# INCREASE PRODUCTION AND LOWER COSTS WITH THESE FIVE QUESTIONS

JOB SITE SOLUTIONS

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**INTRODUCTION:**

When you've seen hundreds of quarry and aggregate operations, you know every day is filled with competing priorities. And, as a result, there's constantly room for improvements. As one of the quarry managers we work with told us:

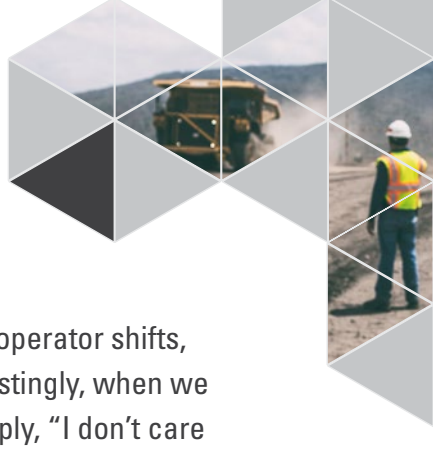
> **"THERE'S ALWAYS A WAY TO BE MORE EFFICIENT. THERE'S ALWAYS SOMETHING THAT YOU DIDN'T SEE OR SOMETHING THAT YOU DIDN'T REALIZE OR MAYBE SOMETHING THAT YOU DIDN'T KNOW HOW IMPORTANT IT WAS."**

In our more than 50 years of experience with hundreds of quarry and aggregate customers, we've discovered that one of the best ways to uncover inefficiencies and areas of improvement is to ask five key questions:

## 5 KEY QUESTIONS

- ARE A FEW SECONDS COSTING YOU MORE THAN A FEW DOLLARS?
- HOW GOOD ARE YOUR FILL FACTORS?
- HOW MUCH IS IDLE TIME COSTING YOU?
- HOW MUCH IS DOWNTIME SLOWING YOU DOWN?
- COULD A SMALLER FLEET SIZE BE THE PERFECT FIT?

Let's take a closer look at how asking these five questions, as well as implementing some best practices, could help lower costs and increase profit.



QUESTION #1

## ARE A FEW SECONDS COSTING YOU MORE THAN A FEW DOLLARS?

There are many elements of business that we measure and calculate by time—operator shifts, crushing sequences and service hours on equipment, just to name a few. Interestingly, when we ask that question of most quarry operations, no one knows the answer. Some reply, "I don't care as long as the crusher box stays full." Others are more curious and ask, "Can a few seconds really make that big of a difference?" Let's look at how "a few seconds" could impact your production.

In this stone quarry example, we have a Cat® 990K wheel loader loading three Cat 775G off-highway trucks (70-ton maximum capacity). We benchmarked the time required for truck exchanges. Average exchange time was 45 seconds. World-class operations' truck exchanges would happen in approximately 42 seconds. It can be challenging to make big changes quickly, but the good news is that even small reductions add benefits to the bottom line. In this case, we began improvements with some operator training. From our initial benchmark to our first follow-up, here were some of the results:

- Exchange time went from 45 seconds to 42 seconds.
- Loader cycle time improved from 42 seconds to 36 seconds.
- We observed truck stacking at dump site repeatedly. By parking one truck, dump and maneuver time was significantly reduced from 199 seconds to 72 seconds. Training also helped increase average payload per truck from 66.39 tons to 68.5 tons.

| ITEM | BENCHMARK | FOLLOW-UP | CHANGE |
|---|---|---|---|
| EXCHANGE TIME | 45 SEC | 42 SEC | **– 3 SECONDS/EXCHANGE** |
| AVERAGE PAYLOAD/TRUCK | 66.39 TONS | 68.5 TONS | **+ 2.11 TONS/TRUCK LOAD** |
| AVERAGE DUMP & MANEUVER | 199 SEC | 72 SEC | **– 127.2 SECONDS/ DUMP AND MANEUVER** |
| WHEEL LOADER CYCLE TIME | 42 SEC | 36 SEC | **– 6 SECONDS/CYCLE** |
| PRODUCTION | 672 TONS/HOUR | 879 TONS/HOUR | **+ 207 TONS/HOUR** |
| COST PER TON | $1.09 COST/TON | $0.83 COST/TON | **– $.26 /TON** |
| OPERATING COST/YEAR | $2.18 MILLION | $1.66 MILLION | **– $.52 MILLION** |

This operation was able to save incremental amounts of time and money that added up to significant changes in production and time efficiency. Looking at the numbers, you may be asking:

WHAT'S THE ECONOMIC VALUE OF AN ADDITIONAL 207 TONS/HR OVER A 10-HOUR SHIFT?

HOW BIG IS THE SAVINGS IN REDUCED FUEL, TIRES, OPERATORS AND REPAIRS?

**IN THIS CASE, THE STONE QUARRY PRODUCED OVER 2 MILLION TONS OF STONE/YEAR AND REDUCED OPERATING COSTS BY $519,021.62.**

Are there relatively small adjustments you could make that would yield an observable difference on the bottom line? Ignoring the opportunity to move more material per day is leaving easy money on the table.

Operator training is not the only way to improve cycle times. Often, the condition of the haul roads forces operators to slow down to maintain safe operations.

Poor road conditions will not only slow down production, but they will also increase costs with extra wear and tear on truck suspensions and tires. Our data indicates that a **5% increase in rolling resistance can result in as much as a 35% increase in production costs.**

## TOP PRODUCERS' **TIME BENCHMARKS**

These benchmarks are based on studies of top-performing quarry customers in sand, gravel and cement operations for more than 50 years.

### HOW DO YOUR TIMES COMPARE?

| | |
|---|---|
| TRUCK EXCHANGES → | LESS THAN **42 SECONDS** |
| WHEEL LOADER CYCLE TIME → | LESS THAN **36 SECONDS** |
| DUMP/EXIT CYCLE → | LESS THAN **72 SECONDS** |

QUESTION #2

## HOW GOOD ARE YOUR FILL FACTORS?

It may seem like an overly simple question, but if your operators aren't effectively filling buckets and properly filling and balancing trucks, you could be losing time, material and profits. We often find that the "move more material in the shortest amount of time" mentality drives equipment managers to select the largest buckets for their machines. Ironically, a large bucket can actually end up lowering productivity if it's more difficult for an operator to fill quickly and smoothly. At the toughest part of the digging cycle, this can also be costing you more in fuel as the operator uses more horsepower to manage the bucket. The more productive option may be a smaller bucket that's easier to fill.

The way operators load trucks to capacity is also a critical practice to observe. Seeing trucks that are clearly underloaded or running with loads that are off-center of the truck bed are indications that the trucks are likely not carrying a full load and what they are carrying may be putting undue stress on the truck components. The result is less payload per truck and, ultimately, higher truck maintenance and repair costs.

**15 TO 20% OF TRUCKS ARE LOADED AT INCORRECT WEIGHTS.**
Aggregates Manager, July 2011

Once measured on the scales, overloaded or underloaded trucks must circle back to the yard to tip off or receive more material. This takes extra time and burns added fuel for both the truck and the loader.

In addition to observing operator loading techniques, it's critically important to analyze the data available from machine technology and identify what behaviors need to be changed. Our results indicate that focusing on operator training is a quick corrective action that yields quick returns. Operators can be coached and trained to help reduce equipment costs and idle time as well as operate machines in a way that puts the least amount of wear and stress on equipment and optimizes fuel efficiency.

QUESTION #3

**HOW MUCH IS IDLE TIME IS COSTING YOU?**

Unless you happen to see equipment being refueled, or you're paying the diesel bill, the cost of fuel is rarely top of mind. However, when we break down owning and operating costs for fleets, fuel is typically the largest operating cost. You can save a significant amount of money in fuel costs and long-term engine costs by simply reducing engine idling. Excessive idling burns extra fuel and adds unnecessary non-productive hours to the engine, shortening its life and wasting your machine's warranty.

## OWNING & OPERATING EXPENSES

After capital costs, fuel is typically the largest contributor to operating costs.

**70-TON TRUCK (775G) $164.44/hour**

- CAPITAL COST WITH INTEREST **47%**
- FUEL **21%**
- OPERATOR COSTS **18%**
- TIRES **3%**
- M&R **10%**

**17.5-TON WL (990K) $228.62/hour**

- CAPITAL COST WITH INTEREST **56%**
- FUEL **17%**
- OPERATOR COSTS **13%**
- TIRES **4%**
- M&R **10%**



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We use telematics data to track fuel consumption accurately by machine and by operator. Idle time (when machines are not handling payload) can run as high as 50%. You can see how efficient cycle times and operator training could reduce your costs significantly. Top-performing operations set their idle time goal at 25%.

In addition to managing idle time, the most profitable performers focus less on fuel consumption and more on fuel efficiency, measuring the number of tons moved per gallon of fuel. The more tons moved per gallon, the higher the return on fuel spend.

In our experience, simply tracking the telematics data from the fleet and using it to educate operators and pinpoint areas of inefficiency will reduce idle time and improve fuel efficiency. Here are some customer results:

**QUARRY SITES** ALGERIA & UNITED KINGDOM

| | |
|---|---|
| **ACTION** | Operator training |
| **RESULT** | 14% reduction in fuel burn (2404 gallons/9100 litres of fuel saved)<br>26.5 tons/24 tonnes CO2 savings |

**CONSTRUCTION AGGREGATES** WESTERN U.S.

| | |
|---|---|
| **ACTION** | Production assessment and optimization |
| **RESULT** | 62% increase in tons/gallon of fuel (fuel efficiency)<br>6.5% reduction in idle time |

**QUARRY/CEMENT OPERATION** U.S.

| | |
|---|---|
| **ACTION** | Data analysis and operator training |
| **RESULT** | 15% increase in tons/gallon of fuel (fuel efficiency) |

Fleets equipped with telematics have the greatest opportunity to track and monitor idle time. As a general rule, when you see idle time on loading equipment, it's time to start taking a closer look for operational inefficiencies:

- Is your crusher too small to keep up?
- Is the loader and/or bucket too small or too large?
- Are trucks too large and creating more wait time?
- Are there too many trucks in the fleet?

There's a lot of data generated by technology. What the data says and what the data means can be different things. Transforming data into useable, actionable information requires time and resources. Many operations never see their true profit potential because they fail to dedicate enough staff to "mining the data" for key insights. If you don't have the resources to use that information to lower costs and increase efficiency, working with a fleet management partner may be a good way to grow your business and your bottom line.

QUESTION #4

## HOW MUCH IS DOWNTIME SLOWING YOU DOWN?

Regular, proactive maintenance and repair is a proven method of avoiding unscheduled downtime. The challenge is that in operations with so many moving parts, getting maintenance and repair completed in a timely fashion can't always be accomplished with your own resources. In hundreds of different aggregate operations, planned maintenance and repair agreements have reduced operating costs a minimum of 10% and sustained mechanical availability at levels above 85%. How? By reducing variability. When maintenance and repair is planned and managed through data and actionable insights, customers realize:

- REDUCED OPERATING COSTS. When machine data is monitored, maintenance and repair is scheduled and executed; repairs are made before failures occur, and operators can be trained to be more efficient.

- INCREASED AVAILABILITY. With our planned maintenance and repair agreements, execution is never optional. This eliminates surprises and increases availability.

- PREDICTABLE COSTS AND CASH FLOW. With machine data, maintenance and repair schedules and contracted rates for parts and service, costs can be managed more effectively and free up cash flow for other operating expenses.

When contracts are tailored to the needs of your operation, you'll get the best return on your investment. Under managed maintenance and repair contracts, equipment dealers use observation and analysis, telematics data and condition monitoring to carry out preventive maintenance and repair. Improved mechanical availability will lead to increased utilization opportunities at the site.

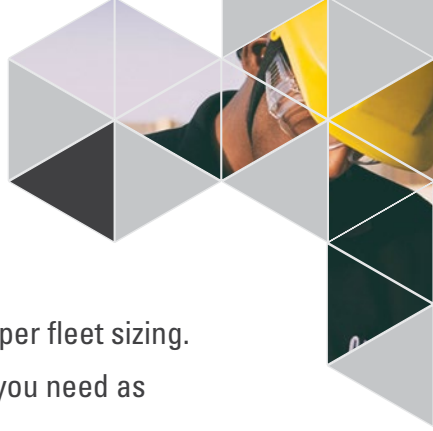
One fleet maintenance and repair customer in the Midwest went from 72% machine mechanical availability to 87% availability in only 60 days. According to the CFO,

> **" WE REALIZED OUR RETURN ON THE CONTRACT INVESTMENT IN 90 DAYS. "**

A historical analysis of expenditure avoidance by the Cat Fleet Monitoring Center reports that every $1 invested in telematics and proactive equipment management has the potential to return $4-$6 in reduced costs.

Take a look at some of the reported results we have helped customers achieve:

- **32%** IMPROVEMENT IN FUEL EFFICIENCY
- **14%** INCREASE IN UPTIME
- **28%** INCREASE IN TONS PER MAN-HOUR
- **24%** INCREASE IN MACHINE AVAILABILITY



QUESTION #5

## COULD A SMALLER FLEET SIZE BE THE PERFECT FIT?

Your haulers are only as effective as their supporting machines—the loaders, excavators and crushers. Of course, site layout and conditions also factor into proper fleet sizing. What once was a very efficient combination of machines may become more than you need as production demands, haul routes or plant sites change.

Haul trucks introduced over the last decade have offered increased capacities—a reflection of a common belief in the aggregates industry that bigger is better. Based on our experience with quarry and aggregates customers, we estimate that 90% of quarries operate with equipment larger than needed.  Why? Let's explore what drove this trend.

> "MOST AGGREGATE OPERATIONS LIVE AND DIE BY THE MANTRA: LOWER COST PER TON. THIS OFTEN CONJURES UP VISIONS OF BIGGER, FASTER, STRONGER WHEN, IN REALITY, MOST COMPANIES NEED TO THINK SMARTER"
>
> Pit & Quarry, October 2015

**90% OF QUARRIES OPERATE WITH EQUIPMENT LARGER THAN NEEDED.**

### EFFICIENCY TOOK A BACKSEAT

In the more than 50 years that we have been working with the aggregates industry, we have experienced a lot of change. When Caterpillar entered the marketplace, there was a good deal of alignment between mining practices and quarry practices. Quarry operations watched mines grow profitably by managing costs and using consistent, efficient processes. Quarries used these same practices in their operations.

In the days of the bull market, things changed. Instead of focusing on lowering cost per ton, businesses focused on revenue. If production costs went up, quarry and aggregate producers raised prices and looked for larger equipment to run more tonnage to maintain their margins. Pricing and production took the lead. Over time, site personnel focused less and less on efficient operation because they didn't see the connection to the bottom line. Efficiency took a backseat, or even worse, was left behind.

When the housing market crashed, businesses had journeyed so far from efficient best practices, their people didn't have the know-how to manage their operations at the lowest cost per ton. Operations were forced to get smaller. And because their previous success was based on adjusting prices, they looked for the lowest-priced equipment, personnel and suppliers. Unfortunately, many got what they paid for.

So today we have a new generation of people who had little exposure to efficient mining practices. They have learned from a progression of less efficient practices passed down the line. As a result, many owners expect larger fleets to deliver more production in less time at lower cost but find that the opposite is true. For example, too many trucks create bottlenecks at loading and dumping sites. Longer waits increase cycle times. Longer cycle times decrease tons/hour moved. The surprising truth is that less can be more.

Caterpillar Job Site Solutions recently helped a U.S. quarry and cement plant with fleet management. They were certain they could increase production and wanted to add new equipment. We completed a site assessment and fleet evaluation. Analysis revealed they could achieve their desired goals by reducing the size of their haul fleet by 20%. Yes, production was down and the solution was to park a truck!

By adopting a more data-driven site and equipment management strategy with the added benefit of a focused Fleet Manager from Job Site Solutions, this customer achieved these additional results:

- $343,200 IN FUEL SAVINGS (88,000 GALLONS/333,100 LITRES)
- 34% IMPROVEMENT IN TONS/HOUR MOVED
- REDUCED OVERTIME (WERE RUNNING EXTRA SHIFTS AND NO LONGER NEEDED THEM)

These questions are just a start toward a more productive cost-efficient operation. Put the experience of Caterpillar Job Site Solutions and your Cat dealer to work for your operation—and get answers that will increase your production and decrease your costs.

**LEARN MORE ABOUT CATERPILLAR JOB SITE SOLUTIONS.**
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