



Productivity prediction – fact or fantasy?
10 September 2009

Last column I introduced the productivity paradigm; fill it up and do it more often, and it was my intention to expand on this further. However, something came across my desk this week which has caused me to diverge as there are some important data and productivity issues tied up in this document. I will address a number of these issues in this and the next couple of columns.

We are working with one of the major mining companies in the lead-up to them taking delivery of a 62.7 CuM electric rope shovel and a number of 327 tonne trucks. I will leave the OEM's names out. The mining company was sent a productivity forecast by the shovel OEM and I wanted to run through this to show why mines almost religiously miss production targets. You see many mines will look to everyone except within, to determine the likely performance of new equipment. Many often turn to the supplier and blindly accept whatever they are told. Down the track when forecasts aren't met there are a multitude of excuses the supplier can use as to why and what has changed since the assumptions were made. I know because I have helped suppliers get out of trouble for overly-optimistic predictions (and in some cases guarantees) on production rates. This is not an attack on a particular supplier as they are mostly the same; why would you expect them to know about productivity? They are mostly salesmen and equipment builders. Sure, in a perfect world our suppliers would take an interest in after-sales performance but most don't. So long as it is running it is doing OK.

Returning to the productivity analysis. The first point to notice is the fudge factors used to arrive at the answer that the client requires. In this case the required answer for truck payload is 327 tonnes. So the Dipper Capacity (heaped), swell factor, dipper compaction and fill factor are all variables in the Excel spreadsheet which can be varied to arrive at the target payload of 109 tonnes.

Here we raise two really important points. Firstly, does the truck having a nominal capacity of 327 tonnes mean anything and secondly will the 62.7 CuM dipper carry 109 tonnes on average. Answering these questions in turn.

Does 327 tonnes nominal truck capacity mean anything? Well yes it does. It means it is going to carry a lot of something. But is it going to carry 327 tonnes of something? Probably not on average.

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Average payload for 327 tonne trucks around the world is 288 tonnes (88% fill) while best practice is 299 tonnes (91.4% fill). This is an issue in itself which I will write on at a later date but we wonder why anyone including a shovel supplier would use 100% of the nominal capacity of trucks when it just doesn't happen on average. The simple answer is that while there is plenty of gossip and innuendo people just don't know. Maybe you can start seeing the value of data. The information is available and you don't have to plan blindly. OK enough advertising.

The second question; will the 62.7 CuM dipper achieve 109 tonnes on average. Back in 2001 we reshaped a 44 CuM dipper to become a 48.4 CuM dipper and it carried 111 tonnes on average so a 62.7 CuM dipper can easily carry 109 tonnes, but will a 62.7 CuM dipper of the supplier's design carry this payload? Average in-dipper density (payload / capacity) for this OEM's dippers is around 1.85 t/CuM which would provide a payload in a 62.7 CuM dipper of 116 tonnes. So in this case they are predicting below average performance achieved by the new shovel? Why?? Are they recommending the operators won't need to fill the dipper up fully to average 109 tonnes per load? What happens if the trucks do only carry say 290 tonnes (97 tonnes per pass)? Again the supplier doesn't know and is making guesses. But you don't need to guess. The data and information is available and you need to use it.

A further point to this question. Another supplier's shovel dippers perform much better. (Keep in mind that while many people believe there are currently only two shovel suppliers, there are actually a number from Russia and China which produce quite reasonably performing machines and at least one dipper manufacturer in South Africa). This other supplier's average in-dipper density is around 2.05 t/CuM. So to move the 109 tonne average payload probably needs a 6-8 CuM smaller dipper which weighs say 8-12 tonnes less. Maybe they could have purchased a smaller shovel or used smaller gears or motors or whatever. Don't ever forget that you are using energy to move your spoil and commodity. Like it or not but the community's attitude to using energy is not getting better so you can't ignore efficiency. The data is available. You can make informed decisions. I will return to this specific case of predicted shovel productivity in the next column.

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PRODUCTION ESTIMATES

DESCRIPTION	UNIT	System 1
Loading Unit		
Material Type		Overburden Waste
Truck Type	model	
Truck Nominal Payload	tonnes	327
	(US tons)	360
Dipper Volumes		
Dipper Capacity (Struck)	lcm	62.7
Dipper Capacity (Heaped)	lcm	60.8
Material Characteristics		
Ave Bank Density	t / bcm	2.15
Ave Swell Factor		1.20
Ave Broken (loose) Density	t / lcm	1.79
In Dipper Compaction		1.00
Fill Factor		0.97
Shovel Parameters		
Dipper Load per Pass	lcm	60.82
	bcm	50.68
	tonnes	108.97
Dipper tare	tonnes	81.00
Shovel RSL	tonnes	190.50
Shovel Overload Condition	% of RSL	99.7
Truck Parameters		
Nominal Truck Capacity	tonnes	326.59
	lcm	182.28
No. of Passes (to fill nom trk to 100%)	passes	3.00
Even Integer Passes		3
Actual Truck Payload	tonnes	327
	bcm	152.0
	lcm	182.5
Truck Overload Condition	% of RSL	100.1
Cycle Times		
Loading Technique		Double - side
Swing Angle	degrees	70
Time / Pass	sec	36
Spct Time	sec	20
Total Load Time (with spct)	sec	128
Truck Payloads		
Actual Truck Payload	tonnes	327
	bcm	152.0
	lcm	182.5
Max. Trucks / Hour		28
Ave Truck Cycle Time	mins	15.0
No of trucks reqd operating n fleet		7
Production		
Theoretical Potential Production	tonnes / hr	9,194
	bcm / hr	4,276
	lcm / hr	5,132
Job Efficiency - estimated	%	90.0%
Truck Presentation Factor	at shovel	85%
Actual Average Production	t / hr	7,034
	bcm / hr	3,271
	lcm / hr	3,926
Productivity		
Annual Scheduled Working Hours	Hr	8,712
Machine Availability - average	%	90.0%
Shovel available hours	Hr	7841
Utilisation - estimated	%	85.0%
Shovel Op Hrs	Hr	6,665
Annual Production		
Total Production	Million Tonnes	46.88
	Million bcm	21.80