

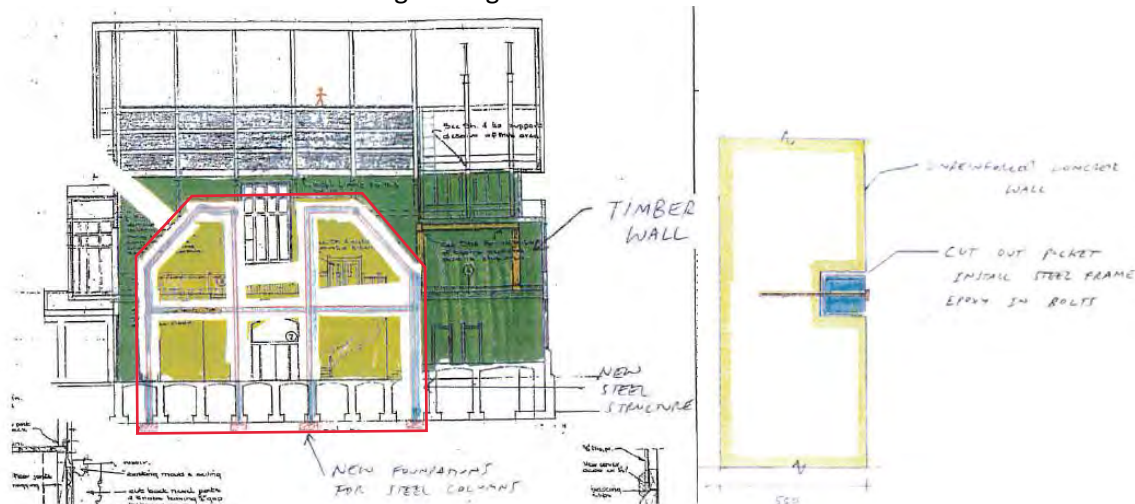
ROTORUA MUSEUM

Summary of Issues to Date – 04/09/2017

Provided below is a brief summary of the numerous issues present at the Rotorua Museum to date. These issues include findings from; the Detailed Seismic Assessment by GDC Consultants Ltd; Timber Deterioration Assessment by Prendos NZ Ltd and detailed investigation by TDC Ltd.

Global

1. Unreinforced concrete full height gable end walls are weak against out of plane (perpendicular) forces. Strengthen walls with new structural steel frames, rebated into concrete, through concrete floor and into new concrete footings in the basement. Rebate can be filled after installation of steel and finished over to match existing heritage fabric.



Concrete wall elevation (yellow) with steel frame (grey) (left) and steel frame detail (right).

2. Unreinforced concrete walls lack bracing against overturning from out of plane (perpendicular) forces. Create new structural walls perpendicular to the concrete walls to provide bracing. Utilize existing low concrete walls by strengthening their connection to the full height unreinforced concrete walls. Install new steel brace frames into existing timber framed walls.

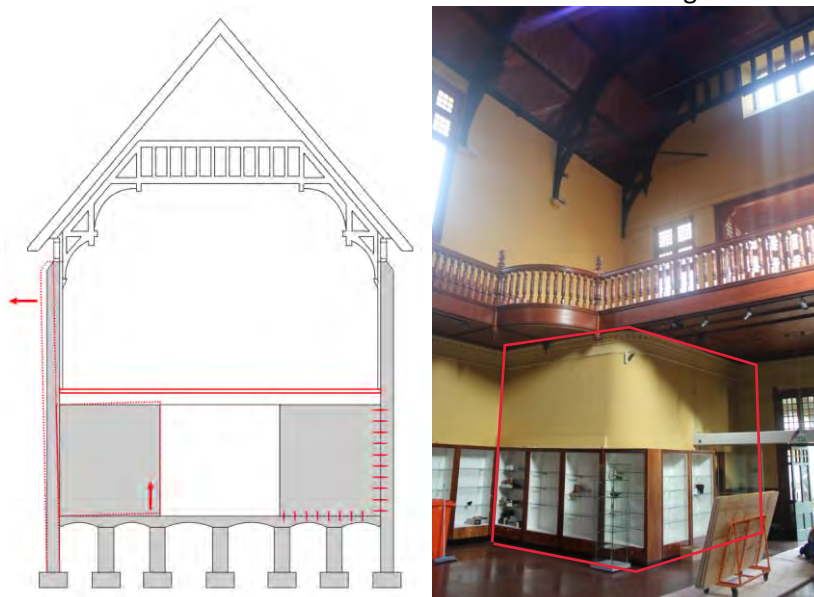


Diagram of full height concrete wall overturning due to out of plane forces on the left v.s. full height concrete wall braced against overturning with strengthened low concrete wall (left) and photo of low concrete wall below mezzanine (right).

3. Numerous timber roof framing and sarking elements have decayed and their connections to the timber top plates have deteriorated due to moisture damage caused by severe leaking of roof tiles over time. Replace decayed timber and install new connections to top plate.

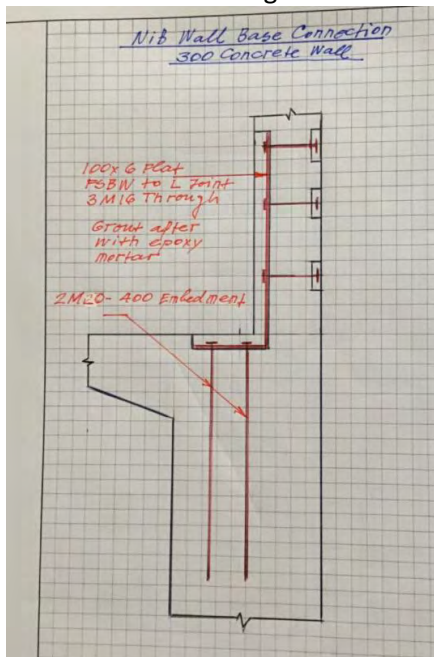


Cracked rafter (left) and severely moisture damaged valley rafter (right).



Cracked and mouldy sarking (left) and visible moisture presence to rafter (right).

4. Concrete nib walls, weak against out of plane overturning forces, selected walls require bracing. Cut a rebate into concrete at floor-wall junction at maximum 1200mm crs and install steel angle brackets bolted through floor and nib wall. Epoxy grout over to match existing.



Bracket detail (left) and concrete nib wall exposed below lathe and plaster/timber framed wall above (right).

5. Concrete floor cracking under vertical loading. Injection grout fill larger cracks and spray glass fibre reinforced concrete overlay to underside of concrete to strengthen the suspended floor slab.



Photo of a larger crack in floor slab (left) and finished surface of glass fibre reinforced concrete overlay (right).

6. Clay roof tiles are leaking severely and causing widespread moisture damage to both structural and service elements of the building. If the moisture damage continues to framing elements the timber decay will cause a severe structural weakness. Repair or replacement of the roof tiles is required to prevent any further decay of timber framing elements. Replacement of the existing heavy clay roof tiles with a lightweight alternative will also reduce the seismic demand on the overall structure and may reduce the scale and complexity of structural upgrade works required. Removal of the existing roof will also allow structural works in the roof space to be carried out more easily.



Roof tiles have broken and slid completely off roof (left) and active water leak through tiles on roof framing (right).

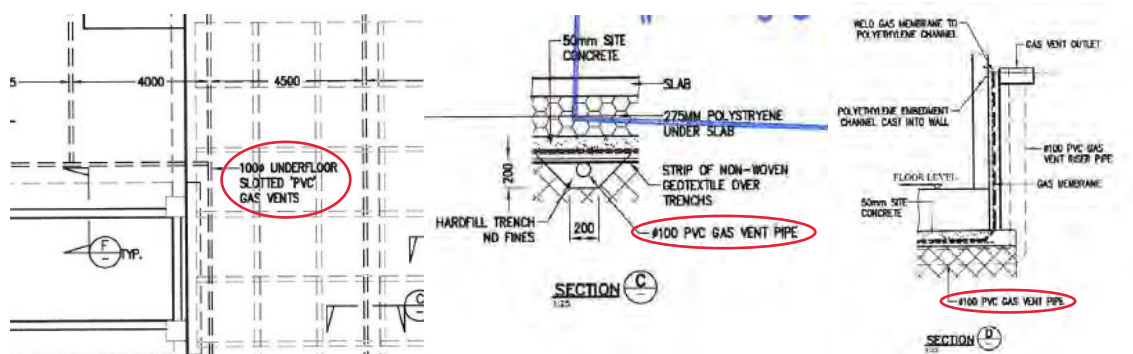
New South Wing

7. Replace existing rigid Reid bar brace connection lugs to structural steel portals frames with new ductile connections.



Structural steel elevation identifying diagonal bracing (left) and photo of actual existing reid-bar brace connection (right).

8. Gas vents possibly not installed with slotted PVC drain pipe as required to receive gas from ground. CCTV inspection of existing vents pipe required to check for slots on underside of PVC vent pipes. Thrust new slotted PVC pipe under existing slab to create effective vents or cut a vent opening in ground slab to collect gas in a sealed chamber and vent to outside.



One plan reference to the under slab gas vent pipes states 'slotted PVC' (left) and details state '100mm PVC' (right).



The photos of these PVC gas vent pipes show no evidence of slotted PVC pipe installed. The i.d. stamp on the PVC pipe in the photo on the right supports the fact that this pipe is not factory slotted. There is a possibility that the pipe could have been slotted on-site prior to installation and these slots are simply not visible in these photos. Therefore a CCTV inspection of the vent pipes is required to check whether the required slots are present. If the slots are present however, there is a possibility that the pipes have become blocked as the hard fill that has been backfilled around the PVC pipes contains a lot of 'fines' material despite the detail above stating 'HARDFILL TRENCH, NO FINES'.

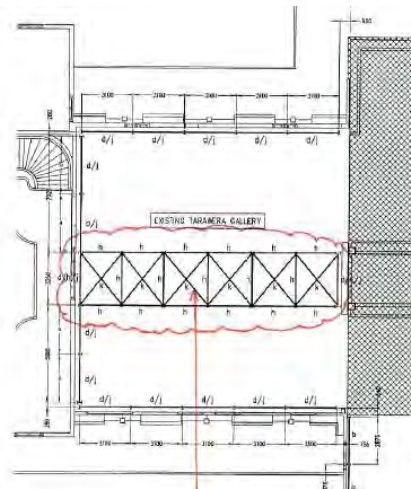
9. Membrane below slab and to exterior of basement and lift shaft walls has failed. Moisture is seeping through masonry block walls, leaving calcium deposits on basement walls and sulphur stains in the lift shaft. Re-seal concrete floor slab and masonry block walls with tanking membrane.



Damaged roll of membrane at time of construction (left) and photo of lift shaft membrane installation (right).

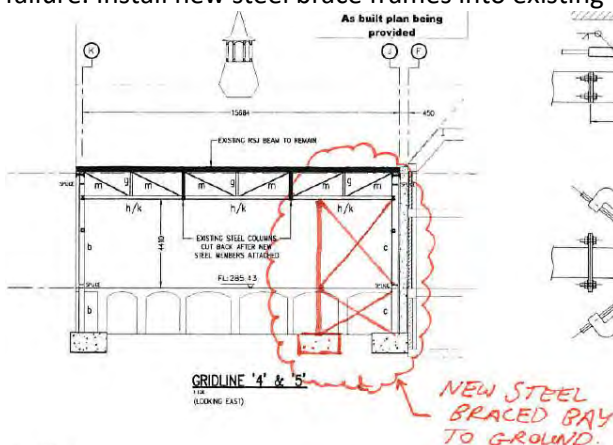
Intermediate South Wing (Tarawera Gallery)

10. A second upper horizontal steel truss, omitted from final design and not installed as required by structural calculations in roof space above central hallway. Install new horizontal steel truss above existing lower steel truss comprised of steel struts and braces, installed in parts for ease of construction in roof space above Pukaki.



Tarawera Gallery prior to fit-out showing lower steel truss above central hallway (left) and structural plan of truss (right).

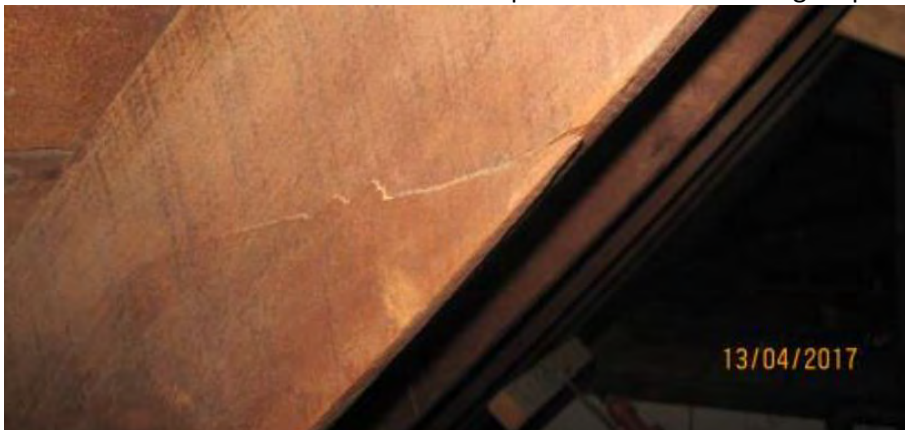
11. Central steel portal likely to experience excessive deflection under seismic event leading to failure. Install new steel brace frames into existing timber partition walls either side of Pukaki.



Sketch detail of new steel brace frame to be installed.

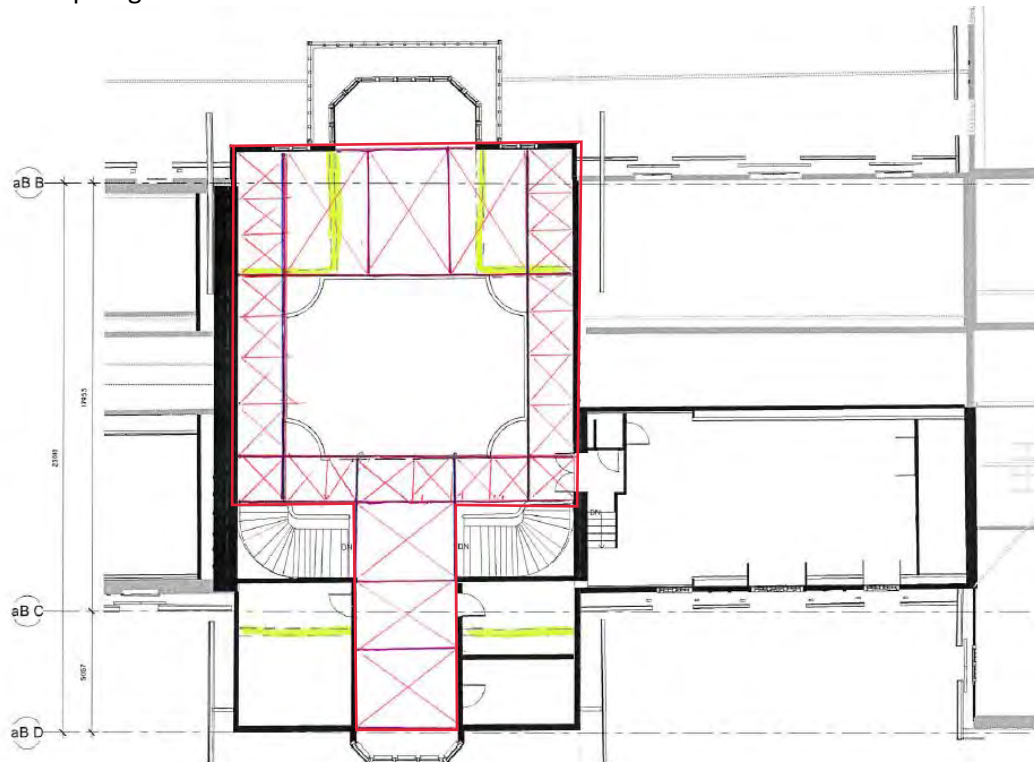
Central Atrium

12. Timber roof beam above atrium has experienced some cracking. Replace beam and connections.



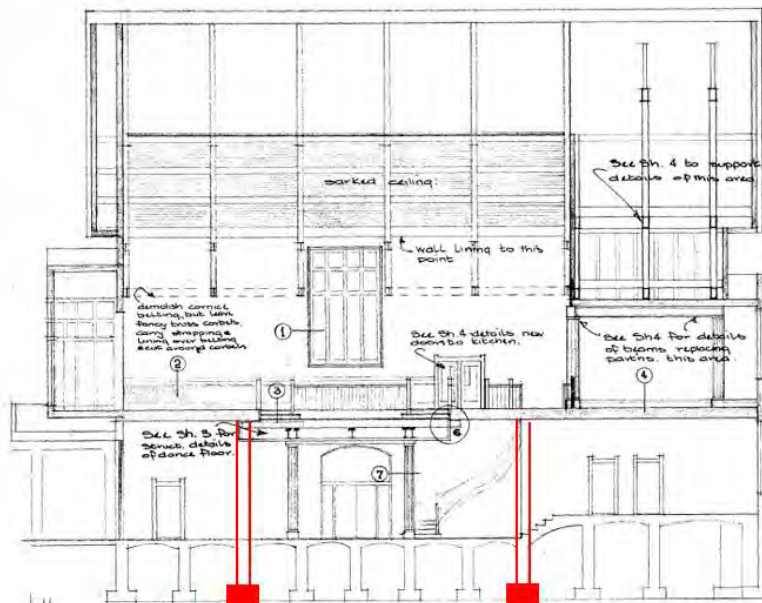
Cracked timber roof framing.

13. Lack of horizontal plane bracing to unreinforced concrete walls at mid height. Install a new horizontal floor diaphragm by removing existing mezzanine floor lining, installing steel bracing into the floor cavity and installing new structural plywood flooring screw fixed to joists to create effective floor diaphragm.



Approximate area of mezzanine floor required for structural diaphragm.

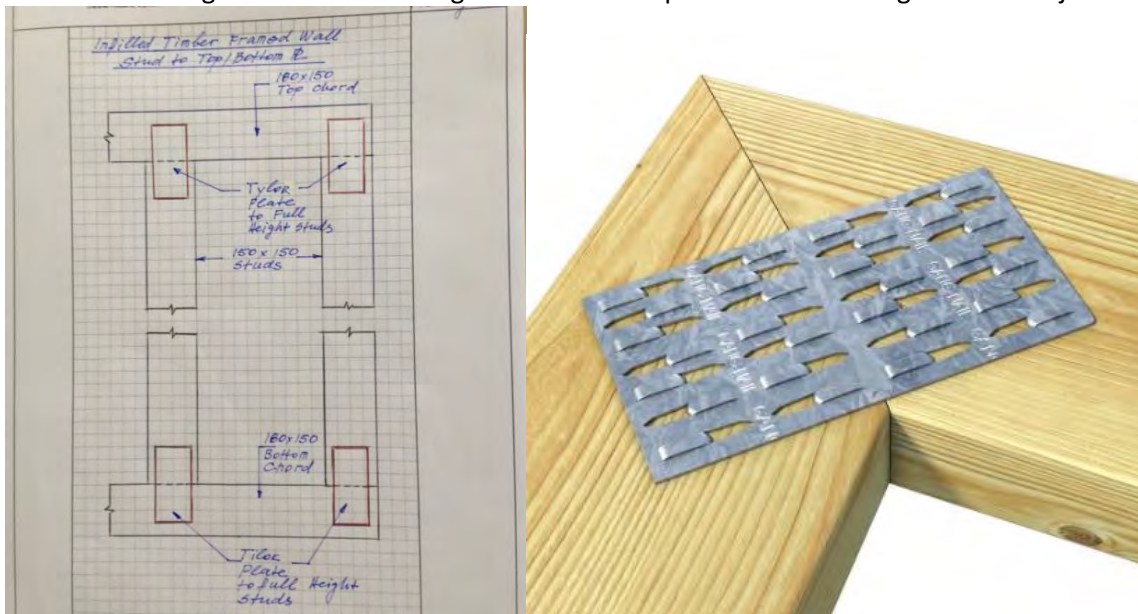
14. Selected foundation footings in Atrium below concrete walls running in the north-south direction lack bearing capacity. Footings need to be widened.



Long section of atrium showing (red) approximate location of concrete walls requiring footings to be widened.

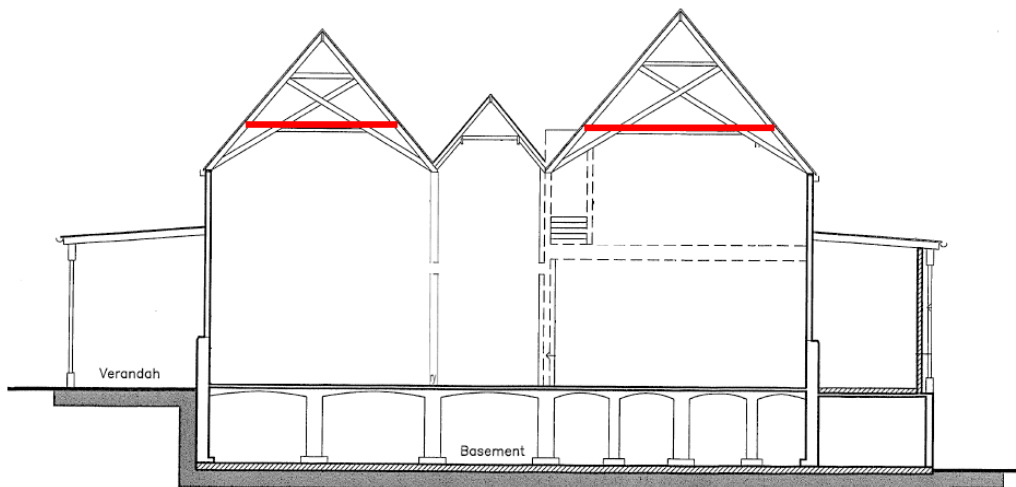
North & Intermediate North Wing

15. Existing timber framed walls lack lateral bracing capacity and require strengthening to create structural bracing walls. Remove lining and install steel plates over to strengthen timber joints.



Sketch detail of plate to stud fixing (left) and example of Tylok plate to be used to strengthen timber connections (right).

16. Lack of an effective roof diaphragm to tie together and strengthen global structure. Install horizontal steel cross bracing in roof space to create a structural diaphragm above the ceiling joists.



Cross section of Intermediate North Wing showing approximate location (red) of required steel bracing in roof space.

17. Number of toilets is insufficient for the museum occupancy load. 7 male and 7 female toilet 2 of which are accessible, is required to achieve building code compliance (See Floor Plan).

18. Existing lift insufficient to provide accessibility to classroom and mezzanine floor (See Floor Plan).

19. Single point of access/egress to North Wing through café and theatre waiting area creates visitor traffic congestion. Improve circulation by removing theatre and creating a second access/egress point by reinstating existing doorway into hallway near Honeymoon Room (See Floor Plan).

North Wing Extension

Area affected by issues 1 & 2.

