



EXPERT WITNESS REPORT

10 Sample Street, Essendon VIC 3040

Tribunal: Victorian Civil and Administrative Tribunal (Building and Property List)

File number: BPXXXX/2024

Applicant: Builder Pty Ltd

Respondent: Owner A and Owner B

Prepared by: Maison Azdari

Inspection date: 19 August 2026

Report date: 27 August 2026

Revision: Final

TABLE OF CONTENTS

[EXECUTIVE SUMMARY](#)

[SUMMARY OF OPINION](#)

[THE EXPERT - CURRICULUM VITAE](#)

[EXPERT'S ACKNOWLEDGMENT AND DISCLOSURES](#)

[INSTRUCTIONS, SCOPE AND DOCUMENTS RELIED UPON](#)

[ASSUMPTIONS](#)

[APPLICABLE LEGISLATION](#)

[SITE AND BUILDING DESCRIPTION](#)

[FIGURES - WALL IDENTIFICATION](#)

[Figure 1: Key plan - side, span and post identification](#)

[Figure 2: Side designations shown on structural drawing S2 Rev A](#)

[Figure 3: Side designations shown on structural drawing S3 Rev A](#)

[Figure 4: Side A elevation, north boundary](#)

[Figure 5: Side B elevation, rear or east boundary](#)

[Figure 6: Side C elevation, south boundary](#)

[INSPECTION LIMITATIONS](#)

[ITEMS AT A GLANCE](#)

[PART A - DEFECTIVE AND INCOMPLETE WORKS](#)

[A1. Retaining walls constructed in concrete sleepers where the approved design specifies timber sleepers, with no design for the material as built](#)

[A2. Post spacing exceeds the maximum specified, Side B](#)

[A3. Four posts are of a smaller steel section than the schedule requires for the height they carry](#)

[A4. Concrete sleepers cut with the reinforcement left exposed and untreated \(Main Issue\)](#)

[A5. Two spans of retaining wall shown on the drawings were not constructed](#)

[DECLARATION](#)

[PHOTOGRAPHS](#)

[A1. Retaining walls constructed in concrete sleepers where the approved design specifies timber sleepers, with no design for the material as built](#)

[A2. Post spacing exceeds the maximum specified, Side B](#)

[A3. Four posts are of a smaller steel section than the schedule requires for the height they carry](#)

[A4. Concrete sleepers cut with the reinforcement left exposed and untreated \(Main Issue\)](#)

[VCAT PRACTICE NOTE PNVCAT2 - EXPERT EVIDENCE](#)

[APPENDIX A - REFERENCE EXTRACTS](#)

[Appendix A1: Structural Engineering Drawings, sheet S9 Rev A, RW1 sleeper retaining wall schedule, Structural Engineering Firm job XX-XX, Rev A issued for construction 30 July 2021](#)

[Appendix A2: Structural Engineering Drawings, sheet S3 Rev A, wall schedule](#)

[Appendix A3: Structural Engineering Computations, page 30, RW1 \(2400\) sleeper design, Structural Engineering Firm, 28 July 2021](#)

[Appendix A4: Structural Engineering Computations, page 29, RW1 \(2400\) design run](#)

[Appendix A5: Outback Sleepers Australia, OSA Product Care Guide, edition 08/23 \(the edition current at the date of installation\), page 4](#)

[Appendix A6: Outback Sleepers Australia, OSA Product Care Guide, edition 08/23, page 4, warranty note](#)

[Appendix A7: Outback Sleepers Australia, 20-Year Product Warranty, clause 13.5, document created 23 August 2023](#)

[Appendix A8: Outback Sleepers Australia, 20-Year Product Warranty, clauses 6 and 7, document created 23 August 2023](#)

[Appendix A9: Structural Engineering Drawings, sheet S2 Rev A, ground floor slab and footing plan sheet 1, western end of the Side C run](#)

EXECUTIVE SUMMARY

ENGAGEMENT

Law Firm Name, 31 July 2026 (XX:XX:XXXXX), for the Respondents in VCAT BPXXXX/2024. Asked to identify defects and non-compliance with the structural drawings, state rectification scope and cost, and give my opinion on any other relevant matter.

INSPECTION

19 August 2026. I measured retained height, post spacing and post section at every span on all three runs. The drawings mark every wall RW1 and name no sides, so I call them Side A (north), Side B (rear, east), Side C (south). Figure 1 shows the numbering.

FINDINGS

- **A1.** Built in concrete sleepers; the certified design is timber. No design or certificate exists for the material as built.
- **A2.** Side B span 7 is 1290 mm against a 1200 mm maximum. The other fifteen are 30 to 50 mm over: noted, not claimed.
- **A3.** Four posts are 100 UC 15 where 150 UC 23 is required.
- **A4.** Sleepers cut for the 1200 mm spans, reinforcement exposed and untreated, contrary to the manufacturer. 36 of 57 spans.
- **A5.** Two Side C spans on the drawings were not built.

SUMMARY OF OPINION

This summary answers the three questions in the letter of instruction, quoted word for word in the Instructions section. The full reasoning, evidence and photographs for each item follow in Part A.

QUESTION 1(A): DEFECTS AND NON-COMPLIANCE WITH THE STRUCTURAL DRAWINGS

The walls were not built in accordance with the approved structural drawings:

- **A1.** Built in concrete sleepers; the approved and certified design is timber. No design or certificate exists for the material as built.
- **A2.** Side B span 7 is 1290 mm against the 1200 mm maximum. The other fifteen Side B spans are 30 to 50 mm over: recorded, not claimed.
- **A3.** Four posts are 100 UC 15 where the schedule requires 150 UC 23.
- **A4 (Main Issue).** Sleepers cut for the 1200 mm spans, reinforcement left exposed and untreated, contrary to the manufacturer's requirement. 36 of 57 spans; the product warranty is void for every sleeper cut.
- **A5.** Two Side C spans on the drawings were not built. The site supervisor, Owner B , advised me on site that the owner and contractor agreed to omit the lower spans against the neighbour's garage wall; the agreement is not provided and the contract-price treatment is unknown to me.

QUESTION 1(B): COST AND SCOPE OF RECTIFICATION

- **A1 and A2.** Structural engineering assessment of the walls as built; any rectification scope follows it.
- **A3.** Engineer recheck of the four posts; if they fail, strengthen to 150 UC 23 equivalent. Replacement is rejected on cost.
- **A4.** Remove cut sleepers one at a time, cold galv spray the cut ends, reinstate; span by span under the engineer's protection measures for the neighbours, the agi pipes and the membrane.
- **A5.** Provide the agreement on the omitted spans or obtain the engineer's determination.

QUESTION 2: OTHER RELEVANT MATTERS

- The piers, drainage, membrane and backfill are concealed and were not verified.

Further information requested: a copy of the agreement not to build the lower spans, and any record of whether the unbuilt spans were included in or deducted from the contract price (A5); a delivery docket or supplier invoice for the sleepers (A4); any concrete sleeper design, if one exists (A1).

My opinions rest on my measurements of 19 August 2026 and the listed documents; if the requested documents are produced my opinions may change and I will report any material change in writing.

THE EXPERT - CURRICULUM VITAE

Maison Azdari

Owner Inspections Pty Ltd, Level 8, 97 Pacific Highway, North Sydney NSW 2065

POSITION

Senior Building Consultant and Expert Witness. Director, Owner Inspections Pty Ltd.

SUMMARY

Building Consultant and Expert Witness with more than 21 years of experience in defect diagnosis, dispute resolution and expert reports for legal proceedings.

CORE COMPETENCIES

- Expert witness reporting (NCAT, VCAT, QCAT).
- Defect and structural inspections.
- Dispute resolution support.
- Waterproofing and water ingress diagnosis.
- Strata and remedial advice.
- National Construction Code knowledge.
- Construction methods and materials.
- Technical report writing.

FORMAL QUALIFICATIONS

- Bachelor of Civil Engineering, Islamic Azad University (2006).
- Diploma of Building and Construction (Building), CPC50210 (2013).
- Certificate IV in Building and Construction (Building).
- Certificate IV in Building and Construction (Estimating), CPC40308 (2012).
- Certificate III in Work, Health and Safety.
- Residential Building Inspector Course, Master Builders (2021).
- Expert Witness Course.
- White Card, Construction Induction.

LICENCES AND ACCREDITATIONS

- NSW Fair Trading contractor licence 366172C (personal), current to 3 March 2029.
- Victoria, Building and Plumbing Commission registered building practitioner DB-U 41642 (personal).
- QBCC licence 15151453 (personal).
- Accredited SBBIS Inspector, NSW Fair Trading (Strata Building Bond Inspection Scheme).
- Owner Inspections Pty Ltd holds NSW contractor licence 366177C, Victorian registration CDB-U 53425 and QBCC licence 15249792.

MEMBERSHIPS

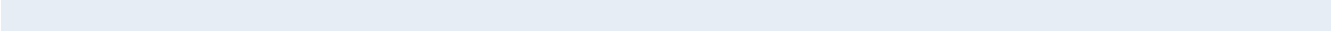
- Executive Committee Member, Australian Society of Building Consultants (ASBC) NSW; ASBC Strata Inspector Panel member 141.
- Member, Building Dispute Practitioners Society (BDPS) 01560.
- Member, Strata Community Association (SCA) NSW 41288.
- Certified member, Engineers Australia.

EXPERIENCE

- Director, Owner Inspections, 2014 to present. Lead consultant on more than 1,000 inspections, including legal, insurance and dispute matters.
- On-site Quality Assurance Officer and Site Supervisor, 2004 to 2010, specialising in defect diagnosis and water ingress.
- Site Manager, residential and commercial projects, 2001 to 2004.

BASIS OF EXPERTISE FOR THE OPINIONS IN THIS REPORT

My opinions in this report concern whether the retaining walls as constructed conform to the dimensions, member sizes and materials specified in the approved engineering drawings, and whether the construction accords with the published requirements of the sleeper manufacturer. These are matters of measurement, comparison against documents, and building practice, and they fall within my experience as a licensed building practitioner in Victoria and as a building consultant on more than 1,000 inspections since 2014. I do not hold registration as a structural engineer. I therefore express no opinion on the structural adequacy of the walls as built, on whether the concrete sleeper section installed is equivalent to the certified timber design, or on whether any departure requires demolition rather than rectification. Each of those questions is identified in this report and referred to a structural engineer.



EXPERT'S ACKNOWLEDGMENT AND DISCLOSURES

CODE OF CONDUCT

I have read and complied with the Expert Witness Code of Conduct annexed to VCAT Practice Note PNVCAT2 - Expert Evidence. I acknowledge that my paramount duty is to assist the Tribunal impartially on matters relevant to my area of expertise, that this duty overrides any obligation to the party retaining me, and that I am not an advocate for any party.

RELATIONSHIP WITH THE INSTRUCTING PARTY AND CONFLICT OF INTEREST

I have no relationship, personal, financial or business, with Owner A, Owner B, Builder Pty Ltd, Design Company Pty Ltd, Engineering Firm Pty Ltd or Building Surveyors Firm Pty Ltd, other than my engagement by Law Firm Name for the purpose of preparing this report. I am not aware of any actual or perceived conflict of interest. Owner Inspections Pty Ltd is remunerated for the preparation of this report on a fixed fee basis for the hours estimated, and that remuneration is not contingent on the outcome of the proceeding or on the content of my opinions.

INSTRUCTIONS, SCOPE AND DOCUMENTS RELIED UPON

INSTRUCTIONS

Law Firm Name, Solicitor Name, letter of 31 July 2026, ref XX:XX:XXXXX, acting for the Respondents.

The letter first asks that I read all the background documents and inspect the Property and the retaining walls, and then asks the following questions, which I set out word for word from the letter and answer in the Summary of Opinion:

Question 1(a). "Please identify any defects and non-compliance with the structural drawings with respect to the retaining walls constructed at the Property? If you identify any defective or non-compliant works, please identify, and explain why they are defective and non-compliant."

Question 1(b). "In your answer to Question 1(a), if you identify any of defective and non-compliant works with the retaining wall, what is the cost to rectify them together with the relevant scope of works for the rectification? Please explain your answer and consider GST, builder's margin and any contingencies."

Question 2. "Based on your inspection of the Property and your qualifications, expertise and industry experience, please provide your opinion as to any other matters you believe are relevant to the construction of the retaining wall on the Property. If you require us to provide you with any further information or assumptions to prepare your opinion as to the above questions and tasks, please let us know."

No oral instructions altered that scope. I was not instructed to withhold agreement on anything, and no conclave has been directed.

SCOPE AND METHOD

One inspection. I attended the property on 19 August 2026. The inspection was visual and non-destructive: no excavation, nothing dismantled, no sleeper or post removed.

Instruments. Tape measure.

Photographs. Taken by me on 19 August 2026.

Assessed against sheet S9 Rev A and the computations. The schedule's first column is headed H-(MAX.), so I have read each row as covering walls up to that height and have taken the row at or immediately above each measured height. A post is assessed against the taller of the two spans it carries. Both are my reading of the schedule; neither is stated in terms on the drawing.

Not verified. Pier diameters and depths, sub-surface drainage, backfill and the polymembrane, all concealed. Sleeper length, thickness, reinforcement size and cover. Post sections were identified by measuring the section dimensions on site, not from a mill certificate.

DOCUMENTS RELIED UPON

- Letter of Instruction, matter BPXXXX/2024, Solicitor Name, Law Firm Name, 31 July 2026
- VCAT Practice Note PNVCAT2 - Expert Evidence, Victorian Civil and Administrative Tribunal, edition of 1 February 2026
- Structural Engineering Drawings, sheets S1 to S14, Rev A, job XX-XX, issued for construction, Engineering Firm Pty Ltd, drawn 14 July 2021, Rev A issued 30 July 2021
- Structural Engineering Computations, 41 pages, job XX-XX, Engineering Firm Pty Ltd, 28 July 2021

- Civil Engineering Drawings, sheets C1 to C4, Rev A, job XX-XX, Engineering Firm Pty Ltd, drawn 14 July 2021, Rev A issued 30 July 2021
- Certificate of Compliance - Structural Matter, s 238(1)(a) Building Act 1993, reg 126, Engineer Name PEXXXXXXX, Engineering Firm Pty Ltd, 2 August 2021
- Building Permit XXXXXXXXXX, file XXXXXXXXX, Surveyor Name BSL-XXXXX, Building Surveyors Firm Pty Ltd, 4 October 2023
- Building Inspection Reports, three reports (footing piers, steel for slab, framework), Surveyor Name IN-LXXXXX, Building Surveyors Firm Pty Ltd, 1 November 2023, 7 May 2024 and 18 September 2024
- Building Quote and invoices, quote QXXXXXXX, invoices IVXXXXX and IVXXXXX, Builder Pty Ltd, 11 July 2023 to 17 November 2023
- National Construction Code 2022, Volume Two, clause H1D3(2), Australian Building Codes Board, in force in Victoria from 1 May 2023
- Cutting Sleepers, published at <https://outbacksleepers.com.au/cutting-sleepers/>, Outback Sleepers Australia, retrieved 20 August 2026
- Email confirming the sleeper manufacturer, Solicitor Name, Law Firm Name, 11 August 2026

LIMITATIONS

Based on a visual, non-destructive inspection of what was accessible on 19 August 2026 and the documents listed. I express no opinion on anything that could not be inspected.

Prepared for VCAT BPXXXX/2024 only. It should be read in full and items should not be read in isolation.

ASSUMPTIONS

The opinions in this report are based on the following assumptions. If any is incorrect, the affected opinion may change.

1. **Approved design.** Drawings S1 to S14 Rev A (30 July 2021) and computations (28 July 2021). No later revision provided.
2. **The works.** Built by the Builder, about August to November 2023.
3. **Manufacturer.** Outback Sleepers Australia. Instructed by the owner via Law Firm Name, 11 August 2026. No cast-in mark found, no delivery docket provided.
 - **Variant not established.** The Applicant's quote QXXXXXX dated 11 July 2023 describes the sleepers as 'concrete sleepers 80mm thick x 1.8m', and its invoice IVXXXXX of 17 November 2023 uses the same description. Outback Sleepers Australia publishes no sleeper of 1800 mm length in an 80 mm thickness: its 1800 mm standard sleeper is 75 mm thick, and its 80 mm thick sleepers are 2400 mm and 2350 mm long. Its published resellers at the relevant time were in South Australia and New South Wales only. If the product is a different manufacturer or variant, item A4 must be reconsidered against that product's published requirements.

APPLICABLE LEGISLATION

Edition applied. Building Permit XXXXXXXXXX issued 4 October 2023, after Victoria adopted NCC 2022 on 1 May 2023, so I have applied NCC 2022 Volume Two. The s 238 certificate of 2 August 2021 and the computations refer to BCA 2019. The provision relied on is materially identical in both editions and both call up AS 4678-2002, so nothing turns on which applies.

- **Building Act 1993 (Vic) s 16(1).** "A person must not carry out building work unless a building permit in respect of the work has been issued and is in force under this Act and the work is carried out in accordance with this Act, the building regulations and the permit." The approved engineering drawings form part of the permit documentation.
- **NCC 2022 Volume Two cl H1D3(2).** "Performance Requirement H1P1 is satisfied for an earth retaining structure associated with the construction of a building or structure if it is designed and constructed in accordance with AS 4678." These walls are Class 10b under the permit.
- **Domestic Building Contracts Act 1995 (Vic) s 8**, if that Act applies. Section 8(a): the builder warrants the work will be "carried out in a proper and workmanlike manner and in accordance with the plans and specifications set out in the contract". Section 8(c): the work will be carried out in accordance with, and will comply with, all laws and legal requirements. Whether the Act applies to this arrangement is a question of law for the Tribunal.

Division 1—Building permit required

16. *Building permit required*

- (1) A person must not carry out building work unless a building permit in respect of the work has been issued and is in force under this Act and the work is carried

2321

Source: Building Act 1993 (Vic), s 16(1), Act No. 126/1993, page 22
<https://www.legislation.vic.gov.au/in-force/acts/building-act-1993>

Building Act 1993 (Vic), s 16(1), first part.

s. 17

*Building Act 1993
Act No. 126/1993*

out in accordance with this Act, the building regulations and the permit.

Penalty: 100 penalty units, in the case of a natural person.
500 penalty units, in the case of a body corporate.

Source: Building Act 1993 (Vic), s 16(1) continued, Act No. 126/1993, page 23
<https://www.legislation.vic.gov.au/in-force/acts/building-act-1993>

Building Act 1993 (Vic), s 16(1), continued.

- (1) *Performance Requirement H1P1* is satisfied for earthworks associated with the construction of a building or structure if they are in accordance with [Part 3.2](#) of the ABCB Housing Provisions, provided that the *site* is classified as A, S, M, H or E in accordance with 4.2.2 of the ABCB Housing Provisions and the work is undertaken in normal site conditions.
- (2) *Performance Requirement H1P1* is satisfied for an earth retaining structure associated with the construction of a building or structure if it is designed and constructed in accordance with AS 4678.

QLD H1D3(3)

- (3) Compliance with [Part 3.4](#) of the ABCB Housing Provisions satisfies *Performance Requirement H1P1* for termite risk management.

Source: National Construction Code 2022, Volume Two, clause H1D3(2)
<https://www.abcb.gov.au/editions/ncc-2022/>

National Construction Code 2022, Volume Two, clause H1D3(2).

The following warranties about the work to be carried out under a domestic building contract are part of every domestic building contract—

- (a) the builder warrants that the work will be carried out in a proper and workmanlike manner and in accordance with the plans and specifications set out in the contract;
- (b) the builder warrants that all materials to be supplied by the builder for use in the work will be good and suitable for the purpose for

Source: Domestic Building Contracts Act 1995 (Vic), s 8, Authorised Version No. 093, page 21
<https://www.legislation.vic.gov.au/in-force/acts/domestic-building-contracts-act-1995>

Domestic Building Contracts Act 1995 (Vic), s 8, Authorised Version No. 093.

SITE AND BUILDING DESCRIPTION

The property. 10 Sample Street, Essendon, Lot XX LPXXXXXX, City of Moonee Valley. Dual occupancy, two attached Class 1a(b) dwellings with Class 10a garages. Site about 42.67 m by 20.12 m, street frontage west, rear boundary east.

The works. The boundary retaining walls, Building Permit XXXXXXXXXXX of 4 October 2023.

Construction. Post and panel: steel universal column posts in bored concrete piers, with sleepers spanning horizontally between them. Built in concrete sleepers.

The three runs. Side A, north, 22 spans and 23 posts. Side B, rear or east, 16 spans and 17 posts. Side C, south, 19 spans built and 20 posts.

The side names are mine, adopted because the drawings mark every wall RW1 and do not label the sides.

FIGURES - WALL IDENTIFICATION

The structural drawings mark every boundary retaining wall RW1 and do not identify the sides separately. The side designations, span numbering and post numbering used throughout this report are shown below and are mine, adopted for clarity of reference.

Figure 1: Key plan - side, span and post identification

Site plan showing the three retaining wall runs, the position of every post, and the direction in which the spans and posts are numbered on each side. Departures from sheet S9 Rev A are marked in red. The wall runs are drawn to scale from the measurements taken on 19 August 2026.

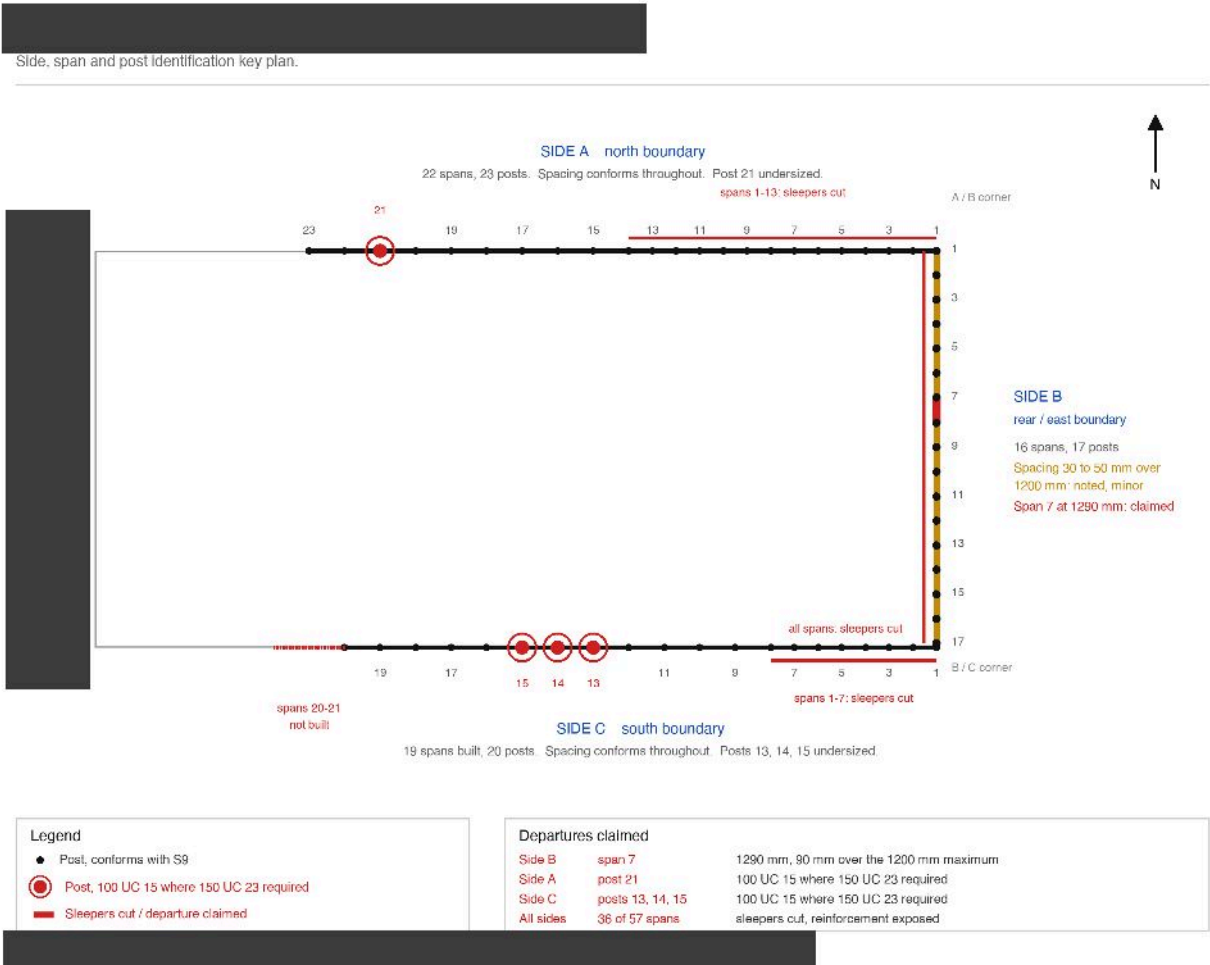


Figure 1: Side, span and post identification key plan, 10 Sample Street, Essendon.

Figure 2: Side designations shown on structural drawing S2 Rev A

The western half of the site. Side A is the north boundary run and Side C is the south boundary run. Both continue east onto sheet S3.

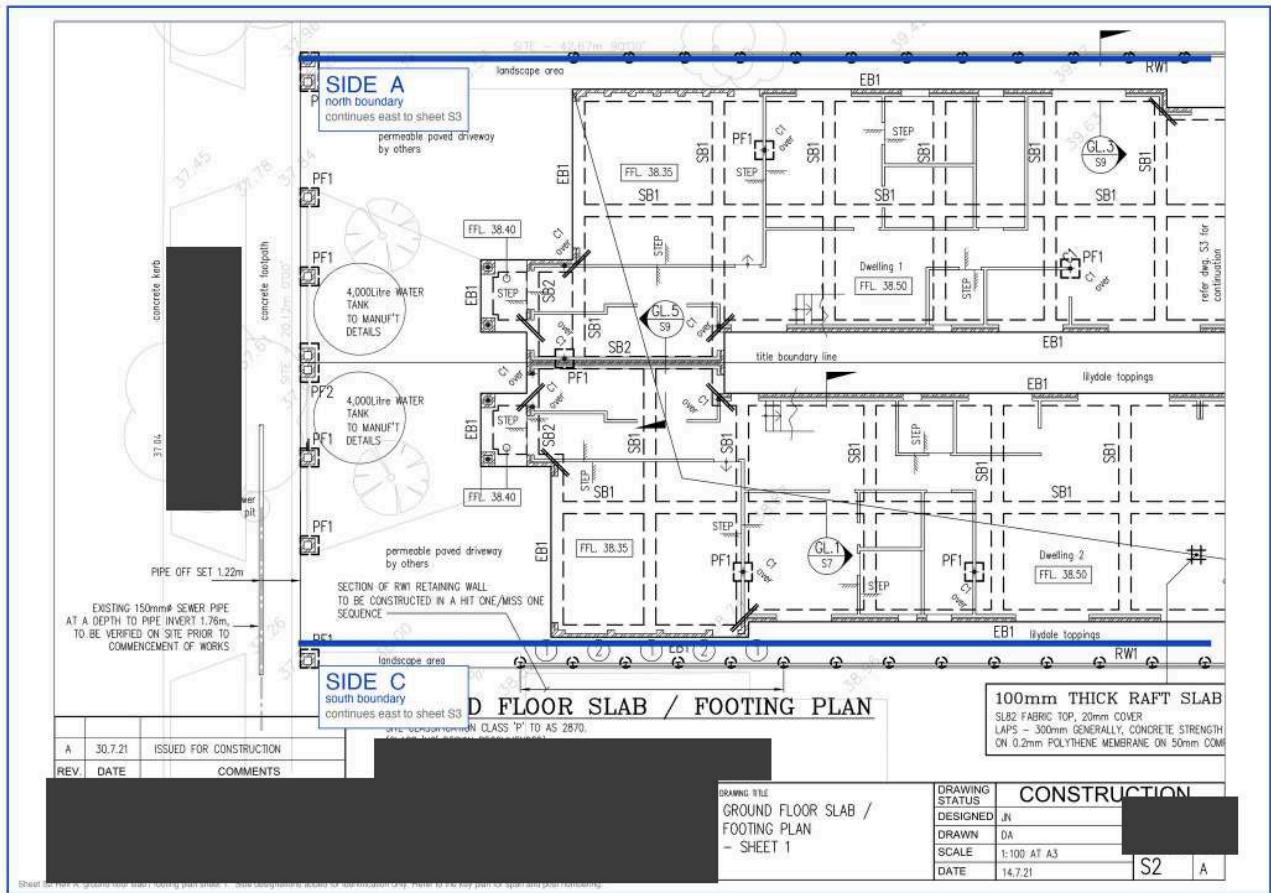


Figure 2: Structural drawing S2 Rev A with the side designations added for identification.

The eastern half of the site, showing all three runs and both corners. This sheet also carries the engineer's wall schedule entry defining RW1.



Figure 4: Side A elevation, north boundary

Elevation of the Side A run drawn to scale from the measured retained heights and post spacings, with the comparison against sheet S9 Rev A beneath. Drawn as seen on site, with post 1 and the A / B corner at the right. Vertical scale exaggerated approximately three times.

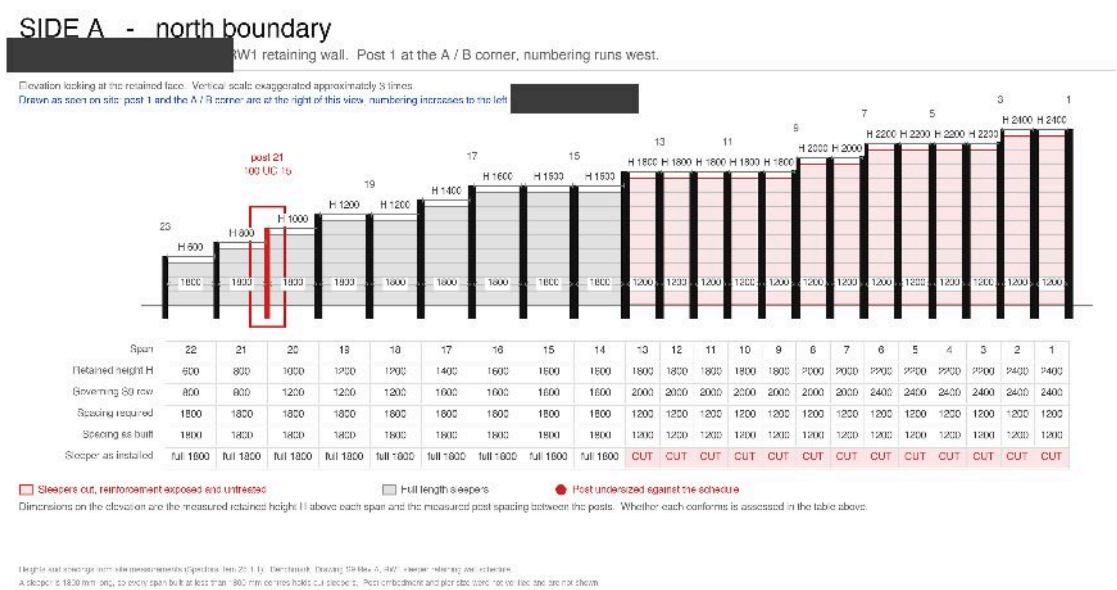
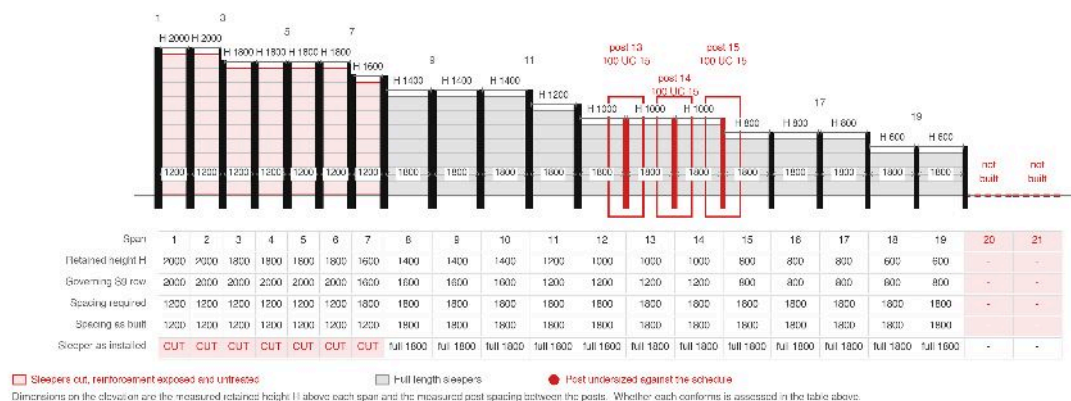


Figure 4: Side A, north boundary, measured elevation and comparison against sheet S9 Rev A.

Elevation of the Side B run. Every span exceeds the maximum post spacing specified for its retained height. Vertical scale exaggerated approximately three times.



Elevation of the Side C run, including the two spans shown on the drawings that were not constructed. Vertical scale exaggerated approximately three times.



^a Height and average butt diameter metrics (specimen IDs 20-21). Dendrochron. Dating SR No. A-467; values inferred and estimated. Specimens 20 and 21 are situated in two separate areas located in 1A (species 18.0 mm apart), so they span but at least two 180 mm centres holds cut pieces. Post-embarkation and pre-departure recovery locations are not shown.

Figure 6: Side C, south boundary, measured elevation and comparison against sheet S9 Rev A.

INSPECTION LIMITATIONS

The following limited the inspection on the date stated. No opinion is expressed on any matter that could not be inspected.

- Pier footings are concealed. Neither diameter nor depth was verified. No opinion is expressed on them.
- Sub-surface drainage, the polymembrane and the free draining backfill required by S9 are concealed and were not verified.
- No geotechnical or soil report was provided and none is referred to in the computations.
- No delivery docket, supplier invoice or product specification for the sleepers has been provided.
- Sleeper length, thickness, reinforcement size and cover were not measured, and no cast-in manufacturer's mark was located.
- I did not examine every cut sleeper end individually. The condition of each cut end is to be determined when the faces are cleaned during rectification.

ITEMS AT A GLANCE

A one line summary of each item. The full item, with its evidence, is in Part A.

Item	Location	What was found	Classification
A1	Sides A, B and C	Built in concrete sleepers; the certified design is timber. No design exists for the material as built	Design; Materials
A2	Side B, span 7	1290 mm post spacing against a 1200 mm maximum. Spans 1 to 16 are 30 to 50 mm over: noted, not claimed	Workmanship
A3	Side A post 21; Side C posts 13, 14, 15	100 UC 15 where 150 UC 23 is required for the height carried	Workmanship; Materials
A4	36 of the 57 spans built	Cut sleepers with the reinforcement exposed and untreated	Workmanship; Materials
A5	Side C, beyond post 20	Two spans shown on the drawings were not built. Site supervisor advised the omission was agreed; agreement not provided	Incomplete

PART A - DEFECTIVE AND INCOMPLETE WORKS

Items observed by the expert during the site inspection. For each item: the observation, the applicable standard, the reason it does not comply, the recommendation, and the photographs.

A1. Retaining walls constructed in concrete sleepers where the approved design specifies timber sleepers, with no design for the material as built

Classification: D - Design and documentation; M - Materials

Location: Sides A, B and C, the whole of the retaining walls

OBSERVATION

All three walls are concrete sleepers spanning between steel posts. No timber sleeper anywhere.

THE APPROVED DESIGN AGAINST THE WALLS AS BUILT

	Approved design	As built
Sleeper (the 'waler')	200 x 100 F5 treated pine, H3 treated	Concrete sleepers
Wall type on the drawings	RW1, timber sleeper retaining wall, 2.4 m max retention	Concrete sleeper wall
Design checked in the computations	100 x 200 F5 treated timber, weak axis bending, all six runs	No concrete sleeper is checked anywhere
Certificate of Compliance, 2 Aug 2021	Certifies the timber design	No certificate for the wall as built

APPLICABLE STANDARDS

- Structural Engineering Drawings, sheet S9 Rev A, RW1 sleeper retaining wall schedule, Structural Engineering Firm job XX-XX, Rev A issued for construction 30 July 2021: "WALER: 200 x 100 F5 T/PINE (H3 TREATED)" (Appendix A1)
- Structural Engineering Drawings, sheet S3 Rev A, wall schedule: "RW1 - TIMBER SLEEPER RETAINING WALL, 2.4m MAX RETENTION. REFER TO DETAIL ON DWG. S9" (Appendix A2)
- Structural Engineering Computations, page 30, RW1 (2400) sleeper design, Structural Engineering Firm, 28 July 2021: "100mm x 200mm F5 Treated* (Weak) (Single layer sleepers)" (Appendix A3)
- Building Act 1993 (Vic), s 16(1)
- National Construction Code 2022, Volume Two, clause H1D3(2)

NON-COMPLIANCE

- **Design is timber.** S3 defines RW1 as timber; S9 specifies 200 x 100 F5 treated pine; all six computation runs check timber.
- **No concrete design.** None in the 41 pages of computations.
- **Certificate.** The 2 August 2021 certificate covers the timber design only.
- **Result.** Not built to the approved design, and nothing certifies what was built.
- **Instructed.** The Respondents say concrete was accepted provided design and spacing were unchanged. A2 shows the spacing was not.
- **The surveyor's records.** The Relevant Building Surveyor recorded an approved inspection of the rear retaining wall footings on 1 November 2023 and attended again on 7 May 2024. Those records do not certify the sleeper material and no design for a concrete sleeper wall was provided to the surveyor so far as the documents show, but they are matters the Tribunal should weigh.

RECOMMENDATION

Structural engineer to assess the walls as built against AS 4678 and the computations' assumptions, then certify or specify rectification. Must cover whether the concrete sleeper is at least equivalent in bending to the 200 x 100 F5 pine the spacings came from, and whether the piers remain adequate.

Cost provisional until that is done.

ALTERNATIVE REMEDY

Depends on the engineer. If the walls are certified, the remedy may be the certification alone. If not, the range runs from local strengthening to demolition. Outside my expertise.

This item requires a structural engineer to determine the full extent and method of rectification.

Related items: A2, A3

R TO

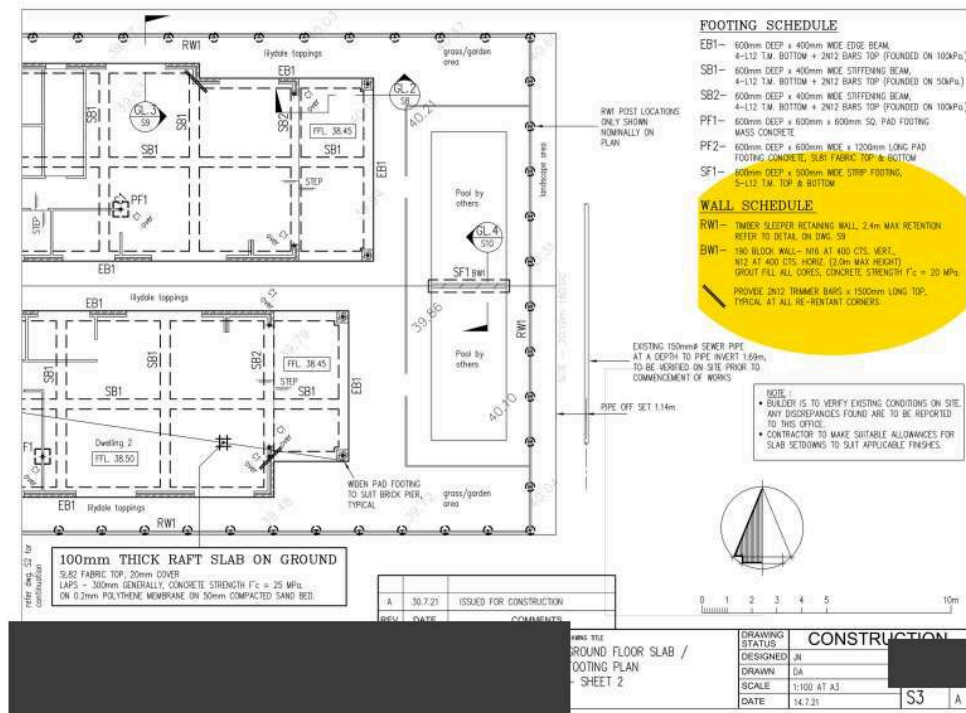
RW1 SLEEPER RETAINING WALL SCHEDULE					
H-(MAX.)	SPACING	UPRIGHT	WALER	'W'	'D'
2400mm	1200	150 UC 23	200 x 100 F5 T/PINE (H3 TREATED)	600Ø	2800
2000mm	1200	150 UC 23	200 x 100 F5 T/PINE (H3 TREATED)	600Ø	2600
1600mm	1800	150 UC 23	200 x 100 F5 T/PINE (H3 TREATED)	450Ø	2400
1200mm	1800	150 UC 23	200 x 100 F5 T/PINE (H3 TREATED)	450Ø	1900
800mm	1800	100 UC 15	200 x 100 F5 T/PINE (H3 TREATED)	450Ø	1400
400mm	2400	100 UC 15	200 x 100 F5 T/PINE (H3 TREATED)	350Ø	1100

NG TITLE

DRAWING

CONSTRUCTION

Appendix A1: Structural Engineering Drawings, sheet S9 Rev A, RW1 sleeper retaining wall schedule, Structural Engineering Firm job 21-60, Rev A issued for construction 30 July 2021 (highlighted).



Appendix A2: Structural Engineering Drawings, sheet S3 Rev A, wall schedule (highlighted).



Design moment in upright (about top of footing, per m of wall)

	Pressure (kPa)	Thrust (kN/m)	Thrust (kNm)	Pressure (kPa)	Thrust (kN/m)	Thrust (kNm)	Comments
Soil - $K_a \gamma_e H_e$	16.78	20.13	15.17	800	15.11	20.13	(at wall base)
Surcharge - $K_a q_e$	1.94	4.56	0.95	1200	5.59	8.39	Max. pressure at base
Additional	0.00	0.00	0.00	2400	0.00	0.00	Uniform pressure dist.
Total		24.79	32.16		21.70	28.52	
Total thrust (Vw) =		24.79 kN/m		Total moment (Mw) =		21.70 kNm/m	
Total ult. thrust (Vw*) =		32.16 kN/m		Total ult. moment (Mw*) =		28.52 kNm/m	
Total ult. thrust (Vw*/Φn) =		35.73 kN/m		Total ult. moment (Mw*/Φn) =		31.69 kNm/m	

Sleeper design - AS1720.1 Section 3

Double sleepers at layer =	12 (Single layer sleepers)
Double sleepers laminated =	12 (Yes/No)
Total layers =	12
Critical layer for design =	12
Critical layer centroid depth =	2300 mm
Design depth (d) =	57 mm
Design width (b) =	157 mm
Description =	150mm x 200mm F5 Treated
Capacity factor (φ) =	0.9 Table 3.1 Category 3
Duration factor (K1) =	1.00
Stability factor (K2) =	1.00
FB =	14.0 MPa
Modulus of elasticity (E) =	19100 MPa
Area (A) =	309 x 10 ³ mm ²
Section modulus (Sx) =	15.0 x 10 ⁶ mm ³
Modulus of elasticity (E) =	19100 MPa
Moisture factor (K4) =	1.00
Temp. factor (K5) =	1.00
Shrinkage factor (K6) =	1.00
Site modifier (mod b) =	1.00
OK (b.66)	
OK (b.67)	
Deflection horizontal at top (δ _{top}) =	8.8 mm
Deflection horizontal at bottom (δ _{bot}) =	3.8 mm
Total deflection horizontal (δ _{total}) =	12.7 mm
OK (b.71)	
OK (b.72)	

Steel upright design - AS4100 Section 5

V* = Vw* / Φn =	42.67 kN
M* = Mw* / Φn =	28.03 kNm
Description =	150UC23.4 (S302)
Flange yield (fyf) =	320 MPa
Area (Ag) =	2980 mm ²
Stiffness (I) =	12.5 x 10 ⁹ mm ⁴
Shear modulus (G) =	80000 MPa - C1.4
Capacity factor (φ) =	0.9 Table 4.4
Warping constant (Iw) =	21.1 x 10 ¹⁰ mm ⁶
Torsional constant (J) =	51.7 x 10 ⁶ mm ⁴
Effective section mod. (Z _{ex}) =	176 x 10 ⁶ mm ³
Effective section mod. (Z _{ey}) =	75.5 x 10 ⁶ mm ³
Modulus of elasticity (Es) =	200000 MPa - C1.4
M _{xx} =	56.8 kNm - C1.5.2
M _{yy} =	160.2 kNm
M _{zz} =	160.2 kNm
OK (b.75)	
OK (b.77)	
Deflection horizontal at top (δ _{top}) =	8.8 mm
Deflection horizontal at bottom (δ _{bot}) =	3.8 mm
Total deflection horizontal (δ _{total}) =	12.7 mm
OK (b.71)	
OK (b.72)	

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Appendix A3: Structural Engineering Computations, page 30, RW1 (2400) sleeper design, Structural Engineering Firm, 28 July 2021 (highlighted).

Photographs for this item are at Photographs, item A1.

A2. Post spacing exceeds the maximum specified, Side B

Classification: W - Workmanship

Location: Side B, the rear or east boundary, span 7 (claimed); spans 1 to 16 (noted)

OBSERVATION

- **Span 7:** 1290 mm, 90 mm over.
- **Spans 1 to 6 and 8 to 16:** 1230 to 1250 mm, 30 to 50 mm over.
- **Heights:** 2400 mm spans 1 to 8, 2200 mm spans 9 to 12, 2000 mm spans 13 to 16.
- **Posts:** all 150 UC 23, conforms.

MEASUREMENT

Measured with a laser distance meter and a tape measure, post centre to post centre, at each span. Retained height measured on the retained face from finished ground level at the base of the wall to the top of the uppermost sleeper. Recorded on site at the time of measurement.

SIDE B: REQUIRED SPACING AGAINST MEASURED SPACING

Spans	Retained height	Governing S9 row	Spacing required	Spacing as built	Result
7	2400 mm	2400	1200 mm	1290 mm	Departure, 90 mm over
1 to 6, and 8	2400 mm	2400	1200 mm	1230 to 1250 mm	Noted, minor
9 to 12	2200 mm	2400	1200 mm	1230 to 1250 mm	Noted, minor
13 to 16	2000 mm	2000	1200 mm	1230 to 1250 mm	Noted, minor

APPLICABLE STANDARDS

- Structural Engineering Drawings, sheet S9 Rev A, RW1 sleeper retaining wall schedule, Structural Engineering Firm job XX-XX, Rev A issued for construction 30 July 2021: "H-(MAX.) 2400mm, SPACING 1200; H-(MAX.) 2000mm, SPACING 1200" (Appendix A1)
- Structural Engineering Computations, page 29, RW1 (2400) design run: "Surcharge = 5.00kPa, Drained" (Appendix A4)
- Building Act 1993 (Vic), s 16(1)

NON-COMPLIANCE

- **Requirement.** S9 allows 1200 mm maximum spacing at both 2400 mm and 2000 mm retained height, so every Side B span is limited to 1200 mm.
- **Claimed.** Span 7 at 1290 mm.
- **Not claimed.** The other fifteen spans are 30 to 50 mm over. I do not advance them as defects. I express no opinion on whether a variation of that size affects the performance of the wall; that is a structural question outside my expertise, and it is included in the referral at item A1.
- **Tolerance.** No tolerance on post spacing is stated in the drawings or in the computations. I have not identified any published tolerance for the spacing of structural members in a retaining wall. The Victorian Guide to Standards and Tolerances 2015 does not deal with retaining walls. I have not read AS 4678-2002, which is not held in my library; I searched the publisher's full text reader for the words tolerance and tolerances and neither returned a result, while control searches of other terms returned results from the same document. I express no view on what else the standard contains.

- **Why the spacing matters.** The 1200 mm spacing in the schedule was derived from a design in which the member spanning between the posts is a 200 x 100 F5 treated pine sleeper. In the computations that sleeper reaches 0.79 utilisation at 1800 mm centres and falls to 0.41 when the spacing is reduced to 1200 mm. The walls are built in concrete, and no equivalent check exists for the sleeper actually installed.

RECOMMENDATION

The engineer engaged under A1 to advise whether span 7 is acceptable with the sleeper installed and, if not, specify the remedy, possibly an additional post and pier.

For the record, the pier overturning check is the most utilised in every run: 0.91 at 2400, 0.95 at 2000. A fact from the computations, not an opinion on adequacy.

ALTERNATIVE REMEDY

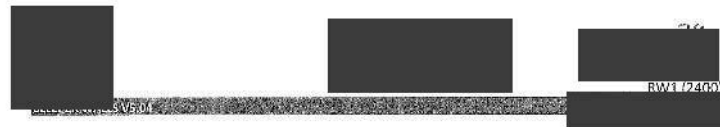
Depends on the capacity of the wall as built, which is for the engineer.

This item requires a structural engineer to determine the full extent and method of rectification.

Related items: A1, A3

R TO	RW1 SLEEPER RETAINING WALL SCHEDULE					
	H-(MAX.)	SPACING	UPRIGHT	WALER	'W'	'D'
	2400mm	1200	150 UC 23	200 x 100 F5 T/PINE (H3 TREATED)	600Ø	2800
	2000mm	1200	150 UC 23	200 x 100 F5 T/PINE (H3 TREATED)	600Ø	2600
	1600mm	1800	150 UC 23	200 x 100 F5 T/PINE (H3 TREATED)	450Ø	2400
	1200mm	1800	150 UC 23	200 x 100 F5 T/PINE (H3 TREATED)	450Ø	1900
	800mm	1800	100 UC 15	200 x 100 F5 T/PINE (H3 TREATED)	450Ø	1400
	400mm	2400	100 UC 15	200 x 100 F5 T/PINE (H3 TREATED)	350Ø	1100
NG TITLE			DRAWING	CONSTRUCTION		

Appendix A1: Structural Engineering Drawings, sheet S9 Rev A, RW1 sleeper retaining wall schedule, Structural Engineering Firm job 21-60, Rev A issued for construction 30 July 2021 (highlighted).



Wall:	RW1 (2400) 2400mm high, 5.0kPa surcharge (Drained)	
Loads:	Surcharge = 5.0kPa, Drained	
Steel Upright:	150UC29.4 (6300) (Salv.)	
	$M^* = 38.05 \text{ kNm} < \phi M = 50.63 \text{ kNm}$, $V^* = 42.87 \text{ kN} < \phi V_{\text{lim}} = 160.16 \text{ kN}$	OK (0.75, 0.27)
	$\phi(d) = \eta(d/272) [5.8 \text{ mm}]$, $\delta(d) = \eta(d/189) [12.7 \text{ mm}]$	OK
Timber Upright:	Not Applicable	
Footing:	$M^*_{\phi} = 42.11 \text{ kNm} < \phi M_r = 46.48 \text{ kNm}$	OK (0.91)
Sleepers:	100mm x 200mm F5 Treated ^o (Weak) (Single layer sleepers)	
	$M(d)^* = 0.97 \text{ kNm} < \phi M(d) = 1.48 \text{ kNm}$, $M^* = 0.92 \text{ kNm} < \phi M = 1.48 \text{ kNm}$	OK (0.66, 0.62)
	Critical sleeper layer is 12 from top of sleeper wall bending about weak axis	
	$\delta(d) = L/476 (2.5 \text{ mm})$ on layer 12, $\delta(d) = L/425 (2.8 \text{ mm})$ on layer 12	OK

Geometry

Wall assumed fully drained	
Geometry	Retaining height must be a multiple of the sleeper vertical dimension (2400mm)
Retaining height (H) =	2400 mm
Post centres (ccs) =	1200 mm
Upright =	5 (Timber/Steel/Block)
Risk class =	C (A1/B1/C1 - Significant damage or risk to life - Table 3.1)
Backfill type =	1 Class(1), Class(2), Uncontrolled, (In-situ - Table 3.1(A))
Soil parameters	
Internal friction (ϕ) =	30° ($\phi^* < \phi < 45^\circ$)
Incline (β) =	0° ($\phi^* < \beta < 45^\circ$) in 0.0
Soil weight (γ_s) =	18.0 kN/m ³
Cohesion (c) =	0 kPa
Footing - Cohesionless	
Total footing depth (d) =	2800 mm (From surface)
Ignore sap (ig) =	100 mm
Footing diameter (dia) =	500 mm
Soil cohesion (c_f) =	0 kPa (0 for cohesionless)
Design $c^*_{\phi} = \phi^*_{\text{dec}} (0.7) =$	0.0 kPa (in situ material)
Sleepers	
Sleeper depth (JSC) =	100 mm (Vert. dimension)
Sleeper width (dSW) =	200 mm (Vert. dimension)
Max number of layers =	12 (2400mm high)
Live Load duration =	Permanent
Long term LL factor (ϕ_{LL}) =	1.00 AS 1170.0 Table 4.1
Duration factor (ϕ_{T}) =	0.5 /

Design loads - Appendix J & Section 4 - AS4678

Min. surcharge =	5.0 kPa - Table 4.1	Additional upright overturning	
Water height (hw) =	0.0 mm (Drained)	Thrust (Va) =	0.00 kN
Surcharge (s) =	5.0 kPa	Overturning (Ma) =	0.00 kNm
Heard only factor =	1.35 (1.35)	Load factor =	1.50
Earth factor =	1.25 (1.25)	Long term LL factor (ϕ_{LL}) =	0.40
Live load factor =	1.50 (1.50 - 0.0 for stabilising effect)	Va* =	0.00 kN
Stabilising factor =	0.80 AS4678 - Appendix D	Ma* =	0.00 kNm
		(Thrust/moment applied at the top of the wall)	

Material design factors - Section 5

$\phi_{\text{uc}} =$	0.70	$c^*_{\text{dec}} \phi_{\text{uc}} =$	0.0 kPa	$\phi_{\text{S 2.1}} =$	
$\phi_{\text{uo}} =$	0.85	$\phi^* =$	25.1°	$\phi_{\text{S 2.2}} =$	
Design factor (ϕ_{dr}) =	0.90 Table 5.2			$\phi^* =$	0.456 rad
	$\phi_{\text{a}} =$	0.388 (Rankine)	Depth of tension zone =		0 mm
	$\phi_{\text{a}} =$	2.575 (Rankine)	Acting soil height (hs) =		2400 mm

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Appendix A4: Structural Engineering Computations, page 29, RW1 (2400) design run (highlighted).

Photographs for this item are at Photographs, item A2.

A3. Four posts are of a smaller steel section than the schedule requires for the height they carry

Classification: W - Workmanship; M - Materials

Location: Side A, post 21; Side C, posts 13, 14 and 15

OBSERVATION

- **Side A.** Posts 1 to 20 are 150 UC 23, posts 21 to 23 are 100 UC 15. Post 21 carries span 20, measured 1000 mm.
- **Side C.** Posts 1 to 12 are 150 UC 23, posts 13 to 20 are 100 UC 15. Posts 13 to 15 carry spans measured 1000 mm.

MEASUREMENT

Post section identified by measurement of the section dimensions on site and by comparison with the sections named in the schedule. Retained height measured with a laser distance meter.

THE FOUR POSTS

Side	Post	Spans carried	Tallest height carried	Required upright	As built
A	21	20 and 21	1000 mm	150 UC 23	100 UC 15
C	13	12 and 13	1000 mm	150 UC 23	100 UC 15
C	14	13 and 14	1000 mm	150 UC 23	100 UC 15
C	15	14 and 15	1000 mm	150 UC 23	100 UC 15

APPLICABLE STANDARDS

- Structural Engineering Drawings, sheet S9 Rev A, RW1 sleeper retaining wall schedule, Structural Engineering Firm job XX-XX, Rev A issued for construction 30 July 2021: "H-(MAX.) 1200mm, UPRIGHT 150 UC 23; H-(MAX.) 800mm, UPRIGHT 100 UC 15" (Appendix A1)
- Building Act 1993 (Vic), s 16(1)

NON-COMPLIANCE

- **How the schedule is read.** The first column of the S9 schedule is headed H-(MAX.), a maximum. The 800 mm row therefore covers walls up to 800 mm; the 1200 mm row covers walls above 800 mm and up to 1200 mm. A wall measured at 1000 mm exceeds the 800 mm row and falls in the 1200 mm row. This is my reading of the column heading. The schedule does not state it in terms.
- **The computations support that reading.** Each RW1 run is designed at a stated retained height. There is a run at 800 mm and a run at 1200 mm, and no run at 1000 mm. The 100 UC 15 appears only in the 800 mm and 400 mm runs, and the 800 mm run is designed for 800 mm of retained soil. On the documents, the 100 UC 15 was not designed for a 1000 mm wall.
- **Requirement.** The 1200 mm row specifies a 150 UC 23 upright.
- **How a post is assessed.** A post carries the sleepers on both sides of it, so the taller of its two spans governs. On that basis each of the four posts requires 150 UC 23, and each is a 100 UC 15.
- **All other posts conform** on all three runs.
- **Instructed fact.** The owner supplied the steel posts. I have not investigated who selected or placed them and express no opinion on that.
- **Limit of my opinion.** Whether a 100 UC 15 is in fact adequate at these four positions is a structural question, not one I answer. It is included in the referral at item A1.

RECOMMENDATION

First step: engineering recheck. The structural engineer (the same engineer engaged under item A1) is to recalculate whether the 100 UC 15 posts as installed meet the design requirements at these four positions, given the retained height and the spacing as built. If they do, the engineer certifies them and no physical work arises.

If the recheck fails: strengthen, not replace. Strengthen the four posts to a capacity at least equivalent to a 150 UC 23, to a detail designed by the engineer. I do not recommend replacing the posts: replacement requires breaking out the concrete piers and reinstating the wall at each position, and its cost is out of proportion to the strengthening alternative.

The detailed breakdown pricing is provided in the Scott Schedule.

ALTERNATIVE REMEDY

The engineering recheck is the reasonable first remedy, because if the 100 UC 15 sections are certified as adequate the item is resolved at the cost of the engineering assessment alone. Strengthening is the reasonable remedy if the recheck fails. Replacement of the posts is not a reasonable alternative, for the cost reason given above.

This item requires a structural engineer to determine the full extent and method of rectification.

Related items: A1, A2

R TO

RW1 SLEEPER RETAINING WALL SCHEDULE					
H-(MAX.)	SPACING	UPRIGHT	WALER	'W'	'D'
2400mm	1200	150 UC 23	200 x 100 F5 T/PINE (H3 TREATED)	600Ø	2800
2000mm	1200	150 UC 23	200 x 100 F5 T/PINE (H3 TREATED)	600Ø	2600
1600mm	1800	150 UC 23	200 x 100 F5 T/PINE (H3 TREATED)	450Ø	2400
1200mm	1800	150 UC 23	200 x 100 F5 T/PINE (H3 TREATED)	450Ø	1900
800mm	1800	100 UC 15	200 x 100 F5 T/PINE (H3 TREATED)	450Ø	1400
400mm	2400	100 UC 15	200 x 100 F5 T/PINE (H3 TREATED)	350Ø	1100

NG TITLE

DRAWING

CONSTRUCTION

Appendix A1: Structural Engineering Drawings, sheet S9 Rev A, RW1 sleeper retaining wall schedule, Structural Engineering Firm job 21-60, Rev A issued for construction 30 July 2021 (highlighted).

Photographs for this item are at Photographs, item A3.

A4. Concrete sleepers cut with the reinforcement left exposed and untreated (Main Issue)

Classification: W - Workmanship; M - Materials

Location: Sides A, B and C, every span built at 1200 mm post spacing

OBSERVATION

- **Sleepers are 1800 mm long.** At 1800 mm spacing they are uncut.
- **At 1200 mm spacing they were cut on site.** I observed cut sleeper ends on 19 August 2026.
- **At the cut ends the reinforcement is cut through and exposed at the cut face, and no protective coating has been applied.** The photographs at A4 show a cut end with the reinforcement visible at the face and corrosion staining at the bar positions.
- **Spans affected:** Side A 1 to 13, Side B 1 to 16, Side C 1 to 7. 36 of 57 spans. I did not examine every cut end individually; the spans are identified from the post spacing, since a 1200 mm span cannot take an uncut 1800 mm sleeper.
- **Condition of the cut ends.** Corrosion staining was visible at the exposed reinforcement of the cut ends I observed. I did not examine every cut end individually; the condition of each is to be determined when the cut faces are cleaned during rectification, and any sleeper then found with section loss, spalling or delamination is to be replaced under the method at Recommendation.
- **No cut steel post is claimed.**

WHERE THE SLEEPERS WERE CUT

Side	Spans at 1200 mm spacing (sleepers cut)	Spans at 1800 mm spacing (sleepers full length)
A	1 to 13	14 to 22
B	1 to 16 (all spans)	none
C	1 to 7	8 to 19
Total	36 spans	21 spans

CAUSE

Cutting severs the reinforcement and removes the cover at the cut face, exposing the steel unless it is coated.

<https://outbacksleepers.com.au/wp-content/uploads/2023/10/OSA-Product-Care-Guide.pdf>

<https://outbacksleepers.com.au/cutting-sleepers/>

APPLICABLE STANDARDS

- Outback Sleepers Australia, OSA Product Care Guide, edition 08/23 (the edition current at the date of installation), page 4: "When cutting our products please adhere to the following points to ensure best practice ... ENSURE that you wash the cut end of the sleeper with a light garden hose ... DO NOT use a pressure hose ... Cover the now exposed Reo Bars with Cold Galv Spray to protect the Reo Bars inside to prolong the life of the sleeper." (Appendix A5)
- Outback Sleepers Australia, OSA Product Care Guide, edition 08/23, page 4, warranty note: "PLEASE NOTE: Cut sleepers are void from our Product Warranty or any issues arising from the product." (Appendix A6)
- Outback Sleepers Australia, 20-Year Product Warranty, clause 13.5, document created 23 August 2023: "This Warranty does not cover nor extend to any further change to the aesthetic condition or appearance

of the Sleepers after they are supplied to a Customer which includes cutting sleepers and / or other alterations made to the sleepers." (Appendix A7)

- Outback Sleepers Australia, 20-Year Product Warranty, clauses 6 and 7, document created 23 August 2023: "Outback Sleepers Australia warrants that all Sleepers supplied to a Customer comply with Australian Standard AS 3600 - Concrete Structures (2018) ... will use concrete with a compressive strength of at least 60MPa" (Appendix A8)

NON-COMPLIANCE

- **Requirement.** The manufacturer permits cutting and directs that the exposed reinforcement then be covered with cold galvanising spray. OSA Product Care Guide edition 08/23, the edition current at installation. The guide introduces the direction as best practice; I treat it as the manufacturer's stated requirement for its own product, not as a Code provision.
- **Departure.** No treatment applied.
- **Durability basis.** The manufacturer warrants that the sleepers comply with AS 3600 Concrete Structures (2018) and use concrete of at least 60 MPa. AS 3600 sets the cover to reinforcement required for durability by exposure classification. Cutting a sleeper removes that cover at the cut face. I do not hold AS 3600 and I do not state a cover figure for this product.
- **Warranty.** The Care Guide states cut sleepers are void from the product warranty. Warranty clause 13.5 frames the exclusion as a change to aesthetic condition, which it says includes cutting. Clause 13.6 also imposes conditions for the warranty to be effective. Whether a warranty was ever in place, and what the exclusions mean, are contract questions on which I express no opinion.

RECOMMENDATION

Remove the cut sleepers one at a time, apply cold galvanising spray to the cut end so that the exposed reinforcement is fully covered, and reinstate each sleeper before the next is removed.

Carry the work out span by span, not across multiple spans at once, so that the retained ground is supported at all times and the neighbouring properties are not put at risk of collapse.

The structural engineer (the same engineer engaged under item A1) is to specify, before the work starts: the temporary protection of the neighbouring properties against ground movement during the rectification, and the measures required to prevent damage to the agricultural drainage pipes and the membrane behind the sleepers while sleepers are out.

Sleepers found on removal to have lost reinforcement section, or with spalled or delaminated concrete at the cut, are to be replaced rather than re-coated and reinstated.

The detailed breakdown pricing of this work is provided in the Scott Schedule.

ALTERNATIVE REMEDY

For a cut sleeper that is otherwise sound, removal, coating and reinstatement as described is itself the lesser remedy, and wholesale replacement is not a reasonable alternative to it. Replacement applies only to individual sleepers found damaged on removal.

Related items: A1

- Quick Cut Saws with a Masonry or Diamond blade are most commonly used when cutting sleepers and UFPs on site.
- **ENSURE** that you wash the cut end of the sleeper with a light garden hose to remove the surplus by-product that generates when cutting concrete products. **DO NOT use a pressure hose to wash the sleeper.**
- Cover the now exposed Reo Bars with Cold Galv Spray to protect the Reo Bars inside to prolong the life of the sleeper.

PLEASE NOTE: Cut sleepers are void from our Product Warranty or any issues arising from the product.

Source: Outback Sleepers Australia, OSA Product Care Guide, edition 08/23, page 4
<https://outbacksleepers.com.au/wp-content/uploads/2023/10/OSA-Product-Care-Guide.pdf>

Appendix A5: Outback Sleepers Australia, OSA Product Care Guide, edition 08/23 (the edition current at the date of installation), page 4 (highlighted).

Source: <https://outbacksleepers.com.au/wp-content/uploads/2023/10/OSA-Product-Care-Guide.pdf>

- **ENSURE** that you wash the cut end of the sleeper with a light garden hose to remove the surplus by-product that generates when cutting concrete products. **DO NOT use a pressure hose to wash the sleeper.**
- Cover the now exposed Reo Bars with Cold Galv Spray to protect the Reo Bars inside to prolong the life of the sleeper.

PLEASE NOTE: Cut sleepers are void from our Product Warranty or any issues arising from the product.

Source: Outback Sleepers Australia, OSA Product Care Guide, edition 08/23, page 4
<https://outbacksleepers.com.au/wp-content/uploads/2023/10/OSA-Product-Care-Guide.pdf>

Appendix A6: Outback Sleepers Australia, OSA Product Care Guide, edition 08/23, page 4, warranty note (highlighted).

Source: <https://outbacksleepers.com.au/wp-content/uploads/2023/10/OSA-Product-Care-Guide.pdf>

to and/or egress of said item, the Sleepers.

13.5 This Warranty does not cover nor extend to any further change to the aesthetic condition or appearance of the Sleepers after they are supplied to a Customer which includes cutting sleepers and / or other alterations made to the sleepers.

13.6 For this Warranty to be and remain effective the following must occur:

13.6.1 the Sleepers be used in installation of a Lawfully Constructed Retaining

Source: Outback Sleepers Australia, 20-Year Product Warranty, clause 13.5, page 5
<https://outbacksleepers.com.au/wp-content/uploads/2023/08/20-Year-Product-Warranty.pdf>

Appendix A7: Outback Sleepers Australia, 20-Year Product Warranty, clause 13.5, document created 23 August 2023 (highlighted).

Source: <https://outbacksleepers.com.au/wp-content/uploads/2023/08/20-Year-Product-Warranty.pdf>

from the date that a Customer commences installing Sleepers for the Customer's Lawfully Constructed Retaining Wall.

6. Outback Sleepers Australia warrants that all Sleepers supplied to a Customer comply with Australian Standard AS 3600 – Concrete Structures (2018).
7. Outback Sleepers Australia warrants that all Sleepers supplied to a Customer will use concrete with a compressive strength of at least 60MPa (that is, 60 million pascals).

Source: Outback Sleepers Australia, 20-Year Product Warranty, clauses 6 and 7, page 2
<https://outbacksleepers.com.au/wp-content/uploads/2023/08/20-Year-Product-Warranty.pdf>

Appendix A8: Outback Sleepers Australia, 20-Year Product Warranty, clauses 6 and 7, document created 23 August 2023 (highlighted).

Source: <https://outbacksleepers.com.au/wp-content/uploads/2023/08/20-Year-Product-Warranty.pdf>

Photographs for this item are at Photographs, item A4.

A5. Two spans of retaining wall shown on the drawings were not constructed

Classification: I - Incomplete works

Location: Side C, the south boundary, at the western end of the run beyond post 20

OBSERVATION

The Side C wall terminates at post 20. Two further spans shown on the structural drawings beyond that point were not constructed.

On the day of my inspection, the site supervisor, Owner B , told me on site that the property owner and the contractor had agreed not to build the lower four spans of this wall, because they sit against the neighbouring property's garage wall. Of those four spans, two (spans 18 and 19) were in fact built and two (spans 20 and 21) were not.

A copy of that agreement has not been provided to me, and what Owner B told me is information received, not something I can verify from the documents held.

I am also unaware whether the contract price included the two unbuilt spans, and if it did, whether their cost was deducted from the contract total. No contract document held by me answers this.

SIDE C, EXTENT BUILT AGAINST EXTENT SHOWN

	Shown on the drawings	As built
Spans	21	19
Posts	22	20
Terminates at	post 22	post 20

APPLICABLE STANDARDS

- Structural Engineering Drawings, sheet S2 Rev A, ground floor slab and footing plan sheet 1, western end of the Side C run (Appendix A9)
- Building Act 1993 (Vic), s 16(1)

NON-COMPLIANCE

Against the drawings, two spans are missing.

If the agreement described to me is produced, the omission is an agreed variation rather than incomplete work, and this item falls away as a defect. Whether any adjustment to the contract price should have followed is a contractual question for the parties and their lawyers, not a matter for me.

Whether the omitted spans were structurally required at that location is for the structural engineer.

RECOMMENDATION

First, provide a copy of the agreement between the owner and the contractor not to build the lower spans, and any contract or payment record showing whether the two unbuilt spans were included in, or deducted from, the contract price. If the agreement is established, no rectification arises.

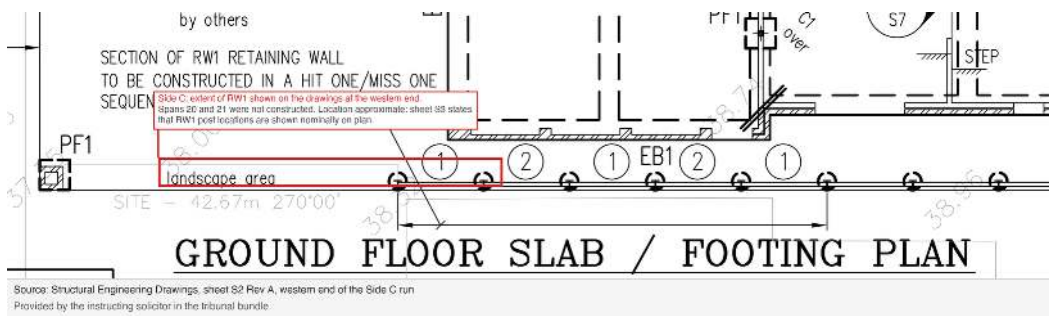
If no agreement can be produced, refer to the engineer. If the spans are required, build them to the governing schedule row including piers, posts, sleepers and drainage. If they are not required, obtain an amended drawing recording the variation.

ALTERNATIVE REMEDY

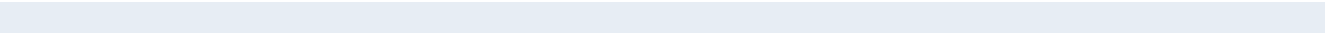
If the agreement is produced, or no retention is needed, documenting the variation is the remedy. Building the spans is not.

This item requires a structural engineer to determine the full extent and method of rectification.

Related items: A1



Appendix A9: Structural Engineering Drawings, sheet S2 Rev A, ground floor slab and footing plan sheet 1, western end of the Side C run (highlighted).



DECLARATION

I, Maison Azdari, of Owner Inspections Pty Ltd, Level 8, 97 Pacific Highway, North Sydney NSW 2065, declare that I have read and complied with the Expert Witness Code of Conduct annexed to VCAT Practice Note PNVCAT2 - Expert Evidence. I acknowledge that my paramount duty is to assist the Tribunal impartially on matters relevant to my area of expertise and that this duty overrides any duty to the party retaining me. I have not acted, and will not act, as an advocate for any party. The opinions in this report are my own and are based on my specialised knowledge arising from my training, study and experience. Where an opinion is provisional, or where a matter falls outside my expertise, I have said so in the report. If I change my opinion on a material matter after this report is provided, I will communicate that change in writing to the party retaining me as soon as practicable.

DECLARATION AS TO INQUIRIES

I have made all the inquiries that I believe are desirable and appropriate and that no matters of significance which I regard as relevant have to my knowledge been withheld from the Tribunal.

Signed:  _____

Maison Azdari

Date: 27 August 2026

PHOTOGRAPHS

Photographs taken during the inspection, grouped by item.

A1. Retaining walls constructed in concrete sleepers where the approved design specifies timber sleepers, with no design for the material as built



A2. Post spacing exceeds the maximum specified, Side B



A3. Four posts are of a smaller steel section than the schedule requires for the height they carry



A4. Concrete sleepers cut with the reinforcement left exposed and untreated (Main Issue)



VCAT PRACTICE NOTE PNVCAT2 - EXPERT EVIDENCE

Reproduced in full.



PRACTICE NOTE – PNVCAT2	
Expert Evidence	
Application	Proceedings in all Divisions
Effective date	1 February 2026
Supersedes Practice Note	PNVCAT2 issued on 8 December 2022
Special note	Please ensure that you are using an up-to-date version of this practice note. Other practice notes may also apply.
Further information	A complete set of current practice notes are available on the VCAT website at www.vcat.vic.gov.au .

Contents	
Special Note	1
Introduction	2
Definitions	2
How does this practice note apply?	2
What is the duty of an expert witness to the Tribunal?	3
What must be included in the report of an expert witness?	3
What happens if the expert witness changes his or her opinion?	4
What format is recommended by the Tribunal for an expert witness report?	4
When must an expert witness report be filed and served?	5
Can the Tribunal direct expert witnesses to meet?	6
How is expert evidence given at a hearing?	7
Can the Tribunal appoint an expert or special referee?	8

- | Special Note |
|---|
| 1. With effect from 1 February 2026, amendments to the <i>Victorian Civil and Administrative Tribunal Rules 2018</i> (Vic) come into operation: <ul style="list-style-type: none">a. to establish new divisions of the Tribunal (see rule 2.01); andb. to provide for the President to give directions about divisions and practice areas of the Tribunal as a matter of the business of the Tribunal (see rule 2.02). |

2. From 1 February 2026 new VCAT practice areas published on the VCAT website replace the former lists.

Introduction

3. Expert witness evidence may be relied upon by the Tribunal to form an opinion about a specialised or technical matter that is relevant to the issues to be determined in a proceeding. Where expert evidence is provided in the form of a written report and/or the expert being called as a witness, it is important that the expert's opinion is soundly based, complete, impartial, dispassionate, and within the scope of his or her expertise.
4. Schedule 3 of the *Victorian Civil and Administrative Tribunal Act 1998* sets out certain powers in relation to expert witnesses and expert evidence. This practice note should be read in conjunction with Schedule 3 of the Act and sets out the primary obligations of an expert witness and further requirements about the preparation and giving of expert evidence.
5. In any proceeding, the Tribunal may at its discretion vary the operation of a practice note by direction or order.
6. This practice note has been approved by the Rules Committee pursuant to s 158 of the *Victorian Civil and Administrative Tribunal Act 1998*.

Definitions

Word	Definition
Act	<i>Victorian Civil and Administrative Tribunal Act 1998</i>
Expert Witness	A person who has specialised knowledge based on the person's training, study or experience. (This is the definition in s. 3 of the Act.)

7. A word or term used in this practice note has the same meaning as defined in the Act or in the *Interpretation of Legislation Act 1984* (Vic).

How does this practice note apply?

8. This practice note applies to:
 - a. any evidence given to the Tribunal by an expert witness;
 - b. the retainer by parties to a proceeding, of any expert witness to provide a report for use in evidence before the Tribunal; and
 - c. arrangements for a tribunal-appointed expert or special referee.

9. Parties to a proceeding must ensure that any expert retained by them to provide a report for use in the proceeding is made aware of the contents of this practice note and, where relevant, PNVCAT 11 – Use of Generative Artificial Intelligence, at the time of such retainer.

What is the duty of an expert witness to the Tribunal?

10. An expert witness has a paramount duty to the Tribunal and not to the party retaining the expert.
11. An expert witness has an overriding duty to assist the Tribunal on matters relevant to the expert's expertise.
12. An expert witness is not an advocate for a party to a proceeding.

What must be included in the report of an expert witness?

13. The report of an expert witness must include the following matters:
- a. the full name and address of the expert witness;
 - b. the expert's qualifications, experience and area of expertise;
 - c. a statement setting out the expert's expertise to make the report;
 - d. reference to any private or business relationship between the expert witness and the party for whom the report is prepared;
 - e. all instructions that define the scope of the report (original and supplementary and whether in writing or oral);
 - f. the facts, matters and all assumptions upon which the report proceeds;
 - g. reference to those documents and other materials the expert has been instructed to consider or take into account in preparing his or her report and the literature or other material used in making the report;
 - h. the identity and qualifications of the person who carried out any tests or experiments upon which the expert relied in making the report;
 - i. a statement:
 - i. summarising the opinion of the expert;
 - ii. identifying any provisional opinions that are not fully researched for any reason (including the reasons why such opinions have not been or cannot be fully researched);
 - iii. setting out any questions falling outside the expert's expertise; and
 - iv. indicating whether the report is incomplete or inaccurate in any respect.

- j. A signed declaration by the expert that:
"I have made all the inquiries that I believe are desirable and appropriate and that no matters of significance which I regard as relevant have to my knowledge been withheld from the Tribunal."
 - k. Where relevant, a cover page in accordance with clause 18.
 - l. Where relevant, a disclosure in relation to Gen AI as required by PNVCAT 11 – Use of Generative Artificial Intelligence.
14. If an expert report relates to completion or rectification works, the report of an expert witness must also include the following:
- a. if rectification or demolition or other alteration of premises is recommended, the reasons for such recommendation and the likely costs involved (including, where relevant, how those costs have been calculated);
 - b. whether any alternative remedy or remedies are a reasonable alternative.
15. The requirements of clause 13 do not apply strictly to reports obtained from treating doctors and hospitals, unless the Tribunal directs otherwise. Doctors and hospitals are nonetheless encouraged to follow these requirements to the extent practicable.

What happens if the expert witness changes his or her opinion?

16. An expert witness who changes an opinion on a material matter (including on the basis of another expert's report) must as soon as practicable communicate that change of opinion in writing to the party retaining the expert.
17. A party receiving notice that an expert witness retained by that party has changed his or her opinion on a material matter must forthwith file with the Tribunal and serve on all other parties a notice of such change of opinion, specifying the reasons why his or her opinion has changed and setting out his or her revised opinion. Where appropriate, a supplementary report by the expert witness must also be filed and served.

What format is recommended by the Tribunal for an expert witness report?

18. To assist the Tribunal, the report of an expert witness should contain a cover page that clearly identifies, as relevant:
- a. the file number given by the Tribunal for the relevant proceeding;
 - b. the date of the report;
 - c. if the report relates to a person, the name of that person;

- d. if the report relates to a property, the address of that property and the date(s) of any inspection;
 - e. the party for whom the report has been prepared; and
 - f. the person from whom the expert received his/her instructions.
19. A report should, where practicable, adopt the same numbering sequences used in other Tribunal documents and/or include appropriate cross-references. For example, an expert responding to another expert witness report that deals with particular matters should use the same numbering.
20. Unless otherwise directed by the Tribunal, in all practice areas other than the Property, Valuations, Compensation & Charges, and Resources & Environment practice areas, the report of an expert witness should be filed with the Tribunal in hard copy. Where practicable, the report should be filed in A4 size, be stapled but not bound, and be two-hole punched so that it can be included in a file or binder. All pages should be consecutively numbered. In the Land and Environment Division unless otherwise required by an order of the Tribunal, all expert reports must be filed and served in electronic format.
21. If the report contains a document that cannot be conveniently reduced to A4 size or would be difficult to read at that size (e.g. a spreadsheet or building plan), the document should be folded within the report so that it can be read without being removed from the file or binder, or included as a separate attachment.
22. If the original report contains colour photographs or material, all copies filed with the Tribunal should be good quality colour reproductions.
23. Unless the Tribunal directs, or the parties agree otherwise, copies of expert witness reports provided to or served upon other parties must be in the same format as those filed with the Tribunal. Some parties may agree to receive an expert report from another party in electronic format (e.g. email attachment, facsimile, computer disk etc).
24. In more complex matters, or proceedings involving multiple parties, the Tribunal may require the report of an expert witness to be filed or served in electronic format, sometimes in addition to the filing and service of printed copies. In such event, the copy filed with the Tribunal should be provided in a Microsoft Office Word “.docx” or “.doc”, or Adobe “.pdf” format that enables copying and pasting of text or parts of the report.

When must an expert witness report be filed and served?

25. In more complex matters, the time for filing the report of an expert witness will usually be set out in a procedural timetable contained in a direction or order of the Tribunal. Parties may be directed to file their expert witness reports at the

same time, or for the filing of reports to be staged with the opportunity for supplementary reports by way of reply.

26. If there is no direction or order setting a time for the filing of the report of an expert witness in a proceeding then, except with the leave of the Tribunal, a party must file with the Tribunal and serve on each other party a copy of the report of any expert witness upon whose evidence that party intends to rely not less than ten (10) business days prior to the date scheduled for commencement of the relevant mediation, compulsory conference or hearing at which the expert witness report will be relied upon.
27. In a proceeding involving multiple parties, a party may seek an order of the Tribunal (sometimes called a representative order) that allows for service of an expert witness report only on certain nominated parties, provided other parties are given an opportunity to access the report by alternative means (e.g. if the report is available for inspection and/or downloading on a website).
28. The Tribunal may refuse to allow an expert witness report to be relied upon, or refuse to allow an expert witness to be called by a party, if the report of that witness is filed and served outside of any time limit imposed by a direction or order, or is contrary to this practice note.

Can the Tribunal direct expert witnesses to meet?

29. If directed by the Tribunal to do so, an expert witness shall:
 - a. meet with any other expert witnesses retained in the proceeding in a similar or related field of expertise and attempt in good faith to narrow any points of difference between them (sometimes called an expert 'conference' or 'conclave'); and
 - b. provide the Tribunal with a joint report specifying (as the case requires) matters agreed between the experts, matters not agreed, and the reasons for the disagreement (sometimes called a 'Scott Schedule').
30. If the Tribunal directs an expert witness to confer with other expert witnesses, the Tribunal may:
 - a. require the expert witnesses to meet and confer between themselves, or in a meeting facilitated by a Tribunal member or mediator; and/or
 - b. order that the meeting of expert witnesses take place in the absence of the parties and/or their legal advisers, except with the leave of the Tribunal;
31. If a meeting of expert witnesses is ordered as part of a mediation or compulsory conference, unless the parties agree or it is otherwise ordered, all discussions, concessions and agreements reached, including any joint report prepared as

part of the mediation or compulsory conference process, shall be on a 'without prejudice' basis and for the purpose only of the mediation or compulsory conference.

32. If any expert witness directed by the Tribunal to meet with any other expert is instructed by a party not to reach agreement in respect of certain points of difference, the fact of such instructions must be reported in writing to the Tribunal by the expert witness concerned.

How is expert evidence given at a hearing?

33. In all proceedings, the Tribunal may regulate the conduct of a hearing and, in doing so and subject to the principles of procedural fairness, may:
- a. regulate the order of presentation of expert witness evidence;
 - b. regulate cross-examination, and/or
 - c. limit the time to be taken in presenting the evidence of an expert witness, or the time for cross-examination or re-examination of that witness.
34. In more complex proceedings, the usual practice of the Tribunal is that the report of an expert witness will be taken 'as read' (i.e. it will be assumed that the Tribunal and parties have read the report before the hearing). The expert should not ordinarily read his or her report, but will be given an opportunity to draw the Tribunal's attention to key elements of it.
35. A party will usually call an expert witness during the presentation of that party's case at a hearing. Any other party seeking to cross-examine that expert witness should be present when the expert evidence is presented.
36. In more complex hearings, the Tribunal may of its own initiative require that the expert witnesses retained in the proceeding in a similar or related field of expertise all attend at the same time for the purpose of giving concurrent evidence (sometimes called 'hot tubbing'). In such circumstance:
- a. the conduct of the process of concurrent evidence will be at the discretion of the Tribunal;
 - b. usually, all of the experts will be 'sworn in' and then give their evidence in a panel format, with issues in the proceeding dealt with sequentially by all experts (e.g. each defect in a building case);
 - c. experts may be given the opportunity to ask each other questions;
 - d. the Tribunal and parties (or their professional advocates) will be given an opportunity to ask questions of the experts;

- e. cross-examination of individual expert witnesses will usually take place after the concurrent evidence has been given, unless otherwise directed by the Tribunal.

Can the Tribunal appoint an expert or special referee?

- 37. The Tribunal's usual practice is to have regard to expert evidence provided by the parties in a proceeding. However, in appropriate cases the Tribunal may appoint its own expert under Clause 7 of Schedule 3 of the Act or a special referee under s 95 of the Act. The Tribunal may do this at the request of the parties, or occasionally on its own initiative.
- 38. If the parties jointly seek a Tribunal-appointed expert or a s 95 special referee, this should be done by seeking a consent order. The request for a consent order should contain, as a minimum:
 - a. the name of the proposed expert or special referee, details of his/her expertise, and confirmation that he/she has agreed to accept the appointment. (Note: If this confirmation is not available there should be a specific reservation of liberty to apply);
 - b. the questions to be considered or determined, or the task to be performed, by the expert or special referee;
 - c. the date by which any documents are to be provided to the expert or special referee and by whom. Where possible these documents should be clearly identified;
 - d. the date by which the expert or special referee is to complete any report or determination (subject to an extension of time being granted by the Tribunal);
 - e. details of payment arrangements – the expert or special referee will generally not be required to deliver up the report/determination until his/her account has been paid in full.
- 39. Following receipt of the request for a consent order, the Tribunal may make the consent order appointing the expert or special referee, or refer the request to a directions hearing to consider appropriate orders. The appointment of the expert or special referee is within the discretion of the Tribunal, and the Tribunal may decline to make the order if the terms of appointment appear to be outside the proposed appointee's expertise.
- 40. If the Tribunal proposes to appoint an expert or special referee on its own initiative:
 - a. the Tribunal will first obtain the views of the parties in writing or at a directions hearing, including (in the case of a Tribunal-appointed expert)

Victorian Civil and Administrative Tribunal (VCAT)

VCAT Practice Note PNVCAT2

Page | 8

the views of the parties on the matters the Tribunal must consider under Clause 7 of Schedule 3 of the Act;

- b. the costs of the expert or special referee so appointed will initially be shared equally by the parties, unless otherwise ordered by the Tribunal;
- c. the expert or special referee will be requested to provide an estimate of their costs, and the parties may be required to make an initial payment on account of the estimated costs before the expert or special referee commences any work under the appointment and/or provide security for costs in a manner specified by the Tribunal;
- d. after the expert or special referee completes his or her appointment and renders a final account, the parties will be required to pay any balance within seven (7) days in the same proportion as for the initial payment, unless otherwise ordered by the Tribunal. Payment may be required before the expert or special referee provides a report to the Tribunal;
- e. the proportion of costs paid by a party for the expert or special referee will be treated as a cost in the proceeding if there is a subsequent costs application by a party.

- END OF PRACTICE NOTE -

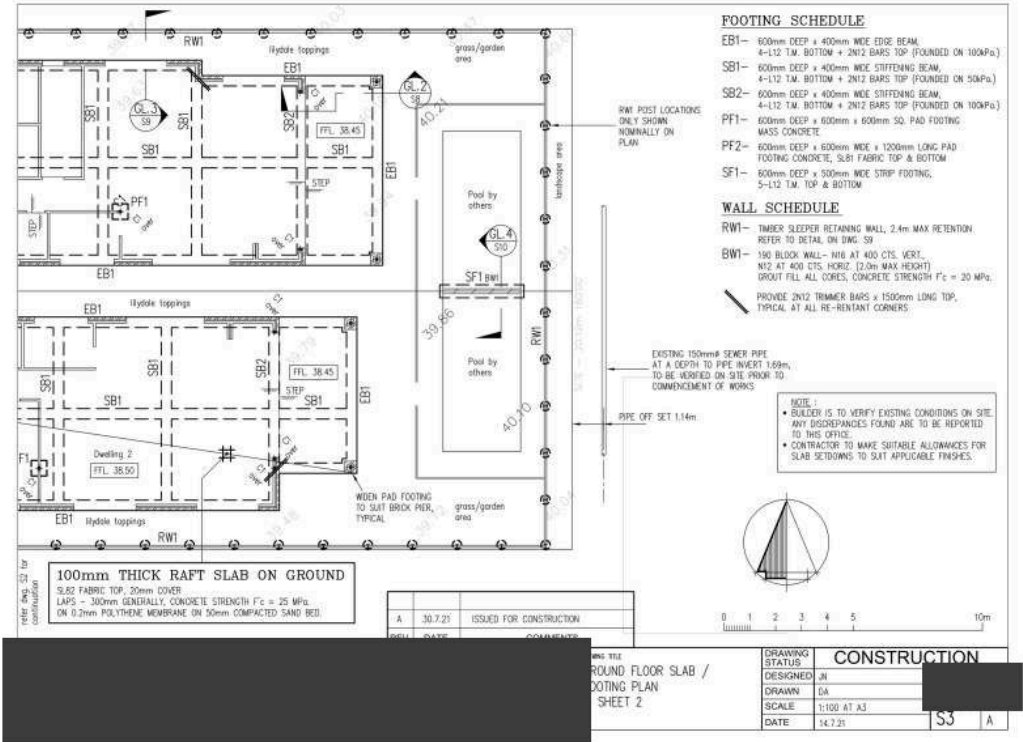
APPENDIX A - REFERENCE EXTRACTS

R TO

RW1 SLEEPER RETAINING WALL SCHEDULE					
H-(MAX.)	SPACING	UPRIGHT	WALER	'W'	'D'
2400mm	1200	150 UC 23	200 x 100 F5 T/PINE (H3 TREATED)	600Ø	2800
2000mm	1200	150 UC 23	200 x 100 F5 T/PINE (H3 TREATED)	600Ø	2600
1600mm	1800	150 UC 23	200 x 100 F5 T/PINE (H3 TREATED)	450Ø	2400
1200mm	1800	150 UC 23	200 x 100 F5 T/PINE (H3 TREATED)	450Ø	1900
800mm	1800	100 UC 15	200 x 100 F5 T/PINE (H3 TREATED)	450Ø	1400
400mm	2400	100 UC 15	200 x 100 F5 T/PINE (H3 TREATED)	350Ø	1100

NG TITLE	DRAWING	CONSTRUCTION
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Appendix A2: Structural Engineering Drawings, sheet S3 Rev A, wall schedule



Structural Engineering Drawings, sheet S3 Rev A, wall schedule

Appendix A3: Structural Engineering Computations, page 30, RW1 (2400) sleeper design, Structural Engineering Firm, 28 July 2021

RW/1 (2400)

SLEEPER WALLS V5.04

Design moment in upright (about top of footing, per m of wall)

	Pressure kPa	Thrust kN/m	Thrust* kN/m	Lever arm mm	Mw kNm/m	Mw* kNm/m	Comments
Soil = $K_a \gamma_s h_a$ =	16.78	20.13	25.17	800	16.11	20.13	Max. pressure at base
Surcharge = $K_a s$ =	1.94	4.66	6.99	1200	5.59	8.39	Uniform pressure dist.
Additional =	0.00	0.00	0.00	2400	0.00	0.00	
Total =		24.79	32.16		21.70	28.52	
Total thrust (Vw) =	24.79 kN/m		Total moment (Mw) =		21.70 kNm/m		
Total ult. thrust (Vw*) =	32.16 kN/m		Total ult. moment (Mw*) =		28.52 kNm/m		
Total ult. thrust (Vw*/ ϕ_n) =	35.73 kN/m		Total ult. moment (Mw*/ ϕ_n) =		31.69 kNm/m		

Sleeper design - AS1720.1 Section 3

Double sleepers at layer =	0 (Single layer sleepers)						
Double sleepers laminated =	N (Yes, N) o						
Total layers =	12						
Critical layer for design =	12			Critical layer for design =			
Critical layer centroid depth =	2300			Critical layer centroid depth =			
$w(d_l)^*$ =	4.87 kN/m			w^* =			
$M(d_l)^*/\phi_n$ =	0.97 kNm/m			M^*/ϕ_n =			
Description =	100mm x 200mm F5 Treated*			Area (A) =			
Design depth (dD) =	97 mm			Section modulus (Zy) =			
Design width (dW) =	197 mm			Stiffness (Iy) =			
				Modulus of elasticity (E) =			
Capacity factor (ϕ) =	0.6 Table 2.1 - Category 3						
Duration factor (k1) =	0.57			Moisture factor (k4) =			
Stability factor (k12) =	1.00			Temp. factor (k6) =			
f_b =	14.0 MPa			Sharing factor (k9) =			
$\phi M(d_l) = \phi^*(k1=0.57)*k4*k6*k9*k12*f_b*Z =$	1.48 kNm			Size modifier (mod.b) =			
$\phi M = \phi^*k1*k4*k6*k9*k12*f_b*Z =$	1.48 kNm			OK (0.66)			
$j2 =$	3.00			OK (0.62)			
Deflection horizontal $j2*\delta(d_l) =$	2.5 mm			span / 476			
$\delta(II) =$	0.3 mm			span / 3944			
Long term deflection horizontal $\delta(d_l+II,II) =$	2.8 mm			span / 425			

Steel upright design - AS4100 Section 5

$V^* = Vw^* \cdot \phi_n$ =	42.87 kN									
$M^* = Mw^* \cdot \phi_n$ =	38.03 kNm									
Description =	150UC23.4 (G300)									
Flange yield (fyf) =	320 MPa									
Area (Ag) =	2980 mm ²									
Stiffness (Ix) =	12.6 x10 ⁶ mm ⁴									
Shear modulus (G) =	80000 MPa - Cl 1.4									
Capacity factor (ϕ) =	0.9 Table 3.4									
Warping constant (Iw) =	21.1 x10 ⁶ mm ⁶									
Torsional constant (J) =	50.2 x10 ⁶ mm ⁴									
Effective section mod. (Zex) =	176 x10 ⁶ mm ³									
Effective section mod. (Zey) =	73.5 x10 ⁶ mm ³									
Modulus of elasticity (Es) =	200000 MPa - Cl 1.4									
$M_{sx} =$	56.3 kNm - Cl 5.2			$\phi M_{sx} =$	50.7 kNm					
$\phi V_v = \phi V_u =$	160.2 kN			OK (0.75)						
$\phi V_{vm} =$	160.2 kN			$\phi V_{vm} = \phi V_v^* [2.2 - 1.6 * M^* / \phi M_{sx}]$						
				OK (0.27)						
Deflection horizontal at top $\delta(d_l) =$	8.8 mm			ht / 272						
$\delta(LL) =$	3.8 mm			ht / 626						
$\delta(II) \text{ (other)} =$	0.0 mm			ht / 0						
Total $\delta(II) =$	3.8 mm			ht / 626						
Total deflection horizontal $\delta(d_l+II,II) =$	12.7 mm			ht / 189						

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RW1 (2400)

SLEEPER WALLS V5.04

Wall: (RW1 (2400)) 2400mm high, 5.0kPa surcharge (Drained)
 Loads: Surcharge = 5.00kPa, Drained
 Steel Upright: 150UC23.4 (G300) (Galv.)
 $M^* = 38.03\text{kNm} < \phi M = 50.69\text{kNm}$, $V^* = 42.87\text{kN} < \phi V_{vm} = 160.16\text{kN}$ OK (0.75, 0.27)
 $\delta(d) = ht/272$ (8.8mm), $\delta(d+|\Psi|I) = ht/189$ (12.7mm) OK
 Timber Upright: Not Applicable

Footings: $M^*o = 42.31\text{kNm} < \phi M_r = 46.48\text{kNm}$ OK (0.91)
 Sleepers: 100mm x 200mm FS Treated* (Weak) (Single layer sleepers)
 $M(d)^* = 0.97\text{kNm} < \phi M(d) = 1.48\text{kNm}$, $M^* = 0.92\text{kNm} < \phi M = 1.48\text{kNm}$ OK (0.66, 0.62)
 Critical sleeper layer is 12 from top of sleeper wall bending about weak axis
 $\delta(d) = L/476$ (2.5mm) on layer 12, $\delta(d+|\Psi|I) = L/425$ (2.8mm) on layer 12 OK

Geometry

Wall assumed fully drained
 Geometry Retaining height must be a multiple of the sleeper vertical dimension (2400mm)
 Retaining height (ht) = 2400 mm
 Post centres (cts) = 1200 mm
 Upright = S (T)timber, (S)steel, (B)oth
 Risk class = C (A),(B),(C) - Significant damage or risk to life - Table 1.1
 Backfill type = 1 Class(1), Class(2), (U)ncoloured, (I)nsitu - Table 5.1(A)

Soil parameters

Internal friction (ϕ) = 30° ($0^\circ \leq \phi \leq 45^\circ$)
 Incline (β) = 0° ($0^\circ \leq \beta \leq 45^\circ$) 1 in 0.0
 Soil weight (γ_s) = 18.0 kN/m^3
 Cohesion (c) = 0 kPa

Footings - Cohesionless

Total footing depth (d) = 2800 mm (From surface)
 Ignore top (ig) = 100 mm
 Footing diameter (dia) = 600 mm
 Soil cohesion (cf) = 0 kPa (0 for cohesionless)
 Design $cf^* = cf^* \Phi_{uc} (=0.7)$ = 0.0 kPa insitu material

Sleepers - Minor axis bending

Sleeper depth (dSD) = 100 mm (Horz. dimension)
 Sleeper width (dSW) = 200 mm (Vert. dimension)
 Max number of layers = 12 (2400mm high)

Live Load duration = Permanent

Long term LL factor (Ψ_l) = 1.00 AS 1170.0 Table 4.1
 Duration factor (k_1) = 0.57

Design loads - Appendix J & Section 4 - AS4678

Min. surcharge = 5.0 kPa - Table 4.1
 Water height (hw) = 0.0 mm (Drained)
 Surcharge (s) = 5.0 kPa

Additional upright overturning

Thrust (Va) = 0.00 kN
 Overturning (Ma) = 0.00 kNm
 Load factor = 1.50
 Long term LL factor (Ψ_{lo}) = 0.40
 $Va^* = 0.00\text{ kN}$
 $Ma^* = 0.00\text{ kNm}$
 (Thrust/moment applied at the top of the wall)

Material design factors - Section 5

$\Phi_{uc} = 0.70$ $c^* = c^* \Phi_{uc} = 0.0\text{ kPa}$ Cl 5.2.1
 $\Phi_{uo} = 0.85$ $\phi^* = 26.1^\circ$ Cl 5.2.2 $\phi^* = 0.456\text{ rad}$

Design factor (Φ_n) = 0.90 Table 5.2
 $Ka = 0.388$ (Rankine) Depth of tension zone = 0 mm
 $Kp = 2.575$ (Rankine) Acting soil height (ha) = 2400 mm

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- Quick Cut Saws with a Masonry or Diamond blade are most commonly used when cutting sleepers and UFPs on site.
- **ENSURE** that you wash the cut end of the sleeper with a light garden hose to remove the surplus by-product that generates when cutting concrete products. **DO NOT use a pressure hose to wash the sleeper.**
- **Cover the now exposed Reo Bars with Cold Galv Spray** to protect the Reo Bars inside to prolong the life of the sleeper.

PLEASE NOTE: Cut sleepers are void from our Product Warranty or any issues arising from the product.

Source: Outback Sleepers Australia, OSA Product Care Guide, edition 08/23, page 4

<https://outbacksleepers.com.au/wp-content/uploads/2023/10/OSA-Product-Care-Guide.pdf>

Outback Sleepers Australia, OSA Product Care Guide, edition 08/23 (the edition current at the date of installation), page 4

Source: <https://outbacksleepers.com.au/wp-content/uploads/2023/10/OSA-Product-Care-Guide.pdf>

- **ENSURE** that you wash the cut end of the sleeper with a high garden hose to remove the surplus by-product that generates when cutting concrete products. **DO NOT use a pressure hose to wash the sleeper.**
- Cover the now exposed Reo Bars with Cold Galv Spray to protect the Reo Bars inside to prolong the life of the sleeper.

PLEASE NOTE: Cut sleepers are void from our Product Warranty or any issues arising from the product.

Source: Outback Sleepers Australia, OSA Product Care Guide, edition 08/23, page 4
<https://outbacksleepers.com.au/wp-content/uploads/2023/10/OSA-Product-Care-Guide.pdf>

Outback Sleepers Australia, OSA Product Care Guide, edition 08/23, page 4, warranty note

Source: <https://outbacksleepers.com.au/wp-content/uploads/2023/10/OSA-Product-Care-Guide.pdf>

Appendix A7: Outback Sleepers Australia, 20-Year Product Warranty, clause 13.5, document created 23 August 2023

to and/or egress or salt from, the Sleepers.

13.5 This Warranty does not cover nor extend to any further change to the aesthetic condition or appearance of the Sleepers after they are supplied to a Customer which includes cutting sleepers and / or other alterations made to the sleepers.-

13.6 For this Warranty to be and remain effective the following must occur:

13.6.1 the Sleepers be used in installation of a Lawfully Constructed Retaining
Source: Outback Sleepers Australia, 20-Year Product Warranty, clause 13.5, page 5
<https://outbacksleepers.com.au/wp-content/uploads/2023/08/20-Year-Product-Warranty.pdf>

Outback Sleepers Australia, 20-Year Product Warranty, clause 13.5, document created 23 August 2023

Source: <https://outbacksleepers.com.au/wp-content/uploads/2023/08/20-Year-Product-Warranty.pdf>

Appendix A8: Outback Sleepers Australia, 20-Year Product Warranty, clauses 6 and 7, document created 23 August 2023

from the date that a Customer commences installing Sleepers for the Customer's Lawfully Constructed Retaining Wall.

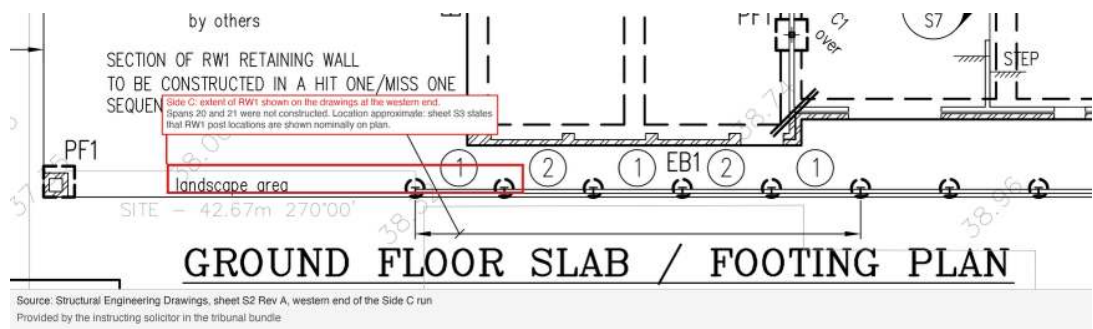
6. Outback Sleepers Australia warrants that all Sleepers supplied to a Customer **comply with Australian Standard AS 3600** – Concrete Structures (2018).
7. Outback Sleepers Australia warrants that all Sleepers supplied to a Customer will use concrete with a compressive strength of at least 60MPa (that is, 60 million pascals).

Source: Outback Sleepers Australia, 20-Year Product Warranty, clauses 6 and 7, page 2
<https://outbacksleepers.com.au/wp-content/uploads/2023/08/20-Year-Product-Warranty.pdf>

Outback Sleepers Australia, 20-Year Product Warranty, clauses 6 and 7, document created 23 August 2023

Source: <https://outbacksleepers.com.au/wp-content/uploads/2023/08/20-Year-Product-Warranty.pdf>

Appendix A9: Structural Engineering Drawings, sheet S2 Rev A, ground floor slab and footing plan sheet 1, western end of the Side C run



Structural Engineering Drawings, sheet S2 Rev A, ground floor slab and footing plan sheet 1, western end of the Side C run