

The Liebherr PR 724 Litronic incorporates a hydrostatic drivetrain that enables up to 20% less fuel consumption, depending on the application.

Advances in electronics enable dozers to be more productive and fuel efficient with less operator input.

Electronics Raise the Grade on Dozers

As emissions regulations become more stringent, equipment manufacturers continue to incorporate sophisticated electronics into engine and machine control systems to improve both equipment and operator performance. Dozers are just one vital piece of equipment to reap the benefits.

“Dozers can be one of the more challenging earthmoving machines to master, especially when it comes to fine grading,” says Dean Peterson, new product introduction manager for Caterpillar dozers. “Advances in electronic technology, both on the engine and on the machine, are helping operators of various skill levels respond quicker and more accurately to deliver a smoother grade and increase overall performance and productivity.”

THE POWER OF ELECTRONIC INTEGRATION

Advances in engine electronics help manufacturers deliver more value through a higher degree of powertrain integration. This means the engine and powertrain are able to communicate more effectively to control other machine functions.

“Electronic technology not only affects the engine, but the whole drivetrain and its components,” says Robert Klima, product manager - crawler tractors, Liebherr

Construction Equipment Co. “When the engine controller communicates with the transmission controls, the machine can adjust to individual applications, making the required power and torque available only when it’s needed. This results in high efficiency for the overall machine.

“For example, pushing through a turn requires more power than straight pushing of dirt,” he explains. “If this power was available all of the time, it would increase fuel consumption.”

Electronics enable power to be customized to specific applications — often at the push of a button. Komatsu, for example, utilizes a hydrostatic transmission and engine control technology with two selectable working modes. E Mode is intended for all general dozing, leveling and spreading applications, providing adequate speed and power while saving fuel. P Mode is intended for slot dozing, ripping, uphill dozing and other applications where engine power has priority over fuel consumption.

“With fuel prices increasing constantly, more owners are paying closer attention to fuel costs and efficiency,” says Bruce Boebel, dozer product manager, Komatsu America. “When given the opportunity to reduce fuel consumption by choosing pre-selected modes, operators have simpler choices to be more efficient.”

“Hydrostatic drive allows the operator ultimate control of the dozer, from steering to maintaining constant ground speed,” says Jon Gilbeck, dozer product marketing manager, John Deere. The company has been using hydrostatic powertrains on its machines since 1976.

The benefits of hydrostatic transmissions include infinite speed control, power management, live power turns, counter rotation while staying in gear and dynamic braking. In addition, compared to conventional machines with powershift transmissions, fuel savings can be as high as 20%, depending on the manufacturer and application.

“Advanced controls have definitely influenced fuel consumption. This is especially true for hydrostatic-driven machines,” says Klima. “Modern controls make power available only when it’s needed and no longer require gear shifting. This results in lower fuel consumption at a better performance compared to conventional-driven machines.”

Electronic integration is also revolutionizing powershift transmission controls, resulting in greater versatility and efficiency. According to Peterson, this includes the ability to:

- shape engine lug curves to optimize performance and fuel economy and reduce emissions;



Powertrain integration and machine control and guidance technologies have had a dramatic influence on dozers. The AccuGrade Control System on this Cat D6T dozer optimizes performance, improves jobsite efficiency and significantly reduces operating costs.

- vary machine power to improve productivity in the upper gears and control track slip, and protect the powertrain components in first gear to significantly reduce operating costs;
- compensate for varying parasitic loads to maintain consistent track power;
- improve shift quality and reduce clutch loads during high energy shifts;
- utilize a shift up/idle back principle to save fuel, improve dozing cycle fuel efficiency and better match machine speed to application and ground conditions;



Electronic advancements allow the variable speed, hydraulically driven fan on the 205-hp John Deere 850K dozer to automatically speed up and slow down to cool the engine. Utilizing all the power for the engine, not the fan, when appropriate reduces engine load and fuel consumption.

•automate blade and ripper controls to maintain optimal blade load, reduce track slip, protect the grade, and maintain peak productivity.

Advanced electronic controls also enable breakthrough powertrain technology, such as the electric drive available on Caterpillar's D7E.

SIMPLIFIED OPERATOR CONTROL

The role of the dozer operator continues to evolve. "The operator's role has changed in terms of controlling various functions of the dozer," says Peterson. "In most ways that work is much easier. Controls are more comfortable and ergonomic. Machine direction, speed, blade pitch and angle are now controlled with a simple joystick or thumb switch inputs. Advanced controls automate portions of the cycle, improving productivity and reducing operator fatigue."

For example, electronically controlled drivetrains no longer require the operator to shift gears, or even use brakes. The drivetrain controller, combined with the engine controller, ensure the machine is adjusted perfectly. This takes the pressure off the operator to determine when it's time to upshift or downshift. The operator

can instead focus on the task at hand, with less mental and physical fatigue.

"The electronic technology that controls our dozers today is much more sophisticated, yet is meant to be seamless to the operator," says Boebel. "Outside of simplified controls, owners and operators may not necessarily see the electronics that are improving their dozer's performance. But they will notice that they aren't filling it with fuel as often or get a job done faster than expected."

MAKING GRADE CONTROL POSSIBLE

According to Peterson, powertrain integration and machine control and guidance technologies are the two areas that have had the most dramatic influence on dozer productivity and efficiency. "Machine control and guidance is another key area where electronics help us deliver more customer value," he says.

The evolution from pilot to electrohydraulic controls has largely been

Learn more about advancements in crawler dozers and other grading equipment in the Fleet Management section of ForConstructionPros.com.

GPS Cuts Contractor's Costs

Jace Nix (shown at right) has been operating dozers his entire adult life. Now, as vice president of GT NIX Construction, a family-owned company based in Mountain View, WY, he is the one to make decisions about dozer purchases.

Nix bought a new Komatsu D51EX-22 two years ago. The dozer operates six days a week for eight to 10 hours a day on civil construction jobs all over the state.

"With about 1,500 hours of operation to date, it's one of our primary machines," Nix notes. "Due to the advancements in dozer system technology [electronics], we've noticed enhanced performance with this dozer."

GT Nix does a lot of finishing with the D51EX-22. "The Topcon Positioning System has cut our blade usage in half. Stakes on the jobsite have been eliminated," says Nix. "The operator can see everything about the job right on the screen in front of him. There's no more looking at plans; everything he needs is right there to analyze."

GPS technology has allowed an average operator to become an excellent operator, Nix adds. "We can do things with our GPS system that even the best operators can't do at these speeds," he states.

Nix has seen gains in fuel efficiency, as well. "We've reduced our fuel consumption by 20%," he confirms.

Productivity has also increased. According to Nix, "We've increased our production by 30%, conservatively, due to these advances in electronics."



driven by the desire to integrate automated grade control systems into the machines. Automated grade control enhances efficiency, reduces rework and enables even novice operators to achieve grade quickly.

The majority of today's dozers are outfitted with some type of automatic grade control system, which controls blade functions. Several different types are available, ranging from 2D systems such as laser controls to 3D systems such as GPS or total stations. No matter which system is used, all have one thing in common: they improve the overall work efficiency by eliminating several of the steps required if preparing a site in a conventional way.

With automatic grade control, the final site design can be planned in the office and then loaded into the grade control system mounted on the machine. The system will then automatically control the blade to form the site. At the same time, it records

the blade position. As a result, the final site design is controlled from the very start.

"Electrohydraulic controls enable grade control systems, which allow the dozer to automatically make adjustments accordingly," says Gilbeck. "This has revolutionized the use of dozers — how efficient they are and how fast they can go."

Such technology does take some of the decision making out of the operator's hands. But no matter how much electronics and electrohydraulic controls have enhanced dozer performance, the operator remains a critical component to precise grading.

"Operators today are held to a higher standard," says Boebel. "Customers are demanding the technology that makes their machines more productive. But they also recognize how important it is for operators to be integrally involved to maximize machine productivity and minimize input costs." **ET**

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