ACIAR PROJECT FST/2019/128

Coconut Veneer Grading Guidelines

Coconut and other non-traditional forest resources for the manufacture of Engineered Wood Products (EWP)

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Purpose

This guideline outlines practical grading considerations for coconut veneer. Aimed at Fijian veneer producers and forestry extension agents, it provides standardised guidelines to separate and classify veneer qualities based on veneer defects. The guideline intends to provide a consistent and transparent method to assess veneer quality, aid in product utilisation, provide quality assurance, and enhance economic returns.

Disclosure statement: The guideline will need further assessment and development as more coconut is subject to veneer processing and observed veneer defects can be further correlated to final product quality.

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1. Introduction

Coconut veneer, produced from senile palms, represents an emerging resource with significant potential for value-added applications. While international standards such as AS/NZS 2269:2012 provide clear guidance for grading conventional hardwood and softwood veneers, their direct application to coconut veneer is limited due to the distinct anatomical and processing characteristics of coconut. This creates a need for tailored guidelines that address the specific qualities and defects found in coconut veneer.

This grading guideline has been developed to provide a practical framework for assessing coconut veneer based on visible features and common processing defects. The thresholds proposed are adapted from both existing veneer standard (AS/NZS 2269:2012) and previous research (McGavin et al., 2019; Leggate et al., 2017), representing the most current and informed approach available. While the guideline is designed for present application, it is expected to evolve as commercial-scale processing expands and further evaluation is undertaken.

By promoting a consistent approach to veneer grading, this guideline aims to improve material recovery, support transparent and fair quality assessment, and build confidence in coconut veneer for high-value applications. Ultimately, adopting these guidelines will help ensure alignment between veneer quality, utilisation, and market value for coconut timber as a raw material for engineered wood products (EWPs).

2. Grading classification

Classification of coconut veneer into Grades A, B, C, and D is based on visible veneer defects. Each sheet is assigned the grade determined by its most limiting defect, meaning, the lowest-performing attribute across all criteria sets the final grade. This approach ensures consistency and transparency.

- Grade A - Highest quality veneer, suitable for applications requiring excellent appearance and structural integrity.
- Grade B – Upper mid quality veneer with minor defects, acceptable for most structural and visual applications (see Figure 1).
- Grade C – Lower mid-quality veneer with moderate defects, suitable for core layer of non-appearance EWPs.
- Grade D - Lowest acceptable grade for use with extensive but remains within the acceptable defect range.
- Grade F – Reject grade. Veneers that fail to meet the minimum requirements and should be discarded (see Figure 2).

Table 1 outlines the grading thresholds for coconut veneer defects across Grades A–D. Each veneer sheet is classified according to its most limiting defect; Grade F applies when thresholds are exceeded, and the sheet is rejected.

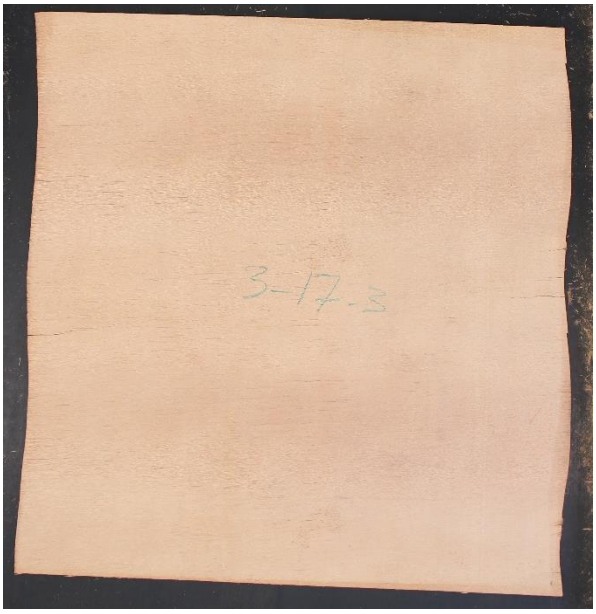


Figure 1 Example of Grade B coconut veneer, showing smooth surface, minimal visible defects, and medium density suitable for face or structural applications.

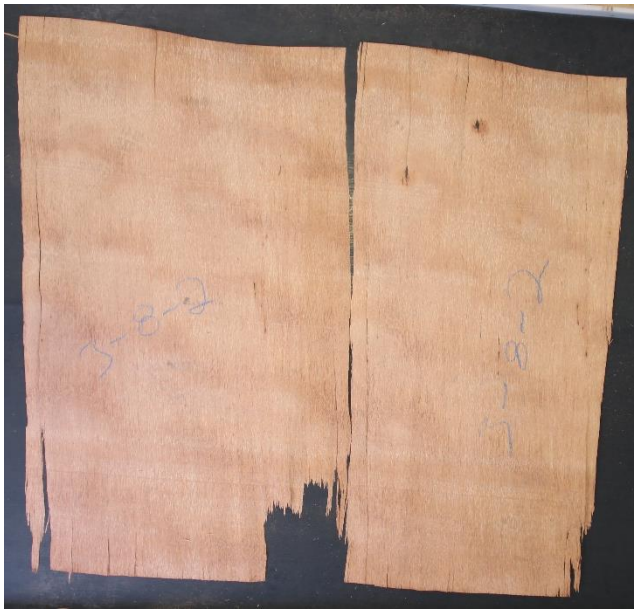


Figure 2 Example of Grade F coconut veneer, with severe tear-out (>75 mm) and defects beyond the minimum acceptable thresholds.

Table 1 Coconut veneer grading guidelines.

Defect	Grade A	Grade B	Grade C	Grade D
Density	≥600 kg/m^3	≥450 kg/m^3	No restrictions	
Roughness	Slightly rough	Slightly > Medium rough	Medium (fuzzy after sanding)	Too deep for sanding
Splits	≤3 mm across grain; Max 300mm long; ≤2 per sheet	≤3 mm across grain; Max 500mm long	≤9 mm across grain; Max 900mm long	≤5 mm across grain (full sheet) OR; ≤15 mm across grain ($\frac{1}{2}$ sheet) OR; ≤25 mm across grain ($\frac{1}{3}$ sheet)
Brittleness	Slightly brittle	>Slightly brittle	Brittle	Very brittle
Collapse	Not allowed	Minor collapse	Some collapse	Extensive collapse ≤75 mm across grain
Decay	Not allowed			≤75 mm across grain
Holes and tear-out	≤6 mm	≤6 mm across grain Max 600mm^2	≤50 mm across grain	≤75 mm across grain Max 1500mm^2
Compression	Flat	Fairly flat	Wavy	Splits will overlap
Handling splits	≤3 mm across grain; Max 300mm long; ≤2 per sheet	≤3 mm across grain; Max 500mm long	≤9 mm across grain; Max 900mm long	≤5 mm across grain (full sheet) OR; ≤15 mm across grain ($\frac{1}{2}$ sheet) OR; ≤25 mm across grain ($\frac{1}{3}$ sheet)
Wane	Not allowed			≤75 mm across grain
Insect track	Not allowed	Allowed, without frass	Allowed, with frass	≤75 mm across grain
Cumulative defects	≤20 mm across grain	20-45mm across grain	45-60mm across grain	60-75mm across grain

Note:

[1]This guideline will be refined as the commercial scale of activity increases. Values are derived from AS/NZS 2269.0:2012 and previous DPI work.

[2]The veneer grade will be determined by the most limiting veneer defect.

[3]Dimensions are considered across the width of the veneer within a 300mm length.

3. Veneer grading criteria

The following coconut veneer grading criteria are based on prior DPI research (McGavin et al., 2019 and Leggate et al., 2017) and largely adapted from AS/NZS 2269.0:2012. While coconut veneer shares similarities with traditional hardwood and softwood, it also presents unique challenges that require specific thresholds. The following defects and characteristics are considered in assigning veneer grades.

Density

Coconut veneer shows wide density variation, typically ranging from 400–700 kg/m³. Denser material is found near the log's outer periphery, while the inner core has lower density. This variation is especially pronounced in older trees, which develop a dense outer layer and soft inner tissue, while younger trees generally produce more uniform, low-density material.

Veneers with excessive low density may be structurally weak and should be identified during grading. Visual assessment of density differences can assist in sorting material for suitable end uses. Colour can serve as a preliminary guide to density, with darker tones generally indicating higher density.

Defect	Grade A	Grade B	Grade C	Grade D
Density	≥600 kg/m^3	≥450 kg/m^3	No restrictions	

Roughness

Coconut veneer generally exhibits a rougher surface compared to traditional wood veneers due to the presence of fibrovascular bundles. Sanding can be utilised to improve smoothness though this occurs at the final product stage. Roughness must therefore be managed during processing, as high roughness negatively affects glue bonding and product performance. Proper log pre-conditioning and optimised lathe settings are key to improving veneer smoothness.

Defect	Grade A	Grade B	Grade C	Grade D
Roughness	Slightly rough	Slightly > Medium rough	Medium (fuzzy after sanding)	Too deep for sanding

Splits

Splits in coconut veneer are primarily caused by compression, shrinkage, or internal stress release during processing. They reduce both structural integrity and appearance, particularly for face-veneers. While distinguishing process-related splits from handling damage can be difficult, this section focuses only on process related splits. Optimising log pre-conditioning and lathe settings is essential for minimising split occurrence. Splits widths are measured across the grain and within any 300-millimetre section.

Defect	Grade A	Grade B	Grade C	Grade D
Splits	≤3 mm across grain; Max 300mm long; ≤2 per sheet	≤3 mm across grain; Max 500mm long	≤9 mm across grain; Max 900mm long	≤5 mm across grain (full sheet) OR; ≤15 mm across grain ($\frac{1}{2}$ sheet) OR; ≤25 mm across grain ($\frac{1}{3}$ sheet)

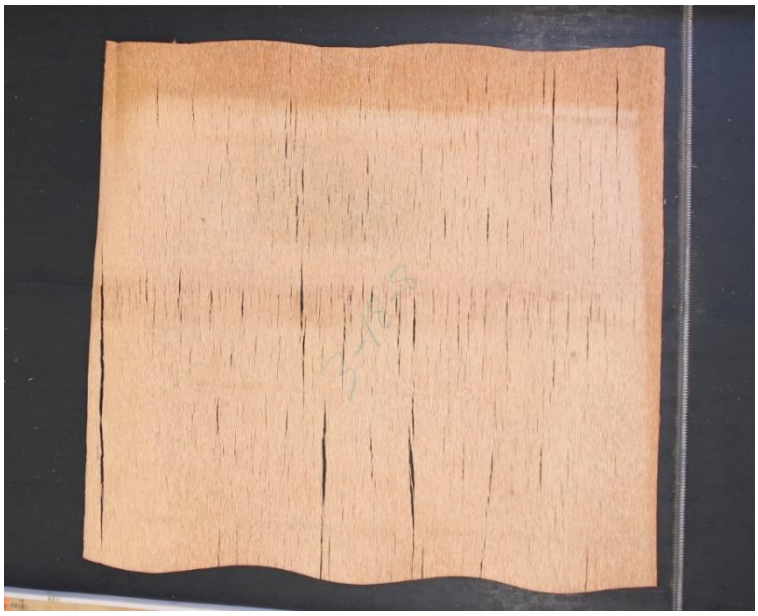
Brittleness

Brittleness in coconut veneer can hinder handling and reduce usability during manufacturing. Brittleness tends to increase with higher-density material; however, this is also the most favourable and highly sought after veneer. Proper log pre-conditioning and optimised lathe settings can help reduce this issue, and targeting slightly thicker veneers may also improve handling. Given its impact on processing and product quality, reducing brittleness should remain a key focus.

Defect	Grade A	Grade B	Grade C	Grade D
Brittleness	Slightly brittle	>Slightly brittle	Brittle	Very brittle

Collapse

Collapse in coconut veneer appears as surface fracturing or splitting caused by internal stresses during processing. Its impact depends on the final application. Proper log pre-conditioning and optimised lathe settings are key to reducing this defect and should be a focus of processing. For grading, collapse is not permitted in Grade A, minor collapse is allowed in Grade B, moderate levels in Grade C, and extensive collapse in Grade D, provided no single area exceeds 75 millimetres across the grain within any 300-millimetre section.



Defect	Grade A	Grade B	Grade C	Grade D
Collapse	Not allowed	Minor collapse	Some collapse	Extensive collapse ≤75 mm across grain

Decay

Decay occurrence is likely due to pre-existing defects in the standing palm or delays between harvest and processing. Because decay cannot be addressed during veneering, its prevention depends on effective palm selection, timely harvesting, and proper log storage. For grading purposes, decay is not permitted in Grades A, B and C. Grade D may include decay, but individual areas must not exceed 75 millimetres across the grain within any 300-millimetre section.

Defect	Grade A	Grade B	Grade C	Grade D
Decay	Not allowed			Not >75 mm across grain

Holes and tear-out

Holes and tear-out may result from factors such as decay, insufficient veneer thickness, or mechanical damage to the log. These defects are generally manageable through improved processing protocols and log quality control. For grading, Grade A and B veneers may contain holes or tear-out not exceeding 6 millimetres across the grain and a maximum area of 600 square millimetres. Grade C allows defects up to 50 millimetres across the grain, and Grade D up to 75 millimetres, with a maximum area of 1500 square millimetres. All measurements occur across the grain within any 300-millimetre section.

Defect	Grade A	Grade B	Grade C	Grade D
Holes and tear-out	Not >6 mm across grain	- Not >6 mm across grain - Max 600mm^2	Not >50 mm across grain	- Not >75 mm across grain - Max 1500mm^2

Compression

Compression in coconut veneer is identified by waviness or a lack of flatness, which, in severe cases, prevents proper pressing and weakens glue bonds during product manufacture. It may result from inherent wood characteristics such as wavy grain or from poor processing practices, including inadequate pre-conditioning or incorrect lathe settings. For grading, Grade A veneers must be flat, Grade B fairly flat, Grade C may be wavy, and Grade D allows severe compression where splits begin to overlap.

Defect	Grade A	Grade B	Grade C	Grade D
Compression	Flat	Fairly flat	Wavy	Splits might overlap

Handling splits

Handling splits are caused by mechanical damage during veneer movement and stacking, particularly between the clipper outfeed and veneer stacks. These splits should not create overlaps or gaps when the sheet is laid flat. For grading, Grade A permits up to two splits not exceeding 3 millimetres across the grain, 300 millimetres in length. Grade B allows splits up to 500 millimetres long. Grade C allows splits up to 9 millimetres wide and 600 millimetres long. Grade D allows full-sheet splits up to 5 millimetres wide, or partial splits up to 15 millimetres (half sheet) and 25 millimetres (one-third sheet) across the grain.

Defect	Grade A	Grade B	Grade C	Grade D
Handling splits	- Not >3 mm across grain - Max 300mm long - Max 2	- Not >3 mm across grain - Max 500mm long	- Not >9 mm across grain - Max 600mm long	- Not >5 mm across grain (full sheet) - Not >15 mm across grain ($\frac{1}{2}$ sheet) - Not >25 mm across grain ($\frac{1}{3}$ sheet)

Wane

Wane occurs when the veneer includes parts of the log's natural edge due to insufficient rounding before peeling. Managing this defect involves balancing veneer volume recovery against maintaining higher grade quality. Wane becomes more common with lower quality logs exhibiting sweep, taper, or ovality. For grading, wane is not allowed in Grade A, B or C. Grade D may contain wane not exceeding 75 millimetres across a 300-millimetre width.

Defect	Grade A	Grade B	Grade C	Grade D
Wane	Not allowed			Less than 75mm across 300mm

Insect track

Insect tracks are relatively uncommon but can occur, nonetheless, the effect of these tracks on veneer usability and value depends largely on the intended end product. For grading, Grade A veneers must be free of insect tracks. Grade B allows tracks without frass, Grade C permits tracks with frass, and Grade D accepts insect tracks up to 75 millimetres across the grain within any 300-millimetre section.

Defect	Grade A	Grade B	Grade C	Grade D
Insect track	Not allowed	Without frass	With frass	Not >75 mm across grain

Cumulative defect

Cumulative defects assess the total size of all defects within any 300-millimetre section across the grain, providing an overall measure of veneer quality. This evaluation helps capture the combined effect of multiple small defects that might individually be acceptable but collectively impact usability. For grading, Grade A veneers may have up to 20 millimetres of cumulative defects, Grade B between 20 and 45 millimetres, Grade C between 45 and 60 millimetres, and Grade D up to 75 millimetres across the grain.

Defect	Grade A	Grade B	Grade C	Grade D
Cumulative defect	Not >20mm across grain	>20-45mm across grain	>45-60mm across grain	>60-75mm across grain

4. References

Standards Australia/Standards New Zealand. (2012) *Plywood – Structural – Part 0: General requirements.* AS/NZS 2269.0:2012. Sydney/Wellington: Standards Australia/Standards New Zealand.

McGavin, R., Leggate, W., Bailleres, H., Hopewell, G. & Fitzgerald, C. (2019) *A guide to the rotary veneer processing of coconut palms.* Canberra: Australian Centre for International Agricultural Research.

Leggate, W., McGavin, R. & Bailleres, H. (2017) *A guide to manufacturing rotary veneer and products from small logs.* Canberra: Australian Centre for International Agricultural Research.