Using Sawing Simulation for a Successful Optimisation Project

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Introduction: Some Keys to a Successful Optimisation Project
Project Planning: 
It’s Not Just the Optimiser

• Given traditional Aus/NZ sawing practices, applying modern optimisation systems may involve more than just adding an optimiser – may mean a significant change to sawing practices

• Particularly for changes to primary breakdown & gang

• Choosing correct equipment – for your mill, log supply, and product mix is essential
Getting the Project Approved

- Implementing this kind of technology will likely be a substantial investment
- All your planning will be for naught if the project isn’t approved!
- A credible case must be made to justify the project
Ensuring System Performance

- These technologies are not simple
- “Bugs”, or configuration (parameter) errors are possible
- It’s not always possible to “see” solution errors
- Appropriate performance testing is a must, both for system acceptance and ongoing QC
Where does Simulation Fit within an Optimisation Project?
Types of Projects: When to Use Simulation (and When Not To)

Greenmill sawing functions that may be optimised:
- Primary log breakdown
- Cant breakdown, including curve-sawing gangs
- Board edging
- Docking

Of these, simulation is *not* particularly effective for board edging and docking projects.
Board Edger and Docker Projects

Traditional template testing may be used for:

• Project justification
• Performance testing, including acceptance tests
Primary Log and Cant Breakdown

- Simulation is most effective for these projects
- One simple reason: You can’t “template” a log… or a cant
  Only way to determine uplifts is to “saw” the same logs or cants with both the current and proposed equipment
  Only way to do that is with simulation
Primary Log and Cant Breakdown

• Also, changes to the mill operation (sawing patterns, mill flow) is likely to be more substantial

⇒ A comprehensive analysis – encompassing the overall mill operation – is required
Benefits of Optimisation Modeling in Project Planning

1. Ensuring correct mill design and equipment decisions
2. Accurate return-on-investment calculations
3. Better understanding of system requirements for your application
4. Getting the project approved!
Ensuring Correct Mill Design and Equipment Decisions

- e.g. Determine recovery differences for different primary log breakdown systems
  ⇒ Informed equipment decision, recognizing trade-offs between complexity and yield
- Develop detailed data on mill flow (machine piece counts), considering different log supply and production options
  ⇒ A mill design capable of producing the required production mix and volume
Better Understanding of System Requirements for *Your* Application

- Through modeling, a clear understanding is developed of the equipment requirements, both for piece counts and sawing patterns
- Assists with specifying equipment requirements – particularly when North American equipment is to be applied to Aus/NZ application
Getting the Project Approved!

- For corporate boards and lenders, a sawing simulation study provides evidence of “due diligence”
- More weight if done by independent and recognized 3rd party
- Many company policies require an independent simulation study for any significant capital project
The Simulation Study Method
The Simulation Study Method

- Sawmilling is a complicated process
- While benefits from optimisation are indeed significant, they are not huge on a percentage basis

⇒ To develop valid results that may be acted on with confidence, a well-structured analysis method must be used
The “Base Case” Model

- It is *never* valid to compare simulated future results with actual current mill results! It will never be a valid “apples-to-apples” comparison
- Instead, future results must be compared to a calibrated model of the current mill
- A good simulation model must include allowances for imperfections in the mill process
- The “Base Case” model is calibrated against a combination of mill test and historical results
The “Base Case” Model

- Generally, development of the Base Case is the most time-consuming part of a simulation study.
The Study Log Mix

- Best to base on historical log data
- Usually best to use a full year’s log supply data, to recognize typical seasonal variations
The Study Log Sample

- For studies of the benefits of optimisation, study must be based on “true-shape” log form, not “computer logs”
- A good simulation program will support log scan data from various optimisation vendors
- But if the mill doesn’t already have a log scanner – what then?
The Study Log Sample

Possible sources of log scan data:
- Logyard scanners
- A scanner at a company sister mill
Log: 206/1
Pattern: 140x45bA
Dia= 318  Len= 3.85
Tap= 20.7  Swe= 52
Hor= 0  Ver= 0
Val= 84.38  Rec= 0.476
The Study Log Sample

Scanner data is *not* “free data”!

- It must be checked, to discard any bad data
- Data must be from a system with an appropriate scan conveyor; do not use data scanned on a belt or flat chain
What if no scan data is available?

- Manual log measurement techniques are available
What if no scan data is available?

- Manual log measurement techniques are available
- Labour intensive, but good form data is developed
The Log Sample Size

- Required sample size will depend on the characteristics of the log supply: species / diameter range, and qualities
- Typically between 200 and 500 logs
- “Weighting Factors” are applied to the sample, to weight to the historical mill diet and total log count
Analysis of Alternative Scenarios

- After the Base Case, often straightforward
- Generally speaking, change only one thing at a time
e.g. For analysis of a primary breakdown, with
  - Optimised pattern side-shifting
  - Optimised log alignment (skew) angle
  - Sideboard thickness optimisation

Simulations should add each of these features cumulatively
Analysis Results

- Analysis results should be presented as numerical results, plus example log plots.
- Numerical results alone should never be presented – don’t believe anything from a computer that you can’t verify!
- Review of example log plots is also essential to gain a better understanding of the “how’s and why’s” behind the overall results.
Key Results of SAWSIM ® Analysis for Mill X

Analysis of Primary Sawline Upgrade Alternatives

- **Line Type:**
- **Kerf:**
- **Curve Sawing:**
- **Optimized Cant Offsetting:**
- **Rotation:**

<table>
<thead>
<tr>
<th>Logs</th>
<th>Sawlog 3</th>
<th>Sawlog 4</th>
<th>Sawlog 5</th>
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<tbody>
<tr>
<td>Sawlog Volume (Cubic Meters)</td>
<td>1,000</td>
<td>1,000</td>
<td>1,000</td>
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<tr>
<td>Total Length (m)</td>
<td>19,713</td>
<td>19,713</td>
<td>19,713</td>
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<tr>
<td>Avg. Top Dia. (cm)</td>
<td>21.77</td>
<td>21.77</td>
<td>21.77</td>
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<tr>
<td>Avg. Length (m)</td>
<td>5.73</td>
<td>5.73</td>
<td>5.73</td>
</tr>
<tr>
<td>Avg. Sweep (cm)</td>
<td>3.54</td>
<td>3.54</td>
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Lumber:

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<tr>
<th>Lumber size</th>
<th>m³</th>
<th>%</th>
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<tbody>
<tr>
<td>16x76</td>
<td>0.0</td>
<td>0.0%</td>
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<tr>
<td>25x76</td>
<td>29.1</td>
<td>5.8%</td>
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<tr>
<td>25x114</td>
<td>58.6</td>
<td>11.6%</td>
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<tr>
<td>25x152</td>
<td>24.9</td>
<td>4.9%</td>
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<tr>
<td>25x228</td>
<td>2.2</td>
<td>0.4%</td>
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<tr>
<td>38x76</td>
<td>10.1</td>
<td>2.0%</td>
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<tr>
<td>38x114</td>
<td>168.4</td>
<td>33.5%</td>
</tr>
<tr>
<td>38x152</td>
<td>86.9</td>
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<tr>
<td>38x228</td>
<td>40.0</td>
<td>8.0%</td>
</tr>
<tr>
<td>50x152</td>
<td>74.6</td>
<td>14.8%</td>
</tr>
<tr>
<td>50x228</td>
<td>8.6</td>
<td>1.7%</td>
</tr>
</tbody>
</table>

Total (m³) 503.2 100% 543.8 100% 559.3 100%

Yield (%) 50.3% 54.4% 55.9%

% Change Base 8.1% 11.1%

Chips (Green tonne) 327.75 329.01 307.32
Chip Recovery (Green tonne / m³) 0.328 0.329 0.307
% Change Base 0.39% -6.23%

Revenues:

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<th>Lumber</th>
<th>Chips</th>
<th>Total</th>
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<tr>
<td></td>
<td>231,928</td>
<td>6,527</td>
<td>238,455</td>
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<tr>
<td></td>
<td>251,283</td>
<td>6,553</td>
<td>257,835</td>
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<tr>
<td></td>
<td>260,657</td>
<td>6,121</td>
<td>266,778</td>
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Value Recovery ($ / m³) 238.46 257.84 266.78
% Change Base 8.13% 11.88%

Machine Passes:

<table>
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<tr>
<th></th>
<th>Frame Saw / Band Saw - Log</th>
<th>Frame Saw / Band Saw - Cant</th>
<th>Edger - Sideboards</th>
<th>Edger - Cant boards</th>
<th>Edger - Total</th>
<th>Trimmer</th>
<th>Sorter</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>3,530 Base 3,624 2.7%</td>
<td>3,443 Base 5,844 69.7%</td>
<td>7,158 Base 9,026 26.1%</td>
<td>5,014 Base 7,726 54.1%</td>
<td>12,172 Base 16,752 37.6%</td>
<td>15,892 Base 19,178 20.7%</td>
<td>27,779 Base 32,242 16.1%</td>
</tr>
</tbody>
</table>

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Verifying Optimiser Performance Using Sawing Simulation
Verifying Optimiser Performance

- Appropriate acceptance tests must be incorporated in any optimisation project
- In addition to piece rates and sawing accuracy, the correctness of optimisation solutions must be confirmed
- For board edging and docking, use template testing
- But for logs and cants? You can’t template a log, or a cant…
- It’s not always possible to “see” solution errors
Verifying Optimiser Performance

- One solution: Use a recognized sawing simulation program as the “standard" against which the optimiser’s solutions can be compared
- Care must be taken to specify the test procedure and acceptance criteria; it is not enough to just say “the optimiser must recover X% of SAWSIM®”
Verifying Optimiser Performance

A 2-step acceptance test procedure:

- Step 1: “SAWSIM®-Duplicates” run
  Reproduce the optimiser’s solutions in SAWSIM®
  Confirms optimiser’s piece yield projections for a given solution
Verifying Optimiser Performance

A 2-step acceptance test procedure:

- Step 2: “SAWSIM®-Optimum” run
  Define to SAWSIM® same solution constraints considered by the optimiser
  Allow SAWSIM® to determine an optimum solution
Verifying Optimiser Performance

Acceptance criteria:

Value of "SAWSIM®–Duplicates" run must be X% of the "SAWSIM®–Optimum" run

Appropriate value for X depends primarily on log size; higher value is appropriate for larger logs
Benefits of Acceptance Test Analysis

- Thorough, 3rd-party review of optimiser setup parameters; inevitably find errors or possible refinement
- Any optimiser “bugs” are identified and corrected
- Mill personnel end up with a better understanding of their system
Verifying Optimiser Performance

A well-calculated optimisation solution is for naught if the mechanical systems are imprecise.

In addition to solution correctness, for log and cant systems it is important to conduct tests of the mechanical implementation of optimiser solutions: are the faces projected by the optimiser being accurately placed in the log?
Additional Sawing Simulation Applications
Additional Sawing Simulation Applications

- Many other applications within mill operations planning and optimisation
- For many Aus/NZ applications, as part of a production planning (cut plan optimisation) system: determine the optimum sawing pattern mix for each log sort, to produce a req’d production mix in the most profitable way
Discussion / Questions

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