Timber grading in Sri Lanka

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Timber

Timber is a natural product when extracted for utility purpose it comes out in

1. Various lengths
2. Sizes
3. Form
4. Taper
5. Fluting
6. Defects (split, check, borer holes and fungi)

Defect in timber
• 1. Natural defect
• 2. Seasoning defects
• 3. Defect caused by fungi
• 4. Defects caused by insect
• 5. Felling defects
• 6. Defects in preparation or manufacture of logs.

Attachment:

Timber grading

• How much is a log worth?

Three main factors determine the value of a log
(i) Grade: quality of the log and the lumber
(ii) Scale: quantity of lumber within a log
(iii) Species.

Sale price of both logs and sawn timber, where grading is not done is based on classification of species and sizes only.
How log price varies with species and girth classes

<table>
<thead>
<tr>
<th>Teak log price (Rs/m3)</th>
<th>Hora log price (Rs/m3)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mid Girth classes (meter)</strong></td>
<td><strong>Rs: per m3</strong></td>
</tr>
<tr>
<td>1.50 above</td>
<td>88450.00</td>
</tr>
<tr>
<td>1.22 -1.48</td>
<td>62150.00</td>
</tr>
<tr>
<td>1.00 -1.20</td>
<td>43945.00</td>
</tr>
<tr>
<td>0.82 -0.98</td>
<td>31130.00</td>
</tr>
<tr>
<td>Below 0.8</td>
<td>18655.00</td>
</tr>
</tbody>
</table>

Prices paid for logs of different species and grade, all values are in rupees per cubic meters of 1m mid girth log in 2013

<table>
<thead>
<tr>
<th>Grade</th>
<th>Teak</th>
<th>Hora</th>
<th>Lunumidella</th>
</tr>
</thead>
<tbody>
<tr>
<td>High grade (prime: A/90)</td>
<td>65,620.00</td>
<td>22,572.00</td>
<td>6,555.00</td>
</tr>
<tr>
<td>Medium grade (B grade)</td>
<td>34,540.00</td>
<td>11,880.00</td>
<td>3,450.00</td>
</tr>
<tr>
<td>Low grade (C/50 grade)</td>
<td>17,270.00</td>
<td>5,940.00</td>
<td>1,725</td>
</tr>
</tbody>
</table>
Timber grading

- Classification for quality is known as grading in timber trade.
- There is a recognized set of standards needed to group logs and sawn timber into quality classes.
- Grading rules: inspection and assessment of anomalies with penalty points of log shape, defects, deterioration

System of grading

1. The Yield system
2. The Cutting System
3. The Defect System
4. Combination System
5. Stress Grading System.
1. The Yield system:

- Sound clear volume of a log as an indicator to determine the quality. (% of sound volume from the log volume).

Scaling deduction of 16 foot log with 20 inch scaling diameter

Defect section (rule 1):

- Percent deduction = \( \frac{4}{16} = 25\% \)

Defect section (rule 2):

- Percent deduction = \( \left( \frac{6}{16} \right) \left( \frac{60}{360} \right) = 6.14\% \)

Defect section (rule 3):

- Percent deduction = \( \frac{8 - 2}{20} = 30\% \)

Defect section (rule 4):

- Percent deduction = \( \frac{10}{20} \cdot \left( \frac{4}{16} \right) = 12.5\% \)

Defect section (rule 5):

- Percent deduction = \( \frac{(8 - 1) \cdot 4}{20 \cdot 1} = 5.29\% \)
2. The cutting system

- This system is applied for grading of sawn timber usually re-sawn to smaller sizes before use.
- The grade shall be determined from the worse face of the piece by determining the % of the total surface sound face cutting.

3. The Defect system

- Quantitative valuation of defects is done by using units of defects which is a quantitative representation of the approximate degrade of the utilizable material for each defect. See example in table.

<table>
<thead>
<tr>
<th>Standard defects</th>
<th>Equivalent units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Two sound knots of 2-6 cm diameter for every 2 m log length with interval between knots not less than 1.5m</td>
<td>2 units</td>
</tr>
<tr>
<td>2. One or two splits with a total length of upto 10% of the log length</td>
<td>1 unit</td>
</tr>
<tr>
<td>3. One or two bends with a total deviation over 20% upto 30% shortest log end diameter.</td>
<td>3 units</td>
</tr>
<tr>
<td>4. Radial shakes not reaching the longitudinal surface of the log more than 10% of the diameter and 5% of the length of the log but not more than 8% of the length of the log for one shake</td>
<td>1 unit</td>
</tr>
<tr>
<td>Total units</td>
<td>7 units.</td>
</tr>
</tbody>
</table>
Bend fraction = Deviation or deflection of bend/the shortest diameter of top end of log

<table>
<thead>
<tr>
<th>Bend Fraction Ratio</th>
<th>Defect Value in Percent</th>
<th>Defect Value in Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>One bend of 1/12</td>
<td>5 7</td>
<td>One unit</td>
</tr>
<tr>
<td>One bend of 1/10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One bend of 1/8</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>One bend of 1/6</td>
<td>12</td>
<td>Two unit</td>
</tr>
<tr>
<td>One bend of 1/5</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>One bend of 1/4</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Two bens or one of 1/3</td>
<td>23</td>
<td>Three unit</td>
</tr>
<tr>
<td>Two bens or one of 1/2</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>One or Two bend of over 1/2</td>
<td>Reject or re-buck log into two (2) standard length logs with reduced bend defects.</td>
<td></td>
</tr>
</tbody>
</table>

Figure 11.—Case 8, Crook.
4. Combination System

• Defect and cutting systems should be applied for grading of sawn timber

• Defect and Yield systems should be applied for grading of logs.

  Eg: Proposed STC grading System

5. Stress Grading System

  this system designed by engineering calculations for timber construction (Scantlings)

• Visual Stress Grading
  A piece will satisfy the requirements of the grade if the defects do not exceed limits specified.

• Machine Stress Grading
  A piece will satisfy the machine requirements if it has been passed through an approved grading machine and the whole piece has been classified as complying with the grade
• **Veneer log**: very high quality log with few if any visible defects. Color, growth rate and amount of sapwood versus heartwood.

• **Sawlog (factory log)**: that are sawn into lumber.

• **Other log classes**: that are sawn into pallet (appearance is not important)
Principles of timber grading

- Grade represent the size, quality, and quantity available for potential manufacture of specific end products (Lumber, veneer, or chip.)

Eg. STC prime teak saw log (SPS)

<table>
<thead>
<tr>
<th>Grading requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>Length 3m or above, mid girth 90cm or over</td>
</tr>
<tr>
<td>Quality</td>
<td>Fresh cut, cylindrical, well trimmed, bend (2 units), knots (2 units), Borer hole (2 units), checks/splits (1 unit), shakes is not allowed, surface defect is not applicable, center hole is confined to pith, Heart displacement is not applicable, etc.</td>
</tr>
<tr>
<td>Quantity</td>
<td>75% sound wood or over.</td>
</tr>
</tbody>
</table>
Grading Rules

Principle: Inspection and assessment of anomalies with penalty points. (1) Shape (2) Defects (3) Deteriorations (4) Maximum global penalties allowed.

3 different kings of rules

<table>
<thead>
<tr>
<th>Logs</th>
<th>Sawn timber for joinery</th>
<th>Sawn timber for structure</th>
</tr>
</thead>
</table>

Pictures:
- Logs shape
  - conicity
  - bend (curve)
  - buttress
  - flattened section
  - humps
Logs defects

knots  cupshakes  twisted grain
radial splits  twisted grain  galls

Log deterioration
Maximum number of penalties allowed in each grade for each type of defect for logs

<table>
<thead>
<tr>
<th>SHAPE</th>
<th>Grade</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conicity</td>
<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Bend (curve)</td>
<td></td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Flattened section</td>
<td></td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Butteness</td>
<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Humps</td>
<td></td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>DEFAULTS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knots and knobs</td>
<td></td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Inbarks, galls, blister grain, thorns, etc.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Splits, cracks, breaks</td>
<td></td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Cupshakes</td>
<td></td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Abnormal heart</td>
<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Spiral grain, entangled grain, etc.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>DETERIORATIONS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pin holes, discoloration</td>
<td></td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Grub holes, teredo holes</td>
<td></td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Heart decay</td>
<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Off the heart rot</td>
<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

MAXIMUM GLOBAL PENALTIES ALLOWED: 6 for logs up to 6 m

Grade reduction

- The process of visualizing and quantifying the portions of the log not suitable for the production of lumber (or other product), is known as grade reduction.
- In addition to grade reduction, application of the grading rules requires the scaler to assess the quality of the products that could be produced from the log. This requires an assessment of the size, frequency and distribution of knots, and an assessment of any visible spiral grain or twist of the log.
- These defect include firmwood defects such as rot, hole, char and missing wood and non-firmwood defects such as shake, checks, frost cracks, shatter, splits, forks, catface, deadside, lighting scar, bark seams, sweep and crook.)
Grade deduction

• The volume of the log not available for the manufacture of lumber or the other products is the grade reduction volume.

• In applying the grading rules, the scaler must deduct this volume from the gross log volume and express the remaining volume as a percentage of the gross volume. This percentage represents the percentage of the log that can be manufactured.

• \( \text{Gross Volume} - \text{Defect Volume} \times 100 = \% \text{ Suitable for Manufacture} \)

Gross Volume

Methods of determining scaling deduction

Lumber is a manufactured product derived from a log in a sawmill, or in a sawmill and planing mill, which when rough, shall have been sawed, edged and trimmed at least to the extent of showing saw marks or other marks made in the conversion of logs to lumber on the four longitudinal surfaces of each piece for its overall length, and which has not been further manufactured other than by cross-cutting, ripping, resawing, joining crosswise and/or endwise in a flat plane surfaced with or without end matching and working. (Source - the National Lumber Grades Authority)
Defect Deduction method

- 1. Squared defect method
- 2. Pie-cut method
- 3. Length-deduction method

Determining Grade Reduction for Collars (shells)

Examples of Logs with a Portion of the Collar Too Thin to Produce Lumber.

Examples of Logs with Entire Collar Too Thin to Produce Lumber.

Examples of Logs with Sufficient Collar to Produce Lumber.

- Defect less than 20% of the log diameter
- Collar meets minimum requirements (exceeds Interim)
Determining Grade Reduction for Sound Hearts (Residual cores)

<table>
<thead>
<tr>
<th>Sap Rot</th>
<th>Advanced Sap Rot</th>
<th>Residual Core is a Grade Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Diagram" /></td>
<td><img src="image2.png" alt="Diagram" /></td>
<td><img src="image3.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>

Determining of Trim Allowance

The Application of Trim Allowance Around Heart Rot and Hole.

Collar Too Thin to Cut Lumber

Application of Trim Allowance for Butt Rots

Ring Shake and Only the Core is Thick Enough to Produce Lumber.
Application of trim allowance to checks, shake and determining length for grading

Short Breakage Pieces Contained in a Conventional Load.

Examples of Short Logs Left After Bucking at the Scale Site and Deemed to be 2.5 m Long (Interior) and 5.2 m Long

Assessing Grade in Logs with Crook, Sweep and Pistol Grip

Visually Bucking a Log with Crook to Assess Lumber Recovery.

Visually Bucking a Log with Sweep to Assess Lumber Recovery.

Visually Bucking a Log with Pistol Grip to Assess Lumber Recovery.
Scaling deduction of 16 foot log with 20 inch scaling diameter

Defect section (rule 1):
Percent deduction = \( \frac{4}{16} \times 100 = 25\% \)

Defect section (rule 2):
Percent deduction = \( \frac{6}{16} \times 100 \approx 6.14\% \)

Defect section (rule 3):
Percent deduction = \( \frac{8 - 2}{20} \times 100 = 30\% \)

Defect section (rule 4):
Percent deduction = \( \frac{4}{16} \times 100 = 25\% \)

Defect section (rule 5):
Percent deduction = \( \left( \frac{8 - 2}{20 - 1} \right) \times 100 \approx 5.59\% \)

Percent deduction = \( \left( \frac{10}{20} \right) \times 100 = 50\% \)

Teak (Tectona grandis)

<table>
<thead>
<tr>
<th>Defect section</th>
<th>Super prime saw log</th>
<th>Prime saw log</th>
<th>Standard saw log</th>
<th>Economy saw log</th>
<th>Salvage log</th>
<th>Short log</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ( \text{E} ) (E1)</td>
<td>Log &amp; over</td>
<td>Log &amp; over</td>
<td>3% &amp; over</td>
<td>3% &amp; over</td>
<td>2% &amp; over</td>
<td>2% &amp; over</td>
</tr>
<tr>
<td>2. ( \text{E} ) (E2)</td>
<td>20.1 &amp; Over</td>
<td>20.1 &amp; Over</td>
<td>18 &amp; Over</td>
<td>18 &amp; Over</td>
<td>16 &amp; Over</td>
<td>16 &amp; Over</td>
</tr>
<tr>
<td>3. ( \text{E} ) (E3)</td>
<td>16 &amp; Over</td>
<td>16 &amp; Over</td>
<td>14 &amp; Over</td>
<td>14 &amp; Over</td>
<td>12 &amp; Over</td>
<td>12 &amp; Over</td>
</tr>
<tr>
<td>4. ( \text{E} ) (E4)</td>
<td>Log &amp; over</td>
<td>3% &amp; over</td>
<td>3% &amp; over</td>
<td>3% &amp; over</td>
<td>2% &amp; over</td>
<td>2% &amp; over</td>
</tr>
<tr>
<td>5. ( \text{E} ) (E5)</td>
<td>20.1 &amp; Over</td>
<td>18 &amp; Over</td>
<td>16 &amp; Over</td>
<td>16 &amp; Over</td>
<td>14 &amp; Over</td>
<td>14 &amp; Over</td>
</tr>
<tr>
<td>6. ( \text{E} ) (E6)</td>
<td>16 &amp; Over</td>
<td>14 &amp; Over</td>
<td>12 &amp; Over</td>
<td>12 &amp; Over</td>
<td>10 &amp; Over</td>
<td>10 &amp; Over</td>
</tr>
<tr>
<td>7. ( \text{E} ) (E7)</td>
<td>Log &amp; over</td>
<td>3% &amp; over</td>
<td>3% &amp; over</td>
<td>3% &amp; over</td>
<td>2% &amp; over</td>
<td>2% &amp; over</td>
</tr>
<tr>
<td>8. ( \text{E} ) (E8)</td>
<td>20.1 &amp; Over</td>
<td>18 &amp; Over</td>
<td>16 &amp; Over</td>
<td>16 &amp; Over</td>
<td>14 &amp; Over</td>
<td>14 &amp; Over</td>
</tr>
</tbody>
</table>

**ABBREVIATIONS:**
- \( \text{E} \) = Eddy (not applicable)
- \( \text{E} \) = Eddy (straight grained)

- **Others:**
  - 100% sound and over
  - 95% sound and over
  - 90% sound and over
  - 85% sound and over
  - 80% sound and over
  - 75% sound and over
  - 70% sound and over
  - 65% sound and over

- **Standard:**
  - Hardwood
  - Standard
  - Rough
  - Standard grade
  - Rough grade

- **ABBR:**
  - **E** = Eddy
  - **SE** = Straight Eddy
  - **R** = Rough
  - **GR** = Grade
  - **W** = Worthy
  - **SW** = Standard Worthy
  - **NW** = Not Worthy
  - **SW** = Standard Worthy
  - **NW** = Not Worthy