Closed Side Setting (CSS) Measurement Device

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Outline

- Introduction
- Crusher Operation and current CSS measurement techniques
- Impact of not measuring and monitoring the CSS accurately and frequently
- New Alternative- The “C-Gap”
- Benefits of the “C-Gap”
- Implementing the “C-Gap”
- Summary
Introduction

About Brant Tapley:
- Graduated WASM 2004- Minerals Eng & Chemistry
- Gold, base metals, magnetite
- Australia, Norway and Russia
- Currently a consultant at Independent Metallurgical Operations (IMO)
  - Plant Optimisation
  - Feasibility Studies
  - Test work studies
  - Due Diligence
- Director of Tres Mina Resources Pty Ltd
Introduction - continued

About Mintap Services Pty Ltd:

- Introduced to the series III CSS measuring device in Norway

- Registered company in 2012

- Awarded the Australian and New Zealand Distribution rights (can supply Worldwide too)

- Been trialling the now Series IV unit since July 2013
Crusher Operation

What is the Closed Side Setting (CSS)?
- Minimum gap setting of when the mantle bowl rotates within the crusher or moving plate is closest to the fixed plate in a jaw crusher (‘closed’ position)
  - Secondary’s: typically 30-60mm
  - Tertiary’s/Scats: typically 8-20mm
  - Jaw Crushers: 80-150mm
- Gyratory’s: typically 90 to 220mm
# Current CSS Measurement Techniques

<table>
<thead>
<tr>
<th>Technique</th>
<th>Pro’s</th>
<th>Con’s</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead Weights</td>
<td>Accurate measurement</td>
<td>- Costly</td>
<td>Only used for tertiary crushers of small CSS’s</td>
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<tr>
<td></td>
<td></td>
<td>- Single use</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>- Disposal issues (lead)</td>
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<tr>
<td></td>
<td></td>
<td>- Heavy (manual labour)</td>
<td></td>
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<tr>
<td>Aluminium Balls</td>
<td>Cheap</td>
<td>- Inaccurate (ball expands once crushed)</td>
<td>Most common technique for measuring secondary’s and gyratory’s</td>
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<tr>
<td></td>
<td></td>
<td>- Prolonged downtime</td>
<td></td>
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<td></td>
<td></td>
<td>- Requires more than one Operators</td>
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<tr>
<td></td>
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<td>- Isolations required</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>- Limited use</td>
<td></td>
</tr>
<tr>
<td>Clay filled hessian bags</td>
<td>Cheap</td>
<td>As above</td>
<td>An alternative to Al balls</td>
</tr>
<tr>
<td>Steel Drums</td>
<td>Cheap</td>
<td>As above</td>
<td>Another alternative</td>
</tr>
<tr>
<td>Old Oil Filters</td>
<td>Cheap</td>
<td>As above Environmental issues</td>
<td>Not recommended - from personal experience!!!</td>
</tr>
<tr>
<td>Manual Measurements</td>
<td>More accurate</td>
<td>- Downtime</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>- Safety</td>
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<td></td>
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<td>- Laborious: 2 Maint staff to check,</td>
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WWW.MINTAP.COM.AU
One ‘alternative’

Moving Conveyor Belt

Waiting for the crushed oil filters to arrive
Lead weight OPEX

Actual case study:

- Site has one small Omnicone 350 scats crusher
- Measures CSS once per shift (only one face, not the recommended N, S, E and W);
- Annual lead cost = AUD$22k

This cost does not account for environmental disposal
Production downtime analysis

Example: Met manager wants to check the CSS on a gyratory to ensure it's at 100mm CSS

What’s required:

1. Raise work order, organise maintenance schedule and organise excavator to clear the top of the crusher of loose rocks
2. Conduct JSA/Take 5 equivalent on task or generate SOP (0.5 hour)
3. Shut down crusher. Clean loose rocks, isolate crusher, feeders and conveyor belts (2 hours)
4. Obtain access to bottom of crusher, inch crusher motor manually to ensure it’s at the closed position then measure gap with a tape measure or equivalent (1 hour)
5. Leave crusher, de-isolate, restart (1 hour)

Time taken - 4.5 hours production downtime

Long downtime and personnel availability results in the job not being completed as often as required
CSS Measurement Techniques- c’td

- Measuring Metal to Metal one/shift is not calibrating

Why?

- does not take into account wear

- complete reliance upon the mantle height measurement (mm)
Monitoring Mantra

“You don’t know what you don’t know
You don’t measure what you don’t value
You can’t value what you don’t measure
If you can’t measure it you can’t control it
If you can’t control it you can’t improve it.”

Secondary Crushers- Russia
Production impact of not measuring CSS

- Closed circuits (with screen(s))
  ◦ Higher recirculating loads impacting new tonnage rates
  ◦ Reduced screen efficiency with associated higher screen wear

- Open circuits
  ◦ Larger top size and overall size downstream

Lower crusher throughput and/or larger $P_{80}/P_{100}$ will impact:
- Milling and beneficiation throughput
- Targeted grind/crush size

Tertiary crusher product reporting to a rod mill
Other impacts

- Crusher Wear Life
  ◦ Reduced choke feeding/autogenous crushing leading to higher wear hence downtime and costs
Ideal CSS Measurement Strategy

1. Measure CSS every shift and record for operations and maintenance planners
2. For cone crushers, measure N, S, E and W
3. Minimal downtime
4. Safe
5. Minimal people required
6. Accurate and reliable
7. Minimal cost
8. No environmental disposal issues
New Alternative: The “C-Gap”

• How’s does it work?
• Bulb sizes- ability for one unit to measure all crushers
• Hose lengths
• Ability to be calibrated
• +/- 1mm accuracy
• Runs on 4 x AA batteries
• IP54 splash and dust proof container
• RCM Certified (AS/NZS CISPR 22: 2009)

German designed, trialled and manufactured
### Measuring ranges and Hose lengths

<table>
<thead>
<tr>
<th>Measuring Range (mm)</th>
<th>Hose Lengths (m)</th>
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<tbody>
<tr>
<td>7-22</td>
<td>5</td>
</tr>
<tr>
<td>10-22</td>
<td>7</td>
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<tr>
<td>18-34</td>
<td>11</td>
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<tr>
<td>33-49</td>
<td>15</td>
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<tr>
<td>48-60</td>
<td>30</td>
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<td>52-75</td>
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<td>163-185</td>
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<td>183-205</td>
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<tr>
<td>200-220</td>
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Advantages of the “C-Gap”

1. Safety
2. Ability to quickly measure every shift thus minimise downtime
3. Only one person required
4. Accuracy
5. Reduced costs
   a) Lead weights, Al foil etc
   b) Improved asset management (longer wear times, more reliable measure of when to replace a mantle/concaves/liners
6. Significantly reduce lead consumption- enviro benefits
7. Minimal store stock- spare bulbs and AA batteries
Other Information

1. Field trials (x 8)
   a) MMG Golden Grove
   b) Goldfields St Ives
   c) KCGM- CSI Plant
   d) SJ Crushing Ridges – Iron Ore
   e) RTIO ERA Ranger
   f) Newcrest Cadia Valley Operations
   g) Northparkes Gold
   h) CITIC Pacific Iron Ore

2. 12 months manufacturers warranty

3. Direct purchase or Hire purchase*available
   *Australian and New Zealand customers only
Implementation Strategy

Ways to justify the purchase of a C-Gap:

- Determine time it takes to measure the gap currently and apply a $/min factor to it;

- Annual spend on lead weights/yr;

(assuming the CSS is measured!!!)

- Determine impact of operating outside normal CSS parameters to crushing and downstream performance;

- If the crushers are operated and maintained by Contractors, strongly suggest they purchase one.

- And Safety of course!!!!
Summary

1. C-Gap replaces rudimental, cumbersome, laborious, unsafe and costly methods;
2. Allows operators to check the CSS every shift, not every week or worse, not at all;
3. Caters for Gyratorys, Jaws and Cone Crushers
4. CSS 7-220mm
5. Hose lengths up to 30m
6. Accuracy +/- 1mm
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