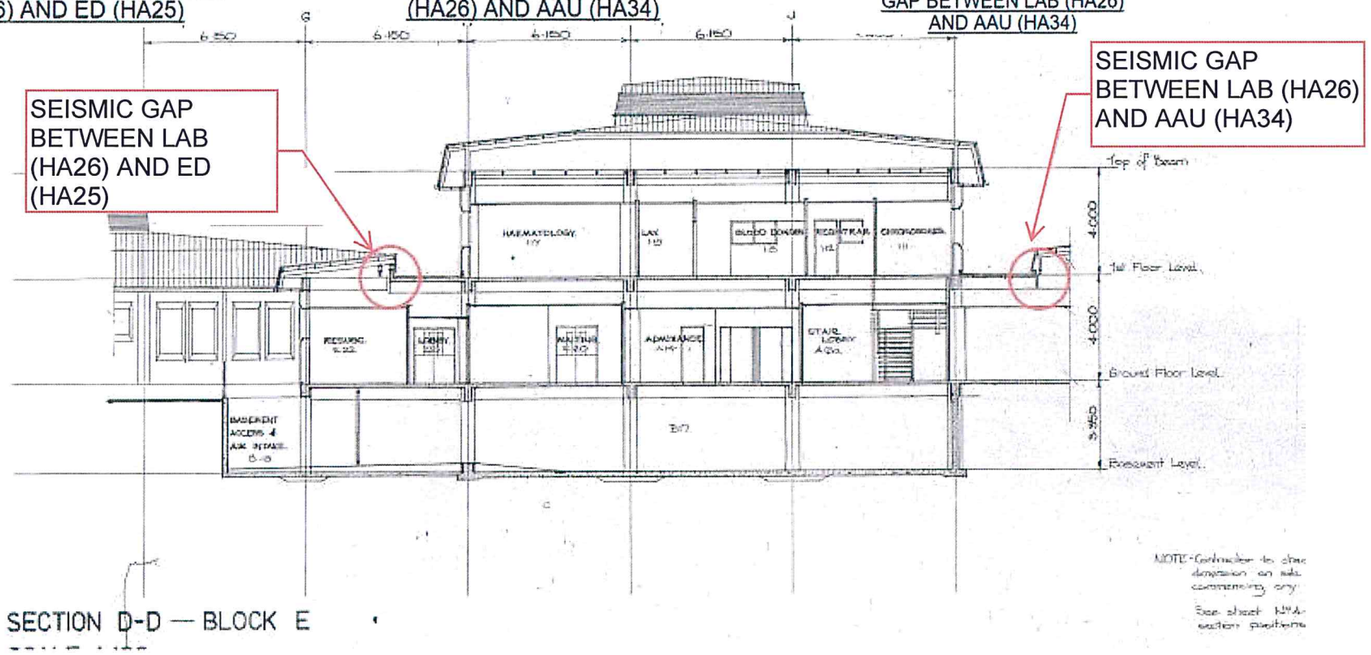
SEISMIC GAP BETWEEN LAB (HA26) AND ED (HA25)

SEISMIC GAP BETWEEN LAB (HA26) AND AAU (HA34)

: COVER PLATE OVER SEISMIC GAP BETWEEN LAB (HA26) AND AAU (HA34)



SECTION D-D — BLOCK E

1:100 @ A1
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New Zealand

STRUCTURES

SCALES
1:750 [A1], 1:1500 [A3]

ORIGINAL SIZE
A1

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DRAWING VERIFIED	**DESIGN VERIFIED**	**APPROVED DATE**
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PROJECT
HAWKES BAY DISTRICT HEALTH BOARD
398 OMAHU ROAD, HASTINGS
ACUTE SERVICES BUILDINGS

TITLE
CROSS SECTION D-D

WSP PROJECT NO. (SUB-PROJECT)	SHEET NO.	REVISION
2-S5000.13	S06	1

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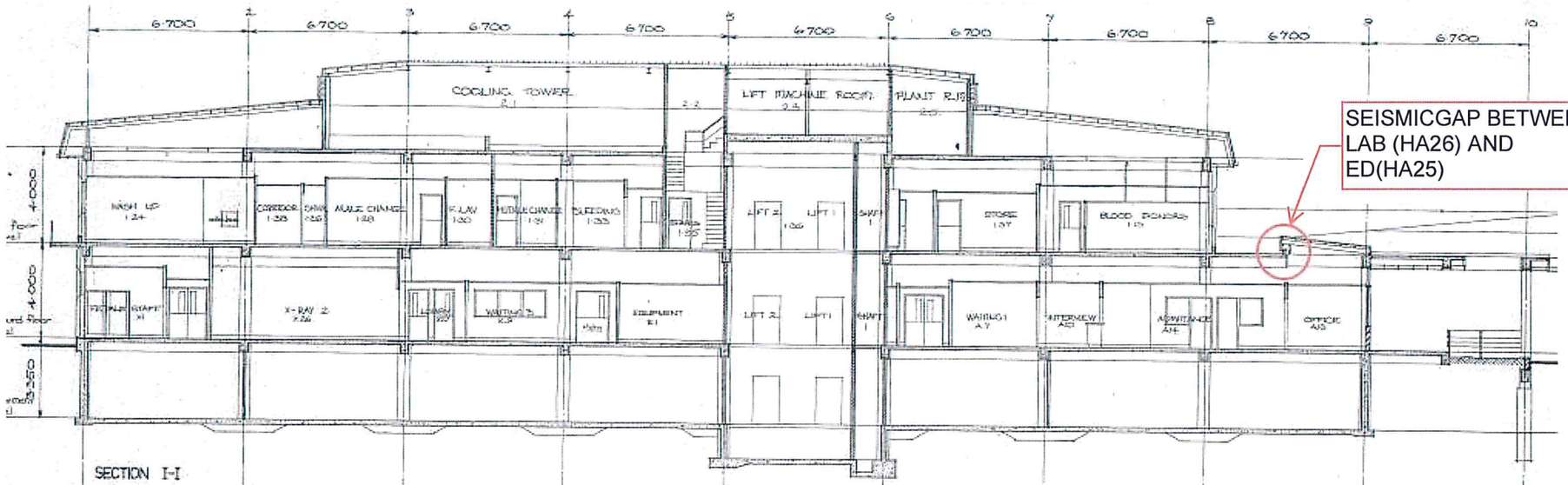
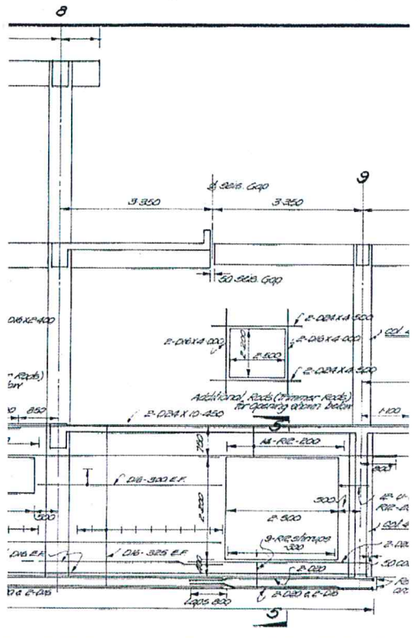


SECTION I-I
SCALE 1:100



ARCHITECTURAL DETAIL AT SEISMIC GAP

SEISMIC GAP BETWEEN LAB (HA26) AND ED (HA25)

1:100 @ A1
1:200 @ A3
0 2000 4000 6000 8000 10000 mm

REVISION	AMENDMENT	APPROVED	DATE
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Napier 4142
New Zealand

STRUCTURES

SCALES		ORIGINAL SIZE
1:750 [A1], 1:1500 [A3]		A1
DRAWN	DESIGNED	APPROVED
G.LI	G.LI	N.EVANS
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PROJECT
HAWKES BAY DISTRICT HEALTH BOARD
398 OMAHU ROAD, HASTINGS
ACUTE SERVICES BUILDINGS

TITLE
CROSS SECTION I-I

WSP PROJECT NO. (SUB-PROJECT)	SHEET NO.	REVISION
2-S5000.13	S07	1

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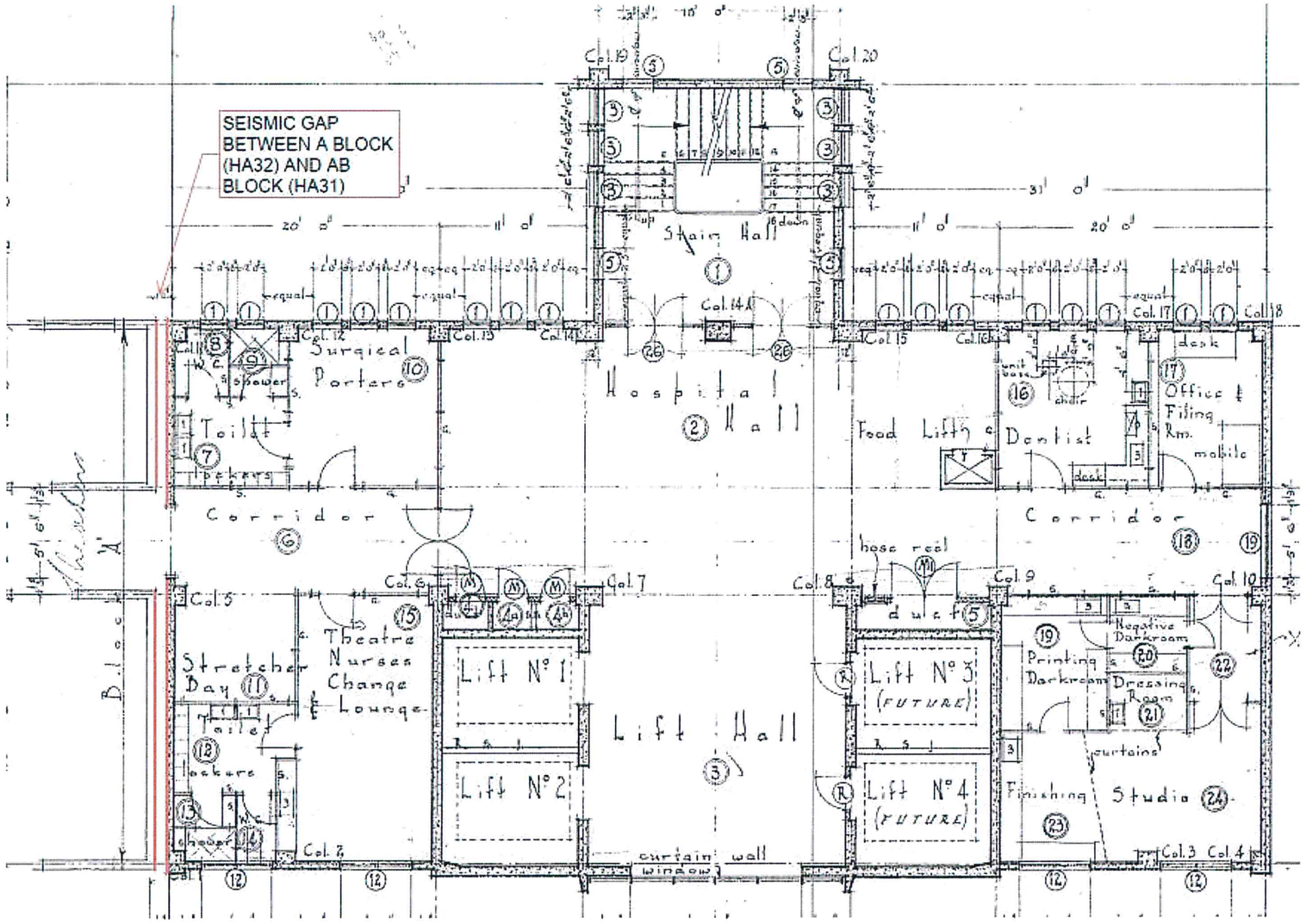
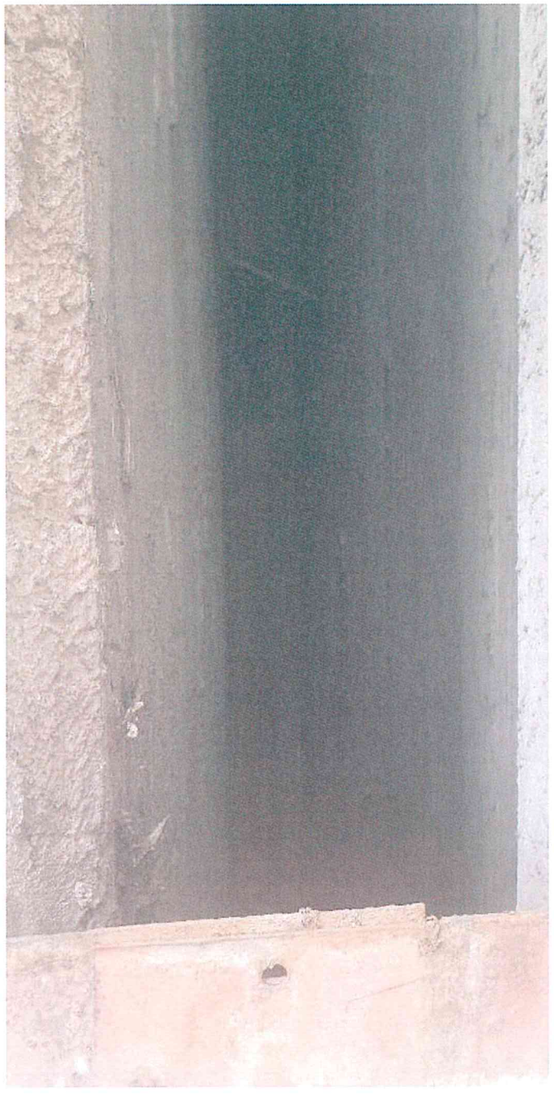


TYPICAL FLOOR PLAN OF AB BLOCK



SEISMIC GAP BETWEEN A BLOCK (HA32) AND AB BLOCK (HA31)

1:100 @ A1
1:200 @ A3
0 2000 4000 6000 8000 10000 mm

REVISION	AMENDMENT	APPROVED	DATE
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HAWKE'S BAY District Health Board
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Napier 4142
New Zealand

STRUCTURES

SCALES: 1:750 [A1], 1:1500 [A3]
ORIGINAL SIZE: A1

DRAWN	DESIGNED	APPROVED
G.LI	G.LI	N.EVANS

DRAWING VERIFIED	DESIGN VERIFIED	APPROVED DATE
S.MCCONWAY	S.MCCONWAY	2021-12-10

ISSUED FOR CLIENT USE

PROJECT
HAWKES BAY DISTRICT HEALTH BOARD
398 OMAHU ROAD, HASTINGS
ACUTE SERVICES BUILDINGS

TITLE
TYPICAL FLOOR PLAN OF AB BLOCK

WSP PROJECT NO. (SUB-PROJECT)	SHEET NO.	REVISION
2-S5000.13	S08	1

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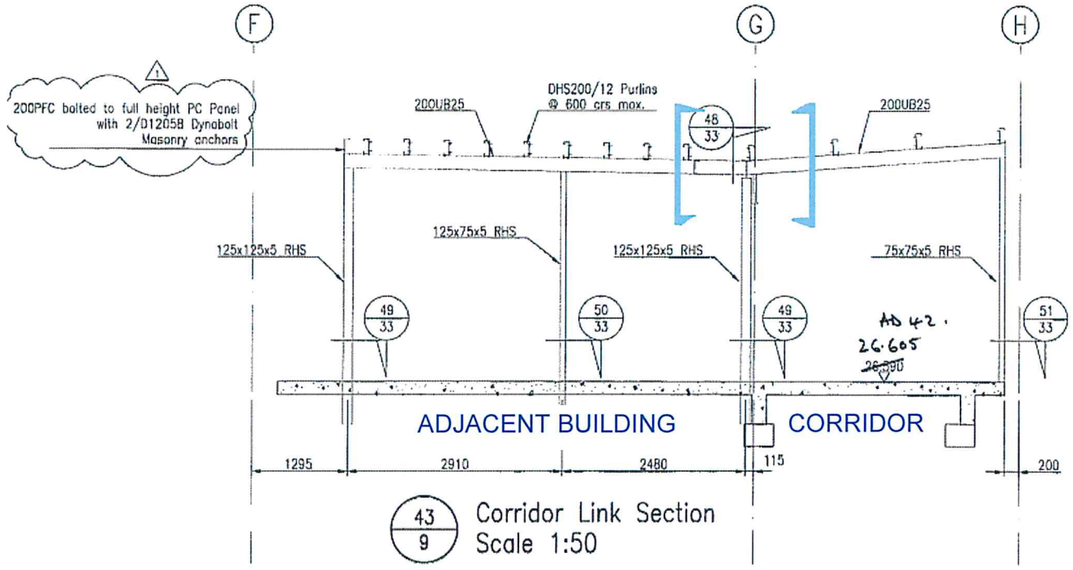

TYPICAL THEATRE CORRIDOR SECTION (GRID LINE H AGAINST ADJACENT BUILDING WITHOUT GAP)

STEEL RAFTER ABOVE CORRIDOR CONNECTS TO STEEL BEAM BETWEEN POSTS ON ADJACENT BUILDING (PHOTO TAKEN FROM CORRIDOR)

STEEL BEAM AND POST ALONG CORRIDOR (PHOTO TAKEN FROM ADJACENT BUILDING)

300 mm
200
100
50
0 10 mm

1:100 @ A1
1:200 @ A3
0 2000 4000 6000 8000 10000 mm

REVISION	AMENDMENT	APPROVED	DATE
1	ISSUED FOR CLIENT USE	N.E	10/12/2021

HAWKE'S BAY District Health Board Whakawāteatia

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New Zealand

STRUCTURES

SCALES: 1:750 [A1], 1:1500 [A3]
ORIGINAL SIZE: A1

DRAWN	DESIGNED	APPROVED
G.LI	G.LI	N.EVANS
DRAWING VERIFIED	DESIGN VERIFIED	APPROVED DATE
S.MCCONWAY	S.MCCONWAY	2021-12-10

ISSUED FOR CLIENT USE

PROJECT
HAWKES BAY DISTRICT HEALTH BOARD
398 OMAHU ROAD, HASTINGS
ACUTE SERVICES BUILDINGS

TITLE
TYPICAL THEATRE CORRIDOR SECTION

WSP PROJECT NO. (SUB-PROJECT)	SHEET NO.	REVISION
2-S5000.13	S09	1

Original sheet size A1 (841x594) Plot Date 2021-11-05 at 10:21:49 AM \\corp.pbwan.net\ANZ\ProjectsNZ\2s\2-S5000.13 Acute Services Buildings, Structural Eng\Home\01_Proj_Mgmt\Task 1 Site Plan\CAD\(X) Other Category\+AutoCAD\2-S5000.13 (1).dwg S01(1)

Appendix D

Non-Structural Elements in Acute Services Buildings

Inventory and Assessment of Non-Structural Components

Rating: As defined by Kestrel Group
Well restrained - 1; Partially restrained - 2; No restraint - 3;
Adequate movement - 1; Some movement - 2; No movement - 3
Incorporated - 1; Uncertain - 2; Inadequate - 3
NI - No Information

HBDHB Hawke's Bay Fallen Soldiers Memorial Hospital Acute Services Buildings

Non Structural Component	**Location within building**	**Applicability** (tick rows that will affect continuing functionality) ✓	**Continued Functionality**				**Comments**	**Likely Damage (1/100 yr event)**	**Likely Damage (1/500 yr event)**
			Non-structural element restraint 1, 2, 3, NI	**Element movement capacity 1, 2, 3, NI**	**Specialised equipment with internal capacity to withstand shaking 1, 2, 3, NI**	**Overall CF rating** (worst of the three) **CF500, CF100 or CF Nil**			
Architectural									
Glazed exterior (rigid glazing frames)	Theatre block and A, B, AB block (multi-storey building with the potential of falling from height)	☐	2	NI		2	Multi-storey blocks built before seismic window framing. Theatre glazing window detailing uncertain.	Potential minor cracked or broken glass.	Fallen glass is the possible potential damage.
Exterior wall component (Adhered veneer)	A, B blocks	☐	NI	3		3	Tile façade mortared to reinforced concrete spandrel beams.	Potential minor cracking	Potential spalling of tiles would be a hazard to buildings and access ways below.
Suspended ceilings (light)	Generally for all corridors and building ceilings	☐	2	2		2	Generally, light ceiling tiles supported with wire hangers gravity support at regular spacing. Small gaps were provided between end of ceiling tee to perimeter wall. Supporting tees pop riveted to wall angles.	Potential loss of edge tiles.	Potential loss of tiles over extended areas. Unlikely to cause loss of building functionality.
Mechanical									
Boilers, furnaces, pumps		☐				NI	Building upgrade done in 2012		
Chillers		☐				NI	Building upgrade design in 2013		
Heat pumps/Heat exchangers	Within Tunnel to the Villas - at the Plant Room	☑	1	NI	NI	1	Heat exchanger sits on a full size plinth footing. Supported by steel channel frames which anchored to floor by threaded anchors	Anchor capacities unlikely to be exceeded	Potential cracking of plinth footing at anchor hold down locations. Relatively thin plinth footing has less likelihood of sliding. Potential failure of anchor bolts in tension or shear.

HVAC units (Suspended Fan Coil Unit in Ceiling)	All acute service buildings	☐	2	2		2	Suspended HVAC units supported by rod hangers at corners to concrete floor or secondary timber beams above. No braces were observed	Minor concrete cracking at the rod hangers anchorage location is likely, due to the relative short support length to the upper floor/beams it is less likely to swing or impact other elements	Potential falling hazard may happen if the capacity of fixings above are exceeded. Damage between ductwork and HVAC unit at connection is possible due to relative movement.
Fans/blowers/filters		☐				NI			
Air compressors		☐				NI			
Specialist medical gas equipment		☐				NI			
Vents, flues	All acute service buildings	☐	2	2		2	Light weight air vent grille & supply air diffuser supported directly on ceiling tiles or ceiling grids, not independently supported by vertical rod hangers to prevent falling	Potential interaction with ceiling tiles where they pass through	May subject to falling from the ceiling due to lack of independent hanger support
Suspended equipment		☐				NI			
Storage Tanks and Water Heaters									
Structurally supported tanks and		☑				NI	Block AB water tanks at upper level	Depends on restraint /oveflow arrangements	Flooding could affect lifts, services and access to Blocks A and B.
Fuel tanks		☐							
Gas tanks		☐							
Compressed gas		☐				NI			
Fire Protection									
Suspended fire protection piping, & risers	All acute service buildings	☐	1	2		2	Supported by ring hangers at regular spacing, no sway braces required where there is short support length.	Minimal impact on pressure pipes due to lightweight nature and supported at regular spacing. May be subject to interaction with other elements in ceiling space.	Potential damage at building joints, rigid bends and penetrations through walls or floors. Impact from other unbraced elements.
Suspended fire sprinklers heads	All acute service buildings	☐	2	3		3	Generally, 35mm diameter rigid fire sprinkler droper penetrates through ceiling tile without oversized hole/ clearance.	Potential minor localised fire sprinkler head damage due to dropper penetrating through ceiling tiles without flexible droppers or oversized holes with escutcheon plates.	Potential wide spread fire sprinkler head damage due to dropper penetrating through ceiling tiles without flexible droppers or oversized holes with escutcheon plates. Damaged sprinkler head may cause potential flooding.
Fluid Piping		☐				NI			
Hazardous materials		☐				NI			
Fuel		☐				NI			
Non hazardous		☐				NI			
Non -Fire Protection									

Pressure Piping (Gas)	All acute service buildings	☑	1	1		1	**Ceiling Space:** Small diameter of medical gas pipes are restrained at regular spacing clamps onto support. **Old Service Tunnel:** Pressure pipe (35mm dia) and fixed to unistrut supporting frame with clamp. Pipes either fixed on cantilevered unistrut arm with clamps or directly fixed to unistrut column with clamp. Unistrut columns fix to top and bottom of tunnel with steel angle cleat and anchor bolt	**Ceiling Space:** Minimal impact on pressure pipes due to lightweight nature and supported at regular spacing. May be subject to interaction with other elements in ceiling space. **Old Service Tunnel:** Potential minor damage on the pressure pipework at tunnel, not subject to interatction with other elements, supporting frame restrainted to tunnel walls	**Ceiling Space:** Potential damage at building joints, rigid bends and penetrations through walls or floors. Impact from other unbraced elements. **Old Service Tunnel:** Potential pipe damage at tunnel joints due to differential movement between each tunnel section. With gaps between pipeworks, it is less likely to have interaction with other elements.
Fluid Piping	All acute service buildings	☑	2	2		2	**Ceiling Space:** Fluid pipes are generally supported by rod hangers at regular spacing without sway braces. Rod hangers are chemset or threaded into concrete floor above.	**Ceiling Space:** Minimal impact on fluid pipes due to the gap clearance between different elements. May subject to interaction with other elements in ceiling space where there are no or small gaps provided.	**Ceiling Space:** Potential damage at the vulnerable locations on pipework such as joints, rigid bends, connections to rigidly mounted equipment and risers subject to significant relative movement between floors. Subsequent water leakage damage may resulted from damaged pipes. May also subject to interaction with other elements in ceiling space where there are no or small gaps provided.
		☑	1	2		2	**New Service Tunnel to Villas:** Pipeworks were supported by steel hollow support frames. Fluid pipes supported by rod hangers to wall and floor at middle plantroom with no braces observed. Fluid pipes supported by pipe frames without longitudinal brace. The steel support frames at one section were not restrained to tunnel wall at top and bottom with rusted connections, due to water leakage through the concrete floor from above.	**New Service Tunnel to Villas:** Potential minor sliding movement of steel support frames and tilting sideway is possible at the first section of tunnel, further may result in interaction between different pipeworks. Pipeworks at middle section of tunnel may subject to interaction with other elements	**New Service Tunnel to Villas:** Potential significant sliding movement of steel support frames and tilting sideway is likely at the first section of tunnel, further may result in interaction between different pipeworks. Pipeworks at middle section of tunnel may subject to significant interaction with other elements and causing water leakage.
		☑	1	1		1	**New Service Tunnel Others & Old Service Tunnel:** MTHW & Chilled cold water flow and return pipework. All pipeworks runs along the length of tunnel, they were supported by steel unistrut frames at regular centres which attached to tunnel walls. Pipeworks restrained on steel frames with either cleats, clamps or rods.	**New Service Tunnel Others & Old Service Tunnel:** Potential minor influence on fluid pipes at these locations is unlikely due to the anchored steel support frames provided. Pipeworks are restrained to support frame with clamps.	**New Service Tunnel Others & Old Service Tunnel:** Minor influence on fluid pipes at these locations due to the anchored steel support frames provided. Potential cracks at the anchorage locations of steel support frames.
Hazardous materials		☐				Ni			
Fuel		☐				Ni			
Non hazardous		☐				NI			

Ductwork									
Suspended ductwork	All acute service buildings	☑	2	2		2	Supply & return air ductwork generally supported by steel trapeze at the bottom and rod hangers at top at regular spacing to upper concrete floor or secondary timber beams. No sway braces provided with gaps between other elements.	Ductworks may subject to minor swing and impact other elements where there are minimal gap clearances.	Unbraced ductworks may swing and impact other elements. Potential damage at restraint locations, such as at wall or floor penetrations, bend locations or at connection to rigidly mounted equipment. May also be damaged by differential movement at building seperations.
Air diffusers	All acute service buildings	☑	2	2		2	Air diffusers independtly supported by steel trapeze at bottom and rod hangers at corners with a relative short support distance to upper attached concrete floor.	May subject to minor sideway movement with minimal damage to ceiling system	Air diffusers may post a falling hazard if not adequately supported. May lead to localised falling of ceiling tiles.
Electrical equipment									
Control panels, motor controls, switchgear	New service tunnel to villas - Plant room	☑	2	NI		2	Main switch board(control panels)/Data distribution panels mounted at top and bottom to tunnel wall . Restraint could not be inspected. Essential control panel is supported by steel standing frame which anchor top and bottom to tunnel wall.	Minor damage is possible on the mounted connections.	Potential damage to internal eletrical components of control panels depending on restraint.
Emergency generator		☑	1	NI	NI	1	HBDHB working with Unison Line Company		
Transformers		☑	NI	NI	NI				
Batteries, battery rack		☐							
Solar panels		☐							
Antennae		☐							
Electrical distribution									
Electrical raceways, cable trays	All acute service buildings	☑	2	2		2	Cables generally tied together by means of wires and attached to the underside of ductworks or directly laid on ceiling tiles. Cable trays are available at some locations and supported by rod hangers at regular spacing	Cables may swing and impact other elements in the ceiling space, may fall or hang off on the ceiling. Minor influence on continuing functionality	Potential eletrical hazards. Potential damage at vulnerable locations including running through seismic separations, wall/floor penetrations etc
Distribution panels		☑				NI			
Lighting									
Pendant light fixtures		☐							
Heavy light fixtures		☑				NI			
Surface Mounted lighting		☑	1	2		2	Light weight lighting units are positively clamped onto ceiling grid and supported by wire hangers at corners	Potential minimal damage to light fixture and ceiling tile due to relative movement	May subject to major framing damage due to large relative movement between light fixture and ceiling. Less likely to fall from the ceiling due to the wire hangers support.
Elevators & escalators									

Cables, counterweights, guiderails		☐							
Motor, controls		☐							
Escalator		☐							
Conveyor		☐							
Storage									
Storage racks		☐							
Hazardous storage		☐							
Computer & Communications									
Computer access/floating floors	Q Hub in Physiotherapy building	☑	2	2		2	Computer racks/cabinets supported by steel frame and post above and sit on top of floating floor. Diagonal braces were provided at top of racks/cabinets. No hold downs from cabinets to floating floor were observed at bottom of cabinets. No brace under the floating floor was observed. Design intention is purely rely on the steel frame to provide lateral restraint.	Potential misalignment of floor tiles, damage to supporting anchored pedestals is less likely due to the floor area is enclosed by sourrouding walls	Floating floors may collapse if not adequately braced and anchored. Slender steel beams across the top of cabinets may not provide adequate support if the floating floor callapse and may incurr damage to cabinet or intenral damage.
Cabling		☑				NI			
Computer racks /cabinets	All acute service buildings except Physiotherapy	☑	1	1		1	Computer racks/cabinets sit on top of concrete slab ground floor. Anchored to top and bottom into floor and support by steel hollow columns & unistruts. And restrained by steel unistrut frame above.	Minor cracking damage is likely at the cabinet anchorage location, less likely to affect continuing function	May subject to significant cracking at cabinet anchorage location or failure of anchor bolt, may suffer internal damage. Slide, tip, overturn or collapse is less likely since cabinets are adequately restrained
Computer racks /cabinets	Radiology Hub	☑	3	1		3	Computer racks/cabinets sit on top of floating floor apparently without restraints.	May subject to slide, tip, overturn.	Unbraced floating floors is possible to collapse.
Large computer and comms equip (speakers, monitors)		☐				NI			
Components									
Specialised medical equipment (list)		☐				NI			

Appendix E

Qualitative Comments on Anticipated Levels of Overall Damage

Assessment of Levels of Damage

Hawkes Bay Fallen Soldiers Memorial Hospital

Building Number	Building Name	Updated Rating (X% NBS (IL4)) to NZS1170.5:2004	Risk Category (as defined by Kestrel Group to indicate relative reliability of Assessments	Identified Potentially Critical Secondary Structural and Heavy Non-structural elements	Comments	Likely Damage (1/100 yr event)	Likely Damage (1/500 yr event)
HA 37	Theatre Block	50%	3	Some large ventilation units are suspended by chains off the roof framing. A heavy mezanine plant room is located one storey above celing height. Large air conditioning units are located above each theatre: their fixing is uncertain.	Upgrading included SLS2 check (to PSHA 2012, say 80% SLS2 1170.5) Peer review of design recommended non-structural elments be upgraded. Not sure if this is being undertaken.	Some damage to services likely (unless upgraded).	Onset of damage to services likely (unless upgraded)
HA 27	Radiology	30%	4	Ceiling Level Plant Room	The small 50 mm seismic gaps mean potential pounding with Laboratory building at canilevered beam ends. The services across the gaps are not detailed for movement. No restraints to some Radiology IT hub equipment, which would affect functionality.	Some minor cracking of RC columns (the critical elements) is likely. Services damage possible. Potential loss of ceiling tiles in isolated locations.	Signficant yielding of RC columns. Cracking and spalling likely. Future use could be afffected. Some services likley to be affected. Potential loss of ceiling tiles over extended areas and tile damage at sprinkler head locations.
HA 27a	Radiology Extension	25%	4	Ceiling Level Plant Room	2nd chord of steel trusses are now critical elements. Their potential for buckling is not ideal.	Damage to trusses should not happen but is possible. The Plant room could be affected by displacements of restraining trusses. Potential loss of ceiling tiles in isolated locations.	Possible bucking of truss chords could lead to failure and collapse. Plant room functionality possibly affected. Potential loss of ceiling tiles over extended areas and tile damage at sprinkler head locations.
HA25	Emergency Department Entry	45%	3	DSA previously recommended. It includes amblulance bays that need to remain functional	Junctions with adjacent buildings are uncertain.	Unsure of interaction with Radiology Building but being single storey any damage expected to be limited.	Ambulance bays could be affected by any material falling from Laboratory Block. Interaction with adajcent buildings could affect functionality but uncertain to what extent.
HA 30	ICU	25%	4	Plant Room restraint relies on roof framing on one side for restraint, which could affect funtionality.	Apart from plant room restraint the building structure would be expected to perform well.	Plant Room functionality could be affected. Potential loss of ceiling tiles in isolated locations.	Plant room displacement possible leading to loss of some services. Potential loss of ceiling tiles over extended areas and tile damage at sprinkler head locations.
HA26	Laboratory Block	45%	3	Isolation of fixed main stair stringers has been designed and was to be incorporated in building upgrade	Fexural capcity of Rc columns is critical.	Onset of concrete cracking to the concrete columns and beams. Some pounding with adjacent buildings possible. Potential loss of ceiling tiles in isolated locations.	Damage possible around seismic gaps from pounding with adjacent buildings, including HA34 AAU leading to signficantly increased loadings in second storey columns. Significant yielding of RC columns with concrete spalling likely. Future use could be afffected. Potential loss of ceiling tiles over extended areas and tile damage at sprinkler head locations.
HA26a	Laboratory Extension	50%	3		The small 50 mm seismic gaps lead to potential pounding with adjacent single storey buildings.	Onset of concrete cracking to the concrete columns and beams.	Significant cracking of RC columns possible. Potential loss of ceiling tiles in isolated locations.

HA28	SCBU	30%	4		SCBU was built as part of original cllinical services block and so is similar to Radiology but without foundation walls	Some minor cracking of RC columns both above and below ground floor is likely. Potential loss of ceiling tiles in isolated locations.	Yielding of RC columns above and below ground floor slab possible. Cracking and spalling likely. Some services likley to be affected. Potential loss of ceiling tiles over extended areas and tile damage at sprinkler head locations.
HA23	Physiotherapy	30%	4		Pysiotherapy was built as part of the original cllinical servies and so is similar to Radiology	Some minor cracking of RC columns (the critical elements) is likely. Services damage possible. Potential loss of ceiling tiles in isolated locations.	Yielding of RC columns. Cracking and spalling likely. Some services likley to be affected. Potential loss of ceiling tiles over extended areas and tile damage at sprinkler head locations.
HA34	AAU	24%	4			Damage due to ground floor braces failures posssible. Cracking of ground floor columns then likely. Potential loss of ground floor ceiling tiles in isolated locations. First floor , plant room and their services unaffected.	Damage from differential settlements possible associated with some liquefaction of deeper lenses. Partial collapses feasible. Potential loss of ceiling tiles over extended areas and tile damage at sprinkler head locations.
HA29	B Block	67%	3	Brick facades to spandrel beams and exposed stone to west wall.	Isolation of fixed west end stair stringers currently underway	Onset of cracking of walls and beams. Potential loss of ceiling tiles in isolated locations.	Cracking and spalling particulalrly of spandrel beams, initiated. Potential for cladding elements to drop on adjacent buildings/ accessways. Potential loss of ceiling tiles over extended areas and tile damage at sprinkler head locations.
Ha29a	Ata Rangi	34%	3		DSA recommended		Potential for cladding elements from Block B to drop onto this building.
H29b	Waioha	85%	2		Extended in 2016		Potential for cladding elements from Block B to drop onto this building
HA31	AB Block	67%	3	Lift machinery and water tanks at 6th floor		Onset of cracking of walls and beams. Potential loss of ceiling tiles in isolated locations.	Cracking and spalling particulalrly of spandrel beams, initiated. If the water tanks on the upper storey were to discharge water the effects on lifts, services, access and water damage to Blocks AB A and B would affect their continued functionality. Potential for cladding elements to drop on adjacent buildings/ accessways. Potential loss of ceiling tiles over extended areas and tile damage at sprinkler head locations.
HA32	A Block	67%	3	Brick facades to spandrel beams		Onset of cracking of walls and beams. Potential loss of ceiling tiles in isolated locations.	Cracking and spalling particulalrly of spandrel beams, initiated. Potential for cladding elements to drop on adjacent buildings/ accessways. Potential loss of ceiling tiles over extended areas and tile damage at sprinkler head locations. Potential loss of ceiling tiles over extended areas and tile
HA32a	Paediatrics	60%	3		DSA recommended		Potential cracking of linings and cladding. Potential loss of ceiling tiles over extended areas and tile damage at sprinkler head locations.
HA20	Service Entry	34%	3				Potential cracking of linings and cladding
HA12	Chiller Plant Room	100%	2				Plant and equipment should be unaffected
HA13	Boiler House	100%	2				Plant and equipment should be unaffected

HA11	Dangerous Goods Store	76%	2				No damage expected
HA15	Helicopter Service	100%	2				Wall braces likely to be close to yielding but structure remains standing

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