

Trial of Granulated Blast Furnace Slag as Raw Material in Berrima Clinker

Part I - Use of Granulated Blast Furnace Slag (GBFS) to produce clinker during 3 days trial

Trial Aim:

1. Confirm that we can use 7% GBFS to produce clinker with our required chemistry, LSF, AR, SR and that the performance of product is not affected. Note: MgO in clinker will increase up to 2% which is outside of current clinker of 1.5%
2. Understand the impact of GBFS on Raw Mill output and performance.
3. Determine the impact of GBFS on kiln heat consumption.
4. Determine the impact of GBFS on kiln output.

Scheduled Trial Start Date:

TBA based on conformant clinker stock after shutdown August'11

Trial Controller:

Andrea Booker

Trial Plan:

	What	When	Who	Comments
	TRIAL PREPARATION AND LOGISTICS			
1.	Empty A frame during kiln shutdown July'11		SS/CF	At least area TP0 and TP3-TP4 needs to be cleared for a successful trial
2.	Start Kiln		SS	Shutdown duration still to be confirmed
3.	Send NC clinker during start-up to TP0		SS	NC clinker should be blended with clinker from mole as much as possible
4.	Send good clinker to mole		SS	
5.	Estimate day when good clinker stock at 70kt (60kt minimum security stock agreed by management +10kt required for 3 days of trial). The estimated day will be the start of the trial date		CF	Minimum 2 weeks after kiln start based on sales (cement + Morgan) and clinker stock after shut
6.	Estimate day/time for stockpile turn around to start build a stockpile without Blue shale		CF	
7.	Start build stockpile without blue shale addition		SS/AB	Contingency for stockpile without

	What	When	Who	Comments
				BS on normal chemistry is to run raw mills to 300 tph so BS feeder can deliver BS as required
8.	Ensure area in A frame beneath TP6 to TP9 is clear and kept clear.		SS PC's	
9.	Receive and store GBFS on shale pad. Pile to be clearly sign posted		BV	Estimated 1800 t to be confirmed by GY
	TRIAL			
10.	Run raw mills at maximum output RM6=200 tph and RM7=140 tph for at least 24 hours before trial @ residue of 14% (Action Limits – 12.6% to 15.4%) on 90 microns.		SS's, PC's	This is to collect data prior trial for raw mills. John Parsons to develop a trend page on YOKO.
11.	Run kiln at 315 tph feed for at least 24 hours before trial		SS's, PC's	This is to collect data prior trial for kiln. John Parsons to develop a trend page on YOKO.
12.	Run Raw Mill's to achieve a Blending Silo level of \approx 5,000 by trial start at 4am on 8/8/2011		SS's, PC's	
13.	Keep the SS:Gypsum (or FB:Gypsum) bin (bin3) low such that it will be empty by trial start (GBFS will be fed through this bin).		SS's, PC's	As contingency raw mills can be stoped and bin 3 run empty
14.	Place new signs on crusher traffic light (GBFS instead of Mix)		SS/AB	
15.	Check blending silo level as per usual during night shift (2am??). If blending silo level will not achieve 5,000 by 4am take corrective action (ie stop raw mill(s))		SS's, PC's, PA	
16.	Confirm blending silo level is \approx 4,000t ready for trial start. Continue to dip with SM24 sampling to ensure level does not drop further during trial.		SS's, PC's	
17.	Confirm area beneath TP6-9 has remained clear and is ready for trial material. (Note: All material including NC (if produced) to be put in this area, unless otherwise directed)		SS's, PC's	
18.	Limestone stockpile turnaround into a minimal blue shale stockpile, blending silo at correct level, SS:Gypsum (or FB:Gypsum, whichever material is in the feeder at the time) bin empty: a) Fill SS:Gypsum bin with GBFS (bin 3) b) Remove profile gate from this bin c) Turn off blending silo blending, ie, extract from one segment only d) Make changes to the QCX configuration (refer to instructions) Call this trial start time "0hrs".		SS's, PC's,	Limestone pile turnaround can/ should be done before 4 am while running on SS:Gypsum (or FB:Gypsum) mix. Raw mill o/p should be reduced to 300 tph to ensure enough BS delivered from the bin
19.	Monitor GBFS delivery. If required raise this profile gate.		SS's,	GBFS rate will be fixed at 7%.

	What	When	Who	Comments
			PC's	I think GBFS provides SO3. Is there a way that we can let GBFS adjust itself to give some target. This can tell us what is the maximum GBFS we can use to make clinker with our existing chemistry & if there are issues in chemistry of other raw materials then it might be easier to achieve raw meal targets without a need to manipulate raw meal targets or producing off aim raw meal. (I don't know whether QCX can handle 4 targets or not)
20.	If clinker is outside normal specification distribute to TP0 storage area.		SS's, PC's	This material will be blended with normal clinker from mole
21.	Once everything is in spec, distribute material to TP6-TP9 Note: MgO will be >1.8 and indicated red on the spec screen. Ignore this			Cut Line for MgO during this trial is max. 2.4%
22.	2 hrs after trial start collect 10kg of clinker. Process a small portion in the shift laboratory.		SS's, PC's, PA	
23.	Monitor changes to clinker chemistry. Test stage 4/14 every 2 hours. Note, if Alk/SO3 is greater than 1.2 treat this material as non-compliant. Resume normal 2 hourly testing regime after 6-8 hours, retain crushed samples in containers provided in the lab.		SS's, PC's, PA, AB	
24.	When all in spec run raw mills at maximum output RM6=200 tph and RM7=140 tph for at least 24 hours during trial. (We must now run the mills at the same residue and delta P as the earlier pre-trial run so that we can see a change in mill output if slag was considered harder to grind. It might be also worthwhile to consider same grinding pressure during both runs.) Do a drop test at this point. After 24 hours mill o/p can be reduced to maintain a blending silo at 5,000 t		SS's, PC's	This is to collect trial data for raw mills
25.	Run kiln at 315 tph feed for at least 24 hours during trial. (Note: During first day of the		SS's,	This is to collect trial data for kiln

	What	When	Who	Comments
	trial it might be good to hold kiln O/P at 315 tph feed. On the second day if there was some room in the coal mill then it might be worth while to increase the kiln O/P to understand the limit of performance as one of the objectives is also to see how much more capacity in kiln is released assuming use of GBFS will reduce the heat consumption.)		PC's	
26.	After 2 days of trial monitor bin 3 level and top up to ensure is empty close to estimated pile turn around		SS's, PC's	Estimated usage 22 tph at total raw mill feed 315 tph
27.	After 72 hours of operations where compliant clinker is made, return to usual configuration: a) Run bin 3 empty of GBFS. Fill bin 3 with SS:Gypsum (or FB:Gypsum) mix. b) Put the profile gate back on bin c) Drop the bin 3 profile gate d) Change the configurations as per procedure. e) Turn on the blending silo blending again		SS's, PC's, AB	
28.	2 hours after the above changes have been made direct the clinker to NC storage (if results indicate non-compliance). Test clinker as per normal procedure and when chemistry returns to spec re-direct to compliant storage area (mole)		SS's, PC's	
29.	Isolate TP6 to TP9 and RG8 to RG12.		SS's, PC's	

Notes:

The following is anticipated for the trial:

- Kiln operation will change due to the use of the pre-calcined GBFS. Please read Key control parameters attached
- As the alkali sulphur ratio may change (although unlikely) during this trial it will be important to monitor the O₂ levels to avoid tower blockage
- All changes to normal kiln and raw mill operating procedures are to be noted down in forms provided.
- Due to change in Raw meal/clk factor. At 315 tph kiln feed estimated clinker O/P will increase by 10 tph. Hence a different bed depth on grate cooler so cooler table control in Yoko might need tuning (John Parsons)
- Bed depth in the kiln will change marginally, so kiln reaction will change, probably slower and a lot dustier in the front.
- Quench rates will change, and so will BZ retention times. This may effect clinker mineralogy and cement performance.
- Predict coal rate will be similar, probably down a little, but increased clinker output. Calciner temps will increase.

Anything **highlighted** is yet to be confirmed.

Part II – To be confirmed
GBFS Clinker Grinding Trial at Berrima

1. Objective of Trial

The objective of conducting a milling trial of clinker manufactured using Granulated Blast Furnace Slag as a raw material (bulk) at Berrima is to confirm quality of this high MgO cement produced at Berrima so that we can plan to commence manufacture of this material for despatch to the customers.

3. Quality Target

Surface Area: **tbd** m²/kg

SO₃: 2.8%

Mineral Addition: 4.5%

4. Date of Trial: ??

5. Mill to be used for trial: ? Cement Mill

6. Trial Controller: Shift Super

7. Trial Procedure

	WHAT	WHEN	WHO
30	Confirm availability of space in silo ??	??	PC's, SS's
31	Keep CM? clinker bin level low such that it will be near empty at 7 a.m. on ??	??	PC's, SS's
32	Once the clinker bin is empty, stop CM? but keep running DC109, DC110 and FA111 for at least 30 minutes	??	PC's, SS's
33	Fill the clinker bin SS108 with about 250 tons of compliant high MgO clinker.	??	PC's, SS's

34	Keep gypsum loop at similar set point to achieve 2.8% SO ₃	??	PC's, SS's
35	Start CM?, maintain the clinker feed rate set points	??	PC's, SS's
36	Direct mill stream to one of the non-compliant silos (??)	??	PC's, SS's
37	After 30 mins, collect a spot sample of cement. Confirm FI. Test by XRF to confirm SO ₃ 2.7-2.9%. Confirm 4.5% Limestone using LECO to ensure mineral addition is on spec. Confirm chemistry (high MgO).	??	PC's, SS's, PA
38	Repeat spot samples until results are confirmed to be within specification.	??	PC's, SS's
39	Once spot sample confirms the above and the mill is running stable, collect 4 x 10L bucket samples each at 30 minutes intervals. Also, collect 10 x 44 gallon drum samples during the run.	??	PC's, SS's
40	If during the trial, the selected non-compliant silo is full, then direct the mill stream to another non-compliant silo.	??	PA/AS
41	Trial complete, revert the mill to normal SL.	??	PC's, SS's, PA
42	Follow the normal changeover procedure for milling.	??	PC's, SS's

8. Material Assessment

	WHAT	WHEN	WHO
1.	Once trial is over, transfer the 10 x 44 gallon drums and 4 x 10L samples to the laboratory.	??	PC's, SS's
2.	Arrange for: <ul style="list-style-type: none"> 3 x 44 gallon drums to be sent to Boral Labs. Instruct laboratory to test as per normal SL testing. 	??	AB

3.	Contact Tony Song regarding our testing requirements	??	AB
4.	Arrange for the 4 x 10L samples to be tested at Berrima for the following: <ul style="list-style-type: none"> • Chemistry – XRF, LOI, Leco • Physical Properties <ul style="list-style-type: none"> ○ FI ○ 45µm residue ○ NC ○ Setting Times ○ Penetration ○ Soundness ○ Strength (1, 3, 7 and 28d) ○ Shrinkage ○ Autoclave Expansion ○ Sulfate Resistance 	??	AB