# HIGH PRESSURE GRINDING ROLL

## CEEC KALGOORLIE WORKSHOP

7 November 2019

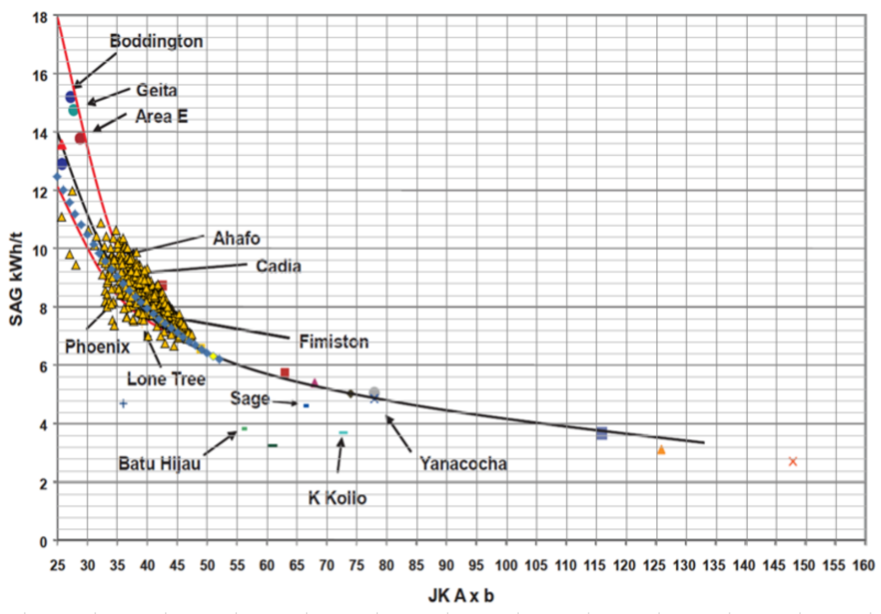
# Content

# Introduction

- Located 125km from Perth – Drive in Drive Out
- Open Pit Mine
- 3 stages of Crushing:
  - 2x Fuller Traylor 1.52 x 2.87m XHD **Gyratory Crushers** (1000 kW)
  - 6 x METSO MP1000 **Cone Crusher** (750kW)
  - 4 x POLYSIUS Ø 2.4m x 1.65m **High Pressure Grinding Rolls** (5.6MW)
- 4 x 15.6 MW Overflow Type **Ball Mills** – Ø 7.9 x 13.4m
- Flotation of gold bearing copper concentrate followed by flotations tails leach

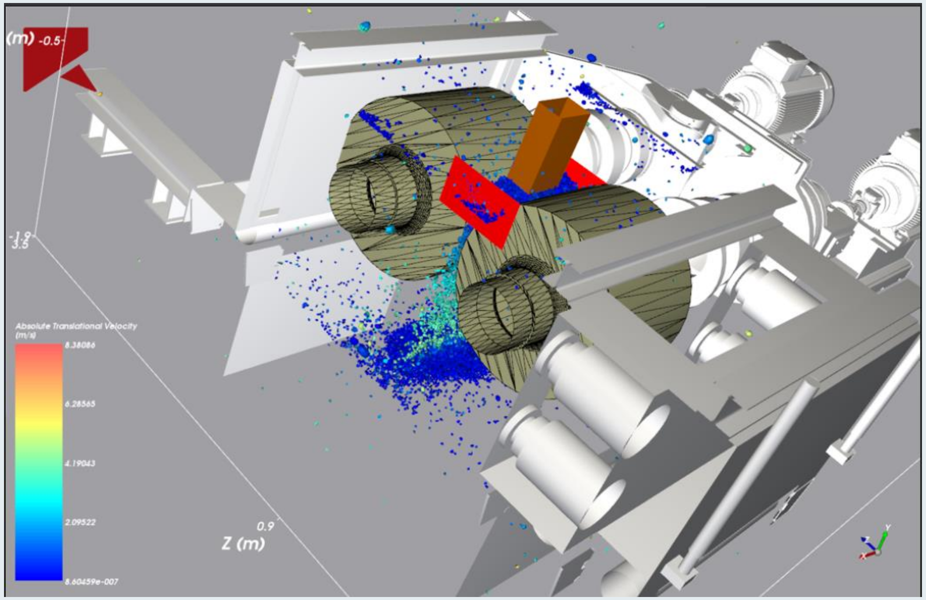
# Background

- NGB ore characteristic:
  - Eight different ore domains,
  - Bond Rod Mill Wi: 23.4
  - Bod Ball Mill Wi: 15.6
  - JKTech breakage characteristic Axb: 27.3
- SAG Mill power requirements ~16 kWh/t
- HPGR power ~35% of SAG power required
- HPGR is dry process, No extra water required
- Dust control required, (extraction unit, sprays)




Acknowledgement:
Jim Sidel, Vielliette and Parker (2005)

# High Pressure Grinding Rolls

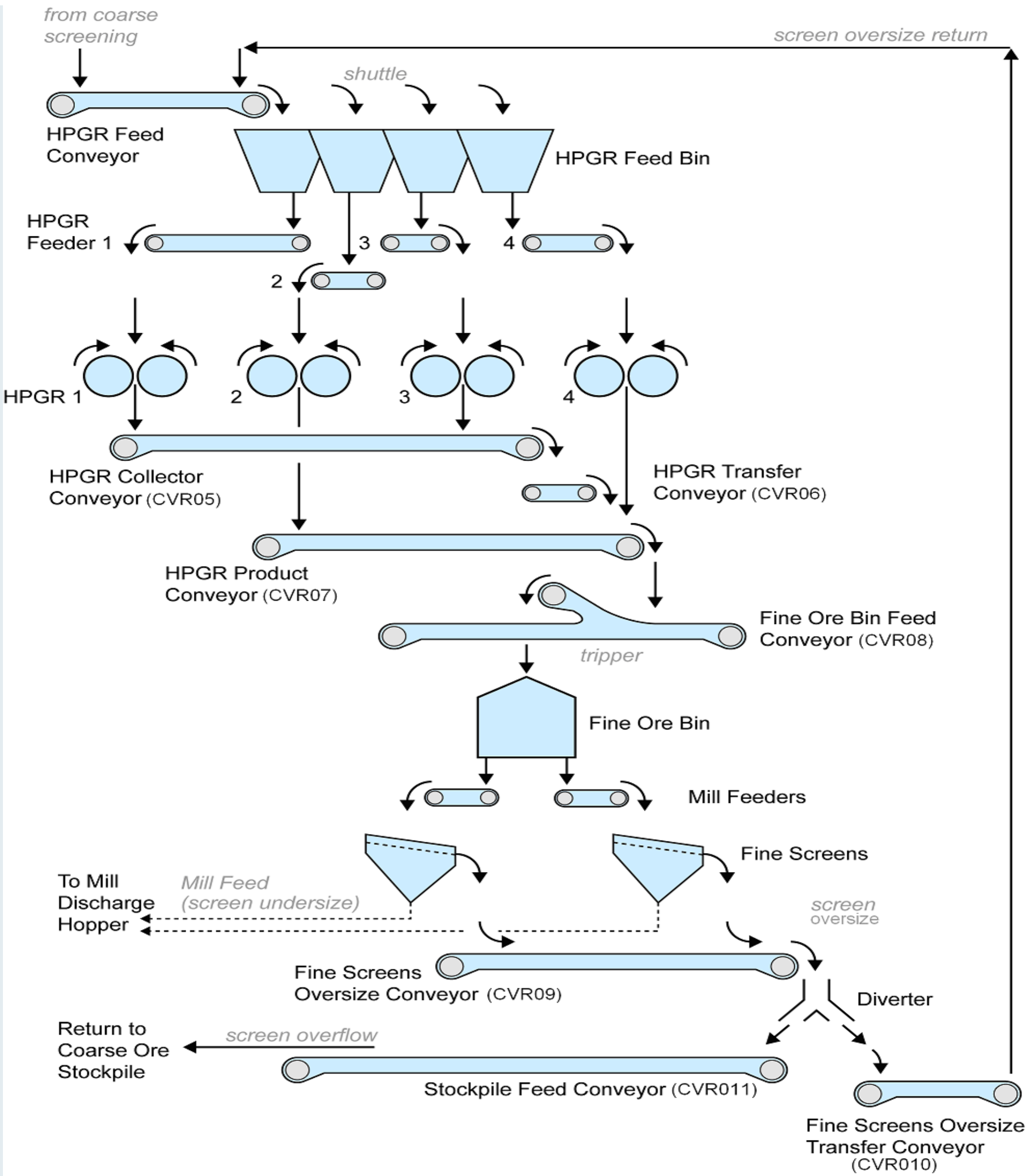




- HPGRs compress and grind the particle bed in the operating gap between two counter-rotating rolls.
- The floating roll is pressed towards the fixed roll to maintain a working gap and pressure set point.
- Increasing the operating pressure will increase the kWh/t.
- Increasing the rolls speed will increase throughput at the same pressure. Speed and throughput is not linear.
- Uneven feed size or distribution across the rolls can cause the roll faces to “skew”.

# Operational HPGRs - NGB

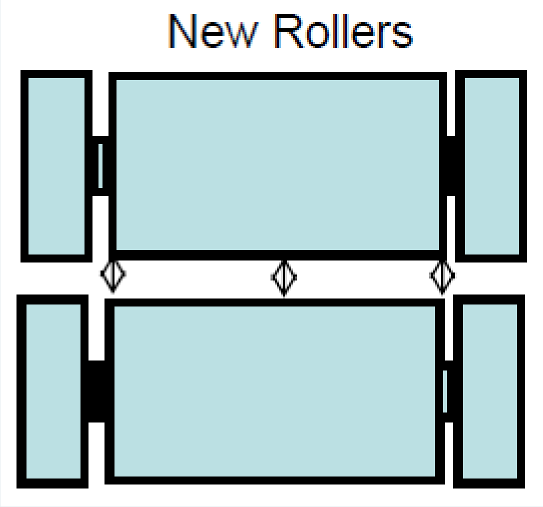
- 4 x POLYSIUS High Pressure Grinding Rolls (5.6MW)
- 2300-3200t/h capacity (each)
- Feed bin serviced by logic driven “shuttle” conveyor
- Metal detect fitted to HPGR Feeder
- Discharge conveyor to Fine Ore Bin which has 3hr buffer storage capacity between the dry crushing plant and the milling section

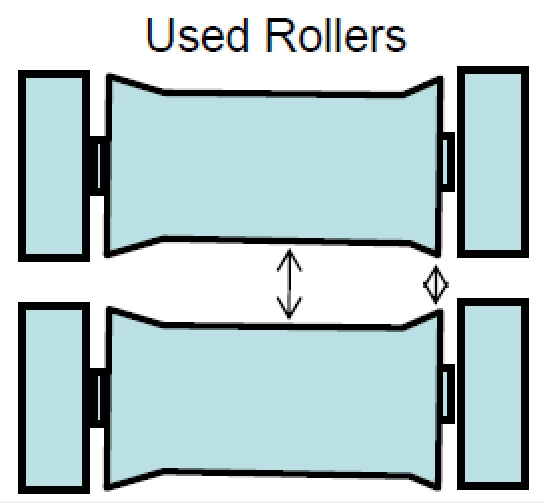


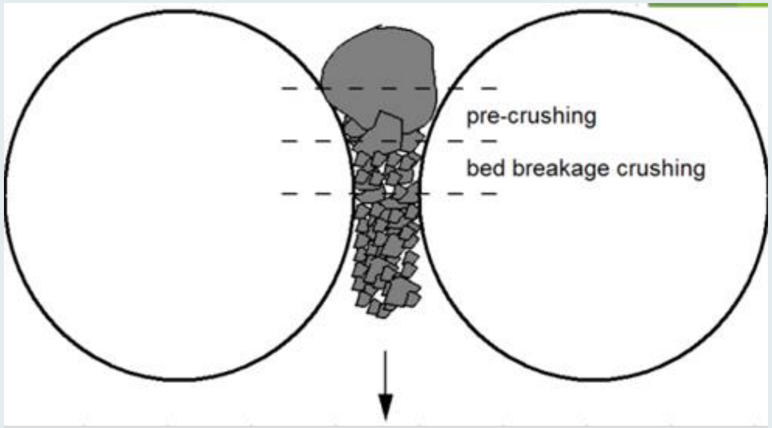
# Monitoring HPGRs

- Process control logic is used to automate the HPGR operation:
    - Control shuttle speed and forward/reverse movement to maintain bin level
    - Metal detects on HPGR feeder to force tramp metal to HPGR bypass chute
    - Feed rate: HPGR discharge conveyor weightometer and feeder speed
    - Temperature motor bearing compensation: Temp increase – drop pressure then drop roll speed

- Rolls operating pressure
- Rolls speed and “gap”
- Various alarms on motors, bearings, skew, pressure, feed and discharge hoppers and belts



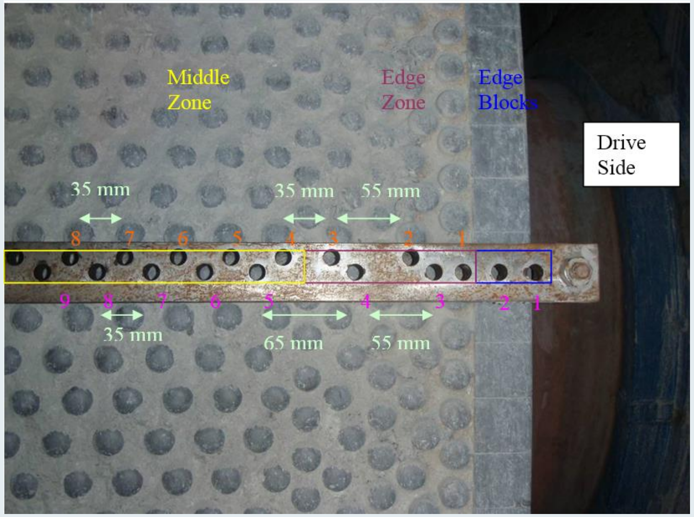



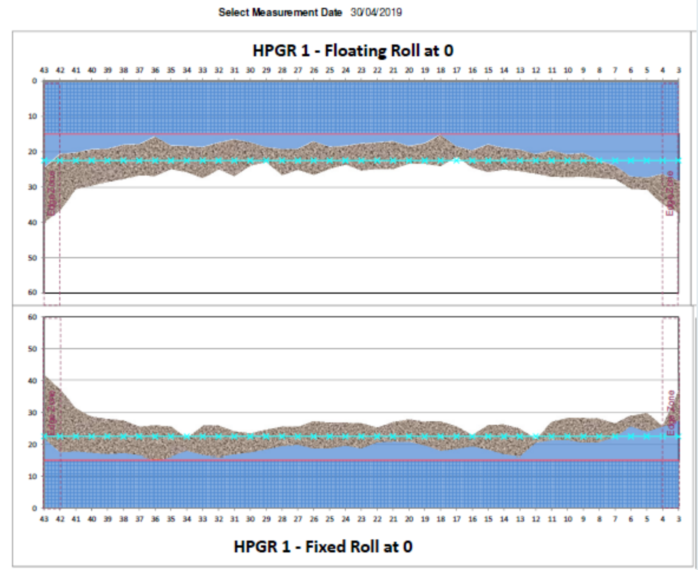



# Maintenance and Challenges

- Planned Maintenance,  weekly and monthly inspections
  - Inspection edge block and cheek plates
  - Inspection bearing condition
  - Roll wear measurements. Wear rate, run hours and tonnes crushed are used to predict rolls life.

- Operational Challenges
  - Poor feed presentation or choke feed interruptions will impact roll wear rates
  - Sensitivity issues with metal detectors. Metal detector triggers bypass chute: coarse product, high circulating loads – low fresh feed/throughput.
  - Feed bin blockages with “sticky” feed
  - At end of roll life, edge block loss or washouts can impact run hours and crushing efficiency
  - Increased operating pressure and throughput has increased equipment motor / bearing temperatures




**Wear Prediction Summary - using Tyre Wear**

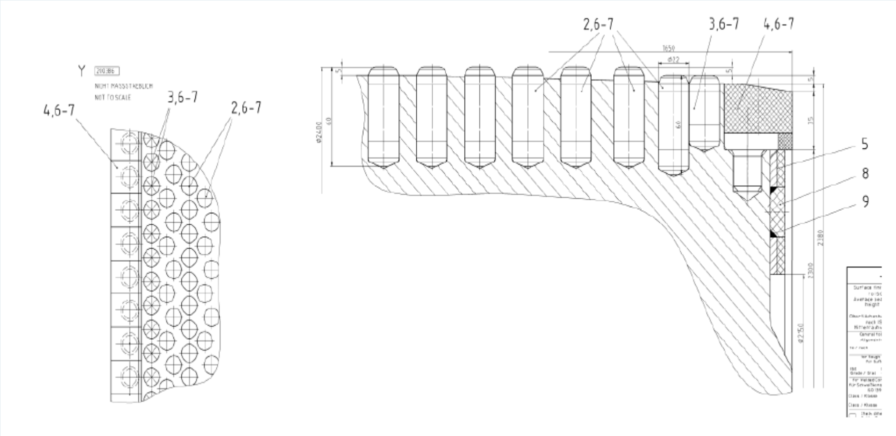
| | Tonnes Treated | Run Hours | Predicted Roll Life Mt | Predicted Roll Life Hours |
|---|---|---|---|---|
| Fixed | 28/05/2019 | 28/05/2019 | 19.9 | 8209 |
| Floating | 26/06/2019 | 25/06/2019 | 21.3 | 8771 |
| Availability used | 82% | 82% | 82% | 82% |

# Continuous Improvements

- Rolls Generations - Design
  - Generation 4, 4A, 5, 5A, 6 (wear surface development).
  - Variations on stud and edge block space configurations, lengths, depths, shape, side face protection.
  - Roll size diameter: 2300mm – 2430mm

- Changing Operational Parameters
  - Bearings pressures: 155Bar to 170Bar
  - Rolls speed: 56Hz – 60.3Hz (21RPM)
  - Rolls gap: 60mm – 100mm

- Maintenance Strategy
  - Allocated maintenance supervisor for HPGR's
  - Regular Inspections and service on HPGRs




# Future Considerations

- Mine feed – trial increased blast factor for finer feed to crushing circuit
- Learning from others with respect to edge lip on rolls to contain feed and reduce wear
- Alternative oil cooling system for bearings
- Rotating Side Plates Modification/New Design

# Question?