

Rare Environmental

Nat Stevens

Via email: Nat@rare-enviro.com.au

22nd May 2023

STRUCTURAL CONDITION REPORT 3 EXISTING 2-STOREY TIMBER BARRACKS BUILDINGS Sydney Harbour Federation Trust Middle Head – Middle Head Road, Mosman NSW 2088

1. INTRODUCTION

We, Richmond + Ross Pty. Ltd., being consulting structural engineers, have undertaken an inspection to the aforementioned structures at the property noted above on the morning of Tuesday 16th May 2023 in the presence of *Nat Stevens* from *Rare Environmental*. The inspection was carried out at the request of *Nat Stevens* to conduct a structural condition report of these structures. Physical walkover access to the 2 storey buildings was provided. At several locations, ceiling/cladding have been locally removed to allow inspection of structural elements within. These locations were strategically selected to provide an understanding of the prevalent structural building conditions. Access to roof structure was accessible through accessible manholes. The inspection was carried out by an appropriately experienced and qualified structural engineer. No existing structural documentation for the existing structures have been made available.

Our assessment is limited to the visible structural aspects of the 3 buildings. The inspection was not structurally exhaustive, not all framing structures were able to be inspected. This includes the lower-level timber framing, timber studwall framing, upper-level floor framing and areas within the roof structure not easily viewable from the accessible manholes. Unless otherwise stated, the following matters are specifically excluded from the assessment:

- safety and condition of electrical wiring;
- plumbing work, including water services, sewers, and gas plumbing;
- any subsurface or otherwise hidden aspects,
- health regulations and requirements.



Figure 1 – 3 Existing 2-Storey Timber Barracks

PRINCIPALS: MAGDA WEGNER, BSc(Eng) MSc(Eng)
NICK MITCHELL, BSc, BE (Hons), FIEAust, CPEng
STUART PIPER, B.Arch (Hons), Grad Dip Prop (Hons)

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Figure 2 – Typical Front View of Barracks with Front Porch Shelter.
Growth within gutters at edge of roof typical



Figure 3 – Typical Rear View of Barracks.
Timber weather board-cladding conceals timber studwall on perimeter brick footings for sub-floor framing.



Figure 4 – Typical Side View of Barracks.
Gable Style Timber Framed Roof with metal sheeting. Weathering of timber cladding paint system evident.



Figure 5 – Gutter Fully corroded through near downpipe due to likely pooling of water and failed drainage.



Figure 6 – Close-up of diagonal bracing member junction with perimeter Timber-Framed Wall Bottom Plate.
Long-term corrosion of nails evident leading to splitting of timber ends.



Figure 7 – Close-up of front porch timber floor framing bearing on brick footings.
Long-term corrosion of nail evident leading to splitting of timber ends.



Figure 8 – Sub Floor footing conditions. Animal tunnelling evident in vicinity of brick pier. Structural impact and settlement to footing unclear without further investigation.



Figure 9 – Localised damage to timber floor plank due to possible overloading.



Figure 10 – Vertical Crack in Perimeter Brick Footing Structure due to possible footing settlement.



Figure 11 – Cementitious patchwork to underside of existing concrete bathroom slab.
Reinforcement bars exposed and indicate surface corrosion.



Figure 12 – Existing Concrete Beam in Bathroom under-slab.

Evidence of poorly cemented concrete with exposed reinforcement showing surface corrosion.



Figure 13 – Existing Sub-floor timber framing. Asbestos packers not engaged with brick pier due to dislodgement of packers or possible footing settlement.



Figure 14 – Timber Flooring beams on brick pier footings supporting floor joists.
Vertical cuts in floor beams at support leading to reduced capacity.



Figure 15 – Close-up of Timber Floor joists at external face of building.
Timber is damp likely due to constant water exposure from failing gutter system.



Figure 16 – Internal timber stud-wall. Splitting of timber stud members apparent at ends of studs



Figure 17 – Typical view of internal gable roof-structure. Sarking, metal mesh, sheeting appear to have been replaced within last 10-15 years. Roof/ceiling structure mostly in good condition.



Figure 18 – Non-serviceable Brick chimney terminating within roof structure.



Figure 19 – Timber Stud-Wall at mid-landing of timber stairs joining 2 storeys. Insect faeces at base of studwall indicate likely termite activity within studwall.

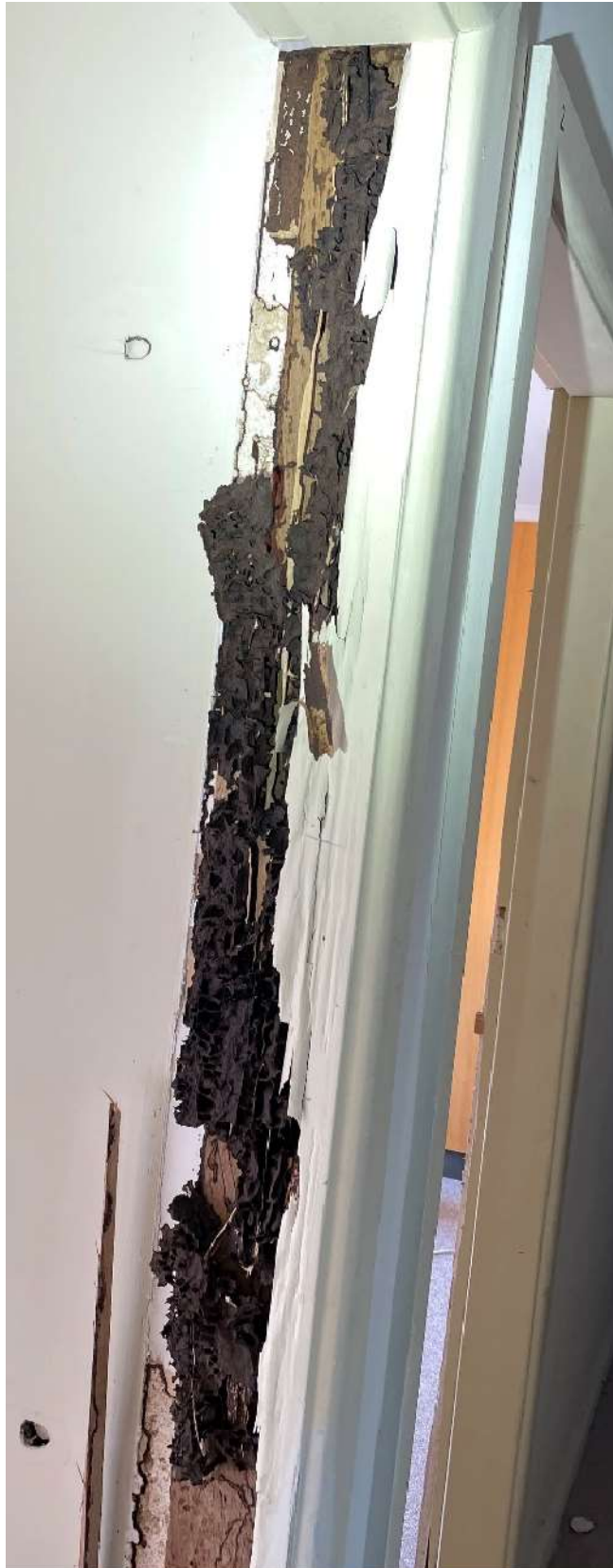


Figure 20 – Timber Casing around door-frame severely damaged from termites.



Figure 21 – Typical view of Upper Level Floor framing. No obvious signs of significant weathering or structural defect at this location.

2. OBSERVATION/DISCUSSION

During inspection it was clear that there was a mixture of construction from different timelines. It was noted that the roof structure, sarking, metal roof sheeting has likely been replaced within the last 10-15 years based on its good condition with limited signs of structural defect. The enclosure of the existing brick chimney within the ceiling cavity confirms that the original structure has been modified since its original build.

There were further signs of recent replacements of ceilings within the buildings also. There was evidence of double-layered gyprock ceilings and newer styled ceiling grid systems within the bathrooms. It is estimated these replacements have occurred within the last 10-15 years also based on their condition and their product.

The original construction for the buildings appear to be limited to the brick footing/pier system that carries the external walls, lower-level timber floor framing, and the timber studwall system throughout the buildings, internally and externally to the lower and upper levels that carry the loads of the buildings and are the primary lateral load resistors. Our assumptions have been based on the style of construction and cladding used, age and type of timber elements used, and the general long-term weathering and deterioration that we observed. It is difficult to assess the age of the upper-level timber framed floor as there was limited access available and our limited observations indicated a timber framed system that was in generally good condition with limited signs of weathering/deterioration. It is possible with good maintenance of the building that this structure has been protected from weathering/biological elements effectively throughout its service.

There were extensive structural defects noted particularly around the perimeter of the buildings, and to these likely original construction elements listed above. These included:

- Termite damage
 - Timber Studwalls in some areas that we were able to expose showed significant signs of termite damage. This was obvious from the termite faecal matter observed at the base of these walls as well as the typical burrowing and hollowing of timber observed. (**Figure 19**)
 - Termite damage was observed extensively within the door casings of the buildings. (**Figure 20**)

- Corrosion of timber fixing elements (nails) leading to timber splitting.
 - Long-term corrosion of the steel nails, mostly around the perimeters of the buildings where they are most vulnerable to long-term weather exposure. Consistently we noted that the expansive nature of this corrosion has led to splitting of timber studs near their fixings, leading to reduction of capacity. (*Figures 6, 7, 16*)
- Timber rot/dampness deterioration due to prolonged water exposure.
 - It was clear that the roof gutter system has failed at each of the 3 buildings inspected. The vegetation growth and fully corroded through gutters were clear indicators.

This has led to **prolonged water exposure** at various points around the buildings where the roof is not draining adequately. The structural consequences have been severe in some locations where it was noted that the timber has significant signs of dampness and was soft under touch, likely from wet-rot. (*Figure 15*)

- Settlements of Footings
 - In some areas it was observed likely that footing systems had undergone differential settlement leading to structural defects. *Figure 10* indicates a fully propagated crack through the brick support footing system that is likely due to long-term differential-settling at the corner of the building that is noted to be sitting on an undulating slope that falls to the North. *Figure 13* shows a brick pier that is no longer supporting the floor structure leading to reduced floor capacity and greater deflection, likely due to long-term settlement. *Figure 8* indicates animal tunnelling in the sub-floor area within the vicinity of brick piers. The stability of these footings in these areas are reduced and cannot be quantified without further investigation.
- Corroded, exposed reinforcement within Concrete slab areas within lower-level Bathrooms.
 - There were signs of exposed, corroded steel reinforcement during inspection of the sub-floor area. This is non-compliant with the requirements of AS3600. Further corrosion of these reinforcement bars may lead to sudden concrete failure/spalling due to the expansive forces of the corrosion, as well as reduced strength of the steel.

4. RECOMMENDATIONS/CONCLUSION

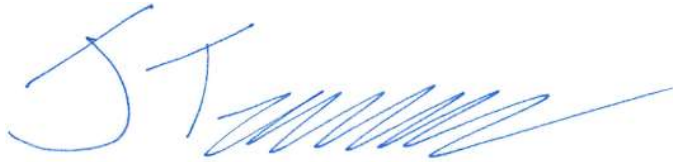
Based on our inspection, we make the following structural remarks and recommendations for any remedial work to ensure compliance with the Australian Standards and the ongoing serviceability of the buildings:

- The failed nature of the roof drainage system and weathering of the external timber weatherboard cladding have the implication that there will be long-term water exposure to certain regions of the buildings. Long-term water exposure leads to structurally compromised structure, which was observed at some locations during inspection. **It is recommended that in all regions where there is suggestion of long-term water exposure, that the structure in these areas is thoroughly investigated for any signs of structural defect and remediated effectively.**
- The long-term degradation evident in some of the timber studwalls indicate that these are nearing the end of their serviceable life.
 - Studwalls that are exhibiting split ends within the timber elements should be replaced to ensure structural integrity of the connection.
 - Damp affected timber to be replaced.
 - Studwalls with corroded nails must have nails replaced with new nails.
 - Termite affected stud members must be replaced with termite resistant timber stud.
- Settled footings must be remediated to prevent adverse structural damage.
 - Subfloor framing to be repacked to brick piers where not engaged.
 - Cracks in brick to be filled with construction approved epoxy/mortar.
- Exposed corroded reinforcement within concrete slabs:
 - Removal of local cracked, degraded concrete to 20-30mm past reinforcement.
 - Mechanically brush back all corrosion and apply rust-kill system (FOSROC Nitoprime Zincrich).
 - Apply concrete repair mortar to seal and smoothe concrete surface with minimum 50mm cover.

Our inspection and subsequent assessment have been undertaken within the limitations imposed by visual inspection and limited access only. We trust this is suitable for your current requirements. Please contact the undersigned should you require further information or clarification.

This advice shall not be construed as relieving any other party of their responsibilities, liabilities or contractual obligations.

Yours faithfully,

A handwritten signature in blue ink, appearing to read 'JT' followed by a series of horizontal, wavy lines.

Justin Tzannes BEng (Sydney) MIE(Aust-4050881)
for
Richmond + Ross Pty Ltd