

# STRUCTURAL CONDITION ASSESSMENT 2023 10 MCKAY STREET, PORT HEDLAND, WESTERN AUSTRALIA



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## 1. EXECUTIVE SUMMARY

AIE – Engineering and Construction Management Pty Ltd (AIE) was engaged by the DFES to complete a structural condition assessment of the building at 10 McKay Street, Port Hedland, Western Australia. The inspection was initiated to evaluate the current building condition and identify the building's condition to current applicable Australian Standards and building code requirements. The inspection took place on 15<sup>th</sup> of February 2023.

It was advised by DFES that no remedial work had been done on the building in relation to the previous AIE report AU20-030-05-001\_1 issued 21<sup>st</sup> May 2020

Visual inspection of the premises internally and externally was conducted as part of this project, where the focus was on the concrete stump foundations, floor bearers / joists and the roof. Limitation in access prevented assessment to be carried out on wall framing and bracing, floor bearer to stump connections, the connection of roof battens to the rafters and rafter tie-down connections.

The building is divided into two sections: the Southern end of the building is currently occupied by the VMR Operations (gridline 1 to 9 on drawing AU23-039-06-001 – Appendix A) while the Northern end is the former Port Hedland Game Fishing Club and currently not in use (gridline 9 to 29 on drawing AU23-039-06-001 – Appendix A). No documentation about the building was available for this report; however, the age of the building is at least 60 years old with some parts of the building over 100 years old.

In regard to the outcome of the inspection, the defects have been separated into building deteriorated defects and code non-conformance observations:

- Five (5) code non-conformances were observed which will need further inspection and engineering design to determine the full extent of the scope. One important observation is that the building does not appear to have incurred structural damage due to the current standards non-conformances and has sustained severe weather conditions over its life span.
- There were a total of twelve (12) structural deteriorated defects with **nine (9) defects assessed as High to Extremely Severe Risk.** It is observed that most of the defects are located at the Northern End of the building except for the walls and subfloor structures where termite damage may have spread through the entire building. The Southern end of the building sustains considerably less structural defects where the main concerns are the termite damage and the damaged concrete stumps. Rectifications are recommended to be carried out immediately (for Priority 0) and within the next 3 to 6 months (for Priority 1 & 2) to prevent further damage to the building structure. The following observations can be attributed to the 3 identified Priority 1 and higher defects:
  - **Priority 0** Failure of verandah floor, wall and roof members as a result of extensive termite damage to the North West corner of the building.
  - Priority 1 Concrete deterioration to 95% of building stumps of the building on the Northern end and 50% of the stumps at the Southern end resulting in reduced capacity.
  - **Priority 1** Failure of verandah roof members along the east side of the building as a result of extensive termite damage.



In summary, the condition of the building at time of inspection was determined as:

- Northern end of the building (Port Hedland Gamefishing Club end Gridline 9 to 29 on drawing AU23-039-06-001 in Appendix A): Extremely High Risk for structural integrity failure. Rectification works are highly recommended prior to building use.
- Southern end of the building (VMR Operation End Gridline 1 to 9 on drawing AU23-039-06-001 in Appendix A): **High Risk** for structural integrity failure. Rectification works are recommended within the next 3 to 6 months. It should be considered that further deterioration or failure of the Northern end of the building can cause further damage to the Southern end given the two sections having the same roof, walls, and floor structures.
- In addition, the building (both Northern and Southern ends) is at **Extremely High Risk during a cyclonic weather event** considering the current structural defects and the code nonconformances. Building use during cyclonic weather events is not recommended unless further inspections, remediation / upgrade works are carried out.

Whist possible with immediate interventions and limited loading with regular inspections, the limited occupancy of the building is not recommended due to associated risk of unknown extent of termite damage. Potential temporary facilities are a more prudent option. The building is not suitable for occupancy during cyclonic event and building abandonment should be strictly followed during such weather event.



## 2. INTRODUCTION

## 2.1 GENERAL

AIE is a specialist engineering consultancy servicing the needs of clients throughout Australia and New Zealand. AIE lead the way in structural engineering with an asset management focus in Domestic, Commercial, and Industrial applications. AIE were engaged by DFES to perform a structural condition assessment on the building at 10 McKay Street, Port Hedland, Western Australia. The inspection was carried out on 15<sup>th</sup> of February 2023.

The building has a timber framed roof, walls, and floor with concrete stumps. The roof has steel sheeting with steel wall sheeting and timber floors. No documentation for the building was available for this report. Based on the heritage document found in the building, the building dates from 1906 with the eastern extension in 1959.

## 2.2 PREVIOUS INSPECTIONS

This is the second inspection of the property by AIE. The inaugural inspection was undertaken by AIE of the property on 16<sup>th</sup> of April 2020 for VMR not DFES. No prior reports were provided to this office. As-built drawings were not provided to AIE for reference purposes.

It was advised by DFES that no remedial work had been done on the building in relation to the previous AIE report AU20-030-05-001\_1 issued on 21<sup>st</sup> May 2020. The defects in this report are almost direct copies of the previous report when the time frames in the previous report state the defects should have all been repaired.

## 3. SCOPE OF INSPECTION

The scope of work was to undertake a visual inspection of all accessible structural components of the building at 10 McKay Street, Port Hedland, Western Australia. The inspection aims to identify structural defects and compliance issues of the building and summarise them into a final condition report. Along with a comment on occupancy of the building. The report will analyse the findings, provide risk ranking for each defect.

The objective of this assessment is to identify defective structural components that may affect the strength, stability and serviceability intended by the original design of the structure. Provision of structural design documentation for building alterations or rectifications are not proposed as a component of this engagement of works.

The building can be divided into two sections and will be discussed separately:

- The Southern end of the building is currently occupied by the VMR Operations (gridline 1 to 9 on drawing AU23-039-06-001 Appendix A).
- The Northern end is the former Port Hedland Gamefishing Club and currently not in use (gridline 9 to 29 on drawing AU23-039-06-001 Appendix A).



## 4. METHODOLOGY

The inspection and assessment were carried out in accordance with methodology outlined in AS ISO 13822-2005(R2016), Section 4.5 Preliminary Assessment. The objective of the inspection is to identify the structural system and possible damage to the structure by visual inspection and inspection tools. Results obtained from the inspection are expressed in qualitative terms as outlined in Section 4.3.

Depending upon the outcomes of the preliminary inspection, preliminary analysis may be carried out to identify future deficiencies that relate to the safety and serviceability of the structure. Results from these checks dictate as to whether further investigations are to be instigated.

Where preliminary inspections and checks indicate that the structure is in a hazardous condition, engineering intervention shall be immediately taken to reduce the danger with respect to public safety. Where uncertainties exist, critical deficiencies shall be immediately assessed, and any necessary actions implemented.

Where preliminary checks identify there is uncertainty in actions, action effects or properties of the structure, detailed assessment in accordance with AS ISO 13822-2005(2016) Section 4.6 shall be initiated.

## 4.1 ACCESS RESTRICTIONS

In general, the inspection team had access to most of the area of concerns within the vicinity of the building such as the stump foundations, floor bearers / joists and part of the roof; however, there were some restrictions to access for inspection in the areas below:

- The wall framing and bracing layout could not be inspected due to the wall sheeting being in place.
- The floor bearer to stump connections were not all accessible for inspection and those that were had an M10 bolt vertically through the bearer.
- The connection of the roof battens to the rafters could not be inspected due to the roof sheeting being in place however most had galvanised straps with 2 nails each side.
- The rafter tie downs inspection was limited due to lack of space in the roof. However, tie downs could be observed though not at the ends of the rafters.
- The roof was inspected through the inspection hole and most members were viewed from a distance due to limited access. The northern roof area was not accessible for inspection due to infill panels.

#### 4.2 VISUAL INSPECTIONS

A full visual inspection of all accessible components was undertaken.



#### 4.3 PRIORITY AND RISK ASSESSMENT DEFINITIONS

Priority ranking is chosen based on the risk level determined from the Qualitative Risk Assessment as defined in Figure 1. The corresponding action is given for guidance only to assist DFES in performing the recommended maintenance work. AIE takes no responsibility for incidents or system failures that occur prior to the recommended action durations.

Risk Ranking	Risk Level	Act	ion	Priority Ranking	Qualitative Co	onsequ	ence:
0	Extremely Severe	Address without operator, warn p stop plant if requir	t delay, notify ersonal in area, ed, etc.	P0	<u>Catastrophic</u>	-	Death, loss of asset, release to environment, such that significant public interest or regulatory intervention occurs or
1	Severe	Address within 3 r	nonths	P1	<u>Critical</u>	-	Severe injury, major asset damage or
2	High	Address within 6 r	nonths	P2			event which causes some loss of performance, unplanned localized damage to environment,
3	Moderate	Address within possibly assign monitor or further	12 months – to maintenance, review	P3	<u>Marginal</u>	or could have resulted in catastrophic consequences under different circumstances. Minor injury, major asset damage, minor confined and non-damaging environmental	
4	Low	Review again in 2	years	P4			exposure.
	Quality	ativo Piek Aeeo	eemont		<u>Negligible</u>	-	General Acceptable Condition.
		Concor					
Probability	/ Catastrophic	Consec	Marginal	Nealiaible	Qualitative Pr	obabili	ty:
Frequent	0	1	1	3			likely to easy in the next 6 menths
Probable	1	1	2	3	<u>Frequent</u>	-	likely to occur in the next 6 months
Occasional	1	2	3	4	Occessional	-	likely to occur in the next 12 months
Remote	2	2	3	4	Bomoto	-	likely to occur in the next 24 months
Improbable	3	3	3	4		-	likely to occur in the next 5 years
						-	the enset
	Severe	Hiah	Moderate	Low			ine assei

Figure 1: Qualitative Risk Assessment Definitions

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## 5. RESULTS AND DISCUSSION

The findings of the inspection were separated into structural deteriorated defects and code nonconformance observations. The drawings AU23-039-06-001 to 004 show the building and observed structural deteriorated defect locations, and these drawings can be found in Appendix A of this report.

## 5.1 CODE NON-CONFORMANCES

Table 1 below summarises the current code non-conformances that were observed during the inspection. Each defect was assigned a unique defect ID. The defects, however, are typical and applied to the whole building. Whilst the building does not comply to the requirements of AS1684 in accordance with the NCC it has been assessed with that code to show current code non-conformances for the building. If assessed in accordance with current codes for the commercial building that it has been used for it will have further non-compliances, mostly due to the age when it was constructed and changes to current codes. The loading and material requirements for modern non-residential buildings are larger than those required for residential buildings, hence the further non-compliances noted above.

It is worth noting that the building **does not** appear to have structural damage due to its current code non-conformances considering the building is at least 60 years old and some parts are over 100 years old. However, it is recommended that the following code non-conformances be rectified to ensure the building complies with current code requirements of AS1684.3-2010 - Residential Timber Framed Construction – Cyclonic Areas.

Defect ID	Code Non-conformances	Relevant Code
N1	The roof battens observed in the roof are at constant spacings with no allowance for edge conditions as defined in AS4055 and AS1684.3.	AS 1684.3 Table 9.14
N2	Roof rafters are under sized for their span and spacing.	AS 1684.3 C3 Supplement 9-2010 Table 29
N3	Hanging Beam undersize for span.	AS 1684.3 C3 Supplement 9-2010 Table 23
N4	There is no sub floor bracing evident. The lateral capacity of the stumps cannot be assessed as the stump connection to bearer is not adequate in accordance with Figure 8.4 of AS 1684.3. The damage to the stumps further diminishes any lateral capacity of the stumps.	AS 1684.3 Figure 8.4
N5	Site drainage away from building inadequate.	AS 1684.3 clause 3.2.3

Table	1:	Code	non-conformances	defect list
1 0.010	•••	0040		401001 1101



## 5.2 STRUCTURAL DETERIORATED DEFECTS

All results have been summarised in Table 3. The table is sorted by the unique Defect ID (1 to 12) and photographs of observations have been exhibited in Appendix B – Photographic Record. General descriptive notes are also included for the asset within the table.

The inspection results are provided in the following table. Table 2 below summarises the number of defects in term of priority ranking based on the risk assessment in section 4.3.

Risk Rating	Description	Priority Ranking	No. of Priority Rankings
0	Extremely Severe	PO	1
1	Severe	P1	3
2	High	P2	5
3	Moderate	Р3	3
4	Low	P4	0
Total			12

Table 2	· Summarv	of structural	deteriorated	defects
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#### Table 3: Structural deteriorated defects

Defect ID	Asset Element	Observation Location	Observation Description	Priority Ranking	Photo Ref
1	Concrete footing	Subfloor – Gridline 1 to 9 of drawing AU23-039- 06-001	All the stumps on grid 7, 8, 9 and grid H and I (around 50% of the stump of the Southern end of the building) sustain hairline cracks mainly at the foundation areas and the crack extends to around 25% to 50% of the stump length. Isolated cases of concrete spalling on some individual stumps on grid A and B. The cracks and concrete spalling on the stump around the embedded steel can be either caused by impact or corrosion of the reinforcement.	P1	1 (a) to 1 (f)
2	Floor Bearer / Joists	Subfloor - General	Floor bearers and joists have visible termite damage in various areas.	P2	2 (a) to 2 (f)
3	Floor Bearer	Subfloor - General	Some floor bearers have splitting of the timber in various areas.	P2	3 (a), 3 (b)
4	Floor	Floor - Veranda	Between grids H12 and J19 there are various sections of the veranda floor that are damaged due to termites and timber rot with other sections of the veranda floor missing.	P2	4 (a), 4 (b)



Defect ID	Asset Element	Observation Location	Observation Description	Priority Ranking	Photo Ref
5	Floor	Veranda Stair	There is no access stair to or from the veranda between grids H12 and J19 but there appears to be a stair missing between grids J19 to J21.	Р3	5 (a) <i>,</i> 5 (b)
6	Roof Rafters	Roof - General	Most rafters and battens within the building roof area (excluding the verandas) are still in good condition when viewed from a distance at inspection points. Not all rafters and battens were inspected due to access limitations. There were some splitting timbers that were recorded during the inspection.	P3	6 (a) to 6 (d)
7	Roof External	Roof – Southern End	Damaged gutter southern end.	Р3	7 (a), 7 (b)
8	Roof General	Front of Building Middle Veranda Section (circa Grid J19-J21)	The veranda edge beam has sustained severe termite damage resulting in local failure and collapse of the beam. The interconnected rafter members have also sustained localised sagging as a result of the failed edge beam. Surrounding edge beams, rafters and other miscellaneous connections are also exhibiting signs of termite damage.	P1	8 (a), 8 (b)



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Defect ID	Asset Element	Observation Location	Observation Description	Priority Ranking	Photo Ref
9	Floor General	North West corner of Veranda	Collapsing floor area in north west of the veranda. There is extensive termite damage throughout the floor, walls and parts of the roof in this area of the building. This collapsing part of the building is now pulling on the remainder of the building potentially causing further damage.	P0	9 (a) to 9 (d)
10	Internal walls	Walls - General	Due to damaged wall sheeting, termite damage was visible in the toilets and kitchen. The full extent of termite damage is unknown which will require removal of the wall sheeting for further inspection.	P2	10 (a) to 10 (c)
11	External Walls	Walls - General	As noted above in defect 9 there is extensive termite damage throughout the floor, walls, and parts of the roof in this area of the building. Based on the termite damage visible in this part of the building as well as that noted in defects 2, 9 and 10 it is likely that there is further termite damage throughout the building.	P2	11 (a), 11 (b)
12	Concrete footing	Subfloor – Gridline 9 to 29 of drawing AU20-030- 001	95% of concrete stumps have moderate to severe cracks in the concrete. Significant concrete spalling is visible on individual stumps at the North East side of the building which extends through the entire length of the stumps. Large sections of concrete breakout at the areas around the embedded steel which can be either caused by impact or corrosion of the reinforcement. Erosion of the concrete cover particularly at Western side on most stumps.	P1	12 (a) to 12 (f)

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#### 5.3 POTENTIAL OCCUPANCY

As there are 12 structural deteriorated defects and multiple code non-conformances to AS1684.3 so the question of building occupancy and its associated risks is discussed in this section. The discussion in this section is predicated on building abandonment during a cyclonic weather event, that is no occupancy during a cyclonic weather event.

Whilst the previous report AU20-030-05-001\_1 noted similar issues, the fact no remedial work was completed in the three years between inspections only increases the associated risks. The previous report was not requested to comment on potential occupancy but its risks at the time would have led to a similar conclusion should it have been requested.

Discussions with a member of VMR noted short term limited occupancy would be ideal for them until a new facility is available. Whilst this is possible with the application of immediate intervention strategies such as termite spraying of the site, temporary works to the damaged foundation piers as well as very regular inspections, and limited loading, short term limited occupancy is not recommended due to the risk of the unknown extent of termite damage.

Providing VMR with temporary office and ablution facilities on the site in the short term may be more prudent. Should that option be considered then site abandonment during a cyclonic weather event should still be used as the building or parts of it may become debris during such an event.

As VMR's storage facility for their equipment is also on the site, either the above mentioned works and restrictions are applied, or temporary facilities should be provided to allow VMR to continue to operate.

## 6. CONCLUSIONS

In regard to code conformance, the building has multiple code non-conformances to AS1684.3, as shown in section 5.1 for both roof and sub-floor lateral bracing. Even though there are no structural defects identified during the inspection that are directly related to these non-conformances especially considering the building age, it is recommended that these non-conformance issues be rectified prior to use, especially when considered with the structural defects.

In relation to structural defects, there are 12 structural deteriorated defects that were identified during the inspection, they have been categorised as follows:

- One (1) of the defects, Defect 9, is extremely severe risk as a result of termite damage to floor, roof and wall members. The damage is likely to cause airborne projectiles during a severe weather event, resulting in additional damage to building or surrounding structures. Barricading to prevent access and rectifications are recommended to be carried out immediately.
- Three (3) of the defects, Defects 1, 8 and 12, are severe risk and rectifications are recommended to be carried out within the next 3 months. Further development of these defects may cause significant structural damage to the building.
- Five (5) of the defects are high risk and rectifications are recommended to be carried out within the next 6 months. These rectifications are to prevent further damage to the structure of the building.
- Three (3) of the defects are moderate risk and rectifications are recommended to be carried out within the next 12 months or monitor for further deterioration.



It has been observed during the inspection that most of the defects are located at the Northern end of the building and rectification works are recommended prior to building use. The Southern end contains some High to Severe Risk defects regarding the termite damage and concrete stump deterioration. Rectification works are recommended to be completed within the next 6 months. It is, however, important to considered that further deterioration of the defects at the Northern end of the building may cause damage to the Southern end.

In general, the subfloor has extensive damage observed in the concrete stumps especially at the Northern end and if untreated could lead to failure of building support. This is considerably important during severe weather events when lateral forces on the building are at their greatest. Isolated areas of termite damage were also observed in the floor bearers.

The building roof components (excluding verandas), in general, appear to be still at the same condition since installation except for some cases of splitting timber members. Wall structure was mostly not accessible but what could be seen exhibited termite damage.

Restriction in access, as stated in section 4.1, prevented the inspection team from fully assessing the structural condition of the components described in section 4.1. Wall and roof sheeting and some areas of local flooring are recommended to be removed in order to carry out a detailed inspection of the wall framing and bracing, rafter tie-downs, and subfloor fixings. It should be considered that gaining access to these areas for inspection may require specialised removalists and should be done in consultation with a licensed contractor. The full extent of termite damage could not be inspected due to finishes, access restrictions and the available non-destructive inspection techniques.

Based on the inspection results and the observations, the building at 10 McKay Street, Port Hedland, Western Australia has been assessed as below:

- Northern end of the building (Port Hedland Game Fishing Club end Gridline 9 to 29 on drawing AU23-039-06-001 in Appendix A): Extremely High Risk for structural integrity failure. Rectification works are highly recommended prior to building use.
- Southern end of the building (VMR Operation End Gridline 1 to 9 on drawing AU23-039-06-001 in Appendix A): High Risk for structural integrity failure. Rectification works are recommended within the next 3 to 6 months. It should be considered that further deterioration or failure of the Northern end of the building can cause further damage to the Southern end given the two sections having the same roof, walls, and floor structures.
- In addition, the building (both Northern and Southern ends) is at **Extremely High Risk during a cyclonic weather event** considering the current structural defects and the code nonconformances. Building use during cyclonic weather events is not recommended unless further inspections, remediation / upgrade works are carried out.

Section 5.3 discusses the potential occupancy of the building and associated risks with possible temporary facilities being a more prudent option or limitations, specific procedures and remediation works should be carried out prior to future occupancy of the building. Without appropriate remediation works to the existing defects, the building is NOT suitable for occupancy during a cyclone event and building abandonment should be strictly adhered to during such event.



## 7. APPENDIX A - INSPECTION DRAWINGS



PROJECT / DRAWING INFORMATION								
	AU23-039							
DESIGNED BY	M. RYAN							
DRAWN BY	M. KOVAC							
CHECKED BY	N.V. TRAN							
APPROVED BY	K BILLETT							
DATE	03 03 23							
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ROOF	LAYOUT

SCALE 1:100	A3	DRAWING NUMBER	AU23-039-06-003

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NUMBER	REFERENCE DRAWINGS	REV	DATE	

PROJECT / DRAWING	PROJECT / DRAWING INFORMATION								
PROJECT NUMBER	AU23-039								
DESIGNED BY	M. RYAN								
DRAWN BY	M. KOVAC								
CHECKED BY	N.V. TRAN								
APPROVED BY	K. BILLETT								
DATE	03.03.23								

10 McKAY STREET PORT HEDLAND						
STRUCTURAL INSPECTION						
CONDITION ASSESSMENT 2020						
ROOF SECTIONS						
SCALE 1:100	A3	DRAWING NUMBER	AU23-039-06-004		REV A	



## 8. APPENDIX B – PHOTO RECORD



# **APPENDIX B – PHOTO RECORD**

## 10 McKay Street, Port Hedland, Western Australia

## Structural Condition Inspection

February 2023

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