USING MACHINE DATA TO DRIVE DOWN COSTS

Machine-generated data dramatically reduces service and repair costs by enabling proactive equipment management.

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At the Cat® Fleet Monitoring Center Rick Lippert tracks customer telematics data and writes equipment management recommendations. The Cat facility monitors 507,000 machines for customers around the world. In this paper, Rick outlines the value of using telematics data to dramatically reduce service and repair costs.

Imagine what went through carpenters' minds when pneumatic nail guns first became available in the 1950s. "Hey, I've spent years hammering nails by hand. I don't need one of those things." "Yeah, they're fast but I'm doing fine the way I've always done it. I don't want to change."

Eventually, the speed, power and efficiency of the new tool won out. Skilled carpenters still carry hammers, but nail guns are now a must-have tool on every job site.

Today, telematics for construction equipment are kind of where the nail gun was decades ago. Despite having been used for years in many other applications, telematics and machine-generated data still have not achieved universal acceptance on heavy construction sites, although progress is being made.

A 2014 survey by the Association of Equipment Manufacturers found that 62% of U.S. construction companies had no plans to implement telematics anytime soon. Another 15% weren't sure if they ever would.

Those numbers are much better today. A survey conducted by Construction Equipment magazine in 2016 found that 61% of construction fleets now have at least some telematics capabilities, although only about 16% have telematics on half of their fleet or more. About one-third of respondents say they collect telematics data themselves and an additional 32% have their equipment dealers monitor data for them.

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+ TELEMATICS ACCEPTANCE BY U.S. CONSTRUCTION COMPANIES

[+] CONSTRUCTION EQUIPMENT MAGAZINE TELEMATICS SURVEY 2016

+ Fleets with some telematics capabilities:	**61%**
+ Telematics on half the fleet or more:	**16%**
+ Currently collecting telematics data:	**33%**
+ Equipment dealers monitoring data for you:	**32%**

Telematics usage has grown in recent years but why do so many in the construction industry still demonstrate reluctance to adopt such a powerful tool?

Anecdotal evidence suggests that many in the industry still see telematics as a "new-fangled" technology that they simply don't need. "I'm doing just fine without it, thank you very much."

And of course, construction company managers are already very busy. They simply don't have the time to wade through a bunch of fault codes and alerts to figure out which ones need immediate attention and which ones can be pushed until later.

Other reasons for slow telematics adoption include poor past experiences with data-based technologies, difficulties in gathering and processing data generated by equipment from different manufacturers, training issues, and (here's the big one) not believing that such technologies will pay a sufficient return to justify the investment in money, effort and change management.

+ TODAY'S TECHNOLOGIES ARE EASIER TO USE THAN EVER

Those common objections appear to be losing some of their traction. Data gathering and data processing technologies have advanced to the point where they are much more user-friendly than they were in their first iterations.

These technologies generate more focused and more useful information than ever. Plus, most major OEMs and many third-party companies offer services that can lift the chores of data analysis off the construction company's already full schedule.

As for mixed fleet issues with telematics, data communication protocols developed by the Association of Equipment Management Professionals (AEMP) in 2010 have helped smooth over the rough spots in data management across a varied fleet. A new set of standards introduced in 2014 expanded the range of common data fields and fault codes even further.

[+] MORE STANDARDIZED DATA POINTS

+ Ambient air temperature
+ Distance traveled
+ Fault codes
+ Hours
+ Location
+ Payload totals
+ Average load factor
+ Engine running status
+ Fuel consumption
+ Idle time
+ Maximum speed
+ Power Take-Off (PTO) hours

> *New standardization protocols increase the ability to gather and analyze from a wide range of equipment, increasing telematics effectiveness for mixed-fleet applications.*

Best of all, the construction companies currently using telematics are seeing benefits. They're gaining valuable insights into actual job costs based on:

- Accurate information about hours worked
- Fuel burned per machine per job task
- Up-to-the-hour data about utilization and idle time per machine, per job site.

Data like these help them track the true costs of doing business to create tighter bids and higher profit margins.

Operational factors like these are important to the bottom-line performance of any construction business, but next to total fuel costs, the most profound impact on the lifetime owning and operating costs of the machines themselves comes from service, maintenance and repair costs. Let's see how telematics and machine-generated data can help dramatically reduce service and repair cost drivers by enabling truly proactive equipment management.

+ WHAT TO LOOK AT AND WHEN TO TAKE ACTION

Anyone who has dipped a toe into data-based equipment management can tell you one thing right off the bat: today's machines generate lots of information.

An equipment manager will see lots of alerts over the course of a shift that indicate fault codes of varying severities. Fortunately, the data analysis capabilities built into data management systems like VisionLink® are more robust and easier to use than ever.

In the case of VisionLink, those fault codes will carry three ratings: yellow, orange and red. Intuitively enough, yellow and orange fault codes are less urgent, while red fault codes demand more immediate attention.

At the Cat Fleet Monitoring Center, we gather and analyze data from hundreds of thousands of machines worldwide. Based on our experiences there, yellow low level fault codes account for 35 to 40% of all the alerts issued. Orange fault codes make up another 35 to 40%. Red high-level fault codes round out the remaining 20 to 30%.

AVERAGE FAULT CODE DISTRIBUTION

LOW (YELLOW):	**35-40%**
MEDIUM (ORANGE):	**35-40%**
HIGH (RED):	**20-30%**

> *Careful benchmarking over the course of a year provided an accurate snapshot of current idle time and fuel consumption.*

The natural temptation is to address only the most urgent alerts—the red fault codes. But we've found that if a company only looks at the red alerts, they're missing opportunities to dramatically reduce lifetime equipment repair costs by catching problems early.

Here's an example: Machines with Tier 4 emissions reduction systems tend to generate Soot Loading alerts. Act on those fault codes early, while they're at the yellow or orange alert level, and an operator only has to hit the regen button or allow the machine to idle, which would enable it to go into low speed regeneration. The cost of either action is close to zero.

However, if the company only takes action on a red alert, the Tier 4 system will derate the engine or even shut down the machine, causing significant lost production. Plus, the machine will require shop service than may cost up to $5,800 and result in much great production loss.

+ THE VALUE OF MONITORING LOWER LEVEL ALERTS

FAULT CODE: TIER 4 SOOT LOADING

LEVEL	ACTION REQUIRED	COST
YELLOW/ORANGE:	Hit Regen Button or park machine and idle to enable machine to go into low speed regeneration	$0 (minor lost production)
RED:	Derate/Shutdown/Shop Service	$5,800 (major lost production)

It's important, then, to keep an eye on low-level as well as high-level alerts. When low-level alerts for a single machine or a group of operators start reoccurring, it pays to investigate the root causes and address the issues sooner rather than later—through operator training, revised maintenance schedules, etc.

If time or personnel are in short supply, it might also be wise to ask the equipment dealer to help monitor fleet data and use their expertise to spot potentially troublesome patterns. That way, small problems can be dealt with when associated costs and downtime are at their lowest point.

+ THE VALUE OF REPAIR BEFORE FAILURE

The concept of Repair Before Failure (RBF) has been talked about since the '90s, but it wasn't really practical before the advent of telematics, which let you figuratively see inside the equipment as it's working and know when problems were about occur.

Even now, many in the industry remain content to "run it until it breaks." The reality is a lot of businesses are too busy to do anything but what they've always done, and many don't have the expertise to effectively implement proactive management procedures.

Those attitudes are changing as more and more construction professionals start to see the bottom-line value of RBF. To put that value into perspective, let's look at an example from the Cat Fleet Monitoring Center:

A customer's excavator was generating orange and red fault codes for low engine oil pressure. The red fault codes indicated that problem was severe enough to cause an engine derate. If it got much worse, the engine ECM would shut the machine down completely.

Getting the machine into the shop right way for a quick repair to the 9.3 liter engine cost the customer in the range of $2,600 to $3,900. After-failure repairs would cost much more—possibly up to $39,000 if a full engine rebuild was required—and would have resulted in much longer downtime during repair.

LOW ENGINE OIL PRESSURE ALERT

REPAIR BEFORE FAILURE VS. AFTER FAILURE REPAIR COSTS

Repair Before Failure Cost:	$2,600-$3,900 Shop Repair
After-Failure Repair/Replacement Cost:	$39,000 Full Engine Rebuild

+ THE VALUE OF REPAIR BEFORE FAILURE (CONT'D)

In another case, we had a customer with a large connected fleet—nearly a hundred connected Cat machines. Our analysts dug into the company's data and listed the top three fault codes for each of 80 machines. Here are just a few of the issues they found where proactive management and RBF could have delivered significant repair cost savings:

FAULT CODE	REPAIR COST BEFORE FAILURE	REPAIR COST AFTER FAILURE
+ LOW ENGINE OIL PRESSURE	$2,000	$52,000 (engine failure)
+ TIER 4 FINAL EMISSIONS	$1,300	$5,200 (replace diesel emissions filter)
+ SHIFTING INTO NEUTRAL	$11,700 (transmission service)	$44,200 (transmission overhaul)

> *All costs approximate, based on the specific machine types and model run by this customer in specific applications.*

Keep in mind that these approximate costs are per asset. Over an entire fleet, the added costs of running to failure really add up. For example, we found 31 assets with large numbers of emission fault codes, and 39 assets with regular "Shifting Into Neutral" alerts.

In the later case, simply training the operators to avoid shifting into neutral and coasting would have cost only about $2,600 per asset. That would have resulted in even more savings by eliminating the transmission wear that required premature service.

Another common objection to using telematics runs along the lines of "It makes sense for big fleets, but I only have a few machines." The truth is, monitoring machine data and engaging proactive equipment management is even more valuable for smaller fleets.

A large operation may have extra machines parked up and ready to go if a critical piece of equipment goes down. For small operations, if a single machine fails, the whole job may shut down. And the costs of servicing the machine will likely be only a fraction of the cost of lost production while the machine is in the shop.

These examples illustrate the value of regularly monitoring data, looking for patterns, and taking action early. With telematics widely available for both new and older equipment, devoting time and resources to data monitoring and proactive equipment management—or outsourcing those tasks to third-party specialists such as you equipment dealer—is simply the smart way to work these days.

+ THE BOTTOM LINE: BETTER COST CONTROL AND INCREASED UPTIME

With all of the benefits they generate, data-based equipment management and Repair Before Failure are valuable investments that pay off in lower costs and greater uptime. Using machine data to monitor costs at the incident level ultimately results in higher machine uptime and more productivity.

The actual return on the investment is difficult to calculate, but when we look across a wide range of customer events and actions, the Return On Investment in telematics and proactive equipment management is typically very high. It's so high, in fact, that people often don't believe the number until they see it for themselves. The number can vary, of course, depending on a wide range of site, fleet and business factors, but as a rule, data monitoring used to drive proactive equipment management typically delivers ROI in neighborhood of 400% to 600%. These numbers come from our Customer Value Tracker where we record the results when each recommendation written by our Cat EM Services analysts was followed, compared with the results when no action was taken.

Actual ROI numbers will vary from situation to situation, of course, but this example from an article published a few years back by the AEMP in their Equipment Manager magazine is indicative of the kinds of results many companies see when they implement telematics and data analysis:

> *A New York-based contractor, who had equipped his fleet's 400 heavy construction machines with telematics,* ***trimmed his operating expenses by more than $1,039,500 in the first year.*** *That included a* ***fuel savings of $104,000a month*** *at one site where the system's reports revealed that seven heavy excavators were left running all day during the winter. Without the ability of telematics to monitor idling patterns, that fuel—and money—would have continued to go up in smoke.*

In an industry that fights for fractions of a percentage point in increased margins on a daily basis, it makes sense to start using telematics data and proactive equipment management, especially while the majority of the construction industry lags in its acceptance of these valuable tools. The companies that do so have a chance to be in the same position as the forward-looking carpenter who started using nail guns while the competition continued to hammer away behind him.

THE VALUE OF TELEMATICS: THREE MORE EXAMPLES

[+] REDUCE FUEL COSTS

SITUATION: A mid-size construction company in Germany used telematics to manage and monitor multiple fleets working in several locations.

RESULTS: Data captured from machine systems has been used to cut idle time, improve maintenance scheduling and monitor fuel consumption. The CEO says the percentage of cost savings is "almost in double-digits."

[+] INCREASE AVAILABILITY AND REDUCE UNIT COSTS

SITUATION: A North American quarry implemented telematics on its off-highway truck fleet.

RESULTS: Availability is up 2% and unit costs are down 2% since the technology was deployed.

Currency amounts are accurate as of January 2021.