Two thirds of Sawing Problems are Caused by Misalignment, Not Saw Preparation

Or rather ..... “Most solutions to sawing problems are found in areas other than Saw Preparation and Misalignment is a good place to start looking”.

INTRODUCTION

Most in the timber processing industry understand how alignment in a sawmill has a big bearing on production quality as well as plant reliability and availability.

The statement Two thirds of Sawing Problems are Caused by Misalignment, Not Saw Preparation is designed to get your attention, and will not to be proved or disproved in the content of this presentation.

Rather than review the how-to of alignment in a sawmill (which will be covered in workshops), we will examine a real life example that involves solving more than one problem in a single fault-finding exercise.

The team combined experience, common sense, observation and analysis with reliable measuring techniques to produce solutions.

From what we have seen, this is a fairly typical example of problems occurring and being solved daily in mills around the world. It is probably more appropriate to declare

"Most solutions to sawing problems will be found in areas other than Saw Preparation, and Misalignment is a good place to start looking".
Alignment case history: Quad Band Mill

The product must be of consistent size with negligible wedge because it goes into another production process that requires parallel board approximately 16mm wide.

Problems:

1. Band saw blades had been cracking.
2. Board size is regularly outside tolerance.

Alignment Case History: Quad Band Mill

Presented in this paper is a situation that recently occurred in the Primary Breakdown area of a sawmill. The mill is fairly new and is still being tuned for optimum performance. The viewpoint is that of the alignment specialist who was called in to be part of a problem solving team. The example illustrates progression through typical stages of problem solving in a sawmill environment.

The product must have consistent size with negligible wedge because it goes into another production process that requires parallel board approximately 16mm wide.

Problems;

All four Quad Bandsaw blades had been cracking, board size is regularly outside tolerance and boards exhibit wedge.
Alignment case history: Quad Band Mill

Simple plan of attack (that worked):

1. Have a clear understanding of the mechanics of the process.
2. Review recent history.
3. Based on above information, focus in most likely areas.
4. Measure all associated items before changing anything.

The plan of attack that worked was also common sense:

- It is important to have a clear understanding of the mechanics of the process in the area where the problems occur. Often the alignment technician is an outsider, relatively new to the plant. To be at his most useful, he needs to understand every facet of the machining process. As well as bringing specialist skills, his fresh viewpoint might be the greatest asset to a team that is experiencing tunnel vision.

- By reviewing recent history of the area, find out whether an event or action occurred that might have triggered the problems. Was there a setworks software change or a jam up or component failure or a maintenance activity that could possibly be associated with the problem?

- Based on 1 and 2 above, target the areas and items to be measured decide how they should be measured and precisely where. A complete alignment survey is not necessary if specific areas can be isolated.

- Measure all associated items before changing anything. Complete information could indicate that accumulated misalignments are the cause, on the other hand one rogue element might be to blame.
Understanding the process:

Product = optimised for side board thickness 16mm. Two passes are made thru the primary area.

Plan view of the Primary Breakdown Area

Understanding the process

The Layout of Primary Breakdown;

This is a standard quad bandsaw layout with a couple of unusual features.

Each bandsaw wheel is mounted on the downstream side of the carriage.

Two passes are made through the bandsaw for every log.

A sharp chain transports the log into the log area and also carries the cant out of the breakdown area.

Chipper heads are followed by long guide anvils.
Alignment case history: Quad Band Mill

Understanding the process:
First pass = one face chipped + 2 x 16mm wingboards are cut each side
The cant is then withdrawn by reversing the sharp chain in preparation for
for a second pass. Double pass is 20 – 30% of daily cut.

The First Pass:
Nothing is particularly special here to begin with.
The log is chipped then the cant is controlled by guide anvils as it
passes through the quad saws.
Four boards approximately 16mm thick are produced.
At the end of this pass, however, the chipper heads are retracted, the
direction of shart chain travel reversed and the centre cant is pulled
back to the infeed in preparation for a second pass.
Alignment case history: Quad Band Mill

Understanding the process:
The cant is presented for a second pass ….
Guide anvils are hydraulically brought inside the line of the chipper heads to control the product during the cut
Chipper heads are clear of the product
2 x wingboards are cut each side

The Second Pass:
For this pass, the chipper heads are not required to cut.
The guide anvils are extended inboard of the chipper to keep the cant clear of the knives and to provide control during the second pass through the quad saws.
Four more boards approximately 16mm thick are produced.
The centre board moves on to the next machining centre.
Alignment case history: Quad Band Mill

Review the recent history

Was there any event or action taken immediately prior to the problems occurring?

- All four band wheels had recently been ground
- Worn sliding pads under all four bandsaw carriages had been replaced with new items.

Armed with an understanding of the process, the next task is ....

**Review the recent history**

Was there any event or action taken immediately prior to the problems occurring?

a) All four band wheels had recently been ground in an effort to alleviate the blade cracking problem. At the time that alignment was to be checked, it was not known whether the grind had completely solved blade cracking.

b) Worn sliding pads under all four bandsaw carriages had been replaced with new items.
Alignment case history: Quad Band Mill

First point of focus: Bandwheels

The figures show measured lead of the bottom wheel lead in mm over the diameter of the wheel (1800mm).

First impression was that extreme band wheel misalignment had occurred..... but why?

What is the cause of wheel no 4 being so badly misaligned?

Focus on the Bandsaw Wheels

It was decided to measure the alignment of the band wheels with respect to the sharp chain centreline using a precision theodolite.

Measurement a few weeks earlier had indicated No.4 wheel was misaligned by 4.0mm over the wheel diameter. This was not remedied at the time as the carriage sliding pads were worn and needed replacing, so it was left for the next maintenance opportunity.

The new alignment figures show measured lead (toe-in or toe-out) of the bottom wheel in mm over the 1800mm diameter of the wheel.

First impression was that extreme band wheel misalignment had occurred..... but why?

What is the cause of wheel no 4 being so badly misaligned?
For sizing and saw changes each bandsaw carriage is traversed by a hydraulic ram.
For saw changes, No’s 3 and 4 carriages are traversed clear of the leading wheels.

Putting the process and history together
The Layout of Primary Breakdown;
This is a standard quad bandsaw layout with a couple of unusual features.
Alignment case history: Quad Band Mill

Piecing the process and recent history together

- Carriage movement is kept straight during traverse by sliding pads.
- All sliding pads had been replaced, top and side pads.
- The C-section bracket which carries side sliding pads was removed to fit the new pads to it.
- A specific clearance value between the side pad and guide is specified and was applied.

Putting the process and recent history together

Lateral carriage movement for sizing is kept straight during traverse by the side mounted sliding pads at each corner of the carriage. Normally a v-rail is designed in for this purpose.

All sliding pads had been replaced including top and side pads.

The C-section bracket which carries side sliding pads was removed in order to fit the new pads to it.

A specific clearance value between the side pad and guide is specified.
Alignment case history: Quad Band Mill

The recent pad change was reviewed in detail:

- Replacement of the sliding pads was carried out with the hydraulic ram extended.
- The two C-section brackets were removed, new pads fitted and replaced with specified pad to rail clearance.
- When the ram was retracted, the carriage jammed during traverse.
- Clearance between pads and rails was then increased.

The recent pad change was reviewed in detail for clarification:

Replacement of the sliding pads was carried out with the hydraulic ram extended. Each carriage was lifted at that position.

The two C-section brackets were removed, new pads fitted to it and then the C-section bracket bolted back in place, and side clearance between pad and guide carefully set with feeler gauge.

Unfortunately the brackets had not been designed with any locating feature such as keys or dowels to ensure it went back in exactly the same place.

When the ram was retracted, the carriage jammed during traverse. The cause was thought to be due to worn slideways in the working zone.

Clearance between pads and guides was increased well beyond the allowable tolerance just to allow the carriage to traverse.
Alignment case history: Quad Band Mill

Observations during alignment checks

- A gap was seen to open between side pad and guide of No 4 carriage when the ram operated from fully extended to fully contracted.
- This indicated that carriage lateral movement was not being controlled.
- The ram spar connection had side load applied during traverse.

Observations by the team during alignment checks

A suspicious looking gap was seen to open between side pad and rail of No 4 carriage when the ram operated from fully extended to fully contracted.

This indicated that the carriage lateral movement was not being properly controlled. This was therefore the most probable cause of severe bandwheel misalignment and corresponding size variations.

The ram spar connection had side load applied during traverse. The connection to the carriage body was offset to the centerline of spar travel due to carriage twist. This is undoubtedly the cause of the carriage jamming when the ram was retracted immediately after pad refit.
Alignment case history: Quad Band Mill

Solution:
Align;

1. The carriage with respect to the C brackets and provide a locating mechanism for future maintenance work.
2. The bandwheel with respect to the sharp chain to achieve acceptable lead.
3. The offset of the carriage guide pads (and thereby the carriage) with respect to hydraulic ram stroke to ensure the spar is not loaded at any position.

This was subsequently sorted.

Solution:
Align;

- The carriage with respect to the C brackets and provide a locating mechanism for future maintenance work.
- The bandwheel with respect to the sharp chain to achieve acceptable lead.
- The offset of the carriage guide pads (and thereby the carriage) with respect to hydraulic ram stroke to ensure the spar is not loaded at any position.

This was subsequently sorted.
Finding the cause of Wingboard Wedge

Although great strides forward had been made with the bandsaw wheels, the problem of wingboard wedge still remained.

Nothing in the recent history provided a clue to where to look first, so specific items were measured for alignment ….
Finding the cause Wingboard Wedge

Check Bandsaw Inclination

After having re aligned the lead of each bandwheel, saw blade inclination between saw guides was measured with respect to the vertical plane using a high accuracy electronic inclinometer.

Inclination has the potential to cause wedge.

The figures show measured camber in mm per metre.

While the as-found condition was not ideal, the cause of significant wedge is still a mystery.
Alignment case history: Quad Band Mill

Chipper and Guide Anvils

**Finding the cause Wingboard Wedge**

**Check Chipper and Guide Anvil alignment**

Chipper camber and lead were checked along with anvil guide plates alignment to ensure they were not contributing to the problem somehow.

The instrument used was a precision theodolite.

The existing alignment of these items proved to be out of tolerance but in isolation was not the likely cause of wedge in the cut.
Alignment case history: Quad Band Mill

Finding the of cause Wingboard Wedge

Check Bandsaw blade lead

Bandsaw blade lead (adjacent to saw guides) was then measured with respect to the sharp chain centreline using a precision theodolite.

The figures show measured bottom wheel lead in mm over the width of the saw blade (175mm). It is evident that the bandsaws were now probably not causing trouble.
Alignment case history: Quad Band Mill

Breakthrough realisation (by the alignment technician) .... When Anvil Guides are extended
LHS dimension A must be = RHS dimension B (+/-0.25mm)

Finding the of cause Wingboard Wedge

Then came a breakthrough realisation…
(And the answer did not lie in rocket science)

An important relationship that was not fully understood was that between the anvil guides and the sharp chain centreline during the second pass.

The requirement is that LHS dimension A must be = RHS dimension B (+/-0.25mm) when the anvil plates are extended.
**Alignment case history: Quad Band Mill**

Check the offset of each Anvil Plate in the extended position

**ANVIL EXTENSION:**
- **As Found**  
  LHS = 11.4 mm  
  RHS = 13.3 mm
- **FINAL**  
  LHS = 10.0 mm  
  RHS = 10.0 mm

The cant tilts on the sharp chain when pushed by the unevenly centred anvil plates.
The wingboards are produced with wedge.

---

**Finding the of cause Wingboard Wedge**

Check the offset of each Anvil Plate in the extended position
The offsets for a “second pass” cut were measured with a theodolite.
The LHS dimension in this case was 1.8mm smaller than the RHS when first measured.
The cant tilts on the sharp chain when pushed by the unevenly centred anvil plates.
The wingboards are produced with wedge.
Conclusions;

- The problem of band saw blades cracking was largely due to band wheels requiring a regrind. The root cause was poorly maintained grinders.
- The variable sizing problem was caused by each bandsaw carriage being largely unconstrained at the sides while in the working zone.
- Subsequent to fitting new sliding pads, when the ram was fully retracted (e.g. for saw changes), side load was being applied to the ram spar and connections. This was corrected.
- Wingboard wedge was caused by unequal offset of guide plates in their extended position during the second pass. A more stringent check procedure is now in place to ensure the guide plates are correctly positioned.
Questions

Thanks for your attention