Managing Wood Quality Variation: Is Segregation the Solution?

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Definitions of Quality

The characteristics of a product or service that bear on its ability to satisfy stated or implied needs.

American Society for Quality

Quality in a product or service is not what the supplier puts in. It is what the customer gets out and is willing to pay for.

Peter Drucker
Why Segregate?

Segregation will lead to a greater financial net benefit for the party segregating the product than if it did not do so – the benefits outweigh the costs.

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Segregate</td>
<td>Don’t Segregate</td>
</tr>
</tbody>
</table>

Roseburg Forest Products

LVL, engineered wood, plywood, composite panels, decorative laminate, lumber (structural and appearance), chip, wood fuel pellets, landscape timbers.

Sources logs from its own forest plus buys stumpage and logs from other suppliers.
Why Segregate?

Variability between Washington Douglas Fir sites

Dryer Grade Veneer Results

Volume Recovery

7 Stands, 1400 stems, > 3000 logs
Why Segregate?

Variability between Oregon Douglas Fir sites

![Graph showing Veneer Recovery % for different sites](image)

**Veneer Recovery**

![Graph showing G1/G2 Veneer Recovery vs Acoustic Velocity](image)

G1G2% = 48.9V - 143.3

$R^2 = 0.91$
Return to Log Values

$/MBF = 327.17x - 188.42$

$R^2 = 0.62$

Return to Log Value vs Acoustic Velocity

Dynamic MOE = f(density*velocity²)

Logs sorted based on velocity
In-line acoustic segregation

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Log segregation within stands can provide significant financial benefits.

Segregation power is improved by using an index based on TOF acoustic velocity and stem parameters.

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Waratah 624 log-making on roadside trial site
- Single threshold study in 55 year old Douglas fir stands
- Logs measured with PH330 and HM200 on site
- Results showed that a stand with average log velocity 3.72 km/sec could be upgraded by selecting the higher stiffness logs

<table>
<thead>
<tr>
<th>Selected</th>
<th>Equivalent to ‘Camp run’ with mean V</th>
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</thead>
<tbody>
<tr>
<td>80%</td>
<td>3.78 km/sec</td>
</tr>
<tr>
<td>50%</td>
<td>3.84 km/sec</td>
</tr>
<tr>
<td>30%</td>
<td>3.90 km/sec</td>
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</tbody>
</table>

~$11/m³
Segregate Where?

- In forest
  - At stump
  - On landings
- At super skids
- At central processing yard
- At mill

Segregate When?

- Prior to harvest
- During harvest
- After harvest
- After delivery

Timing has implications for cost and market flexibility.
Who Segregates?

- Seller
- Buyer
- Seller or buyer’s agent

Segregate What?

- Length
- Diameter
- Stiffness
- Stability
- Compression wood
- Spiral grain
- Propensity to check

- Sweep
- Knot size and location
- Resin pockets
- Density
- Juvenile wood content
- Ring width

*Focus on actual performance properties*
Segregate How?

Diameter over bark  Length

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Segregate How?

Knot Size

Branch size aids

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Segregate How?

- Whorl location detected by laser scanning
- Knots detected from scanning of digital images

3D Sweep

- Why DBH and height are not good enough metrics for some stands!
Terrestrial laser scanning

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Return to Log Values

Value based on lumber plus chip sales minus mill costs.

Sweep reduced value by 10 to 30%

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Segregate How?

Finnish Forestrix Project tested GPS, IMU, and 2D and 3D laser sensors for determining where “harvester” and trees are, tree size and tree form.

Also provide some measures of tree quality?

Real-time sorting with NIR

AccuHarvest

On-Combine Grain Analyzer

Protein, Moisture and Oil Analysis WHILE You Harvest

For Analysis
...Where you need it most
...When you need it most™

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NIR Principle

Density measurement with NIR

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Chips are internal wood sample!

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Segregate How?

Acoustic velocity and MOE are indicators of STABILITY
— strong correlations with microfibril angle, longitudinal shrinkage, and distortion

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Segregate How?

- Internal
  - heart wood / sapwood
  - internal pruned knot whorls (internal checks?)
  - stiffness and strength
  - density
  - moisture content
  - stability
  - resin blemishes
  - propensity to check

Radar, CT log scanners
NIR, Acoustics
Visual (external)

Staying Segregated

Tracking logs through the supply chain

Radio Frequency ID tags

Source: Korten & Kaul 2008
Staying Segregated

Concluding Comments

- Segregation will occur when the financial benefits outweigh the costs.
- When, where, and who segregates stems and logs will affect what is segregated and how segregation occurs.
- What qualities need to be segregated is likely to be customer dependent.
- New sensor technologies are providing a range of new tools for determining how segregation is done.
- The earlier in the supply chain segregation is carried out the greater is the need for standardised tools and procedures – one or a few tools will have to do it all.
- Significant research is required to answer these who, what, why, when, where and how questions.