Fortescue Metals Group Ltd
ACN: 002 594 872
Fortescue House
50 Kings Park Road West Perth
Western Australia 6005
PO Box 910, West Perth, Western Australia 6872

Telephone: + 61 8 9266 0111
Facsimile: + 61 8 9266 0188
Website: www.fmgl.com.au

20 February 2006

The Companies Officer
Australian Stock Exchange Ltd.
Exchange Plaza
2 The Esplanade
Perth WA 6000

Dear Sir

METALLURIGICAL TESTS CONFIRM FORTESCUE'S CLOUD BREAK PRODUCT

Key Findings

- Fortescue High Grade fines product generated sinter quality and production rates within the upper range for existing Marra Mamba products due to favourable particle size, the presence of coarse hard goethite and low alumina.
- The use of Fortescue high grade product maintained or slightly increased key performance measures such as fired sinter strength (tumble index) and productivity at low coke levels.

Fortescue Metals Group Ltd ("Fortescue") is pleased to announce the results of sinter test work #1 that has been conducted by Central South University ("CSU") in China on representative high grade product bulk samples drawn from across the Company's Cloud Break deposit.

The tests confirmed that sinter blends incorporating Fortescue's High Grade fines from its Cloud Break deposit display **favourable commercial sintering characteristics** when compared to current fine ore products sold in the Asian marketplace.

Following earlier tests by the CSIRO on Fortescue's High Grade product from Christmas Creek, these test results further substantiate the Company's belief that ore from the Chichester Range will provide for a **highly commercial product** type with **attractive chemical composition and physical sintering properties**.

#1: For an overview of the sintering process please refer to the Attachment.

A conclusion from the CSU report is that mills can readily operate under a sinter blend incorporating up to 20% of Fortescue's high grade Marra Mamba product from its Cloud Break deposit. Fortescue's marketing team believes this creates enormous sales potential given that Asia consumed some 579 million tonnes ("Mt") of iron ore fines in 2004. This is predicted by industry forecasters to grow to over 800 Mt by 2010 and keep growing thereafter.

The importance of having the latest tests conducted in China is that Fortescue has targeted China as its major export destination. This is evidenced by the **30 million tonnes per annum ("Mt/a) of high grade iron ore sales** that the company has already executed with some eighteen Chinese steel mills. Fortescue's initial production level is targeted at 45 Mt/a and is planned to increase to 60 Mt/a in reflection of ongoing market opportunities.

As background to the study manager, CSU is situated in Changsha within the Hunan Province and is considered a pre-eminent sintering and pelletising research centre for the Chinese steel industry. It has conducted test work for most of the large Chinese steel mills and these tests have been completed on a range of blends containing imported iron ore products.

The interest for the steel mills is to measure the relative efficiencies of the various imported products to determine how different iron ore blends will perform through the sintering process. Importantly the results from CSU are widely regarded by the industry in China and throughout most of Asia and help establish recognised product benchmarks.

The broad detail of the CSU test results is provided in the Attachment noting that sinter test analysis is a complicated process and the tables within the attachment are extensive in their metallurgical and chemical scope. The Competent Person sign off has been provided by Dr John Clout who is head of Fortescue's Resource Strategy team. Dr Clout is regarded as one of the world's leading authorities on iron ore processing and his career has included 12 years with Australia's leading scientific research agency the CSIRO where he gained experience in iron ore beneficiation, sintering, lump quality and the relationship between ore type and process performance.

Yours sincerely
Fortescue Metals Group Ltd

Rod Campbell
Company Secretary

ATTACHMENT:

FOREWORD

KEY POINTS ON SINTERING

- The mining of iron ore produces two main types of product being lump ore (granular size > 6.3 mm) and fines ore (granular size nominally less than 6.3 mm).

- Typically the split between lump and fines is for the percentage of lump to be between ~40% down to ~20% of the mined ore with the balance being fines.

- Lump can be fed directly into a blast furnace without the need for modification. Due to the small particle size of fines it is not used as a direct feed. Modification to the fines ore is required and is done through a process where the ore is agglomerated and melted into a coarse porous solid called sinter. Sinter is then crushed and screened with particles between 5 mm less than 40 mm called 'product' and are charged directly to the blast furnace whilst sinter particles less than 5 mm are called 'Return Fines' and are recycled back into the sintering process.

- A typical sinter blend is made up of a number of different ore types or brands and in a typical sintering process a mill will use at least 5 or more different brands of fine ore to make sinter.

- The use of different brands or fines products is absolutely necessary to balance out the different chemical and physical properties of each ore type in the understanding that a combination of different products will effectively create "hybrid vigour" to give a superior product.

- Few of the > 63% Fe fines products traded have superior physical sintering characteristics for every key sintering property so highest grade does not necessarily mean great physical or metallurgical sintering properties.

- A typical Japanese or coastal Chinese sinter blends will use product from many different countries (eg. from Brazil, Australia and India) and will use different ore types within these products blending Hematite with Marra Mamba and Yandi.

- A typical inland Chinese sinter blend will also use product from different countries and of different ore types as well as a percentage of local domestic magnetite concentrate.

PILOT SCALE SINTER TEST RESULTS FOR FORTESCUE'S SIMULATED HIGH GRADE FINES PRODUCT

COMPETENT PERSONS AND SOURCES OF INFORMATION

Responsibility for the compilation of information relating to sinter test work is accepted by Dr. John Clout, Head of Resource Strategy. Dr Clout holds a senior position with Fortescue Metals Group Ltd.

Declaration in accordance with the JORC code (2004).

"The information in the report to which this statement is attached that relates to metallurgy and sinter testing is based on information compiled by Dr John Clout, who is a Fellow of The Australasian Institute of Mining and Metallurgy.

"In particular, sinter processing results were compiled by Dr John Clout from pilot scale pot grate sinter tests conducted on simulated high grade fines products from Cloud Break and Christmas Creek by the Central South University (CSU) in Changsha (China) and the CSIRO Minerals in Australia. The simulated Cloud Break HG fines composite sample used by CSU was produced by Fortescue from drop test conditioning of 218 samples of approximately one tonne each obtained from 19 bulk holes drilled across the deposit, taking into account full mining widths and dilution predicted from the mining feasibility study. Similarly, the simulated fines used by the CSIRO Minerals were obtained from drop test conditioning 1 m diameter bulk samples (Cloud Break) and a composite of PQ diamond core from 19 holes (Christmas Creek) conducted by Fortescue and AMMTEC, respectively, taking into account full mining widths and dilution predicted from the mining feasibility study. The data for the single ore sintering comparison of Cloud Break and Christmas Creek was generated by the CSIRO Minerals whilst all other sinter test work was by CSU."

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"Dr Clout has reviewed this information in his capacity of Head of Resource Strategy and has satisfied himself that the values quoted are reasonable and accurately reflect the operations involved."

"Dr Clout is a full-time employee of Fortescue Metals Group Ltd and holds the position of Head of Resource Strategy."

"Dr Clout is an internationally recognised expert in the field of iron ore sintering and high temperature processing of iron ores and blends. Dr Clout has sufficient experience which is relevant to the style of mineralization and type of deposit with over 14 years experience in pilot-scale sinter testing of iron ores under consideration to qualify as a Competent Person as defined in the 2004 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves'. Dr Clout consents to the inclusion in the report of the matters based on his information in the form and context in which it appears."

Signed:

Dr John Clout,
Head of Resource Strategy,
Fortescue Metals Group Ltd

PILOT SCALE SINTER TEST RESULTS FOR FORTESCUE'S SIMULATED HIGH GRADE FINES PRODUCT

1. What is Iron Ore Sintering?

Fine iron ores account for approximately 60-80% of the material produced from many Australian iron ores, whilst the remaining 20-40% is of lump. Lump is nominally greater than 6.3 mm and less than 31.5 mm in size whilst fines is nominally less than 6.3 mm. Lump iron ores can be fed directly to the blast furnace to make pig iron, whereas fine ores must first be agglomerated into sinter before they can be fed to the blast furnace. This is because significant amounts of fine particles would simply block the vital upflow of gases and/or be ejected from the top of the blast furnace as dust. Iron ore sinter is produced by mixing of fine ores or concentrates, fluxes (limestone, burnt or hydrated lime, dolomite, or serpentine), and fuel (coke, anthracite), then granulated with water in a rotating drum and building a layer 550 to 800 mm deep onto a horizontal sinter machine grate. The fuel is then ignited at the top of the layer using burners and air is drawn down through the bed under suction, with solids finer than 1 mm melting at ~1300°C and gluing together the coarse >1 mm iron-bearing minerals. Once the fuel has burnt and sintered the mix right to the bottom of the bed the sinter is tipped off the end of the moving grate and subsequently cooled to form a porous hard solid, and is crushed to size. The product sinter, which accounts for about 75-80% of the output of the sinter strand is sized at approximately -40 +5 mm and is fed directly to the blast furnace and the undersized material (-5.0 mm) is recycled back to the sinter strand as "return sinter fines".

Few mills anywhere in the world run with less than 5-6 different ores in their sinter blend. In Asia a number of different ore brands are necessary to make up a typical blend for sintering and a typical example is shown in Figure 1. Some use up to 15 different brands and the ore brands used and their percentages often vary between different sintering machines at the same steel mill and between different companies. The use of different brands at any one mill is absolutely necessary to balance out chemical composition and especially different physical and sintering properties. Few >63% Fe fine ores have all-round excellent sintering quality, since sinter quality is controlled by factors other than grade including the iron-bearing minerals, their size, particle porosity and mineral textures. So the highest Fe grade fines product doesn't necessarily mean guaranteed great sintering properties. For example, the Australian Yandi fines products have seen a significant increase in sales volumes over the last 8 years because Yandi has excellent sintering properties, even though it has only about 58.5-58.9% Fe. Fortescue's high grade fines product (60.2% Fe) is higher in iron than Yandi so high Fe grade alone is not an impediment for use in an Asian sinter blend. So sintering properties are important and these need to be established and optimised at the pilot scale before any fines product can be mixed with other fines into a blend and used at a sinter plant.

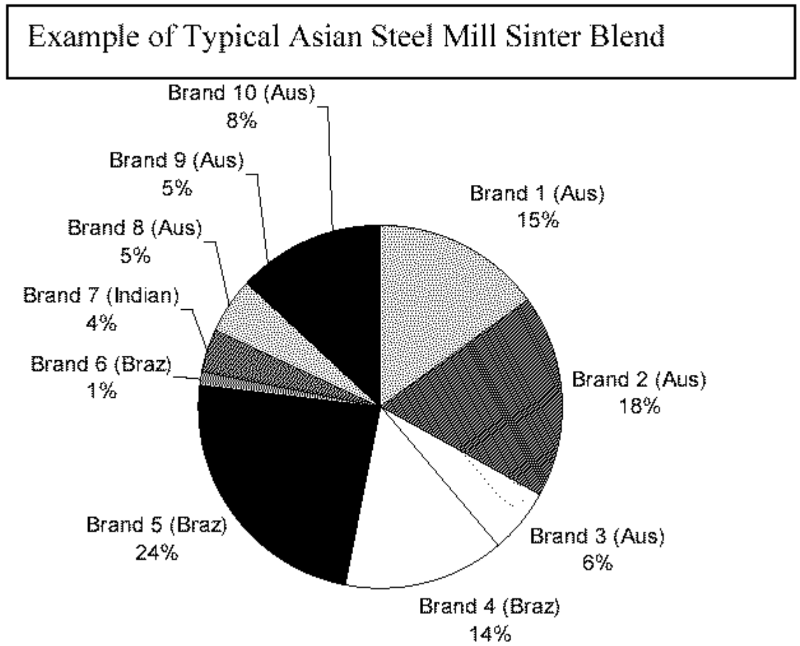

Figure 1 Percentage of different fines ore brands typically used in an Asian steel mill sinter blend. Numbers of fine ores used in Asian mills can vary between 5 and 15 brands.

2. What are Pot Grate Sinter Tests?

Pot grate sinter tests are pilot-scale (15-100kg) sinter tests which are used throughout the world to closely simulate and optimise the full scale industrial sintering process in a laboratory. The tests are relative and are typically well calibrated against one or more full industrial scale sinter strands. The tests are conducted in cylindrical pots or box-shaped containers with varying diameters and bed heights. Pot grate tests are used in association with a pilot-scale drum to mix the raw materials (fines, limestone and other fluxes and coke fuel) with water and produce raw granules for loading into the pot. Changes in ore blends or new deposits are typically examined and optimised using the sinter pot before they are used in a sinter plant. Moisture (water) and coke levels are the main parameters which must be changed to obtain an optimum blending result suitable for use on a sinter strand. The key properties that are most important to steel mills are sinter cold physical strength (Tumble Index) and productivity (rate of sinter produced).

The following pilot scale sinter pot test results are summarised from work conducted by Central South University (CSU) in China and the CSIRO Minerals (CSIRO) in Australia. The interpretation of the results is provided by Dr John Clout on behalf of Fortescue. The work presented here doesn't imply endorsement of the Fortescue product by either CSU or the CSIRO. The details of the sinter test conditions used By CSU and CSIRO are given in Appendix 1.

3. Single Fines Product Test Results

All the single ore tests were conduced on material that came from a single deposit and have not been blended with other ores. The Fortescue simulated high grade (HG) fines product from Cloud Break was used in the pilot scale sinter tests and the actual chemical composition of the sample is given against the Fortescue product target grade in Table 1. The simulated Cloud Break HG fines composite sample was produced from 218 samples weighing approximately 1 tonne each were obtained from 19 bulk holes drilled across the deposit, taking into account full mining widths and dilution predicted from the mining feasibility study. The sample was obtained from rotary sample dividing subsplits and subsequent blending using a pilot scale rotary sample divider (RSD). Differences in weights between the mass splits from the RSD were measured to be within ±0.3%.

The Fortescue simulated HG fines was trialled in single ore tests against existing Australian Marra Mamba (MM 1) and pisolite or Channel Iron Deposit (CID) fines products at CSU.

Table 1 Chemical composition of the Cloud Break HG fines (FMG HG) composite sample used for testing versus Fortescue's HG fines product target

	Fe	SiO_2	Al_2O_3	P	LOI $_{Total}$
FMG HG fines Product target	60.2	3.4	1.9	0.051	7.7
FMG HG	60.3	3.3	1.9	0.050	7.6

a. Granule Quality

The Fortescue simulated HG fines was trialled in single ore granulation tests against existing Australian Marra Mamba (MM 1) fines product sold in Asia. The fines were individually mixed with fluxes and coke in a granulation drum and water was then added to form raw unfired granules. Granulation time was fixed at 3 minutes. Fortescue HG fines gave similar or slightly lower (better) pressure drop (dP) across the bed of raw granules for a range of moisture levels compared to MM 1 (Figure 2). The pressure drop is a measure of air flow resistance which relates to sintering speed and is much better (lower) at 9.0 % moisture for the FMG HG product. The strength of sinter granules as they are transported from the granulation drum to the sinter strand is considered by some mills as a limitation to higher percentage use of Marra Mamba fines in some sinter blends. In Figure 3 the FMG HG fines shows lower breakdown to less than 0.5 mm at the optimum moisture of 9.0% compared to MM 1.

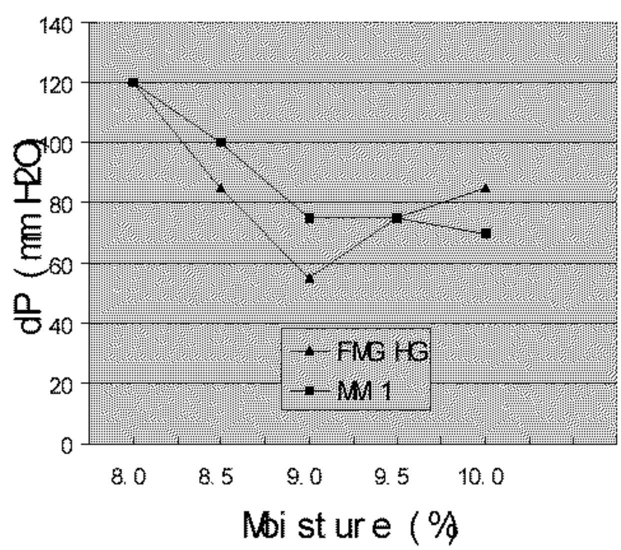

Figure 2 Comparison of pressure drop (dP) across the 500 mm deep bed of sinter granules versus moisture for FMG HG and Marra Mamba fines MM 1.

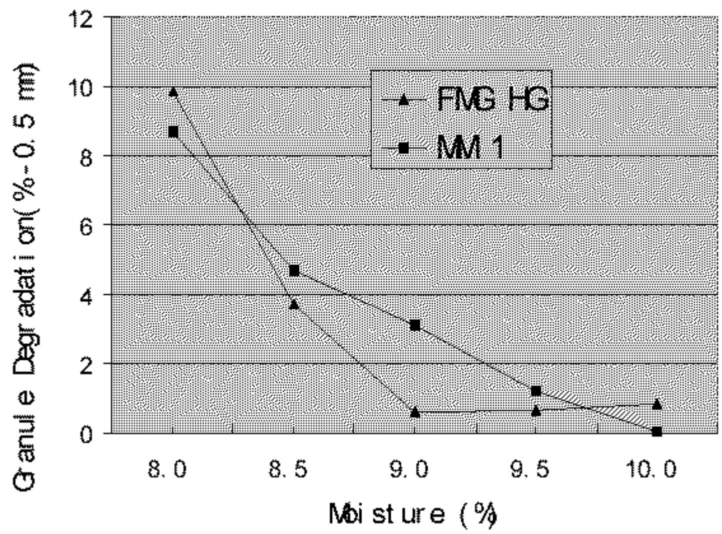

Figure 3 Comparison of breakdown of granules after dropping from 2m height versus moisture for FMG HG and Marra Mamba fines MM 1

b. Sinter Quality and Productivity

The Fortescue simulated HG fines was trialled in single ore sinter tests against existing Australian Marra Mamba (MM 1) and pisolite (CID) fines products sold in Asia. The fines were individually mixed with fluxes and coke in a granulation drum and water was then added to form raw unfired granules. The granules were then fired in a 100 mm diameter sinter pot at CSU. The three fines samples were then tested and their performance compared at different coke rates (Figures 4 and 5). Sinter made from FMG HG fines has similar Tumble Index (TI) to MM 1, with an advantage of high strength at the lower coke level of 3.8%. Note that TI must be >60% to be considered equal to or better than a typical plant TI. Sinter from FMG HG fines is consistently higher in TI compared to sinter from CID 1. When sintered, FMG HG fines gave similar or slightly better productivity compared to MM1 and is significantly better than CID 1.

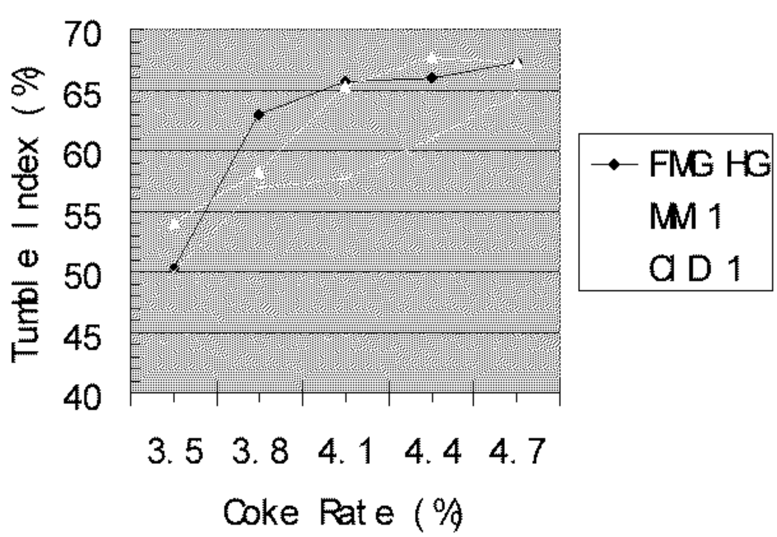

Figure 4 Comparison of the effect on sinter Tumble Index (%+5mm) for different cokes rates for FMG HG, Marra Mamba (MM 1) and pisolite (CID 1) fines products.

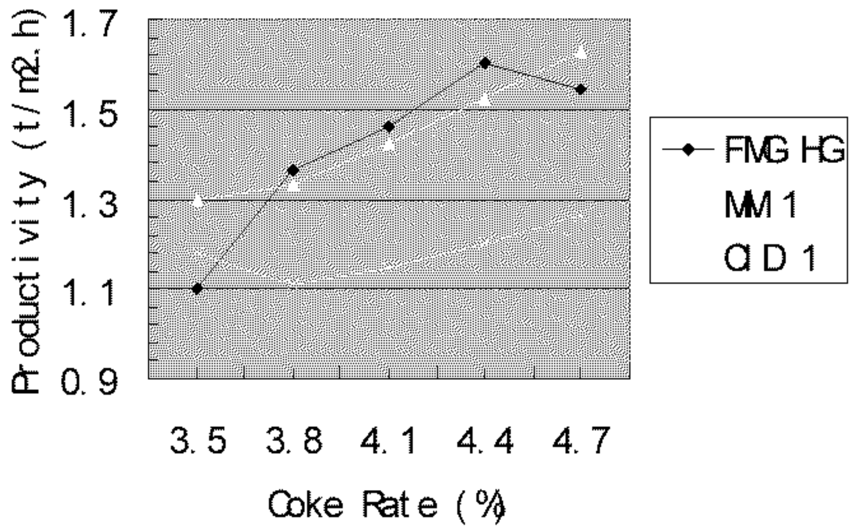

Figure 5 Comparison of the effect on sinter productivity for different cokes rates for FMG HG, Marra Mamba (MM 1) and pisolite (CID 1) fines products.

c. Comparison of Cloud Break and Christmas Creek HG fines

Pot grate sinter tests were conducted on single ores at the CSIRO Minerals pilot scale test facility under the conditions given in Appendix 1. The results show that Cloud Break and Christmas Creek have very similar sintering properties including sintering speed, productivity, TI and yield (Table 2). Sinter productivity is above average for a Marra Mamba product and TI is equal to or slightly better than other Marra Mamba products. The Reduction Degradation Index (RDI) for Christmas Creek at natural MgO level is typical of other Australian fines (45-50% -3mm) when no MgO source is used. RDI and RI tests for Cloud Break single ore sinter were not completed at the time of this report being prepared.

Table 2 Sinter quality and productivity results for single ore sinter tests of Cloud Break HG fines (FMG HG) and Christmas Creek HG fines

Deposit	ΔP	%Coke	%RF	Bulk Den	%TFe	Basicity	Sint. Time	Sint.
	(mmH_2O)	(tdmb)	(tdmb)	(kg/m^3)	(exp)		(s)	Speed mm/min
Cloud Break HG (CBF1)	82.8	4.1	21.9	1657.7	58.6	1.84	930.5	32.2
Christmas Creek HG (CCF 1)	68.5	4.0	21.8	1625.6	58.3	1.86	932.5	32.2

	Bed	RFB	B.Prod	B.F.Rate	Yield	TI %	RDI	RI
	Height (mm)		(t/m^2d)	(kg/t)	(%)	(% +6.3mm)	%	(%)
Cloud Break HG (CBF1)	500.0	0.91	42.5	63.3	77.2	66.6	N/Av	N/Av
Christmas Creek HG (CCF 1)	500.0	1.0	42.4	60.8	74.7	65.5	48.2	76.5

	Mean Prod.	Shatter Details (%Total Sinter Weight)				
	Diameter	-40+25mm	-25+16mm	-16+10mm	-10+5mm	-5mm
Cloud Break HG (CBF1)	12.6	8.7	22.9	19.7	25.9	22.8
Christmas Creek HG (CCF 1)	13.6	12.6	26.0	15.7	20.5	25.3

4. Blend Substitution Test Results

a. Blends Containing Magnetite

The blend tests (Table 3) best simulate the real industrial process and this series containing local domestic magnetite concentrate from China used aim basicity = 1.8, SiO_2 = 5.0%, MgO = 2.1, Fe_{total} = 56.5 – 58.5% and the 100 mm diameter CSU pot. Two blend series were examined, the first base blend containing two different Marra Mamba fines was compared to Blend 1 (8% FMG HG) and Blend 2 (15% FMG HG) and the second Base B containing 20% of MM 3 fines was compared to Blend 3 (20% FMG HG fines). All five blends were tested at three different coke levels (3.5-4.1%). Blend 1 with 8% FMG HG fines produced sinter at the lowest (ideal) coke level with higher yield, productivity and TI (Table 4) compared to the Base blend A; only green bed permeability was sightly higher than Base A. Blend 2 with 15% FMG HG fines performed much better than Base A blend in terms of sinter productivity and especially TI; other results were similar to Base A (Table 5). Blend 3 containing 15% FMG HG fines gave similar yield and productivity, much higher TI, but slightly higher permeability and fuel rate and lower sintering speed compared to Base B (Table 6).

Table 3 Magnetite concentrate blends.

Blends	FMG HG	MM 1	MM 2	MM 3	Brockman 1	DOM Mt Concentrate	CID 2	Brazilian 1	Brazilian 2	Total
Base A	0	7	8	0	10	20	20	15	20	100
Base B	0	0	0	20	5	20	20	15	20	100
Blend 1	8	7	0	0	10	20	20	15	20	100
Blend 2	15	0	0	0	10	20	20	15	20	100
Blend 3	20	0	0	0	5	20	20	15	20	100

Table 4 FMG high grade replacing MM 2 at optimum moisture (8%)

条件 Conditions	透气性 /mmH$_2$O Perm	烧结速度 /mm/min Speed	成品率 /% Yield	利用系数 /t·m^{-2}·h^{-1} Productivity	转鼓强度 +5mm /% Tumble	固体燃耗 /kg/t Solid Fuel	B Ra/Re
Base A -3.5%	**80**	**19.26**	**67.34**	**1.175**	**59.00**	**58.18**	**1.09**
Base A -3.8%	75	20.03	66.32	1.195	62.34	65.54	1.19
Base A -4.1%	40	24.39	72.63	1.473	68.00	64.12	0.89
Blend 1-3.5%	**105**	**20.27**	**69.24**	**1.304**	**65.33**	**56.75**	**1.04**
Blend 1-3.8%	70	20.83	68.97	1.338	68.00	62.34	**1.01**
Blend 1-4.1%	95	22.22	69.36	1.400	67.33	64.42	0.87

Table 5. FMG high grade replacing MM 1 and MM 2 at optimum moisture (8%)

条件 Conditions	透气性 /mmH$_2$O Perm	烧结速度 /mm/min Speed	成品率 /% Yield	利用系数 /t·m^{-2}·h^{-1} Productivity	转鼓强度 +5mm /% Tumble	固体燃耗 /kg/t Solid Fuel	B Ra/Re
Base A -3.5%	**80**	**19.26**	**67.34**	**1.175**	**59.00**	**58.18**	**1.09**
Base A -3.8%	75	20.03	66.32	1.195	62.34	65.54	1.19
Base A -4.1%	40	24.39	72.63	1.473	68.00	64.12	0.89
Blend 2-3.5%	**95**	**20.06**	**66.78**	**1.239**	**64.00**	**58.82**	**1.00**
Blend 2-3.8%	80	23.97	73.03	1.554	67.34	58.83	0.88
Blend 2-4.1%	95	22.39	72.34	1.441	64.00	67.75	**0.99**

Table 6 FMG high grade replacing MM 3 at optimum moisture (8%)

取代矿种 Conditions	透气性 /mmH_2O Perm	烧结速度 /mm/min Speed	成品率 /% Yield	利用系数 /$t\cdot m^{-2}\cdot h^{-1}$ Productivity	转鼓强度 +5mm /% Tumble	固体燃耗 /kg/t Solid Fuel	B Ra/Re
Base B -3.5%	75	21.17	67.11	1.282	59.34	58.53	**1.11**
Base B -3.8%	**70**	**21.63**	**66.53**	**1.257**	**62.67**	**64.89**	**1.04**
Base B -4.1%	95	25.00	77.40	1.636	67.33	59.66	0.79
Blend 3-3.5%	**85**	**20.41**	**67.77**	**1.273**	**61.33**	**67.75**	**1.08**
Blend 3-3.8%	80	21.32	73.17	1.410	62.67	61.60	0.83
Blend 3-4.1%	90	22.22	75.04	1.501	66.00	58.56	0.79

b. Fully Imported Ore Blends

A series of imported fines blends in Table 7 were tested using a 200 mm diameter pot at CSU using blend sinter aim basicity = 1.8 – 1.9, SiO_2 = 4.8%, MgO = 1.8 and Fe_{total} = 57.5 – 58.5%. Compared to the Base Blend 1, Blend 2 with 10% FMG HG fines at 3.8% coke resulted in higher yield, similar productivity, higher TI and lower fuel rate compared to the Base Blend 1 (Table 8); all other results were similar. Blends 3 and 4 with 15 and 20% FMG HG fines, respectively, gave similar or slightly higher sintering speed, productivity and TI compared to the Base Blend 1 (Table 8). However, further tests of blends 3 and 4 at 3.8% coke are required to test for full optimisation, although any new results would be expected to follow the improvements seen in Blend 2 at 3.8% coke.

Table 7 Imported Ore Blends

Fine Ore	FMG HG	MM 1	Brockman 1	Brockman 2	CID 1	CID 2	Brazilian 1	Brazilian 2	Brazilian 3	Total
Base Blend 1		10	15	10	5	30	13	12	5	100
Blend 2	10	0	15	10	5	30	13	12	5	100
Blend 3	15	0	15	10	0	30	13	12	5	100
Blend 4	20	0	13	13	0	24	13	12	5	100

Table 8 Pot Sinter (200mm diameter) Test (Coke 3.8 - 4.2%)

条件	透气性/ mmH_2O Perm	烧结速度 /mm/min Speed	成品率 /% Yield	利用系数 $/t\cdot m^{-2}\cdot h^{-1}$ Productivity	转鼓强度 +6.3mm /% Tumble	固体燃耗 /kg/t Solid Fuel	B Ra/Re
Blend 1 - 3 .8%	95	20.21	66.67	1.423	60.00	64.22	**1.10**
Base Blend 1 -4.2%	120	22.03	67.51	1.385	58.00	71.12	**1.13**
Blend 2 - 3.8%	85	20.31	70.18	1.483	62.00	60.68	**0.95**
Blend 3 - 4.2%	115	23.64	66.08	1.381	60.00	75.83	**1.08**
Blend 4 - 4.2%	115	23.78	64.69	1.420	58.67	75.35	**1.09**

5. CONCLUSIONS

Chemical Composition and Size Distribution – FMG HG fines has:

- Good chemical composition including lower alumina compared to a number of Australian fine iron ores
- Coarse size distribution suitable for granulation

Single Ores Behaviour

- Granulation – FMG HG fines:
  - Is easier to granulate
  - Produces stronger granules
  - Has slightly higher bed permeability, compared to MM 1
- Sintering – FMG HG fines:
  - Has slightly higher tumble and productivity, at optimum coke level compared to MM 1
  - Significantly higher tumble index and productivity over a range of coke levels compared to CID 1
  - Cloud Break and Christmas Creek HG fines have similar sintering behaviour and can both be used in a HG fines product

Blend Behaviour

- FMG HG fines improves sintering speed, yield, increases tumble strength and productivity at lower coke level (<4.1%) compared to MM 2
- FMG HG fines gives better sintering speed, tumble strength and productivity at lower coke level (<4.1%) compared to MM 1+MM 2
- FMG HG fines at 20% gives similar yield, productivity and higher tumble strength (3.8% coke) compared to MM 3
- For typical imported ore blends, FMG HG fines gave higher tumble and productivity at lower coke level when replacing MM 1 and or at 4.2% coke compared to MM 1+CID1 and MM 1 +CID1+CID 2
- Metallurgical properties – RDI of sinter with addition of FMG fines (33-34%) is similar to the base blend A (33.2%)
- Further blend opportunities for Fortescue's fines are being tested and optimised

Potential Levels of Use of Fortescue Fines

- Recommend 10-15% and up to 20% FMG HG fines in blends with magnetite
- Can substitute 20% FMG HG into imported or low temperature sintering blends

APPENDIX 1

Sinter test Conditions

1. Pot Grate testing parameters

Three different pot grate sizes were used to conduct the sinter tests including 100, 200 and 300 mm diameter.

Sintering at CSU for the 100 mm diameter pot was performed under the following fixed conditions–

i. Bed height = 500mm
ii. Pot diameter = 100mm
iii. Size of return sinter = -5 mm, but sized at 1, 3 and 5 mm
iv. Sinter SiO_2 level = 4.9%, or float where ore or blend is above 5%.
v. Aim basicity = 1.8
vi. Aim MgO = natural for single ores and 1.8% for blends
vii. % returns – nominally 35% on an ore basis
viii. Hearth layer size = +5 -12 mm
ix. Ignition temperature = 1100^0C for 1.5min and at 5KPa,
x. Sintering suction at 10KPa, and
xi. Cooling at 5KPa for 5 min.

Sintering conditions at CSU for the 200 mm diameter pot was performed under the following fixed conditions–

a. Bed height = 650mm
b. Pot diameter = 200mm
c. Hearth layer depth = 30 mm
d. Sizing of return sinter = 5 mm
e. Sinter SiO_2 level = 5.0%,
f. Aim MgO = 1.8%
g. % returns – nominally 35% on an ore basis
h. Hearth layer size = -16 +10 mm
i. Ignition temperature = 1100^0C for 1.5min and at 6KPa,
j. Sintering suction at 12KPa, and
k. Cooling at 5KPa for 5 min.

Sintering conditions for single ore tests at CSIRO Minerals for the 300 mm diameter pot were performed under the following fixed conditions–

a. Bed height = 500mm
b. Pot diameter = 300mm
c. Hearth layer depth = 30 mm
d. Sizing of return sinter = 5 mm
e. Sinter SiO_2 level (aim) = 5.0%
f. MgO level = natural
g. Aim basicity = 1.8
h. % returns – nominally 30% on an ore basis
i. Hearth layer size = -16 +10 mm
j. Ignition flame temperature = 1300°C

k. Ignition time = 90 secs
l. Ignition suction = 800 mm H_2O
m. Sinter suction = 1600 mm H_2O
n. Sizing of return sinter = 5 mm

2. Evaluation of the sintering process included –

b. Balanced Productivity
c. Yield
d. Tumble Index, modified ISO 3271 using % +5 mm for CSU and % +6.3 mm for CSIRO Minerals
e. Return fines balance = 1.00 ± 0.15
f. Unit consumption of solid fuel

3. Definitions of sintering process parameters -

Green Bed Pressure Drop (Permeability)

The green bed pressure drop at CSU, a measure of permeability, is defined as the pressure drop across a 500 mm deep x 100 mm diameter bed of granulated sinter mix measured at an air flow rate of 200 L/min. This airflow rate approximates the superficial gas velocity in the sinter pot to a sinter plant during much of the test. At the CSIRO, the permeability was measured by the pressure drop across a 250 mm deep by 150 mm diameter bed of sinter mix at a flow rate of 400L/min.

Sintering Time

The sintering time is defined as the time elapsed from the commencement of the ignition cycle to the time when the waste gas temperature reaches a maximum.

Yield

The yield is the ratio of the mass of product sinter (i.e. +5 mm sinter) to the total mass of sinter produced less the mass of the hearth layer.

$$\%\ \text{Yield} = \{M_p/(M_p + R_{out})\} * 100$$

where Mp is the total sinter product mass (+5.0 mm less the hearth layer mass).

Return Fines Balance (RFB)

The return fines balance is defined as the ratio of the weight of return fines (-5 mm), generated by the shatter treatment, to the weight of return fines charged to the pot:
Return Fines Balance [RFB]

= Mass of Returns Out (R_{out})/ Mass of Returns In (R_{in})

The target was RFB = 1.0 ± 0.15. Only blends that are within balance are optimised and therefore valid for comparison. Some runs that are slightly out of balance are given where it was not possible with further testing to obtain a balanced run and where the data provided gives some perspective as to the results that were obtained.

Optimisation of Sinter Test Runs

The optimisation process included obtaining maximum productivity and tumble index at minimum fuel level whilst achieving the returns fines balance target.

Productivity

The productivity result, expressed as tonnes per square metre of grate area of sintering machine per hour, is calculated from the sintering time, the cross-sectional area of the pot grate, and the weight of product sinter recovered from the test, less the weight of hearth layer. Balanced or normalised productivities (and fuel rates) were used for comparisons in all pot grate test work. They were normalised with respect to the RFB, i.e. assuming RFB=1.0. This was done to enable accurate assessment and comparisons between blends.

(a) If Rout > Rin , then RFB > 1, then

Balanced Productivity = {Balanced mass of product sinter} / {time*pot area}
= {Mp + |Rout - Rin |} / {(sint. time)*(cross-sect. pot)}

(b) If Rout < Rin , then RFB < 1, then

Balanced Productivity = {Balanced mass of product sinter} / {time*pot area}
= {Mp - |Rout - Rin |} / {(sint. time)*(cross-sect. pot)}

Fuel Rate

The fuel rate, defined as the weight (in kilograms) of dry coke required to produce one tonne of product sinter, is calculated from the weight of coke in the sinter mix charged to the pot and the weight of product sinter generated. The "balanced" fuel rate has been calculated on a RFB = 1 basis using:

Balanced Fuel = {Mass of fuel (dry weight)} / {balanced mass of product sinter}
= {kg coke/ t product sinter}

Note that the fuel rates for pot grate tests are much higher than on plant since during the pot grate test much of the heat value from the fuel is lost as heat to the walls of the pot.

Sinter Strength (Tumble Index, TI)

The sinter strength is measured using a modified ISO 3271 test method to determine the TI of the sinter. The TI is quoted as the weight % +5 mm (100 mm diameter CSU pot) or +6.3 mm (200 mm CSU and 300 mm CSIRO Minerals pots) material remaining after the tumble treatment in which 15 Kg of -40+10 mm sinter is tumbled in a 1 m ISO diameter drum for 200 revolutions at a speed of 25 rpm. The target TI for the sinter product was 60% minimum, which when multiplied by a scale-up factor of 1.13-1.3 for the CSU pots gives a typical industry plant ISO 3271 TI at +6.3 mm value of >65%.

*Reducibility Disintegration Index (RDI)**

This test is designed to estimate the behaviour of ferrous burden material whilst it undergoes reduction in the blast furnace. During this reduction the hematite to magnetite and creates a change in volume within the material. This, together with any combined water which is driven off during this reduction phase, can cause disintegration of the material.

The test calls for 500 grams of either lump ore or sinter to be heated in a metal reducing tube to 550°C within 40 minutes. The material is then soaked at 550°C for 30 minutes and then reduced for 30 minutes at that temperature using a reducing atmosphere of 30 per cent carbon monoxide and 70 per cent nitrogen. The sample is then cooled to room temperature, placed in a tumble apparatus and tumbled for 30 minutes at 30rpm. The tumbled sample is then screened at 10, 6.3, 3, 1 and 0.125mm and the Reduction Disintegration Index is usually reported as a mass percent minus 3mm.

*Reducibility Test (RI)**

The test is designed to gain a measure of the reducibility of the material, an all-important feature in blast furnace technology, wherein the object is to convert the iron oxides into relatively pure iron by a series of reduction reactions. The procedure for determining this reducibility measure entails a reduction temperature of 900°C again using 500g sample of -21 +19 mm sinter placed in a vertical reduction tube, using a reducing atmosphere of 30 per cent carbon monoxide and 70 per cent nitrogen. The reduction is carried out for 180 minutes at 900°C during which time the loss in mass of the sample is continuously measured and used to calculate the degree of reduction. Interestingly, whilst the standard calls for the expression of the reducibility as a mass percent of removal of oxygen per minute up to 40 per cent reduction, the most commonly reported value is the final per cent reduction achieved after the 180 minutes at temperature.

* Angove J E, Iron Ore Testing – Applicable Standards