Automated Wood Measurement on Trucks
Logmeter Update

Christian Paccot – Woodtech, Chile
Agenda

- Woodtech
- The problem?
- How it Works?
- Results on Pulp Wood
- Results on Sawmil Wood
- Conclusions - Benefits
WOODTECH
Automatic Wood Measurement on Truck

More than 20 years
Many millions trucks already measured

MARKETS:

PULP WOOD and CHIP → LATINOAMERICA
SAWMILL WOOD → USA

OFFICES: CHILE, BRAZIL AND USA
More than 50 Logmeters Worldwide

- Brazil
- Chile
- Ecuador
- Germany
- Poland
- United States
- Argentina

Offices
- Chile - Santiago
- Brazil - Itapema, SC
- USA - Portland, OR
The Problem?

Which is the Value of Wood Truck Load at the Mill?
Typical Measurement Tool

To Measure the main raw material...
Typical Measurement

measured like this....
Or is measured like this....
Human Factor

- Need log inspection personnel
- Defect detection and log measurements based on scaler experience
- Several minutes to do it right (log count, average length and diameter, etc.)
- Accident risks
Could be measured like this….  

Weight SCALE
CONSEQUENCES…

- Measurement Cost
- Differences:
  - Forest Inventories ↔ Wood at the Mill
  - Wood received ↔ Wood Paid/Mill inventories (MATTs..)
  - Mill Conversion Factors
- Perverse incentives? H2O transport?
- Fraud Risks
- Quality Control: difficult to follow – Cinderella Effect
- Lack of information for Auditing
HOW TO MEASURE?

“The unit of quantity must be OBJECTIVE, REPRODUCIBLE, EASILY AND COST-EFFECTIVELY DETERMINED and FAIR to both the buyer and seller.”

1. **Objective**: Does not depend on human factors.
2. **Reproducible**: No variation with exogenous factors.
3. **Efficient**: Quick and low cost.
4. **Fair**: Equitable for both sides.
5. **Incentive**: Does not create perverse incentives.

- Measuring pulpwood quantity, Russell Morkel (1998)
Beginning of Automated Measurement
Logmeter 2000 – Image Analysis

- Pulp Wood
- Very successful for +20 years
TODAY
LOGMETER: 7 Lasers to ........
TODAY

LOGMETER: .... Up to 17 Lasers
HOW IT WORKS?

VIDEO
Logmeter in Pulp Wood
LOGMETER
Basic Outputs

- FRAME VOLUME
- SOLID VOLUME- MODELS
- BIOMETRIC CHARACTERISTICS
MONDI Poland – Pulpwood & Chips

**Deliverables:**

- Bundle Dimensions
- Log Length
- Frame Volume
MONDI Poland
VALIDATION BUNDLE – 2013

• 50 Times Standard Validation Bundle Measurement
  – Accuracy: 0.19% (Contract: 1.75%)
  – Repeatability: 0.54%

• Average Differences
  Ø Height: -0.1 cm
  Ø Width: -0.1 cm
  Ø Length: 0.0 cm
MONDI Poland
Standard Practice: one Log Length on each Bundle

Which Length you will measure ??
LOGMETER
Measures Length on each visible Log

MONDI Poland: 80 bundle measurements
  - 6 with length differences between 15 and 20 cm.
MONDI Poland
Standard Practice: one Height on each Bundle

Height always measured on the side
Which is the correct height of this load?

The correct measurement is the average height of the load = 1.95m

Operator's Measurement

Height overestimate: + 12.8%
Width Measurement ..... Always at bottom
Which is the **Width** of this Truck?

- ** OPERATOR’S MEASUREMENT **
  - Operator measures at the base of the load
  - Correct measurement
  - Average width of the load
    - 2.08 mt

MONDI Poland
Standard Practice: Some trucks Width from Database

TEST TRUCK PNT 5106  2x3

Width Differences

Data Base Value: 230 cm
Real Value : 228 to 212 cm
## MONDI Poland
### Overall Test Results

LOGMETER comparison with Precise Manual Measurements

### TRUCK 1

<table>
<thead>
<tr>
<th>ID</th>
<th>SV [MP]</th>
<th>Difference %</th>
</tr>
</thead>
<tbody>
<tr>
<td>18442</td>
<td>45.64</td>
<td>0.52%</td>
</tr>
<tr>
<td>18443</td>
<td>45.12</td>
<td>0.63%</td>
</tr>
<tr>
<td>18444</td>
<td>45.63</td>
<td>0.49%</td>
</tr>
<tr>
<td>18445</td>
<td>45.25</td>
<td>0.34%</td>
</tr>
<tr>
<td>18447</td>
<td>45.39</td>
<td>0.04%</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>45.41</strong></td>
<td><strong>0.40%</strong></td>
</tr>
</tbody>
</table>

### TRUCK 2

<table>
<thead>
<tr>
<th>ID</th>
<th>SV [MP]</th>
<th>Difference %</th>
</tr>
</thead>
<tbody>
<tr>
<td>18451</td>
<td>45.92</td>
<td>0.24%</td>
</tr>
<tr>
<td>18454</td>
<td>45.7</td>
<td>0.24%</td>
</tr>
<tr>
<td>18455</td>
<td>45.92</td>
<td>0.24%</td>
</tr>
<tr>
<td>18456</td>
<td>45.67</td>
<td>0.31%</td>
</tr>
<tr>
<td>18457</td>
<td>45.85</td>
<td>0.08%</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>45.81</strong></td>
<td><strong>0.22%</strong></td>
</tr>
</tbody>
</table>
Chipmeter in Pulp Chip
CHIP CONTAINER
Standard Measurement Process

MONDI Poland

- 1 or 2 height measurements
- Container size in database
- Volume calculation by difference
Load volume is calculated by the difference between the Empty container capacity and the “air volume”

\[ V_{Load} = V_{Empty} - V_{Air} \]
Empty Containers Measurement
Database Value:  36,2 M3
Precise Manual Measurement:  37,4 M3
Logmeter:  37,97 M3
Chipmeter®4000
Empty Container Measurement
Chipmeter®4000
Loaded Container
Chipmeter®4000
Loaded Container
Logmeter in the Lumber Industry
Logmeter for Sawmills

Radiata Pine, Arauco - Chile

Solid cubic volume

Log Couter Module
Logmeter for Sawmills

Logmeter provides:

Automatic detection of:

- Small tops
- Large butts
- Excessive sweep

Stem count
Cubic volume

Southern Yellow Pine, T.R. Miller - AL
Log detection and Measurement
Automatically detects Defective Logs

According to the client log specifications:

- Small tops
- Large butts
- Sweep/crook
- Unwanted length (e.g. logs < 33’)

[Images of logs and detection process]

[LOGO: WOODTECH MEASUREMENT SOLUTIONS]
Crook / Sweep
Trunk 1
Capture
Trunk 1

Detection
Trunk 1

Evaluation

NO DEFECT

16 feet

3.52 in
Trunk 2

Detection
Trunk 2
Evaluation

4.79 in
16 feet

DEFECT
Trunk 3
Detection
Automatic or Manual log count

Log Counter Module

Automatic piece count accuracy: 97%
Log Marker module

Operator selects defective logs on the picture and the Log Marker incorporates defects on data and report for weight deduction.

Defect detection is done before the logs are unloaded.
Log Quality Improvement

<table>
<thead>
<tr>
<th>2011</th>
<th>Big Log</th>
<th>Regular</th>
<th>CNS</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Defects/load</td>
<td>Logs on Spec</td>
<td>Defects/load</td>
<td>Logs on Spec</td>
</tr>
<tr>
<td>February</td>
<td>5.4</td>
<td>82%</td>
<td>3.0</td>
<td>92%</td>
</tr>
<tr>
<td>March</td>
<td>5.7</td>
<td>81%</td>
<td>3.1</td>
<td>91%</td>
</tr>
<tr>
<td>April</td>
<td>2.6</td>
<td>89%</td>
<td>1.7</td>
<td>94%</td>
</tr>
<tr>
<td>May</td>
<td>2.5</td>
<td>89%</td>
<td>2.2</td>
<td>93%</td>
</tr>
<tr>
<td>June</td>
<td>1.9</td>
<td>91%</td>
<td>1.6</td>
<td>95%</td>
</tr>
<tr>
<td>July</td>
<td>2.0</td>
<td>91%</td>
<td>1.8</td>
<td>94%</td>
</tr>
<tr>
<td>August</td>
<td>1.7</td>
<td>93%</td>
<td>1.7</td>
<td>95%</td>
</tr>
</tbody>
</table>
Logmeter capability to scale logs under Scribner rule

Scribner volume:
List of logs per load with:
- Small End Diameter
- Large End Diameter
- Length
- Scribner volume
- Cubic volume
Automatic Measurement

Some Impacts…

- Reduced Measurement Cost
- Reduced Truck Waiting Time
- Pay for what you get
- Minimum Inventories Differences
- Avoid Cinderella Effect /Human Factor
- No Perverse incentives
- Diminish Fraud Risks
- Information for Auditing

=> BUSINESS PROFITABILITY IMPACT
Some Automatic Measurement Impacts…

- The impact of scanning, measuring and auditing every single log load entering the mill and before it is unloaded is realized in the improvement of log size and quality enabling smoother running in the mill and resulting in increased efficiencies, recovery and profitability of the operation.
Logmeter®
Measure, Audit and Manage Wood on Truck

Wood Purchase
- Better relationship with suppliers
- Greater transparency – less human intervention
- Reduce truck waiting time & administrative time
- No dependency on conversion factors

Operation
- Production planning
- Log handling cost reduction and possibility of log damage, machinery breakdown and accidents.

Inventory
- Greater certainty about the inventory level
- Reduction in the risk of running out of stock
- Reduction in Safety Stock costs

Quality Control
- Better information about the quality of the wood received
- Better product received
- Greater efficiency
New installation
West Fraser Newberry, South Carolina
¡THANK YOU!

christian.paccot@woodtechms.com
mario.angel@woodtechms.com
Logmeter biometrics Accuracy

The latest tests comparing the performance of the Logmeter system versus manual measurements have been conducted to evaluate the Logmeter 6000. This system measures biometric variables and Scribner volume of Douglas fir saw logs.

Woodtech conducted a test of 12 loads containing 153 scanned logs with the following characteristics: Average SED: 11.38″, Average LED: 15.92″, and Average Length: 36.49′

The Logmeter measurements were compared to manual scaling (roll out). The differences between the two methods were:

**Small End Diameter (SED)**
Average difference: -0.18”
Standard Deviation of difference: 0.83”

**Large End Diameter (LED)**
Average difference: -0.32”
Standard Deviation of difference: 1.34”

**Length**
Average difference: -0.14′
Standard Deviation of difference: 0.28′

Also it is important to mention that these results are for individual log measurements (Logmeter versus scaler) of those logs where the Logmeter was able to scan a good portion of the log. Since the Logmeter measurement models are based on statistical analysis the difference of all measurements (diameter and length) for all logs (external, partially hidden and completely hidden logs in a load) tend to zero when a large number of logs and loads are considered for evaluation permitting the Logmeter to be utilized as a tool for log purchasing.
Logmeter Piece Count Accuracy

**Number of logs per load**

Woodtech conducted a test to evaluate the performance of the Logmeter log count model compared to manual count (completed by a scaler) using roll out scaling. The sample size of this test was 530 loads. The results were as follow:

*Average difference: -1.1 logs*

*Standard Deviation of difference: 5.6 logs*
What are the latest developments?
Logmeter Performance

Logmeter performance was tested using similar approach as check scaling where 100 groups of 12 log loads (50 MBF) were measured by the Logmeter and scalers (using rollout) to compare Scribner volume measurements.
Scribner Volume Accuracy

Percentage of events below Scribner difference percentage

Using 12 log load sample tests to compare Logmeter vs. rollout scaling measurements
Logmeter biometrics Accuracy

The latest tests comparing the performance of the Logmeter system versus manual measurements have been conducted to evaluate the Logmeter 6000. This system measures biometric variables and Scribner volume of Douglas fir saw logs.

Woodtech conducted a test of 12 loads containing 153 scanned logs with the following characteristics: Average SED: 11.38”, Average LED: 15.92”, and Average Length: 36.49’

The Logmeter measurements were compared to manual scaling (roll out). The differences between the two methods were:

**Small End Diameter (SED)**
- Average difference: -0.18”
- Standard Deviation of difference: 0.83”

**Large End Diameter (LED)**
- Average difference: -0.32”
- Standard Deviation of difference: 1.34”

**Length**
- Average difference: -0.14’
- Standard Deviation of difference: 0.28’

Also it is important to mention that these results are for individual log measurements (Logmeter versus scaler) of those logs where the Logmeter was able to scan a good portion of the log. Since the Logmeter measurement models are based on statistical analysis the difference of all measurements (diameter and length) for all logs (external, partially hidden and completely hidden logs in a load) tend to zero when a large number of logs and loads are considered for evaluation permitting the Logmeter to be utilized as a tool for log purchasing.
Logmeter Piece Count Accuracy

Number of logs per load

Woodtech conducted a test to evaluate the performance of the Logmeter log count model compared to manual count (completed by a scaler) using roll out scaling. The sample size of this test was 530 loads. The results were as follow:

Average difference: -1.1 logs

Standard Deviation of difference: 5.6 logs
What is Woodtech’s contribution to the forestry industry?
Developing an unbiased system that operates 24/7

- In a couple of minutes, the Logmeter automatically provides stem count and measures volume of each load saving scaling time and costs (labor, space, machinery, etc.) and all risks associated to scaling (fiber damage and accidents)
Enhancing log procurement

- Forest product companies, due to the Logmeter, have incorporated technology to audit and measure every log load providing key information to purchase and manage the highest cost resource.
Helping forest products companies to improve profitability

• The impact of scanning, measuring and auditing every single log load entering the mill and before it is unloaded is realized in the improvement of log size and quality enabling smoother running in the mill and resulting in increased efficiencies, recovery and profitability of the operation.