Truck and loader matching
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A number of years ago my doctoral supervisor (A Professor of Business) hit me with the statement that the way the mining industry compared equipment was invalid. He said that there were fatal flaws in using rated suspended load, gross allowable load, bucket capacity, struck volume, heaped volume, etc. Consequently we developed a new one. This has had an impact on the way some mines rate equipment but on the whole has not caused much of a ripple…….yet. Mines continue to use flawed approaches to data. The new approach to defining equipment capacity has a significant role to play in defining best practice and in determining an optimal match between truck size and loader capacity.

Our measure is called Maximal Rated Capacity (MRC). The logic for the MRC is that it is a measure of what payload a best practice loading unit of a particular capacity would achieve. Trucks are a little different as they are already sized based on a heaped capacity and are defined in tonnes (which is complete bollocks but anyway that is what we have to work with). I will deal with loaders first and then trucks.

The formula for MRC for any loading machine is

$$\mathbf{MRC = ER_{P95} * RC}$$

Where

ER	=	Efficiency Ratio (t/CuM)
	=	$payload_{P95}$ / RC_{P95}
	=	payload for the 95th percentile / RC for the 95th percentile
RC	=	Rated Capacity (CuM)

When you have sufficient breadth of data this is the only real way of separating performance of the equipment (what it is capable of) from performance of the mine (what it actually does).

With trucks the formula for MRC is

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MRC = Best Practice Payload

Simply what the best practice trucks carry on average

To determine optimal matches these are the numbers you must compare; not what you achieve on site. What you achieve on site has inefficiencies and an (unconscious?) expectation of underperformance built into what is achieved. To determine matches we use the MRC ratio which is the MRC for truck / MRC for loading unit. The best way to demonstrate this is by an example.

This example is where the current match is a Liebherr 996 loading Cat793B trucks. The worldwide performance database shows that the ER_{P95} for the Liebherr996 is 2.16 and we have a 33 CuM bucket on the machine in question.

MRC for Liebherr 996 = ER_{P95} * RC = 2.16 * 33 = 71.3 tonnes.

MRC for Cat793B = 208 tonnes

Again, we know this because we know what best practice Cat793B's achieve.

MRC Ratio for 996 / 793B Match = 208/71.3 = 2.85

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This is a Sub-Optimal 3 pass match with 5% loss. What it says is that any mine using this match is introducing a minimum 5% loss into their process. Normally, the losses are much greater due to site issues. To demonstrate this consider the MRC ratio for the ***average*** 996/793B match = 201/59.4 = 3.38. (Remember, the MRC ratio uses best practice.) Consequently the average mine has a minimum loss of 13% in the match between the trucks and the loaders introduced through a range of site factors. Many sites using this match will use 4 pass loading and that results in a loss of 16%. In a distorted way, site inefficiencies hide the true match inefficiency.

Assuming the mine wants bigger trucks we can calculate the MRC ratio for any trucks.

MRC Ratio for 996 / 320ton Match = 3.87

This is a comfortable 4 pass match with 3% loss

MRC Ratio for 996 / 360ton Match = 4.36

This is a poor 4 pass match with 9% loss or a poor 5 pass match with 13% loss.

MRC Ratio for 996 / 400ton Match = 5.09

This is a good 5 pass match with <2% loss

This is a powerful analytical tool on two fronts. Firstly, you can see what best practice is and compare against it. Secondly, you can make decisions which will facilitate better truck and loader matches (lower losses). In this case the best match is the 996 loading 400 ton trucks in five passes. The 320 ton trucks are a reasonable match in four passes. If you have a 996 loading 793B's and a 3 pass load scenario you probably think you are doing OK but the truth is you have introduced inefficiency into your mine by choosing a sub-optimal match. The problem with this is inefficiency breeds inefficiency and it is only a matter of time before other process "problems" happen which bury the match inefficiency.

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