



White Paper

Onboard Scales and Weighing Systems: Return on Investment Analysis

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Introduction

Competitive organizations know that the real value of onboard scales and weighing systems go beyond the ability to capture accurate payload data quickly and efficiently. The return on investment (ROI) of these systems is derived from the technology's ability to deliver reliable, high-quality information to the right people at the right time. With real-time data of machines and material movement, individuals can then make adjustments to affect production during the shift.

ROI considerations include the evaluation of how onboard scales systems can improve operational efficiency and drive more cost-effective operations, from pit to plant, to sales. With a broader vantage point, quarry operators and others in construction, mining, forestry and waste management/recycling can better understand the true cost of onboard scale systems compared to the real business value they deliver across the organization.

A quick look at lean thinking

A foundational base for effective measurement and ROI evaluation can be found in Lean thinking principles. Lean principles map out strategies to drive out waste throughout an organization to overcome constraints, improve production and ultimately satisfy the customer. Before diving deep into an optimization initiative, it is important to remember lean principles and keep an eye on the big picture to identify possible waste throughout the enterprise workflow, from extraction to processing and loadout. The idea is that in the aggregate-processing value chain, the chain is only as strong as its weakest, or least efficient, link. The overall productivity of a quarry operation, or materials movement operation, is the sum of the several sequential processes, each of which should be evaluated in the production of a high-quality finished product.

By identifying the right issues and focusing on the biggest opportunities for improvement first, organizations can quickly make significant strides in increasing revenue and reducing costs. For some organizations, this may mean focusing on truck idle times, or cutting cycle times. It could also include increased machine fleet visibility to schedule regular preventative maintenance on trucks and improve machine utilization, or it could be gaining greater visibility into each of these areas.

Identifying key productivity measurements around payload, processing and loadout will help organizations achieve the optimal loader scale investment payoff – having the ability to make strategic, informed decisions about operations and production more quickly and with greater precision.

Key productivity measurements

1. Tons of material moved per hour

One of the most important productivity measurements in aggregate production is the amount of material that can be moved per hour. This measurement provides a critical indicator about equipment's cost of ownership, as material moved more quickly costs less because waste is eliminated, production is improved, and revenue increases. This could include material movement during the extraction phase (load, haul, dump), pit productivity at the primary crusher, or loadout operations, where material is tracked and ticketed for customer drop off.

When evaluating loader scales and reporting metrics, it's important to consider that just because a truck is taking more loads per hour, there may not necessarily be an increase in the total number of tons moved per shift. In addition, loading more tons per truck, does not necessarily improve production.

For instance, a North Carolina quarry began tracking production to better manage its machines, loadout process and people. Specifically, managers at this quarry wanted to see if pit production was keeping up with the primary crusher. By measuring tons of material moved per truck, per hour, managers and operators could better evaluate haul truck productivity. The findings were surprising in that the cycle time for one 60-ton truck was two minutes slower than the other identical haul truck. However, it consistently hauled two tons more material per cycle. So, the question became which haul truck is more productive? It turns out the truck that hauls two tons more per cycle and is two minutes slower, actually hauls 10 tons less per hour, than an identical 60-ton truck. Digging into the pit-loader numbers further, the productivity measurements reveal that overloading trucks does not improve production. Trucks carrying more than optimal load weights also have an impact on machine utilization, machine repairs, fuel efficiency and overall operating costs. With proper measures like this in place, this North Carolina quarry can more effectively manage machines and people for more positive outcomes today and down the road.

2. Measure cycle times

By measuring the time between loading events, or cycle times, organizations can determine how efficiently material is being moved. Loadout cycle times measure how quickly a customer truck is turnaround - from entering the quarry gate to be loaded with materials and finally ticketed leaving the quarry. At the extraction phase, load-haul cycle times measure how quickly a haul truck takes loads from the pit face to the crushing and screening plant and returns to the pit. Sophisticated reporting available from onboard loader scales can show more than when the truck is idling or moving and when dumps are made. Real-time information from onboard scales can show time spent queuing to load, loading, hauling, haul stoppage, queuing to dump, dumping, return, and return stoppage. From here, managers can see that perhaps on a typical cycle there is no haul stoppage, but in an average cycle there is one minute of return stoppage. Over one month, this could result in more than 40 hours where trucks are stopped. Digging down into that data, fleet managers and operators may be able to pinpoint locations along the haul route which may be causing the delay, such as damaged roads or tight turns on haul roads. Managers can quickly see the effect that a wet or damaged haul road has on productivity.

The ability to measure cycle times to this degree can help aggregates producers and haul operators identify the underlying causes of delays. Then, organizations can set benchmark productivity rates to measure and then re-measure productivity improvements.

3. Maximize loadout efficiency

In today's highly competitive business environment with tight margins, quarry operators and others in the construction and mining industries need to be extremely focused on optimizing truck utilization and maximizing loadout efficiency. In a nutshell, hauling aggregate is most profitable when the trucks are consistently loaded to capacity. When a truck is underloaded, or when there are delays or bottlenecks that lead to a reduction in the number of loads completed per day, or fewer tons of material moved per day, revenue is lost.

Look for weighing systems that generate reports based on machine, product, date, time, customer, or any other combination of parameters. By analyzing this data, fleet managers can then identify peak loading patterns and generate reports related to machine utilization and loadout operations allowing operational

costs to be determined. Operators will also be empowered with reports that relate directly to their daily work; they will have data to help shape and tweak their performance to be more efficient. Also, because reports are based on actual machine usage productivity and not just engine hours, preventive maintenance can also be effectively planned.

The goal for most aggregate producers is to load trucks quickly and accurately to maximize loadout efficiency and ensure the correct product and the correct load amount is delivered to the customer every time. For example, assuming a 15% margin applies to an average quarry material supply, even missing a single load over the course of a shift due to delays can erase that profit margin for a single day of work. In this case, the cost of operating the truck, including paying the operator, road charges, fuel and tolls is more than revenue earned that day. Because profitability is directly tied to machine utilization and loadout efficiency, each should continually be measured, monitored and optimized.

4. Measure processing efficiency

The ability to quickly and accurately measure production from crushers and screeners can help reduce waste across the production process and increase the profitability of operations. Belt scales can provide real-time monitoring of the flow of material through the system, giving more visibility into plant operations and possible process management issues such as over or underloading, belt stoppage, or time when the belt is running no material.

For example, many processing plants without surge piles rely heavily on the haul trucks to constantly feed the primary crusher. Often, at the beginning of the day the primary is loaded well until the haul trucks all arrive in short intervals. Later in the day, on the other hand, sometimes the primary crusher runs empty or is overloaded and must be cleared manually. In this case, it's not that a larger primary crusher is needed to keep pace with haul trucks, it's that a surge pile is needed or a manager needs to consider deliberately staggering the haul trucks for more efficient processing.

A North American aggregates producer started using belt scales to monitor the empty run time of the conveyor after the primary crusher on more than 20 sites. They managed to reduce empty run time from more than 20% to less than 5% sites resulting in significant energy savings and increased production output.

5. Identify tare weight issues

Another factor to consider when evaluating ROI of loader scales and onboard weigh systems is their ability to avoid truck tare weight errors associated with weighbridges (in-ground scales). Tare weights are often stored in the weighbridge software. However the stored tare weight may not necessarily be the actual tare weight of the truck, because tare weights change over the life of a vehicle (ie modification of the truck body), and tare weights change continuously during the day due to fuel used, passengers, material buildup, and other variables.

Some quarries may decide to save time by using stored tare and not weighing the inbound customer trucks. Only outbound trucks with materials loaded are weighed using the weighbridge. The quarries will then charge the net weight (outbound gross weight minus stored tare weight). This practice can expose the quarries to significant losses. For instance, if the stored tare weights are off by less than 2%, a typical truck would have as much as 560 lbs unaccounted for. With an average of 100 trucks loaded per day, that equates to more than 25,000 trucks per year. As a result, that would mean an aggregates producer is giving away material and essentially 'giving away' more than \$50,000 per year because of tare weight errors.

By using onboard loader scales, aggregate producers can track the actual tonnage loaded onto the customer trucks. The tare weight errors associated with the weighbridge can be avoided all together. For a more sophisticated solution, look for onboard loader scales that can be integrated with weighbridge software. Such integration provides assurance that only the correct tonnage is invoiced to the customers. In additions, through integration, the loader scales will show the details of the trucks, the type of materials and the amount needed to be loaded, making it easy for the loader operator to do their job. A New Zealand quarry integrated weighbridge software with two loader scales in the loadout yard. Not only did they eliminate the truck tare weight errors, but also improved the loadout operation efficiency by 8%. Improved loadout efficiency means, that in a given shift, more tons per hour of material are loaded.

6. Measure fuel consumption

The ability to track and monitor fuel usage is a major consideration in assessing ROI of various weighing and fleet management systems. By understanding the amount of fuel used to move each ton of material, organizations can determine the productivity of each machine. Then, managers and operators can work together to set benchmarks for optimal loading weights and identify strategies for reducing fuel usage across the fleet.

Wrap up

Today's most competitive organizations are always looking for innovative ways to improve productivity and reduce costs across operations, from the pit to production and sales. When material haul operators and aggregate producers adopt the mantra of 'if you can measure it, you can manage it,' every movement of machines and material becomes trackable and quantified. This not only improves the ROI of weigh systems, but it transforms them into sophisticated production management tools. By adopting these strategies and taking a lean thinking approach, quarry managers will gain real-time visibility into payload and production data, eliminate inefficiencies and operating costs, and boost productivity during each shift and overtime.