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MULTI-DISCIPLINARY ENGINEERING & SURVEYING SERVICES

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DETAILED SEISMIC ASSESSMENT REPORT

RANGITIKEI DISTRICT COUNCIL

92 HAUTAPU STREET, TAIHAPE

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Document Control Record

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Document Details					
Document Title	Detailed Seismic Assessment Report				
Address	92 Hautapu Street, Taihape				
Client	Rangitikei District Council				
Job Number	121390				
Revision	**Date**	**Reason for Issue**	**Author**	**Reviewer**	**Approver**
A	13/12/2021		GL	GL	AD

Approval			
Author	Geoff Lanyon	**Approver**	Adrian van Dyk
Title	Senior Structural Engineer	**Title**	General Manager
Signed	G. H. Lanyon	**Signed**	

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Contents

1 Executive Summary

1.1 Background

Resonant Consulting Ltd (Resonant) has been commissioned by the Rangitikei District Council to undertake a Detailed Seismic Assessment (DSA) of the library located at 92 Hautapu Street, Taihape. The aim of the assessment is to determine the seismic rating of the building in relation to the New Building Standard (%NBS).

1.2 Building Description

The library is attached to the north-west wall of the adjacent town hall. The town hall is assessed in a separate report.

The building appears to have been constructed sometime after 1945. Alterations to building were undertaken in 1995.

The building is currently used as a public library.

The roof structure consists of iron cladding supported on timber purlins and trusses.

1.3 Assess Seismic Rating

The assessment has been completed in accordance with the New Zealand Society of Earthquake Engineering document - Seismic Assessment of Existing Buildings – Technical Guidelines for Engineering Assessments, dated July 2017. The seismic rating assumes that Importance Level 2 (IL2), in accordance with the joint Australian/New Zealand Standard – Structural Design Actions Part 0, AS/NZS 1170.0:2002, is appropriate. Refer to Table 1 for a summary of the buildings seismic rating.

Table 1.3.1 - Summary of Seismic Ratings for 92 Hautapu Street

92 Hautapu Street		
Direction	**Seismic Rating (%NBS)**	**Seismic Grade**
Transverse	65	C
Longitudinal	23	D

The Seismic Grade has been determined in accordance with the NZSEE grading scheme. The overall building seismic rating for the building is governed by the sub-floor bracing-plane bracing capacity in both the transverse direction. In the longitudinal direction, out of plane loading on the brick walls between the library and the town hall govern. Refer to Section 8 for a summary of the % NBS scores, and commentary, for the various building structure components and to Appendix C for a Technical Summary Report.

1.4 Basis for the Assessment

The assessment has been based on the following information:

- Southcombe McClean & Company architectural drawings for Taihape Town Hall & Library Upgrade dated 1995.
- Structural Calculations by Powell Sewell Ltd dated 5th October 1995.

1.5 Seismic Retrofit Options

The critical elements are the ground (41%NBS) and first floor (23%NBS) brick walls between the library and town hall. To strengthen the building, these walls need to be demolished and replaced with timber framed walls. Once this has been undertaken, the building will achieve a rating of 65% NBS This is close to the required 67% NBS rating. strengthening. Further strengthening to achieve a rating of 67% NBS is not warranted.

The following elements limiting the capacity below 67% NBS:

- Lack of adequate sub-floor bracing.
- Out of plane loading on the brick walls between the library and town hall.

2 Introduction

2.1 Overview

The Rangitikei District Council has engaged Resonant to assess the seismic capacity of the library located at 92 Hautapu Street, Taihape. The intention of the assessment is to determine the buildings' ability to withstand earthquake loads in terms of the current New Zealand Building Standards and yield a score for the building expressed as "Percentage New Building Standard" (%NBS).

2.2 Scope of Work

As identified in our proposal dated 31st August 2021, the scope of works to be undertaken as part of the assessment:

- Site Inspection and Information Gathering.
- Analytical Work (Calculations), in which an estimate of the seismic rating (%NBS) is achieved.
- Provide a written report outlining the findings of the assessment.
- Provision of a concept strengthening scheme.

2.3 Sources of Information

The assessment of 92 Hautapu Street is based on the following information:

- Architectural Drawings by Southcombe McClean & Company tiled 'TAIHAPE TOWN HALL & LIBRARY UPGRADE' numbered WD1 to WD17 and dated 1995.
- Structural Calculations by Powell Sewell Ltd dated 5th October 1995.
- On-site inspections completed on 22 November 2021.

All the documents have been obtained from the Rangitikei District Council Property File. No geotechnical report was available.

2.4 Site Investigation

A non-intrusive site investigation was carried out to confirm the information in the available documentation.

2.5 Exclusions

This report does not extend to an assessment of non-structural items such as cladding, ceilings, partitions, other fit-out related items, geotechnical ground conditions and latent defects.

It should be noted that for the purposes of this assessment the %NBS refers to the capacity and performance of the lateral load resisting system only. As Building Codes have evolved it is likely that an older building may not meet current Code requirements for aspects such as access and moisture detailing.

3 Background Regulations

3.1 Building Act 2004 and Earthquake Prone Buildings Amendment Act 2016

Before describing how the seismic analysis was completed, the regulatory requirements and definitions for earthquake prone buildings should be discussed.

The Building (Earthquake-prone Buildings) Amendment Act 2016 introduced major changes to the way earthquake-prone buildings are identified and managed under the Building Act.

Earthquake-prone Buildings

Under section 133AB of the Building Act (2004), the definition of earthquake-prone building is:

- A building or a part of a building is earthquake prone if, having regard to the condition of the building, or part, and to the ground on which the building is built, and because of the construction of the building or part
  - the building or part will have its ultimate capacity exceeded in a moderate earthquake, and
  - if the building or part were to collapse, the collapse would be likely to cause:
    - injury or death to persons in or near the building or on any other property, or
    - damage to any other property
- The above does not apply to a building that is used wholly or mainly for residential purposes unless the building:
  - comprises 2 or more storeys; and
  - contains 3 or more household units

A "moderate earthquake" is defined in Section 7 of the Building Regulations 2005 –

"…moderate earthquake means, in relation to a building, an earthquake that would generate shaking at the site of the building that is of the same duration as, but that is one-third as strong as the earthquake shaking (determined by normal measures of acceleration, velocity, and displacement) that would be used to design a new building at that site."

Whether a building, or part of a building, is earthquake prone is determined by the territorial authority in whose district the building is situated.

For the purposes of the above subsection ultimate capacity and moderate earthquake have the meanings given to them by regulations. To assist with application, both ultimate capacity and moderate earthquake are terms defined in the Building (Specified Systems, Change the Use, and Earthquake-prone Buildings) Regulations 2005 (as amended).

These regulations define ultimate capacity as "The probable capacity to withstand earthquake actions and maintain gravity load support assessed by reference to the building and its individual elements or parts" and moderate earthquake as "In relation to a building, an earthquake that would generate shaking at the site of the building that is of the same duration as, but that is one-third as strong as, the earthquake shaking (determined by normal measures of acceleration, velocity, and displacement) that would be used to design a new building at that site if it were designed on 1 July 2017."

3.2 Ratings

The ratings provided within this report have been generated with respect to New Zealand Society for Earthquake Engineering (NZSEE) guidelines. They are often summarised as "%NBS rating" which reflects the design coefficient for a similar building designed today to current codes, referred to as the New Building Standard (NBS).

Per the NZSEE publication "The Seismic Assessment of Existing Buildings", Section A3.2.4 groups building ratings as follows:

Table 3.2.1 NZSEE Grading Scheme

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

It should be noted that the demarcation between a C and D rating, 33% NBS, is aligned with the Building Act of 2004. Although these ratings are calculated in a linear manner, they are meant to represent an exponential scale of earthquake risk.

4 Building Descriptions

4.1 General Building Descriptions

The single level building is located at 92 Hautapu Street, Taihape and appears to have been constructed after 1943.

Construction of the building is as follows:

Roof - the roof is constructed from timber trusses and rafters and is clad with corrugated iron throughout. A deep plywood roof beam spans in the east-west direction.

Walls – walls between the library and the town hall are of unreinforced clay brick construction. The actual construction of the walls could not be determined; however, it is likely that the wall consists of a double thickness brick wall with a veneer brick skin separated by a cavity.

The timber framed walls are clad with timber weatherboard externally and gib board internally.

Floors and Foundations – the ground floor throughout is timber tongue and groove supported on timber joists and bearers. The bearers are supported on timber piles.

Stairs – the two stairs are timber framed and lead from the ground floor to ground level. These are all timber framed and generally comprise timber support posts with timber stringers and treads.

Seismic Resisting Systems

In the longitudinal direction, the lateral earthquake loading is resisted by the timber framed walls and in the transverse direction by the unreinforced brick walls between the library and the town hall and by timber framed walls. This assessment covers seismic loading as the only lateral loads and does not address wind loading on the structure.

Longitudinal and Transverse Directions

There is timber sarking which provides bracing in the roof structure. Cantilever timber piles provide sub-floor bracing.

Foundations

The substructure consists of sub-floor piles.

5 Geotechnical Conditions

No geotechnical report for the site was available.

6 Seismic Analysis

6.1 Seismic Parameters

Building Ductility

Ductility is a measure of the ability of a building to resist the earthquake forces/energy by inelastic deformation. Under current design standards the level of ductility is generally determined by:

- Identifying an appropriate mechanism that can sustain inelastic deformations without leading to collapse of a building
- The ability to achieve an appropriate level of structural detailing to ensure that the chosen ductile mechanism is achievable

The ductility factor μ = 1.0 was selected for the unreinforced masonry walls. A ductility factor μ = 3.0 was chosen for the timber walls in the auditorium and fly tower.

Site Geology

The site geology can have a significant impact on the level of loading imparted on a building during an earthquake. Deep, soft soil conditions tend to amplify the ground motions, increasing the forces on a building structure. The assumed subsoil Class is D classification since no geotechnical report is available for this site.

Importance Level

The Importance Level of a building is a classification from NZS1170.0. Increasing importance levels trigger higher factors of safety in design or analysis. The building is designated Importance Level 2 (IL2). The building is a multi-occupancy commercial building, however as the total expected occupancy is less than 5000 people it is not classified as IL3.

TABLE 3.2

IMPORTANCE LEVELS FOR BUILDING TYPES—NEW ZEALAND STRUCTURES

Importance level	Comment	Examples
1	Structures presenting a low degree of hazard to life and other property	Structures with a total floor area of <30 m^2 Farm buildings, isolated structures, towers in rural situations Fences, masts, walls, in-ground swimming pools
2	Normal structures and structures not in other importance levels	Buildings not included in Importance Levels 1, 3 or 4 Single family dwellings Car parking buildings
3	Structures that as a whole may contain people in crowds or contents of high value to the community or pose risks to people in crowds	Buildings and facilities as follows: (a) Where more than 300 people can congregate in one area (b) Day care facilities with a capacity greater than 150 (c) Primary school or secondary school facilities with a capacity greater than 250 (d) Colleges or adult education facilities with a capacity greater than 500 (e) Health care facilities with a capacity of 50 or more resident patients but not having surgery or emergency treatment facilities (f) Airport terminals, principal railway stations with a capacity greater than 250 (g) Correctional institutions (h) Multi-occupancy residential, commercial (including shops), industrial, office and retailing buildings designed to accommodate more than 5000 people and with a gross area greater than 10 000 m^2 (i) Public assembly buildings, theatres and cinemas of greater than 1000 m^2 Emergency medical and other emergency facilities not designated as post-disaster Power-generating facilities, water treatment and waste water treatment facilities and other public utilities not designated as post-disaster Buildings and facilities not designated as post-disaster containing hazardous materials capable of causing hazardous conditions that do not extend beyond the property boundaries

The design working life of the structure is 50 years. Combined with the IL2 classification, a Return Period Factor "R" of 1.0 has been used for the analysis.

Elastic Site Spectra

The elastic site spectra (for mu = 1, Sp = 1.0 and for mu = 3, Sp = 0.4) is given by:

C(T) = Ch(T)*Z*R*N(T,D)

Library mu = 3						
Structural System	T_s	$C_h(T)$	**Z**	**R**	**N(T,D)**	**C(T)**
X-dir	0.4	2.36	0.13	1.0	1.3	**0.16**
Y-dir	0.4	2.36	0.13	1.0	1.3	**0.16**

6.2 Building Analysis Method

The lateral load resisting systems for the building consists of brick walls in the front part of the building. In the auditorium and fly tower bracing is provided by the timber framed walls. Linear methods are generally appropriate for systems with a nominal ductility of 1.25. Because of the overall low ductility demand on the building, an Equivalent Static Analysis was adopted as recommended by "*The Seismic Assessment of Existing Buildings – Assessment Procedures and Analysis Techniques*" guidelines Part C2 Section 2.6.2 Table C2.1. The assessment was conducted in accordance with Part C8 of guidelines "*The Seismic Assessment of Existing Building - Unreinforced masonry buildings*" and Part C9 of guidelines "*The Seismic Assessment of Existing Building – Timber Buildings*"

Representative 2D frames in the front part of the building and in the auditorium were modelled, for analysis of the existing structure and/or for the strengthening scheme.

6.3 Stairs

There are six stairs constructed in timber frames for the building. Due to the stair's stiffness, relative to the floor diaphragm, they were assessed to not attract any of the floor loading.

6.4 Analysis Assumptions

General Assumptions

- In calculating the self-weight of the structure 24kN/m3 was used for all reinforced concrete elements. Steel weights were calculated from the member sizes. Lightweight roof elements have been assumed to be 0.2kPa. Mezzanine floor self-weight is assumed to be 0.5kPa.
- The following Live Loads & SDLs have been allowed for mezzanine floor:
  - Office Levels = 3.0kPa
- Load combinations used in the analysis are as required by NZS1170.0.
- The building has been designated as an Importance Level 3 (IL2). Post-disaster use - requirements that would necessitate an IL4 rating have not been specified by the client. The design working life of 50 years has been used, giving a return period factor of 1.3.
- The Hazard factor, Z for Taihape is 0.33.
- The Near Fault Factor, N(T,D) is 1.0 as the structure is located more than 20km from any known faults.
- The subsoil class for the site is D – Deep Soil.
- The member capacities have been assessed using the New Zealand Concrete Standard NZS3101:2006 and the guidelines "The Seismic Assessment of Existing Buildings".
- All building materials have been assumed to be in acceptable condition. Allowances for corrosion, spalling or any other latent structural defects has not been considered as part of this assessment.
- Member capacities were calculated per the sizes and dimensions given on the structural drawings and have been verified by field observation or measurement.
- The building has not been checked for wind loads.

Material Properties

Material properties have accounted for the probable strengths. Factors for various materials have been obtained from guidelines "The Seismic Assessment of Existing Buildings". For concrete a probable strength factor of 1.5 has been used while for reinforcing steel a factor 1.3 has been used.

<u>Structural Concrete and Reinforcement</u>

Concrete material strengths vary for different structural components.

- Reinforced Concrete Elements

Probable Compressive Strength	f'_c = 20 MPa – in situ
Probable Yield Strength of Reinforcement	$f_{y,p}$ = 275MPa

- Unreinforced Brick Masonry — f'm = 10.6 MPa F'b =26 MPa Em = 3180 MPa

  Υ = 18 kN/m^3

7 Seismic Assessment Approach

A discussion on the seismic assessment approach is presented in the sections below, followed by a summary of the building's overall capacity in the Section 8.

7.1 Unreinforced Brick Masonry Walls

For the assessment of buildings with unreinforced brick masonry walls as the primary lateral load resisting systems, the structures have been assessed in accordance with Part C8 – "Unreinforced Masonry Buildings" in the seismic assessment guidelines "The Seismic Assessment of Existing Buildings – Technical Guidelines".

7.2 Timber framed structure

The timber framed structure attached to the front part of the building was assessed using NZS1170.Part 5, NZS3603:1993 Timber structures standard and NZS 3604:2011 Timber-framed buildings, as well as section C9 Timber Buildings.

7.3 Foundations

The subfloor piles were assessed using the above NZ standards.

8 Seismic Assessment Results

The seismic %NBS scores for the lateral structure, gravity structure and secondary structural elements for both directions of loading are summarized in the tables as follows, along with commentary on the results and potential options for strengthening to a higher % NBS:

8.1 Building Capacities

Structural Component	**Description**	**Assessed %NBS Score**	**Comments about mode of failure, physical consequences, and potential options for strengthening to higher %NBS**
Longitudinal-Direction (East-West)			
Roof Bracing	Timber sarking	85	Distance between walls exceeds NZS3604 requirements.
Wall bracing	Timber framed walls	100	Plasterboard linings
Brick walls	between library and town hall	23	Out of plane loading
Sub-floor piles	Inadequate pile strength	65	Inadequate strength of timber anchor piles
Overall %NBS for Longitudinal Direction Loading		**23%(IL2)**	**Governed by in plane loading on brick walls between the library and the town hall**

Structural Component	Description	Assessed %NBS Score	Comments about mode of failure, physical consequences, and potential options for strengthening to higher %NBS
Transverse-Direction (East-West)			
Roof Bracing	Timber Sarking	85	Distance between walls exceeds NZS3604 requirements
Wall Bracing	Timber framed walls	100	Plasterboard linings
Sub-floor front	Timber piles	65	Inadequate strength of timber anchor piles
Overall %NBS for Transverse Direction Loading		**65% (IL2)**	**Governed by timber piles.**

9 Severe Structural Weaknesses

The general process of the DSA is determining the probable seismic capacity of the structure and relating this to the ULS loading demands. The intention is also to ensure with reasonable satisfaction that the building can withstand higher levels of shaking. This is referred to as the structural resilience and is a necessary aspect of the buildings behaviour if it is to deliver the overall expected seismic performance.

There are potentially some aspects of a buildings behaviour which may not be adequately captured within these general assessment procedures but are likely to have a step change response resulting in sudden (brittle) and / or progressive, but complete collapse of the buildings gravity load support system in shaking greater than that represented by %ULS shaking. These building aspects are referred to as Severe Structural Weaknesses (SSWs). Potential severe structural weaknesses are described in C1 of “The Seismic Assessment of Existing Buildings” and include the following:

- Out of plane capacity of first and ground floor brick walls between the library and the town hall.

10 Secondary Structure Considerations

10.1 Stairs

There are two stairs constructed from timber framing at the rear of the building to connect the ground floor from the ground surface. Due to the stairs' stiffness, relative to ground floor diaphragm and lateral load resisting system, and capability to accommodate deformation, they were assessed to not attract any floor loading.

11 Concept Strengthening & Investigation

The detailed seismic assessment of the library at 92 Hautapu Street has found that no components of the building have a seismic score of less than 34%NBS, meaning that the building is deemed to be an earthquake prone building. The following section summarises the deficiencies in the building and provides concept strengthening to achieve at least 67 % NBS score for the structural components.

The detailed seismic assessment identified the following as having a seismic score of 10% NBS. Refer to Sections 8 & 10 for details.

- Removal of first floor and ground floor brick walls between the library and the town hall and replacement with timber framed walls with light cladding.

The conceptual Preliminary Strengthening Scheme is attached in **Appendix A** in this report.

12 Conclusion

RESONANT has been commissioned by the Rangitikei District Council to undertake a Detailed Seismic Assessment (DSA) of buildings, located at 92 Hautapu Street, Taihape. The aim of the assessment is to determine the seismic rating of the building in relation to the New Building Standard (%NBS).

The original building was designed and constructed at some time after 1945.

The building is currently used as a library. Lateral loads are resisted in the longitudinal and transverse directions by plaster board lined - walls. The external wall cladding in the form of timber weatherboards also provide some bracing capacity. Similarly, there are unreinforced brick masonry walls and timber framed walls resisting earthquake loading in the transverse direction. The sub-floor structure consists of timber piles. There is no roof bracing present in the roof plane.

Once the unreinforced brick masonry first and ground floor walls between the library and the town hall are removed and replaced with timber framed walls, the library will be at 65%NBS. No further strengthening work for the building is recommended as it is close to the required 67%NBS rating

The assessment has been completed in accordance with the Seismic Assessment of Existing Buildings – Technical Guidelines for Engineering Assessments, dated July 2017. The seismic rating assumes that Importance Level 2 (IL2), in accordance with the joint Australian/New Zealand Standard – Structural Design Actions Part 0, AS/NZS 1170.0:2002, is appropriate. Refer to the below table for a summary of the buildings seismic rating.

92 Hautapu Street		
Building	**Seismic Rating (%NBS)**	**Seismic Grade**
Library	23%NBS (IL2)	Grade C

The Seismic Grade has been determined in accordance with the NZSEE grading scheme. The overall building seismic rating is governed by the failure of the unreinforced brick masonry first floor walls between the library and the town hall. Refer to Section 8 for a summary of the % NBS scores, and commentary, for the various building structure components and to Appendix D for a Technical Summary Report.

Refer to Section 8 for a summary of the % NBS scores, and commentary, for the various building structure components.

13 Explanatory Notes

- This assessment contains the professional opinion of Resonant as to the matters set out herein, in the light of the information available to it during preparation, using its professional judgment and acting in accordance with the standard of care and skill normally exercised by professional engineers providing similar services in similar circumstances. No other express or implied warranty is made as to the professional advice contained in this report.
- The assessment is also based on information that has been provided to Resonant from other sources or by other parties. The assessment has been prepared strictly on the basis that the information that has been provided is accurate, complete, and adequate. To the extent that any information is inaccurate, incomplete, or inadequate, Resonant takes no responsibility and disclaims all liability whatsoever for any loss or damage that results from any conclusions based on information that has been provided to Resonant.
- We have prepared this report in accordance with the brief as provided and our terms of engagement. The information contained in this report has been prepared by RESONANT at the request of its client, The Rangitikei District Council and is exclusively for its use and reliance. It is not possible to make a proper assessment of this assessment without a clear understanding of the terms of engagement under which it has been prepared, including the scope of the instructions and directions given to and the assumptions made by Resonant. The assessment will not address issues which would need to be considered for another party if that party's particular circumstances, requirements and experience were known and, further, may make assumptions about matters of which a third party is not aware. No responsibility or liability to any third party is accepted for any loss or damage whatsoever arising out of the use of, or reliance on this assessment by any third party.

APPENDIX A

PRELIMINARY STRENGTHENING SCHEME

CLIENT	Rangitikei District Council				
SUBJECT					
FILE No. 121390	DATE 7/12/21	PAGE SK1	OF	BY GL	CKD

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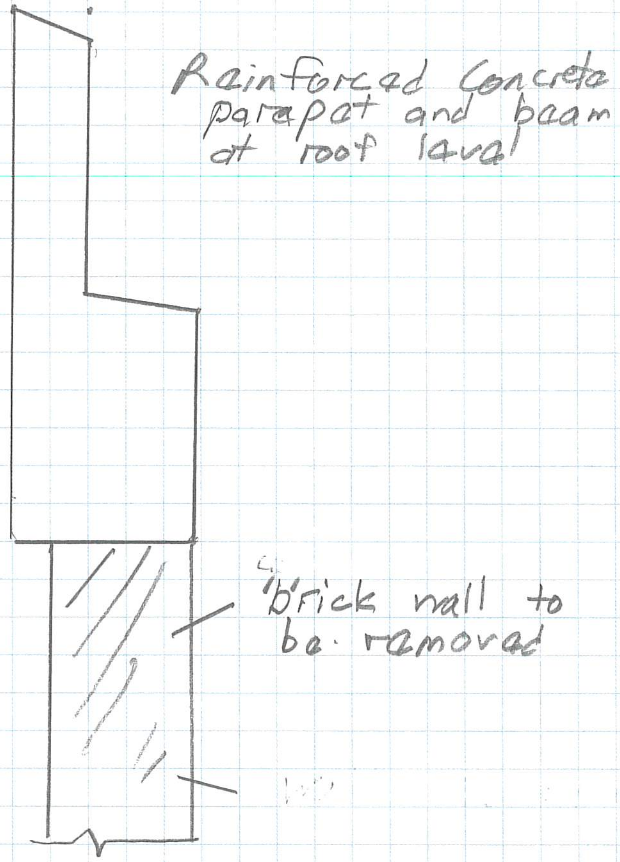
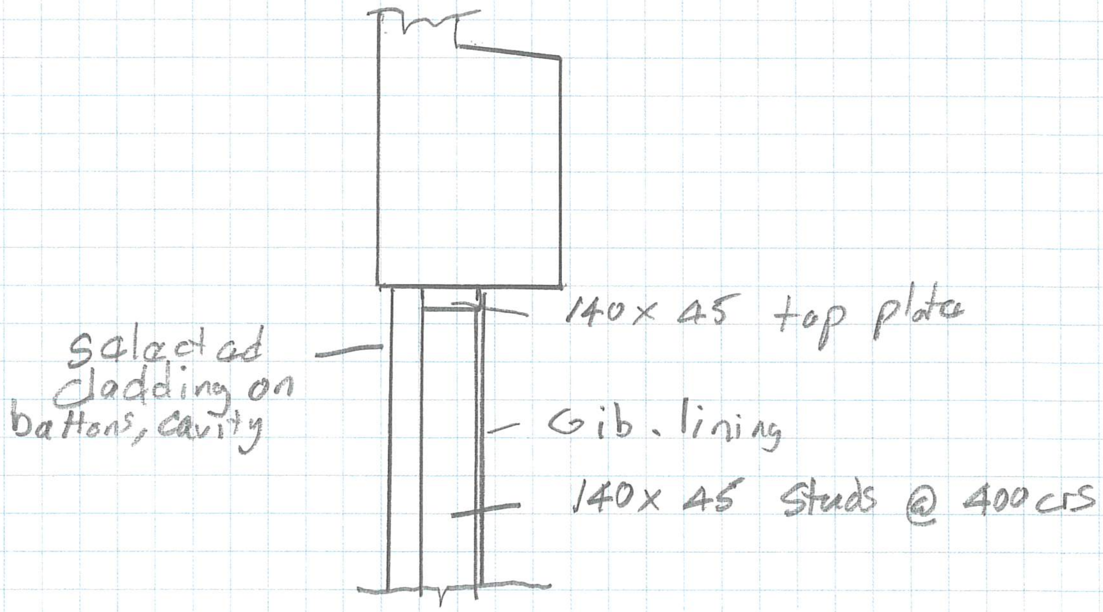


SECTION THROUGH 1st FLOOR WALL



NEW WALL

Note: flashings to be detailed by others

APPENDIX B

STRUCTURAL DRAWINGS

EXISTING CODINGS.

WALL CODING
- A ~ existing timber framed walls
- B ~ existing concrete walls
- ////////// ~ indicates walls to be demolished/removed

WALL FINISHES
1. ~ Hardboard type lining with battens ~ paint fin.
2. ~ vertical timber boarding ~ paint fin or polyurethaned.
3. ~ plywood lining up to dado with vertical timber boarding above ~ paint & polyurethane finish
4. ~ plywood lining up to dado height with plasterglass type lining above with wallpaper finish.

CEILINGS
- (CH) ~ hardboard type ceilings.
- (CB) ~ timber boarded ceilings
- (CP) ~ pressed metal ceilings
- (CT) ~ low level tile or plaster ceiling with high level pressed metal ceiling at high level. (concealed).

FLOORING
- (FY) ~ vinyl flooring
- (FC) ~ carpet flooring
- (FB) ~ timber board (exposed ~ poly)

REFER SHEET NO WD4 & WD5 for EXISTING SERVICES

EXISTING DOOR CODINGS & WINDOW CODING

(E1) to (E12) ~ GROUND FLOOR (refer schedule for reuse of doors & new prep required.)

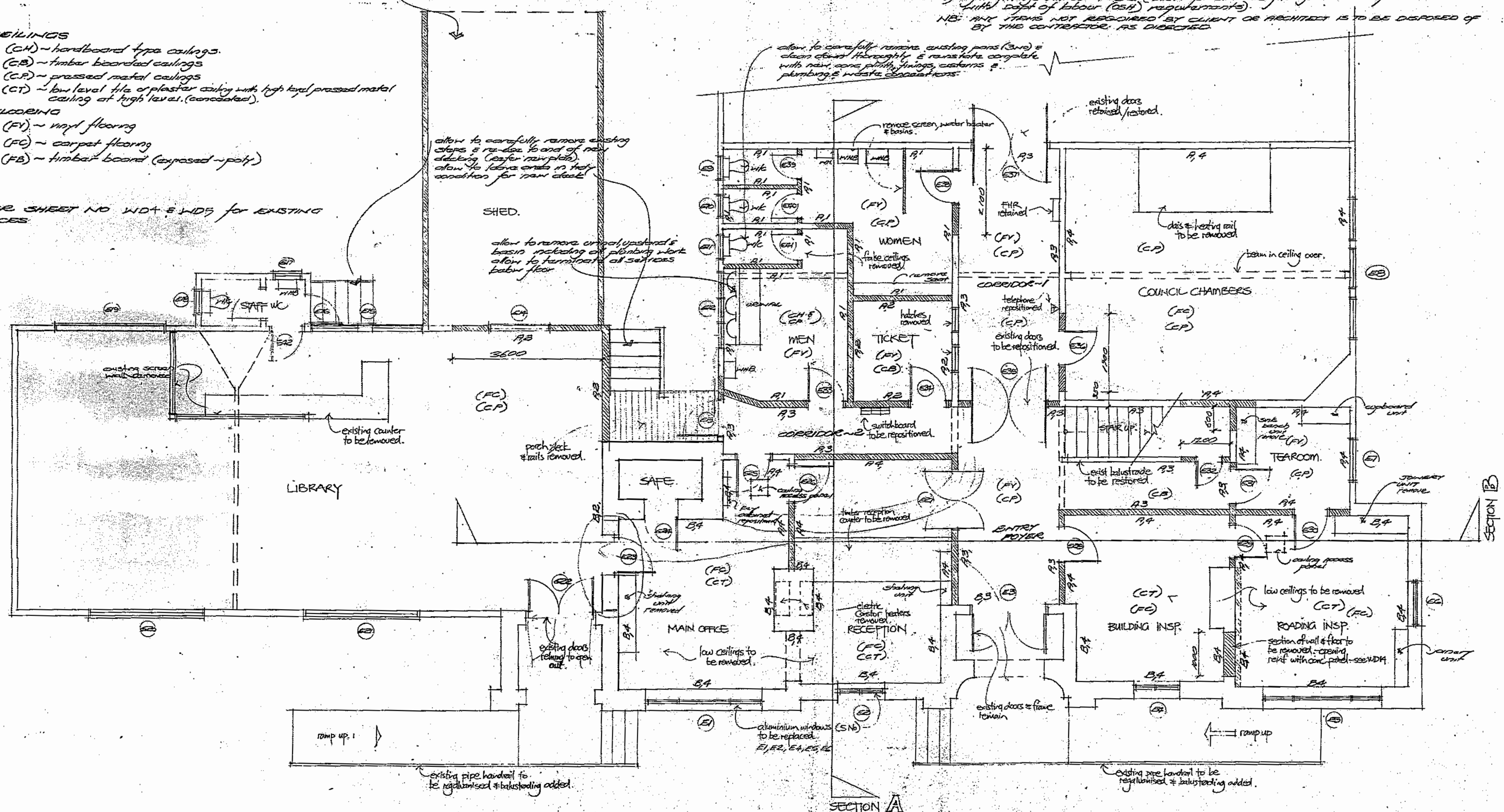
(E50) to (E61) ~ FIRST FLOOR

FITTINGS & FIXTURES.

~ allow to remove the following fittings & fixtures carefully for possible re-use as directed by architect. Store in area allocated on site.

a) toilets & WHB's in ground floor & first floor toilets ~ urinal (if possible)
b) all doors & glazed screens.
c) all heaters
d) all water heaters (zip & instantaneous in womens w/c)
e) fire extinguishers
f) emergency light fittings
g) wall shelving (refer client on site)
h) cupboard units, shelving units (refer client on site)
i) counters
j) light fittings without PCB's (allow for all PCB's fittings to be disposed in accordance with Dept of Labour (OSH) requirements).

NB: ANY ITEMS NOT REQUIRED BY CLIENT OR ARCHITECT IS TO BE DISPOSED OF BY THE CONTRACTOR AS DIRECTED.



NB: the contractor shall carry out a thorough inspection of the site & familiarise himself with the full scope & content of work including the following:
- ~ the structure & fabric including existing walls, floors, ceilings, linings, fittings, doors, windows, frames, etc. ~ check the condition of all including size, construction, finish, ease of removal, ease of extension, ease of making good etc.
- ~ the services including electrical, mechanical, heating, plumbing, drainage & telecommunications, check condition, size, direction of runs, ease of removal, ease of extension & ease of diversion etc.
- ~ allow for all in accordance with the new layout.

ANY OBVIOUS ITEMS OMITTED HERE IN THESE DRAWINGS OR IN THE SPECIFICATION SHALL BE BROUGHT TO THE ARCHITECTS ATTENTION PRIOR TO THE SUBMISSION OF TENDER.

Note: walls to be removed shown shaded.

RANGITIKEI DISTRICT COUNCIL

ARCHITECTS SOUTHCOMBE McCLEAN & COMPANY LTD

LAYOUT - GROUND FLOOR EXISTING | WD 2

APPENDIX C

ASSESSMENT SUMMARY REPORT

LONGITUDINAL DIRECTION (NORTH-SOUTH)

ITEM	%NBS	COMMENT
Roof Bracing	85	Distance between walls exceeds NZS3604 requirements
Timber wall bracing	100	Plaster board lining
First floor adjacent brick walls	23	Out of plane loading
Ground floor adjacent brick wall	41	Out of plane loading
Sub-floor	65	Timber piles

TRANSVERSE DIRECTION (EAST-WEST)

ITEM	%NBS	COMMENT
Roof bracing	85	Distance between walls exceeds NZS3604 requirements
Timber wall bracing	100	Plaster board lining
Sub-floor	65	Timber piles

APPENDIX D

CALCULATIONS

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Brief

DSA for the library is required. Note: wall on South-east elevation is shared with the Town Hall - see DSA report for 90 Hautapu St

Loads

Roof $G = 0.5$ kPa
$Q = 0.25$ kPa

walls $G = 0.5$ kPa timber framed & clad

Floor $G = 0.5$ kPa
$Q = 4.0$ kPa

Seismic use $\mu = 3$ timber framed structure
$Z = 0.33$ class D soils. $t = 0.4$

$C_h(T) = 3.00$ $R = 1.3$ $S_p = 1.3 - 0.3 \times 3 = 0.4$

$C(T) = C_h(T) Z R N(T, D)$
$= 3 \times 0.33 \times 1.3 \times 1$
$= 1.287$

$C_d(T_1) = \frac{1.287 \times 0.4}{2.1429}$ $k_\mu = \frac{(3-1) 0.4}{0.7} + 1 = 2.1429$

$= 0.24$

Seismic loads

at roof : roof area $= 14 \times 7 + 4.4 \times 4.3 + 2.8 \times 2.8$
$= 124.76$

wt $= 62.4$ kN

walls $= 0.5 \times \frac{3.6}{2} (14 + 14 + 7 + 4.3 \times 2)$
$= 39.3$ kN

$\Sigma = 101.7$ kN ×

$V^* = 101.7 \times 0.24$
$= 24.4$ kN $= 488$ BUs

CLIENT Rangitikei District Council
SUBJECT 92 Hautapu St - Library DSA
FILE No. 121390 | DATE 25/4/21 | PAGE 2 | OF | BY | CKD

bracing capacity Gib GS1 = $\frac{2.4}{3.6} \times 60$ = 40 BUs/m

across have 7 + 4.3 + 0.8 + 0.9
= 13.0 m

= 520 BUs > 488 BUs OK.

Note: distance between walls exceeds 6m.

Will require a ceiling diaphragm.
Will also need roof bracing.

along have 14 − 2×2.4 + 1.9 + 0.8 − 13.5
+ 6.1 − 2.4 (window)

= 19.1

= 764 BUs OK

ceiling diaphragm have 7m max rather than 6m
⇒ ≈ $\frac{6}{7} \times 100$ = 85% NBS

Floor area = 14×7 + 4.4×4.2 + 2.7×2.7
= 98 + 18.5 + 7.3
= 123.8 m²

original floor area = 105.3 m²

have cantilever piles on 2×2 grid approx.

ie 6×3 = 18 piles

original = 24.4×2 = 48.4 kN

braced area = $\frac{18.5}{123.8} \times 48.4$ = 7.2 kN

remaining 41.2 kN = 824 BUs

from 3604 BUs/pile = 30 kN ⇒ 30×18
= 540 BUs
@ 65% NBS

CLIENT	Rangitikei District Council				
SUBJECT	92 Hautapu St – library DSA				
FILE No. 121390	DATE 25/11/21	PAGE 3	OF	BY GL	CKD

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1

First Floor Brick Walls

between Town Hall & library are at 23% NBS (refer to 121389 ~~90~~ 90 Hautapu St, Taihape DSA report)

longitudinal direction brick masonry walls 23%