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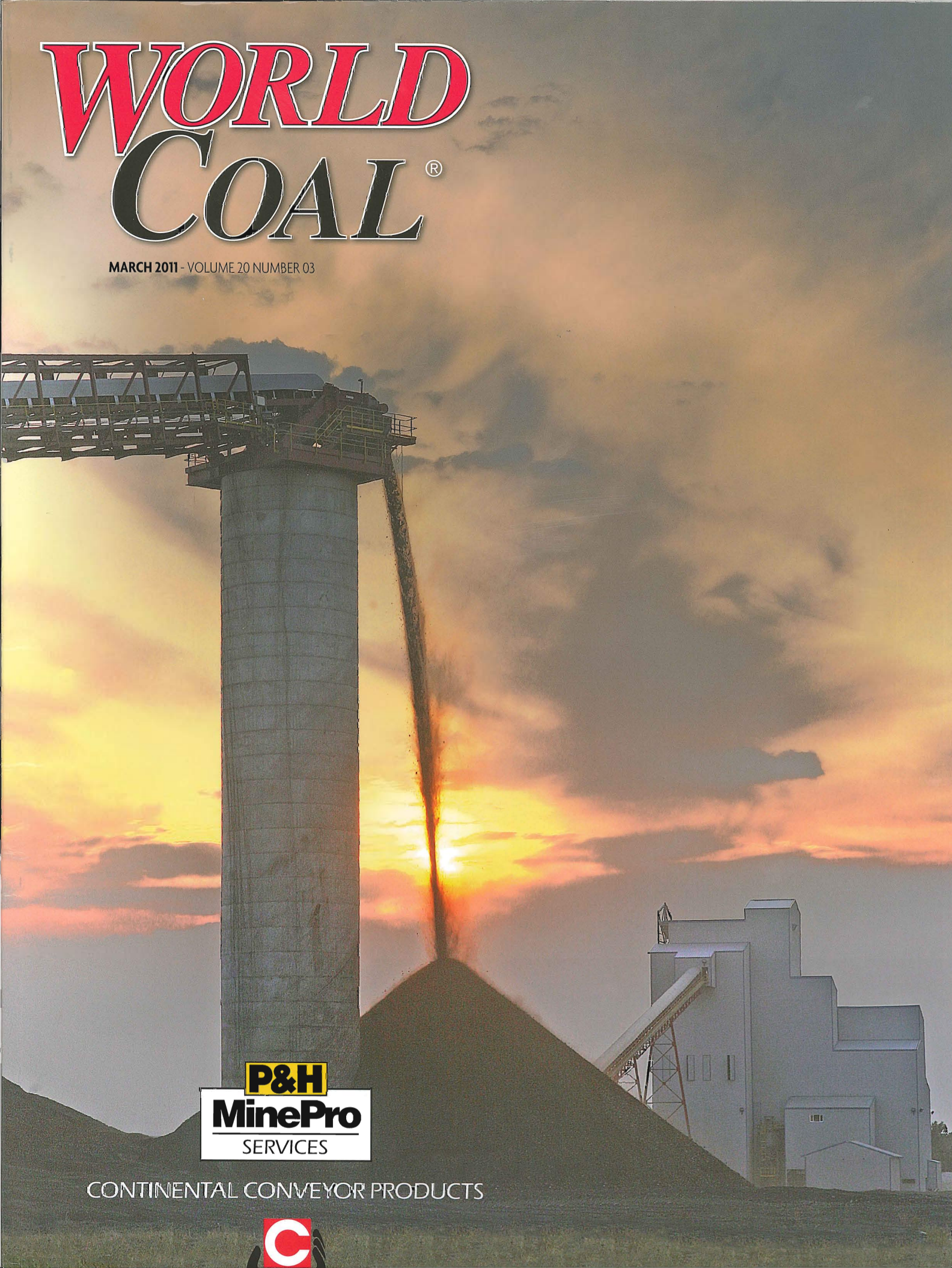

DAVID RIGGS, USC CONSULTING GROUP, US, EXPLAINS WHY A DETAILED EXPLORATION INTO OPERATIONAL DATA CAN HELP OPTIMISE MINE PERFORMANCE.

Digging *deep*

One area of opportunity often overlooked in a surface mining operation is the data that is collected, and the information that resides, in various business intelligence systems, such as dispatch and ERP systems. SAP Business Warehouse, Talpac and Modular Mining System are all examples of such systems.

All of these systems can be put to better use in determining where in the load, haul, dump and return portion of the overall opencast mine cycle variability from optimum cycle time occurs. Also, to what degree overall equipment effectiveness (OEE) is adversely affected by the inability of the operation to execute the same cycle consistently at low levels of variability.

USC Consulting Group has observed OEE as low as 46% before putting this information to use, and as high as 65% once it has been fully implemented (Figure 1).

Table 1. Summary of loads from Shovel 146 (week of 20 February)

Location	No. of loads	Average CT	Best CT	Actual best	Cycles at AB	Truck hours used	Truck hours required	Gap	Lost capacity	Potential loads	Potential increase loads	Potential increase
CPLIFT9	237	19.4	14.9	15.3	6	76.6	58.9	17.8	23%	309	72	30%
CPLIFT8	1203	20.9	18.1	18.5	138	418.6	362.9	55.7	13%	1388	185	15%
CPLIFT7	652	21.4	17.4	18.0	78	233.1	189.1	44.0	19%	804	152	23%
CPRDWRK	122	15.7	13.3	12.8	13	31.9	27.0	4.9	15%	144	22	18%
CPLIFT10	555	20.5	16.6	18.5	72	189.8	153.6	36.3	19%	686	131	24%
CPBKFLL	22	14.5	13.3	8.0	3	5.3	4.9	0.4	8%	24	2	9%
Other	9	41.8	41.8	41.8	9	6.3	6.3	-	0%	9	-	0%
Total	2800	20.61	17.20		319	961.6	802.6	159.0	17%	3355	555	20%

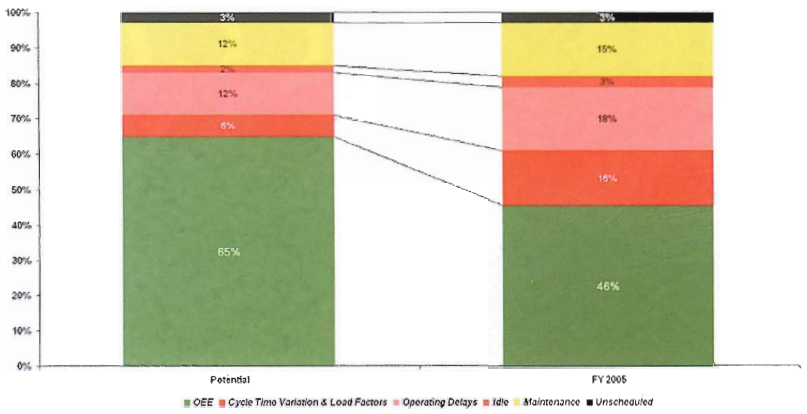

Figure 1. Estimated OEE for TCM haul trucks (based on 2005 actual data).

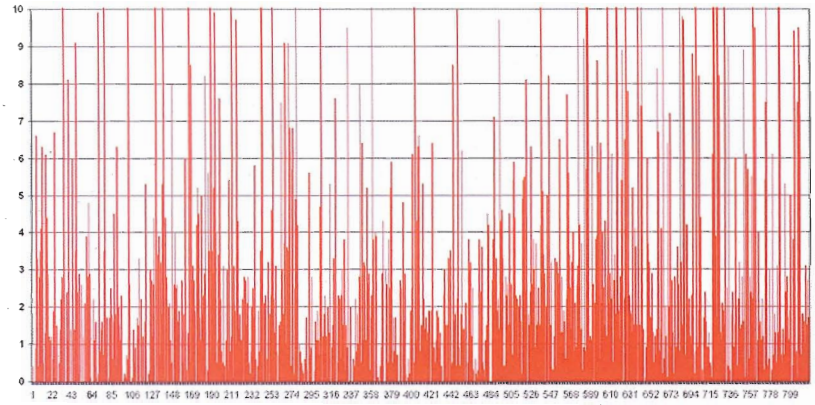

Figure 2. Cycle time variation - spot and queue time (week of 20 February; all loads).

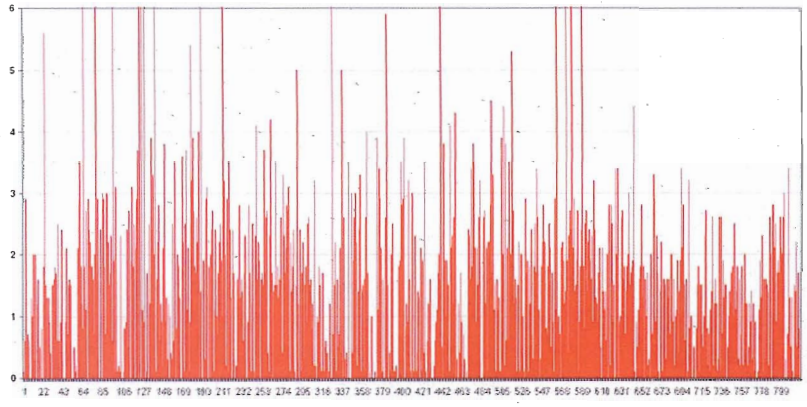

Figure 3. Cycle time variation - dump time (week of 20 February; all loads).

This particular data set was sourced from SAP Business Warehouse and demonstrates that the bulk of capacity losses were due to:

- Cycle time variation and load factors (16%).
- Operating delays and idle (21%).
- Maintenance (15%).

Once tools were put in place to make this information more visible to the dispatchers and shift supervisors, they were able to identify the issues that expanded cycle time during the shift, take corrective action, and ultimately increase the number of hauled tph during operation.

A second data set sourced from the dispatch system helped identify what haul routes were most frequently run, to what degree each portion of the mining cycle demonstrated variation, and for what reason. This information was then made available to the operators during the shift to help increase operating performance.

As seen in Table 1, each of the hauls are identified by location and the average cycle time from the dispatch system is compared to the best demonstrated cycle time, again from the dispatch system, and then compared to an actual best cycle time that was derived from the Talpac modelling tool and confirmed in the field through observation.

The most frequent haul on Shovel 146 was to CPLIFT8 with 1203 loads, while capacity lost due to cycle time variation was 13%. Across hauls to all locations lost capacity averaged 17%.

The next step in the process was to determine where the lost capacity

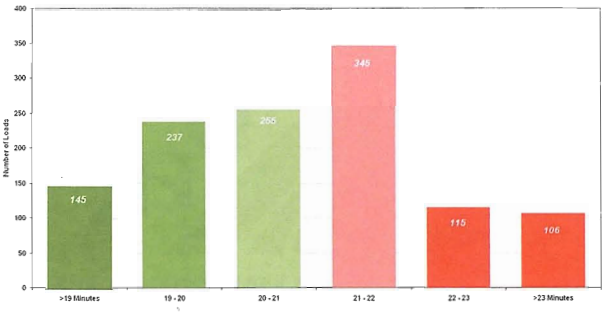

Figure 4. Histogram of haul cycle times - week of 20 February 2006 (from 146 CPST-10BN5E to CPLIFT8; data summarised for the week).

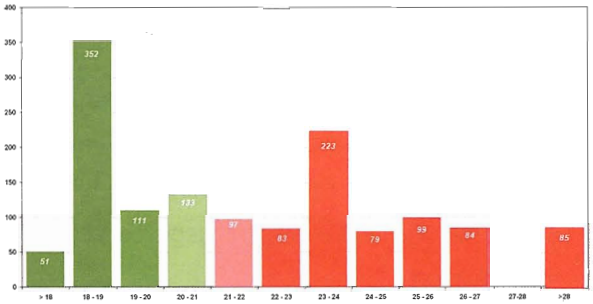

Figure 5. Histogram of daily haul cycle times - week of 20 February 2006 (from 146 CPST10BN5E to CPLIFT8 - data summarised for each individual day).

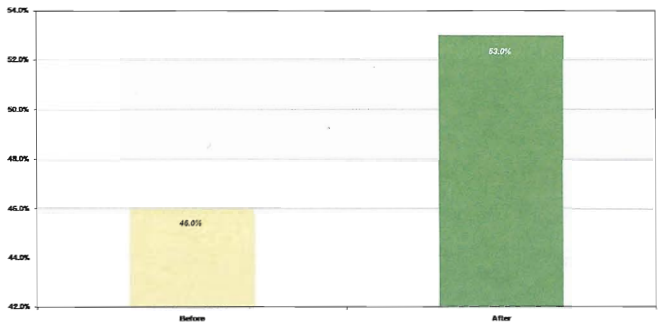

Figure 6. Haulage fleet OEE.

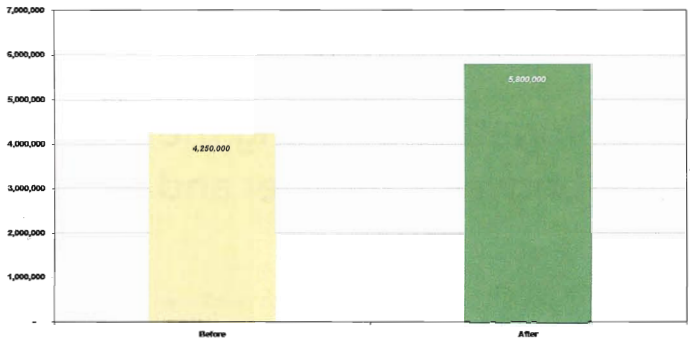

Figure 7. Bcy mined/month.

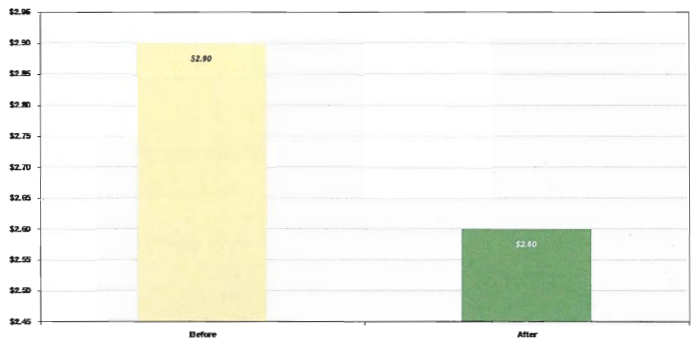

Figure 8. Cost/bcy mined.

occurred. Figures 2 and 3 show acute levels of variation for both the spot and load cycle time, as well as the dump cycle time. In both cases, variability from the optimum was more than 300% or, stated differently, the cycle time could be less than 1 minute or more than 3 minutes.

Once the source of this variation was isolated, operator training was developed and implemented. As a result, variability was drastically reduced, capacity was recovered, and OEE increased.

Another way to look at the data is to increase the resolution. In Figure 4, the company generated a histogram of haulage cycle times that were averaged by the dispatch system for an entire month. This demonstrated a range of cycle times from 19 to 23 minutes, or a variation of about 4 minutes. When the company increased the resolution and looked at a histogram based on daily average cycle times, the range is much wider, varying from 18 minutes to more than 28 minutes – 2.5 times greater than the data summarised on a monthly basis (Figure 5).

Mining operations have many more data collection systems available than ever before to help optimise OEE and capacity utilisation. These three data sources, put to good use, have helped USC Consulting Group enable its mining clients to get a much better return on three of their asset classes:

- The information technology investment.
- The haulage fleet equipment investment.
- Their investment in human resources.

Using business intelligence to drive value

Once clients are getting full utility out of their technology investments in an opencast mining operation, there can be great value generated by using these systems more effectively. In Figures 6 – 8, significant improvements can be seen in overall capacity utilisation measured as OEE, overall banked cubic yards (bcy) mined/month, and a reduction in cost/bcy.

One of the key elements in putting these tools to better use begins with the daily planning process.

Rather than have a fixed tpd target that reflects the overall annual budgeted volume divided by the number of operating days, the company tends to have its clients develop a variable production rate that is based upon the specific areas of the pit that will be mined and the equipment and human resources actually available to deploy.

Once a realistic plan is set based on the actual areas to be mined and available resources, an ongoing review process is used to measure adherence to the plan and identify issues that prevent high levels of plan attainment.

This process supports continuous improvement by encouraging the mine operations team to make changes during the shift that will improve operating effectiveness. For issues that cannot be resolved on shift, operating issue and delay data are collected and analysed after the shift is completed. This data helps to set priorities on which issues to resolve and what resources should be assigned to ensure that problems are corrected.

Opencast mining operations can be significantly improved by following four key steps to ensure that investments in all resources deployed at the minesite are fully utilised:

- Determine to what degree IT investments are being utilised and whether they are delivering the intended benefits (i.e., improved OEE, reduced cost/bcy). If there are gaps or deficiencies, fill or remedy them and train the end users to use these tools on a daily basis.
- Develop daily plans that reflect the actual use of resources deployed and take into consideration variation in haul distances and pit road grades.
- Monitor performance to these plans during the shift and, where possible, make changes during the shift to correct off-schedule conditions.
- Use the data collected from these systems to identify and prioritise issues for resolution and get them corrected. Cycle these processes to generate ongoing improvements.

Digging a little deeper into the data made available through technology, and using it to address operational shortcomings in a timely manner, can lead to top quartile operational and financial performance. WC