Note on Coal Transportation, Storage and Handling

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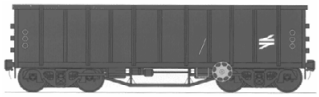
This technical note forms part of a panel discussion on Transport Considerations for Sub-Saharan Coal Exports, Session 7 of 8th Coaltrans South Africa and aims at stimulating a discussion around pricing strategies for coal export terminals.

While busy with a logistics study for Matola terminal exporting coal and magnetite (also see “Upgrading an African Terminal” presentation by Tony Pinto of ELB), it became evident that plant commitment and loading tariffs did not correspond with one another (at that time). A simplified analysis below illustrates the point, which does not necessarily replicate Matola’s conditions but is rather generic.

Assume we need to export 30,000 tonne of coal and magnetite. Table 1 shows typical trains used to deliver bulk commodities.

Table 1: Parameters of rail traffic

Description	**Coal**	**Magnetite**
Wagon type	CFR, CAR, CBL, CBR 	CMR 
Aver. wagon load	50 tonne	60 tonne
Wagons per train	60	60
Trains required	10	9

With an average wagon tippling time of 4.0 minute and 1.5 hour train shunting time, commitment of a tippler station consisting of two tipplers, each handling a single wagon per cycle, will be as per table 2

Table 2: Tippler station commitment

Description	**Coal**	**Magnetite**
Total occupancy, hour	35.0 hour	31.5 hour
Relative tippler commitment	111%	100%

Once material has been unloaded, it must be stockpiled. Assume the following parameters of longitudinal stockpiles (Table 3 and Figure 1)

Table 3: Stockpile parameters

Description	**Coal**	**Magnetite**
Bed width, meter	30	30
Repose angle, degree	31	45
Stockpile height, m	9.0	15.0
Cross section area, m^2	135	225
Average bulk density, t/m^3	0.93	1.75
Stockpile ground area, m^2	7,201	2,286
Storage space relative commitment	315%	100%

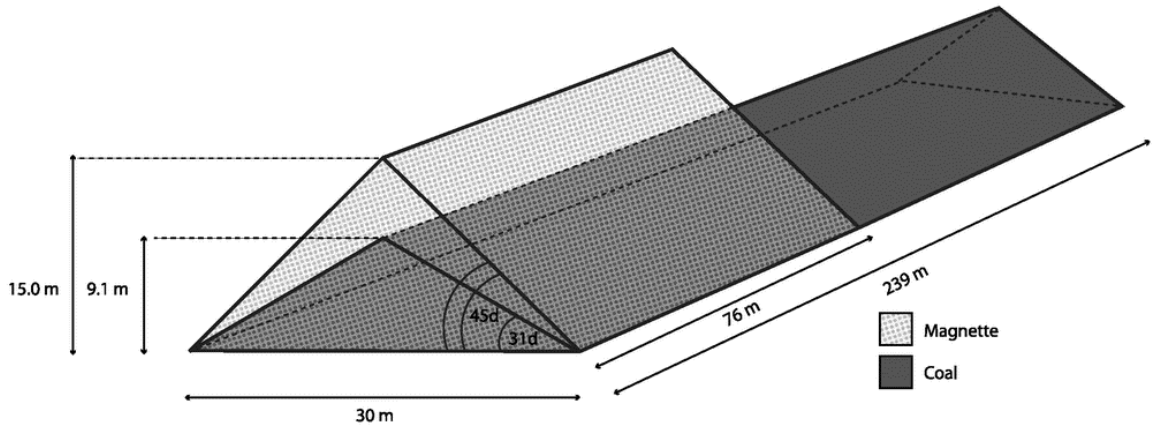


Fig 1: Stockpile shapes (simplified)

Once a ship calls to the port, material must be reclaimed and loaded. Assume a conventional bucket wheel reclaimer is used for that, whose reclaim capacity is determined by the wheel rotation speed, number and volume of buckets on the wheel (see Fig 2).

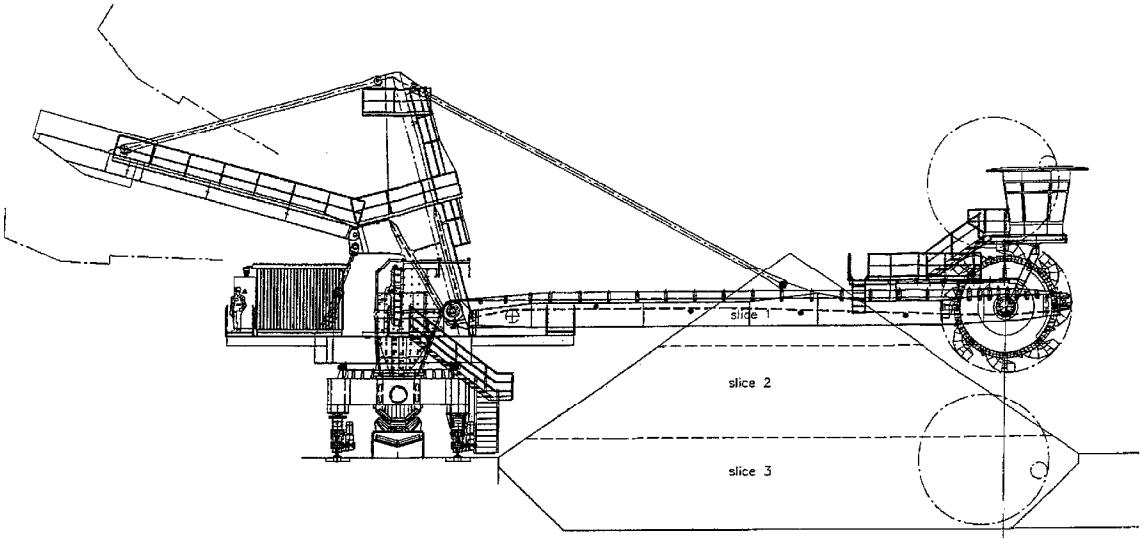


Fig 2: Bucket wheel reclaimer

Due to the bulk density difference, the very same machine capable to reclaim, for example, 18,000 tonne of magnetite per day only loads 9,600 tonne of coal. Operating in average 22 hour per day this will result in the following estimated ship loading times, refer to Table 4.

Table 4: Net ship loading time (other delays excluded)

Description	**Coal**	**Magnetite**
Ship loading time, hour	69 hour	37 hour
Relative commitment	186%	100%

The most intriguing consideration is that terminals around the world are paid a rate per tonne of commodity loaded, and in this specific case the two loading tariffs for coal and magnetite were almost the same, in fact, the tariff was slightly higher for magnetite than for coal (at the time of the study), see Table 5 for the summary.

Table 5: Relative capacity commitment and revenue

Description	**Coal**	**Magnetite**
Tippler commitment	111%	100%
Storage commitment	315%	100%
Shiploading commitment	185%	100%
Loading rate	93%	100%

If we assume all capacities being equally important (i.e. having the same weight), for an overall 104% higher coal handling and storage capacity commitment than the same for magnetite, the terminal receives a 7% lower revenue! In other words, a tonne of coal is approximately equivalent in capacity commitment to two tonnes of magnetite while it fetches a 7% smaller loading rate.

If we had a choice, what commodity should be preferred for exporting through a bulk terminal? The answer is quite obvious.

Of course, loading rates heavily depend on the market conditions and demand for specific commodities; however it is still difficult to admit that loading tariffs for coal and magnetite (or any other ore / concentrate) will change to such an extent that loading coal will become more attractive (from capacity utilisation viewpoint) than a heavy commodity.

Transport, storage and handling are essentially volumetric processes, and ultimately loading rates must be expressed not in mass but rather in volumetric units. Since it involves a huge industry (take shipping alone!), it is difficult to foresee that the pricing strategy will change overnight. However, from the author's personal viewpoint, a tariff premium may have been introduced for loading light bulk materials to make coal an equally attractive commodity for people who move it. This will also improve a return on investment in coal terminals and hopefully increase their number in coal exporting countries, which will eventually contribute to global energy security since coal will remain an important energy source for years to come.