

The Big Picture;

An overview approach to surface mining

by L. Widdifield and R. Riggle

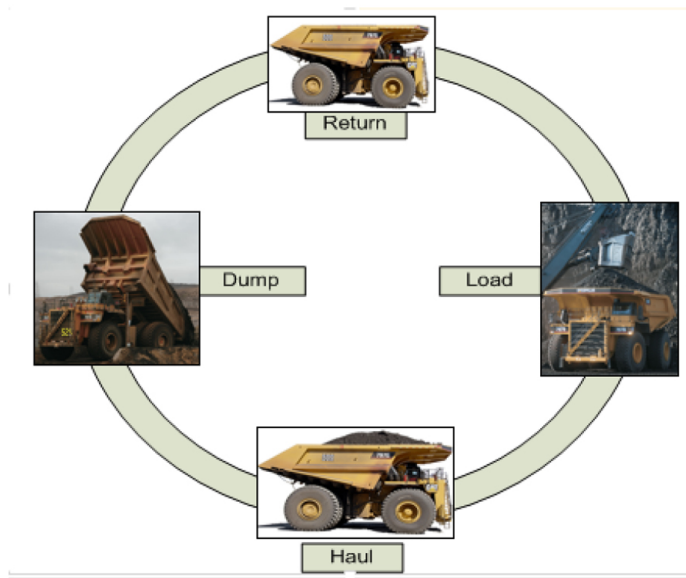
In today's challenging mining environment the "Big Picture" (Caterpillar, 2013) approach to mining is often neglected. With haulage costs approaching up to 45 percent of the overall mining costs, all too often the load-haul-dump-return cycle is not investigated in its completeness. This paper will discuss the aspects

enhance operations have sometimes vanished. Four areas to be discussed in this paper are:

- Look at the "Big Picture" (Caterpillar, 2013);
- Use common sense;
- Identify areas for the biggest improvements in the operations;
- Observation of small details for big impacts to lower cost per ton and increased production.

Figure 1

Caterpillar's Big Picture approach to surface mining.



of taking the time to observe an operation from the "Big Picture" approach. Mining business miners, engineers, trainers, supervisors and managers have ever increasing roles and responsibilities as never seen before. The endless human resource, safety, environmental, cost control issues and performance initiatives, detracts from precious time that in the past may have been dedicated to examining the day-to-day operation. Having examined numerous mining operations over the past several years, one common denominator is lack of time to

properly observe operating practices in the field and recognize both positive and negative observations. The old fashioned vocation of observing the operation to assess the haulage, loading and maintenance processes to adjust, maximize or

Whether miners claim to have been around and experienced it all or are the rookie on the mine site, they are expected to execute the mine plan at the lowest cost possible. So why is it so difficult to execute this task? Shouldn't supervisors just have to man the equipment, tell operators to have a safe day and tally up the numbers at the end of the shift? And let the technology system do the rest? So what could go wrong?

A lot can go wrong.

Mining companies seek help from consultants, training departments, performance reporting systems and an arsenal of resources. Armed with all this information, the supervisors just hop in the pick-up and tell the shovel operator to speed up. Sounds simple enough. But when the improvements don't happen, what could have gone wrong? It comes down to people, the simple things that were not executed over the months previously and as a result the mines performance is not where it should be.

A mine is built by people. Managers who have the vision to develop the ore body in a manner that follows sound engineering practices. The infrastructure to mill the ore and support the equipment needed to move the material. Along the way, equipment is procured and operators trained to run the gear. Engineers and geologists set up the design, the material movement and haulage routes. Sounds easy to this point. So, why is there this constant struggle at mine after mine to move more with less and get the costs down?

Understanding how to make great Miners out of these people is critical to lowering your cost per ton.

The "Big Picture"

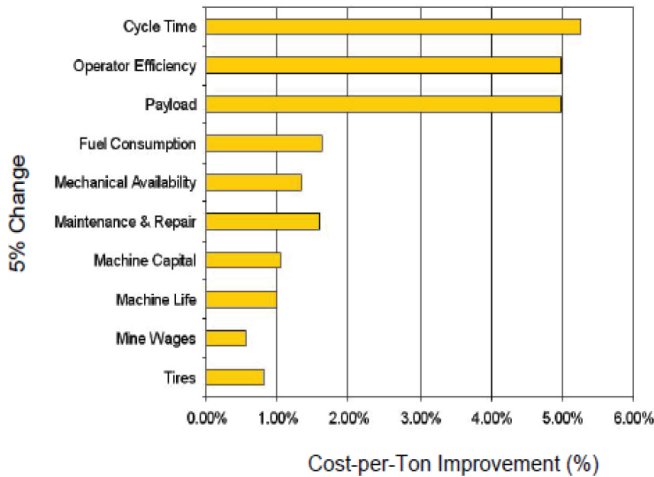
Webster's Dictionary defines the "Big Picture" as the entire perspective of the situation or issue.

The "Big Picture" (Caterpillar, 2013) in Fig.

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Figure 2

Cost per ton sensitivity chart.



1 has a lot going on behind the scenes, shovels, graders, dozers, blasting and probably a mine controller making assignments and directing traffic as well. As you look for improvements in your operation, take a “Big Picture” look at the surface mining operation.

Use a common sense approach. The following list of questions (Clifton, 2013) are designed to cause you to step back and take a real hard look at your operation to observe what is working or not working.

General mine observations

- Is there adequate, well-trained supervision on site – Do they know good basic operating practices?
- Do operators recognize those equipment signals requiring service or repair?
- Do your employees make suggestions to improve operations?
- Are good training programs in place and effective in the field?
- Is continuous improvement your goal?
- Do all people receive safety training – Do they know what to do in case of an emergency situation?
- Is the mine technology performing as planned and accurate?

If answers to the above questions are “yes” then you no doubt have an efficient project. It should be remembered that experience and common sense will be your best tool in utilizing the equipment under any set of given conditions. However, these few questions may remind you and your organization that there are ways to improve any operation. Good efficiency habits is everyone’s job.

Last, but not least, is practicing good communications. Say what you mean, make

sure everyone understands. Poor and unclear communications may result in costly mistakes to the operation.

The load area observations. Loader/shovel operator is the “team quarterback” – Think dig pattern.

When having a discussion with the operator does it include the following?

- Is the face material properly blasted for easy digging with consistent loading cycles?
- Is the loading tool properly equipped for the job (tires, bucket, edges, GET)?
- Does the truck require spotting with a full bucket?
- When over trucked, do truck operators use a good pre-position for fast efficient exchanges?
- Is the truck positioned at a good angle for easy loader cycling and less maneuvering?
- To enhance production are you taking advantage of double side loading with face shovels?
- Do shovels have proper clean-up support in the loading zone?

These are just a few of the variables that will impact the tons per hour exiting the pit. Missing one or two key pieces in this puzzle for maximum performance will result in missing optimal results in the field. Remember step back and look at it from the “Big Picture.”

Haul and return roads

One of the most important issues to be discussed is the haul road system. Well let’s just say it will all fall into place thereafter.

Definition of a haul road: If the rubber rolls over it “it’s a haul road.”

Extensive studies, theoretical and practical analysis are conducted at mine sites every year. Haul roads and haulage systems often degrade over time. Mine operators then struggle for years amidst an active mine trying to get a road into the original design set out years previous. Some of the most common road issues are as follows.

Construction of the base, sub-base and the top road surface should have sufficient material for motor graders to work the surface to remove potholes, ruts etc. Test bed is our supervisor’s truck comfortably doing 40 mph, safely and not vibrating.

Drainage is very important. If not done correctly, a haul road deteriorates within hours of a heavy rain. Thaw and freeze cycles can also

Figure 3

A Caterpillar haul truck.



create safety issues, so miners need to get the moisture off the road as quick as possible. A 3 percent cross fall is generally adequate, with push outs through the berms to let the water escape off the haul road.

Design of the haul road is extremely important for today's ultra-size mining trucks to maintain their maximum safe speed. Corners, ramps, intersections if not laid out correctly will impact truck performance. During most mine site audits more than 50 percent of the corners and intersections are restricting truck speeds and thus performance. Adequate haul road width is critical for trucks to safely pass one another.

Dump areas. As you continue with your mine observations of the haul roads consider the following as haul roads continue to dumping point.

When haul trucks approach the dump area what do you see? Park off to the side and observe the traffic flow, what the dozer operator position the trucks and maintain the berm and dump area. Huge production gains and most certainly reduction in truck damage especially tires can develop through first class dump roads and dumping areas. A few of the important items to observe are:

- Is the dump large enough to handle traffic flow? Does it drain?
- Does the safety berm meet mine safety regulations?
- Is the dump pattern adequate minimizing truck delays?
- Can truckers enter & exit at comfortable safe speeds?
- Do operators lower beds before moving away from the dump point?

Now that you have made your assessment decisions have to be made on the next steps.

Small details make a big impact. The biggest area of gains are in cycle time, operator efficiency and payload. Changes in these areas can result in big gains in your operations. Studies have shown

that for every 1 percent improvement in change can result in a 1 percent improvement in cost per ton.

As Fig. 2 (Caterpillar, 2013) depicts big gains, it is really small gains that make the difference in lower mining costs per ton. Shovel bucket fill factor increases with the correct truck pass match, decreasing truck exchange times, adhering to the 10-10-20 rule are just a few mining practices that will lower the cost per ton.

Conclusion

The "Big Picture" (Caterpillar, 2013) approach means stepping back before jumping into the small details to arm yourself with the key observations.

From here develop an action plan to focus on the right areas for improvement and the correct resources like the A Reference Guide to Surface Mining Applications (Caterpillar, 2013). Consulting with mining experts both inside and outside your operation so that a systematic approach to improving the production rate can be undertaken.

As mentioned earlier, people build mines and people respect what you inspect not what you expect. ■

References:

Caterpillar. 2013. A Reference Guide to Surface Mining Applications.

Clifton, K.H. 2013. Caterpillar. Unpublished works.