

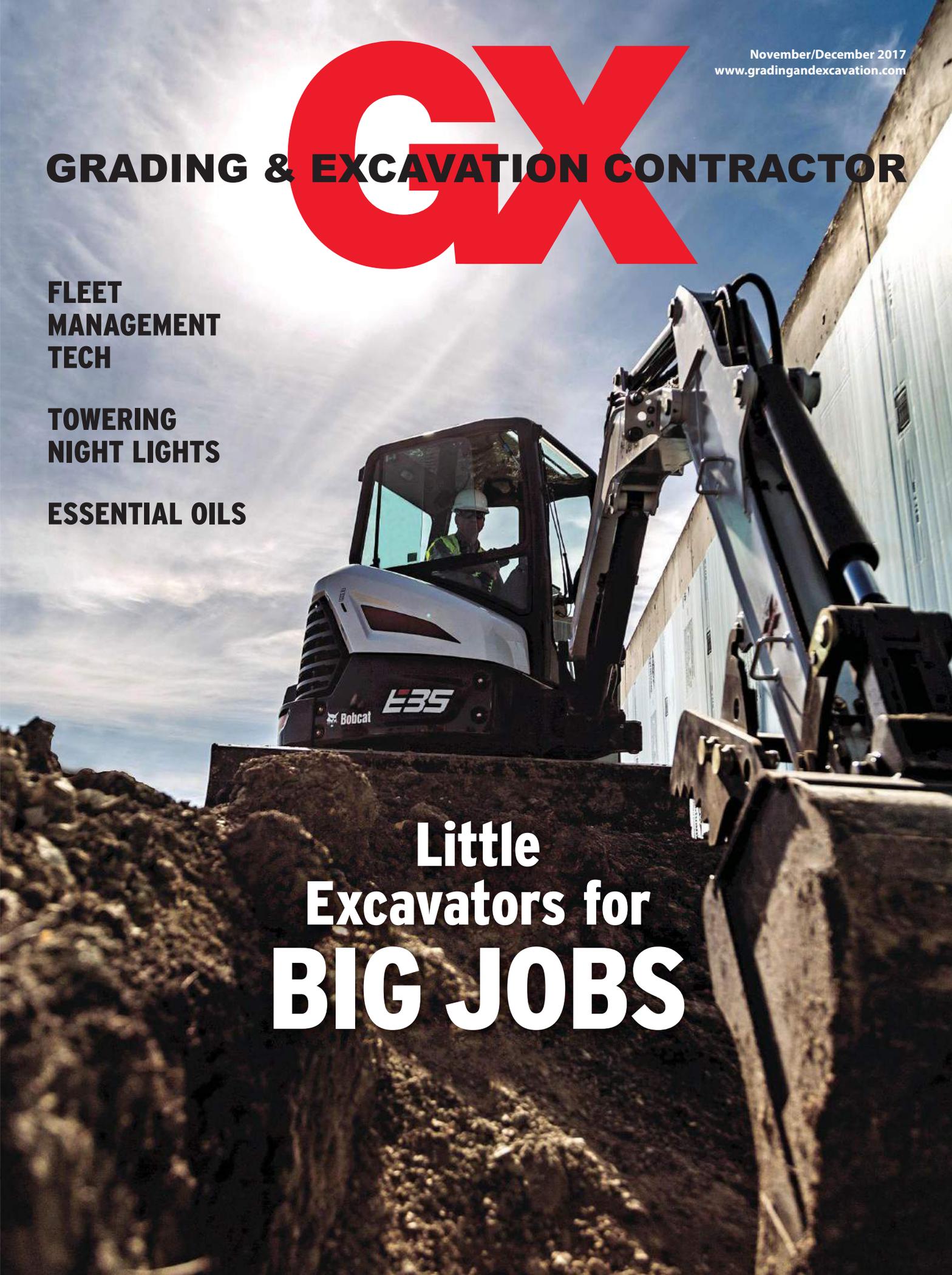
# GRADING & EXCAVATION CONTRACTOR

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**FLEET  
MANAGEMENT  
TECH**

**TOWERING  
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**ESSENTIAL OILS**



**Little  
Excavators for  
BIG JOBS**

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# One with Everything

The latest hardware and software packages for fleet management and telematics

BY CAROL BRZOZOWSKI



An operator uses the John Deere JDLINK Dashboard

**C**ompared to just a few years ago, contractors are becoming more comfortable with using telematics and fleet management systems, notes Brad Stemper, solutions marketing manager with CASE Construction Equipment.

“From that, they are beginning to incorporate it more into their day-to-day operations and making decisions about how and when maintenance is performed, or how their equipment is utilized,” he says. “The familiarity with telematics, in general, is evolving in how people use and interact with it.”

Alan Sharp, business area director for strategic software solutions in Trimble’s civil engineering and construction division, points out that a telematics device combines GPS positioning with cellular communications, and then optional or additional data inputs from the asset to which the telematics box is connected.

“In addition, the device has memory and a processor that allows it to store asset-specific information to do its own computations, and to store data so that it can be forwarded when cellular service is available,” he says. “The memory can store geofence boundaries, for example, so the device itself can determine entry

or exit events that can be combined in different ways to interpret what the asset is doing.”

Contractors are using the technology for functions such as job site coordination and fleet maintenance, while using data to dig deeper into analytics to increase efficiencies, productivity, and the bottom line.

## Latest Capabilities

Among the offers in the market, John Deere provides two telematics products: JDLINK and ZXLINK—the latter focused on Hitachi equipment.

This year, John Deere started licensing the products for five years in-base over the previous three years in-base.

“Five years better aligns with the average length of ownership to the first owner,” says Paul Garcia, product manager with WorkSight Solutions.

The company also has migrated from 3G to 4G. Features include Wi-Fi and Bluetooth circuitry, “laying the groundwork of the platform for us to do other things in the future, machine-to-machine or machine-to-man on the job site,” he says. “Getting that local piece from our telematics offering on the job site, site foremen and other crew leaders can get instantaneous information about machines.”

The system features remote diagnostics and the ability to program sensors and perform functions, such as clearing codes, updating software, and ensuring machines are connected, but without trips to the field.

“It is able to do that over the airways—saving technicians and others a trip to the machine,” notes Garcia.

John Deere has moved to a cloud-based application designed to provide improved performance and scalability in the anticipating field of data becoming larger, he says.

The company has supported the AEMP Telematics Standard approved by the International Standards Association, with its version of an application programming interface (API) allowing contractors to pull in the data provided by its machines with other OEM manufacturers and the software that they might choose to use, says Garcia.

“It’s standardizing the data across the industry and allowing contractors to see all of their fleet in one place,” he adds. “There are some efficiency gains in there, as well as being able to give them a big-picture view. Being able to save basic data like hours and fuel across a whole fleet is so much more powerful than only being able to see it from the Deere machine.”

“Even if it saved them a trip to the Deere machine, they still might need to see their other systems if they don’t have that capability. So there are some efficiency gains as well as an ability to get improved performance on the job site when they can see all of their machines in one place.”

A mapping functionality allows end users to navigate to those machines.

“Many times, job sites are in a place that doesn’t have an address yet, so getting to the job site can be a challenge for technicians and other people who need to get there,” says Garcia. “The mapping capabilities allow end users to get turn-by-turn directions to the machine and get there efficiently.”

Grade control pulls it together and is

being added to motor graders and crawlers as well as grade reference on excavators, Garcia says, adding that this connects the machines back to the engineering office so that when the engineers roll out the plans, they can go onto the machines.

This helps skilled operators improve their performance, and operators who aren't necessarily as skilled get better results, he says.

Drone capability is also under the John Deere WorkSight umbrella. The company has partnered with Kespry Unmanned Aerial Vehicle (UAV) aerial intelligence to allow contractors to fly drones with accurate imaging capabilities to measure job progress or material stockpiles, for example.

After flying the drone over a job site, a portal gives the contractor access to view survey-grade accurate topography, notes Andrew Kahler, product marketing manager for WorkSight and ForestSight.

"It gives a good understanding of the rate at which the job site is progressing, if they're going to hit the deadline, and how they need to readjust assets or the labor force to make up ground and be more efficient," he says.

Additionally, the ability to track stockpiles of aggregate for accuracy and inventory purposes can be accomplished in 10 minutes, Kahler adds.

"When you combine it with telematics and grade control on the job site, all of a sudden these are giving insights into the job site in a way that they never had before," he says. "It's not just data for the sake of data; but it is to gather powerful insights, make good decisions, and increase productivity."

Additionally, John Deere has entered into an arrangement with three providers—LHP Telematics, HCSS, and Telogis—that aggregate OEM data to streamline the integration of John Deere data into their platforms, notes Garcia, adding that it removes the contractor's need to hire IT staff.

John Deere also assists contractors on an individual basis to help them pull data in through their own in-house systems.

Another feature that's gaining traction is the use of location history. It not only helps municipalities that use the equipment during extreme weather events like snowstorms to determine which roads have been cleared and which ones still

need to be done, but "they're also using it where they're doing a lot of grading to groom roads and accessways," says Garcia.

"They might be involved in issues where a resident is claiming damage and they're able to determine if their machines were in that location at that time to figure out liability and responsibility for that."

Spireon recently announced a new partnership with General Motors, whereby Spireon customers who operate GM fleet vehicles are now able to leverage the onboard GM OnStar system as the data delivery mechanism to drive the Spireon FleetLocate fleet management system, notes Belinda Rueffer, director of product marketing.

"That eliminates the need for aftermarket telematics devices and makes adoption of state-of-the-art fleet technology a breeze by removing headaches related to hardware installation or vehicle downtime," she says.

In addition to FleetLocate Connected by OnStar, Spireon's solutions now include an array of features from GPS vehicle tracking to fully-compliant Hours of Service, DVIR, and IFTA reporting solutions.

Volvo Construction Equipment's latest telematics innovation is ActiveCare Direct,

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a 24-7/365-active machine-monitoring and fleet utilization reporting service provided directly from Volvo and available at no cost for select new machine purchases.

“A team of analysts at the Volvo Uptime Center in Shippensburg, Pennsylvania uses a proprietary telematics system to analyze thousands of data points provided via CareTrack, the Volvo telematics system that comes equipped on most Volvo machines,” says Jim Bretz, director with Uptime & Connected Services at Volvo Construction Equipment.

Volvo analysts monitor machine health and alert the dealer or contractor only when an action is necessary—which helps ease the burden for the contractor who typically has to decide how to react to alarm codes, he adds.

“Additionally, Volvo generates monthly fleet utilization reports for the contractor, which provides an easy-to-understand summary of the whole fleet, arming the fleet manager with information that can improve fleet utilization, identify focus areas for operator training, better manage service schedules, improve uptime, and reduce operating costs,” says Bretz.

David Midgley, JCB group telematics manager, notes several developments in the JCB LiveLink telematics system.

One is detailed duty cycle information for a range of JCB products. “Typically, this capability is limited to large excavators and loading shovels, but JCB LiveLink provides detailed activity, output, and health data for telehandlers, backhoes, and compact excavators for enhanced fleet management,” he says.

“Owners and fleet managers of backhoes and telehandlers, for example, can use the system to assess fuel consumption and duty cycle times, as well as travel times between sites, to obtain a more comprehensive picture of operating costs.”

Another development is the JCB LiveLink compliance with the industry data standards developed by major equipment OEMs, ISO standards organizations, and AEMP. “These standards allow machinery-users and third-party integrators to provide fleet-wide telematics services,” says Midgley.

A third development is the LiveLink Control Tower system, which gathers and

integrates data from other telematics systems and allows contractors to utilize the LiveLink benefits on all of their machines.

Additionally, LiveLink Dashboard capability enables contractors to focus on the telematics information that is most important to them—such as security, fuel management or service, and maintenance—and bring “actionable insight” into their business, says Midgley.

Trimble’s VisionLink technology is designed to offer a total solution that pro-

vides data into one centralized area, enabling end users to pull up all of the data on all of the equipment on the job in one place, says Amin, adding that every machine is equipped with Komtrax, free of charge.

Komtrax enables contractors to manage fleet data, view operating parameters, and view a machine’s GPS location. It can be set up for alerts and other critical information.

Amin points out that telematics offers the ability to monitor machine hours, location, performance, and overall equipment

health so that fleet managers can quickly coordinate their job sites for optimal productivity.

“They don’t spend all of their time in front of computers,” he points out. “They are typically spending their time out in the field. Telematics software can send alerts to mobile phones and other devices to get information out to them so they can make decisions on the fly.”

Those decisions are typically asset allocations to help ascertain whether equipment is being underutilized or overutilized.

“If you are monitoring these parameters, you can quickly determine if a job site has too much equipment or even too little equipment,” says Amin.

Komtrax also enables managers to analyze operators.

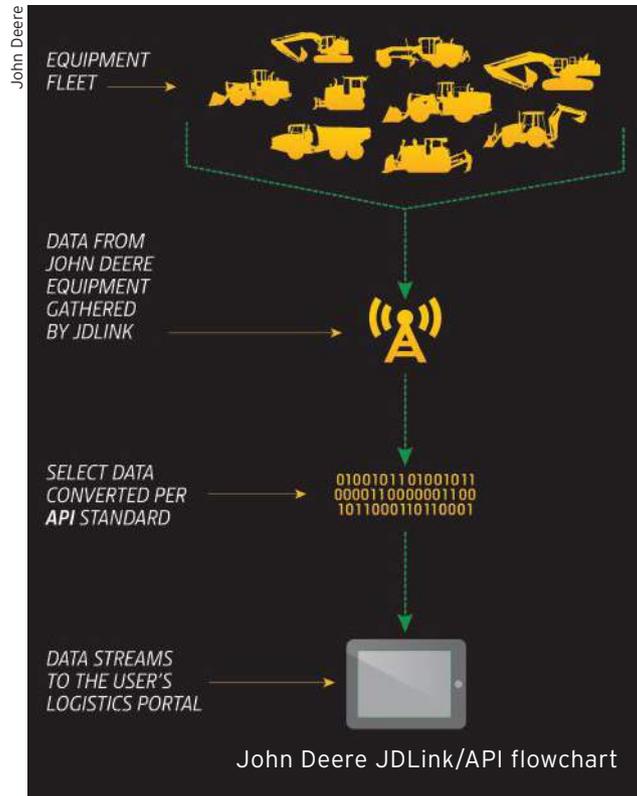
“If a manager notices a particular machine is idling higher than others, or maybe it’s at a higher or lower load than other machines,

they can make those necessary adjustments to increase the productivity at that site,” Amin says. “That might mean discussing specific site conditions with the operator or maybe shifting operators around a little bit to increase the productivity.”

Reducing unnecessary wear and tear is another function, including whether it is time to retire the equipment or purchase new equipment.

The latest offering from CASE Construction Equipment is SiteWatch, a telematics platform compatible with CASE’s entire line of construction equipment. The system includes a three-year subscription with all CASE heavy equipment purchases through CASE ProCare. Three-year subscriptions also are standard on all CASE backhoe purchases.

“We offer it as a standard part of these



vides access to machine-generated data, including machine hour-meter direct reading; machine fuel-meter direct reading; machine diagnostics, errors, and warnings information for health monitoring and maintenance-management purposes; direct connection between health warnings, diagnostic events, and the spare-parts ordering and service-requirements planning database; working versus idling detection; and similar machine manufacturer-specific data.

Ronak Amin, business solutions manager for Komatsu, points out that today’s software is about integration.

“Logging into different websites to obtain data on your mixed fleet and equipment from manufacturers is common in our industry,” he says. “It doesn’t make sense to log into multiple websites to get data.”

API such as Komatsu’s Komtrax brings

packages as a way for contractors of all sizes to become accustomed to the practical benefits of the software, and as a tool for our dealer service organizations to better serve their customers by giving them insights into the performance of each fleet,” notes Stemper.

Sam Simons, president of OEM Data Delivery, says his company is currently testing an Internet of Things (IoT) tracker based on Bluetooth radio technology, expected to be released in October 2017.

“The construction market has unique needs when it comes to the Internet of Things,” Simons says, adding that today’s telematics is an additional cellular device that needs to be rugged, low-cost, simple to install, and easy to manage.

“The construction world usually has people around the equipment,” he points out. “Our Bluetooth tracker devices enable the data capture through their smartphones and tablets. Smartphones and tablets are now becoming very prevalent in the construction world. Construction companies are investing in these tablets and the smartphones and in mobile apps. We’re taking that technology, expanding its capability, and leveraging it.”

It’s being leveraged through a mobile app through which supervisors’ tablets and smartphones become a data capture device via Bluetooth beacons.

“The construction market needs very rugged devices that give utilization data,” says Simons. “These beacons will not only give

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## **“The problem is that the vast majority of fleets aren’t using it to its full potential.”**

utilization data off of equipment, but give utilization data off of non-powered equipment and assets—for example, a bucket that goes onto a loader or a trailer that doesn’t have power or a toolbox.

“There are many, many assets that construction companies spend millions on, and they don’t know the true utilization of those non-motorized assets. We provide that with our beacons.”

Simons points out that there are “a lot of great software companies that have elaborate utilization analysis, engine-idling analysis, and business intelligence; but often construction companies don’t want to pay that much money for that business intelligence. So, the Bluetooth allows an inexpensive way to capture the data and offer business analytics and utilization on the smaller assets and the non-motorized assets.”

Hardly any thought is given to the utilization of a bucket, Simons notes.

“It is always nice to have, but you can’t put an hour meter on a bucket,” he adds, pointing out that his company’s technology is designed to do so with Bluetooth.

### **The Power of Software**

Telematics software has always been “incredibly powerful. The problem is that the vast majority of fleets aren’t using it to its full potential,” notes Bretz, adding that Volvo has placed a strong focus on providing telematics data analysis as a service to contractors.

“Many fleet managers and owners don’t necessarily have the time, training, or resources to dig through the mountains of data and

decipher what the various data points mean for the operation and how to use that information to improve operations,” he points out.

“Providing this as a service makes telematics more powerful because being able to more effectively use that data provided will help customers reduce total cost of ownership of their machines and increase profits. It also helps dealers more effectively serve their customers by knowing when machines need service so fleet managers can work hand-in-hand with their dealer to better plan for service. It’s a win-win.”

Midgley points out that advances in machine-side processing allow more actionable information to be collected, processed, and transmitted to provide fleet managers with the information they need to deploy their machines more efficiently.

While advances in database technology allow increasing amounts of data to be stored, processed, and linked, “companies that collect and act on this data to achieve new levels of insight and improve business processes and operational efficiency will enjoy a competitive advantage.”

To appreciate the power of today’s software offerings, one must consider the different requirements of on- or off-road capabilities and telematics equipment designed for use on heavy equipment versus on road vehicles, notes Sharp.

“While on the face of it, equipment seems to have similar specs, the vibration, shock, electrical protections, and environmental requirements required for onsite equipment are significantly different—as are the reporting requirement needs,” he says.

Case in point: construction fleet managers need to meet their on-road needs for legal conformance, driver safety, speeding, hours compliance, and on-road fuel tax benefits based on different state taxation or permitting requirements—especially around the 2017 mandated legal requirement to log driver operating hours, Sharp says.

For onsite equipment, “it is all about maintenance and tracking machine hours, machine working versus idle utilization, and managing fuel use and refueling needs.

“More common is monitoring onsite productivity in terms of either load and cycle monitoring, tracking material movements of specified material types between specific locations, and incorporating payload data measured either directly from manufacturers’ in-built systems or aftermarket additions to loaders, excavators, or trucks that assist in managing accurate loads and real volumes or tonnage versus approximated number of loads multiplied by average load volume.”

Additionally, it assists in monitoring the counts and all cycle times such as loading, dumping, and carry times to check for operational bottlenecks, he adds.

“As you move higher up the scale, the telematics box becomes a connected site gateway extending the box capability from asset management and load/cycle monitoring to adding further value through integration with machine control systems,” says Sharp.

“This creates additional demands on the telematics box to be able to handle vastly more data, including bi-directional data, taking design data models from the office, using machine control information, and returning 3D production data from the earth-moving, grading excavation, paving, compaction, or drilling and piling equipment equipped with machine control systems.”

That production data is then aggregated by the asset and fleet management system to build real-time 3D models of work completed or in-progress, allowing accurate volumes, progress, cut and

fill, and compaction of soils, landfill, or asphalt to be measured.

It additionally measures input data such as asphalt-rolled temperature and the number of compaction passes, which is an indication of compaction density to provide overall consistency of a surface, he adds.

Telematics also is evolving to meet the needs of specific verticals in the construction industry, Sharp points out.

Examples: recent workflows for drill and blast monitoring; piling operation tracking; and large-scale piling operations such as solar farm construction, dynamic compaction operations, and marine dredging operations—allowing contractors to get much deeper visibility into construction operations than previously possible, he adds.

Using Trimble DPS900 Machine Control System for drilling and piling, contractors also are able to monitor and record for all operations: “every drill hole, pile location, or dynamic compaction drop, replacing manual measurement, post-survey operations and eliminating errors, omissions, sheet interpretation and data falsification—at the same time, providing real-time quality, production, and progress metrics for the operation,” says Sharp.

“Once the machine is connected, we also use the high-speed high-bandwidth connection to deliver GPS corrections from the project base station to all roving assets to get precise GNSS positioning, and also to provide remote control, remote configuration, remote troubleshooting, or remote training for operators,” says Sharp.

All of the capabilities combine in different applications to provide greater project control, increased project visibility, automated data capture, reduced data transaction time, fewer mistakes, and automated project progress management, he says.

Other reported benefits: improved operational control and more accurate scheduling using fewer staff in a safer work environment, increased productivity, lower fuel use, lower operating costs, greater asset utilization, increased traceability, accountability, and a better control for all operational metrics for management.

Side benefits include reduced travel time, fewer extended downtimes, lower support costs, and faster support turnarounds—all of which result in better maintenance of the fleet and lower fleet operating costs, says Sharp.

Other Trimble fleet management solutions include Trimble InsightHQ for quarry operators, combining all activities from excavation, hauling, conveying, crushing, and loadout.

It tracks all weights and ensures compliance with on-road weight limits, resulting in the elimination of fines for non-compliance with more accurate loadout at the stockyard with automated ticketing, as well as the elimination of the need for a weighbridge and more accurate billing operations, says Sharp.

“Trimble GeoManager is designed to meet the needs of the ready-mix supply industry, where the whole loading, carrying, and delivery process can be automated, including full tracking of driver speeds, cornering speeds, drum rotations, and water addition tracking, linking the geolocation and machine operational data together to provide a turnkey solution tracking all key metrics for the work process,” he adds.

VisionLink Landfill for landfill operations focuses on the key metrics of compacted density achieved that allows them to maximize the void space.

“The more trash they can crush into a given void space, the more money they make and the longer the lifespan of a waste cell,” says Sharp. “It’s important to monitor the entire operation

of imported waste, compaction operations, and density achieved along with pass counts from multiple interconnected machines.

“Connecting the machines and providing operator guidance is necessary to optimize the process in real time to ensure the optimal results and track that set of metrics continuously to get the best ROI.”

## Job Site Coordination

Two factors impact job site coordination through telematics: utilization and performance, says Stemper.

“As it relates to performance, by monitoring the operating parameters of a machine throughout the day, business owners and fleet managers can make a variety of inferences about the performance and productivity of any given machine and its operator,” he says.

“They can then use that actionable information to review the operation and make any changes that are required. Is it the wrong machine for the job? Does the operator need coaching in best equipment operating practices? Are there other pieces of equipment upstream of the process that are slowing down the flow of materials onsite, hence the machine is not operating at its full capacity?”

Regarding utilization, “one of the great elements of telematics is that it gives the fleet manager a historical perspective,” says Stemper. “With that, they can look at how a machine or a fleet of machines is used over the course of a day, week, or month. They might recognize that a certain machine is only used 30% of the time where it’s at, and maybe there’s another job site that would get better use out of it.”

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Essentially, it allows the fleet manager to identify underutilized assets and make decisions about how best to deploy the fleet, and whether additional equipment rentals or purchases are needed, he adds.

Telematics and fleet management help companies do more with less, says Sharp.

“By adopting telematics platforms like FleetLocate, a contractor can take on more jobs and increase the agility of the fleet by knowing exactly where the closest employee and vehicle are to the job sites,” says Rueffer.

“They help improve customer service through delivering on promises for job site arrival times, and help shuffle the workforce as needed to optimize routes and operations.”

Telematics reports, such as monthly fleet utilization reports from ActiveCare Direct, provide fleet managers with individual machine summaries to see not only hours to next service, but also how operators compare to each other in terms of work versus idle percentages, says Bretz.

“This allows for an easier way to manage job site coordination by quickly viewing upcoming preventive maintenance schedules, as well as help determine whether certain machines are under- or overutilized, which could be a sign that a machine should be reallocated to another job, or perhaps the wrong size machine is being used.”

## Fleet Maintenance

Fleet maintenance is “arguably the most intuitive use of telematics in fleet management today,” notes Stemper.

“It automates the engine/machine logging that was previously done by hand in logbooks and on whiteboards,” he says. “It makes it easier for fleet management personnel to know when a planned maintenance activity is coming up, and allows them to better plan for that activity so that it has minimal impact on productive working hours.”

Telematics also offers functionality that alerts fleet managers about operating parameters that may be outside the norm, which may be indicative of a problem that needs to be addressed before it grows into a larger downtime event, he adds.

Predictive fleet maintenance with telematics can reduce the machine down-

time and overall costs.

“Seeing things like abnormalities or diagnostic trouble codes, you can make decisions about the equipment before failures may occur,” he says. “You’re drastically reducing unexpected down time. Monitoring engine and working hours can eliminate pulling a machine out of work too early.

“With telematics, because you have the hours at your fingertips, you can actually make sure the machines are being pulled at the right time and the equipment is being fully utilized for the most amount of time.”

Midgely points out “despite the rigors of the work performed by construction machines, it would not be entirely inaccurate to think of a modern construction machine as a hardened computer.

“Telematics is the essential system by



which we monitor and maintain each machine, and the fleet as a whole, for optimal productivity and efficiency,” he adds. “Additionally, when it is necessary to deploy support resources, service personnel can arrive onsite with prior knowledge of the work to be performed and the equipment and parts they require to get the machine back into operation with minimal downtime. The end result is improved productivity, optimized uptime, and reduced cost of ownership.”

Rueffer says FleetLocate manages the fleet maintenance schedule, and vehicles leveraging the GM OnStar partnership also get the added benefit of oil and battery life alerts, as well as remote start and remote lock and unlock.

## Fleet maintenance is “arguably the most intuitive use of telematics in fleet management today.”

John Deere’s technology goes to fleet maintenance as well. Included in-base with John Deere’s telematics platform is a Maintenance Manager application, which includes all of the company’s factory plans to enable contractors to add a factory plan for any machine.

The feature provides flexibility and customization of intervals, enabling end users to add or delete intervals or add any desired customization.

“If they have a routine task where they check the track slack at a certain point, they can put that in there,” says Garcia. “It can be hours-based or calendar-based. It comes with a mobile app that is a companion to Maintenance Manager.”

Technicians can log completed maintenance tasks and take pictures or add documents from their handset.

“It really goes towards a paperless maintenance planning process and this all syncs back to Maintenance Manager so that the fleet manager can see all of this in their maintenance plans,” says Garcia, adding that it also is flexible in that if a machine is not enrolled in a maintenance plan, repairs can be conducted on it regardless as long as the machine has a pin.

Contractors can attach maintenance performed on the machines as well as add the costs and labor involved, offering them better visibility of cost of ownership and cost of maintenance.

Telematics is one of the best ways to manage and schedule fleet maintenance.

ActiveCare Direct provides a quick view of upcoming preventive maintenance schedules and alerts fleet managers to problems with a machine before the machine goes down and causes unplanned downtime.

Additionally, fleet managers will be alerted of possible machine abuses, such as misuse of work modes on Volvo excavators or hot turbo shutdowns, which cause serious damage to the turbocharger over time, Bretz adds.

“For example, ActiveCare Direct will flag instances of high-speed shifts on individual wheel loaders, allowing for the opportunity to correct the bad operator habit before the long-term abuse could lead to an eventual transmission replacement—which can cost up to \$20,000,” he says.

## Data and Analytics

Analytics and data have brought a new level of intelligence to the job site, says Stemper.

“The business owner or fleet manager now knows concrete information about how a machine operates throughout the day that previously required them to be onsite, or relied on information second-hand from the operator,” he says.

“Simple pieces of information, such as engine hours, RPMs, engine-on and engine-off time, give fleet managers actionable intelligence to make better decisions about how equipment and personnel are used and deployed. Accurate service interval information and maintenance monitoring help keep equipment running and minimize downtime during working hours.”

The numbers speak for themselves as to how telematics can be a huge benefit to an operation, notes Bretz.

Contractors using ActiveCare Direct, for example, have seen reduced fuel costs of 10 to 15%, reduced idle time of 7%, and 5-10% improvement of machine utilization.

“The goal of ActiveCare Direct is to increase uptime for customers,” Bretz says. “Using information from telematics to set goals on parameters such as idle time, work percent, fuel efficiency, and the number of machine abuses all serve as ways for fleet managers to improve their operations and increase uptime and profits. It makes fleets more efficient.”

With ActiveCare Direct, dealers work with contractors to set goals for their fleets, such as reducing idle time to a certain percentage to reduce total machine hours. All the numbers provided have a specific purpose tied to the improvement of operations on the job site.

Data analytics leads to savings.

“Contractors don’t always want to crunch the data or make sense of analytics,” says Amin. “They want the data to be presented to them. This is done in daily, weekly, or monthly reports where we can

send the data out to the customer and they’re looking at information.

“Data and analytics can guide contractors to more accurate job costing and managing-operating expenses. Telematics provides that key insight into reducing these costs in a way that the industry probably didn’t think was possible a decade ago. Talk to any contractor about operating costs and it’s pretty much tied to telematics. They know they can make those reductions using the technology.”

Adds Rueffer: “Data and analytics are

changing the landscape of fleet management. With fleet management analytics, you can understand which drivers are at the greatest risk for a serious accident, leverage data to understand which drivers would benefit from coaching, lower the costs of insurance by improving safety scores and showing that a documented and proven fleet safety plan is in place—the possibilities are endless and growing day by day.” **GX**

*Carol Brzozowski specializes in topics related to technology and construction.*

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