Reed Business Information®

30 Vertical integration gains ground



50 How to extend the life of undercarriages



69 Twenty of today's latest mini-excavators



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October 2007
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Underground Solutions

Still designed for long runs, trenchers also offer options for specialized tasks

p. 58

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Cover photo: George Pfoertner ©

FEATURES

TRUCK REPORT: Systems Integration

30 Business Deals Tie Together Truck Components

Not many years ago, makers of heavy trucks bragged that they were "custom builders." They had to be, with outside companies supplying components and subsystems to the OEMs that assembled them. That's changed, and OEMs are not nearly as willing to customize their vehicles to suit customers' demands or whims. Vertical integration, where the OEM decides what goes into its trucks, is gaining ground as heavy truck builders advance their component manufacturing plans or strike new supplier agreements.



PRODUCTION HEROES

40 Articulated Trucks Produce for Those Who Are Prepared

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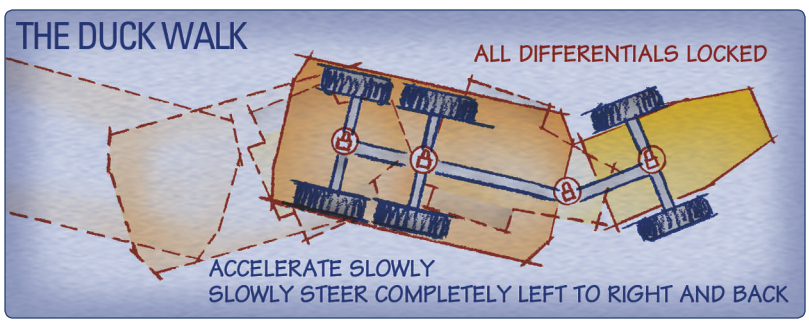

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TRADE-SHOW PREVIEW



46 Sneak Peek at ICUEE

We bring you a sampling of products to be exhibited at the 2007 International Construction and Utility Equipment Exposition (ICUEE). Also known as "The Demo Expo," it will be held from Oct. 16-18 at the Kentucky Exposition Center, Louisville, Ky. For more information, visit www.icuee.com.

MAINTENANCE MANAGEMENT

50 Undercarriage Basics

Considered individually, the various components of a crawler undercarriage — links, pins, bushings, sprockets, rollers, idlers, shoes and frames — seem relatively simple, straightforward parts. But make no mistake; when these components are assembled into a system that supports and propels a track-type machine, the crawler undercarriage becomes a complex mechanism, which might account for half (or more) of a crawler dozer's lifetime repair bill. Senior Editor Walt Moore gives you tips to help extend a machine's track life.



BUYING FILE

58 Trenchers Still Deliver the Straight Goods



With the dip in the new-housing market, trencher manufacturers have felt a pinch from belt-tightening rental houses in 2007. But leading OEMs concede the cyclical buying nature of the rental market may have been in play regardless of the housing slowdown. And, with or without the rental houses buying, there's still considerable work for which sub-100-horsepower trenchers are positioned best.

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Attachment Utilization

We've taken the bold step this past year of expanding our Buying File articles to include attachments when appropriate. Senior Editor Mike Anderson has uncovered some great tools that can be used on various machine types. This month, in his feature on trenchers, Anderson pulls in tools that can be used on alternate carriers to complete applications that might not require a dedicated trencher.

Attachments are solid options for accomplishing certain tasks that do not require a long-term application of a dedicated machine. Recently, we spotted county-owned dump trucks grading the shoulders of a road with a blade mounted from the truck frame.



Rod Sutton, **Editor in Chief**

Managers must consider the logistics and operating costs whenever an operation requires a machine. If an attachment will do the trick, keep the dedicated machines assigned to tasks that will fully utilize them and send an attachment to the jobsite for those other duties.

Machine utilization will need to be tracked even more closely as the economy cycles over the next year or so. Housing's down, and rumblings about nonresidential are beginning. Yet heavy-construction spending shows no sign of slowing, nor does highway and bridge work. According to our economist, Jim Haughey, 2008 will continue to grow in these two areas (12.6 percent and 9.3 percent, respectively).

For some managers responsible for multi-regional fleets, economic outlooks provide valuable insight. For many others, such broad economic trends don't compare at all to the local or regional activity that drives daily business.

In either case, though, the equipment manager has to maintain tight control over costs and utilization. And attachment utilization needs to be included in the mix. Use them where necessary to free up dedicated machines, but keep track of them. Attachments housing spiders in the back lot are useless; only attachments doing work are worth keeping in the fleet.

Rod

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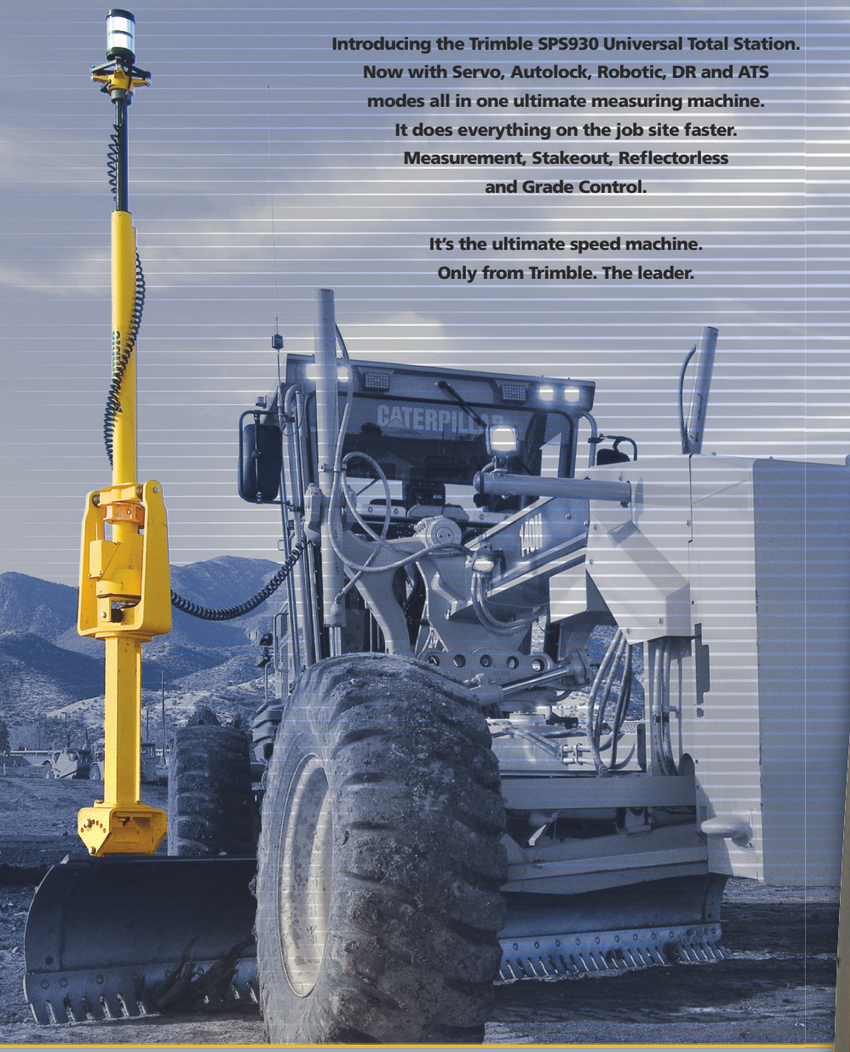

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MARKET WATCH

By KATIE WEILER, Managing Editor

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Potain

Igo T 70 tower crane has a two-section telescopic mast, which climbs to match construction with the addition of 20-foot auxiliary sections. This allows the T 70 to vary its working height between 66 and 106 feet. Varying jib lengths add flexibility. The T 70 has a maximum capacity of 4.4 tons, and it can also lift 1.4 tons at its top radius of 131 feet. The crane is able to travel on a low loader trailer.

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Extec

The X38 SBS crushing plant makes use of technology found in its big brother, the X44 SBS, but based around the smaller Telsmith 38SBS cone. With a cone crushing speed of 780 rotations per minute, the smaller size enables a compact frame design while still providing production for worldwide quarry applications. Powered by a 350-horsepower Cat C9 engine, the X38 is suitable for crushing granite, slate, coal and limestone.

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H-Mach

The FG110C fine grader accessorizes its 10-foot sliding moldboard with a quick-attach front end that can accommodate a variety of attachments, including a loader bucket, sweeper, front blade and scarifier. The versatility is matched by the maneuverability of the utility grader that, at an overall length of 14 feet 6 inches, still manages a turn radius of only 7 feet 10 inches. Powered by a 100-horsepower Caterpillar 3054T diesel engine, the FG110C offers low- and high-speed travel up to 5 and 16 mph, respectively.

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Caterpillar

With new C-Series machines, Cat has increased the size of its "multi terrain" or compact-track-loader offering. With a rated operating capacity of 4,233 pounds (at 50 percent of tipping load), the new 297C is the largest-capacity machine of its type that Cat has ever produced. As a vertical-lift machine designed for enhanced truck-loading capabilities, the 297C is joined by the smaller 287C, which has an operating capacity of 3,854 pounds. The smallest model offered in the product line, the 277C, has radial lift linkage and a rated operating capacity of 3,212 pounds.

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Kenworth Trucks

A Cummins' ISM diesel can save weight and, with a new 425-horsepower rating, can provide high performance for operators of dump, mixer and other vocational trucks, according to Kenworth, which is offering the new rating in its W900S and T800 short-hood models. The 11-liter ISM weighs 500 pounds less than a 13-liter diesel, yet delivers the high power and a healthy 1,550 lb.-ft. of torque, the latter at 1,200 rpm. Up to 500 pounds more payload can therefore be carried on trucks with the ISM engine.

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Cummins

For standby or prime-power applications, Cummins Power Generation's GGM series of LP vapor-fueled generator sets feature ratings of 20, 25 and 30 kW. Powered by a 3-liter industrial engine, the generators run on natural gas or LP liquid fuel. PowerCommand electronic-control system provides regulation of voltage and frequency. An electronic governor provides fast response to load changes. Optional aluminum weather-protective and sound-attenuated enclosures are available.

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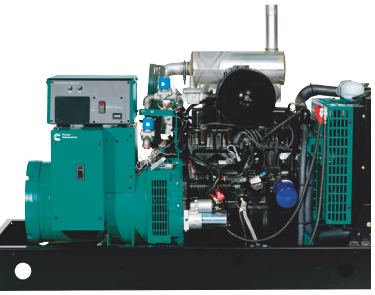

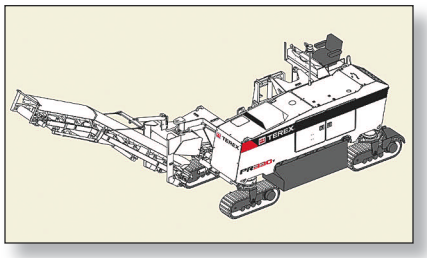

Terex

Terex Roadbuilding has added three new utility mill models to its line of cold planers: CMI PR165, PR220 and PR330. Hydrostatic rotor drive has a built-in relief system to protect components from damage if the cutter hits an obstruction. Parallelogram cutter subframe delivers a 24-inch elevation to lower and raise the cutter. All models feature a 36-inch drum diameter for a 12-inch cutting depth. Cutting widths range from 24 to 48 inches.

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Komatsu

Komatsu D51EX-22 and D51PX-22 mid-sized crawler dozers have been updated with Tier 3 engines that deliver 130 horsepower at 2,200 rpm. Operating weight is 27,778 pounds for the standard (EX) model and 28,881 pounds for the low-ground-pressure (PX) version. Power-angle-tilt blade carries 3.5 to 3.8 cubic yards.

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Caterpillar

The upgrading of Cat's mid-sized excavators from the C-Series extends to the wheeled models. Each of the new D-Series wheel excavators achieves greater performance and reduced operating costs through the use of a Cat ACERT engine with the Cat common-rail fuel system, a new dedicated hydraulic pump for the excavator swing function, and a new heavy lift mode that boosts lift capability by 7 percent. The new M313D, M315D, M316D, M318D and M322D models range in operating weight from about 31,000 to 48,000 pounds, and in net engine output from 127 to 166 horsepower.

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Market Watch



New Holland

With a 2,000-pound SAE-rated operating capacity, the L175 skid-steer delivers a bucket breakout force of 4,300 pounds. It weighs 6,230 pounds and is powered by a 60-horsepower New Holland engine. With a 10-foot lift height and 29 inches of forward reach, New Holland says the machine reaches higher and farther than similarly sized skid-steers. It features the Super Boom vertical lift linkage and a long wheelbase for excellent stability and fast ground speeds.

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Peterbilt Motors

A new Driver Information Display that is standard in Peterbilt conventional-cab models provides important vehicle performance information, helping operators modify driving behaviors to maximize fuel efficiency, Peterbilt says. The display, on the instrument panel above the steering column, is tied to the advanced multiplexed electrical system in 2008-model conventionals. Among the available data are fuel economy for a trip or life of the vehicle; optimum engine speed; average speed over a measured distance; engine operating hours; number of idling hours; and truck and engine serial numbers.

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Roadtec



A cold planer with a maximum milling width of 4 feet, the new Roadtec RX-400 is designed for projects where a compact machine design is an advantage, such as shoulder work. Contractors may start the cut directly in front of curbs, fences, walls or other obstructions. The RX-400 offers milling widths of 2, 3 and 4 feet, and a maximum cut depth of 12.5 inches. A Caterpillar C9 ACERT engine provides 325 horsepower, driving a maximum operating speed of 172 feet per minute. Conveyor swing of 60 degrees to either side adds to the versatility of the RX-400, which joins a product family featuring three established larger models.

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Centreville Mfg.

Towing behind a standard pickup truck, the Autocone 130 stores, places and picks up 130 traffic cones automatically, requiring only the truck's driver to operate. It not only places the cones on the road, but also picks up the cones that are standing upright or have been knocked over. The trailer allows the operator to choose when to drop a cone, or it can be set up to automatically drop cones at preset intervals. The system uses simple controls in the cab of the truck. No truck modifications are required.

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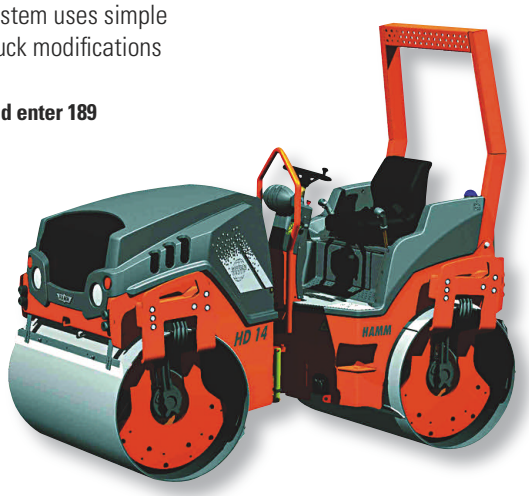

Hamm

With Hamm asphalt compactors, VV stands for "Vibration Front, Vibration Rear," and the new 4.6-ton HD 14 VV offers operators the choice of running vibration in the front drum only, rear drum only, in both drums, or no vibration at all. The HD 14 VV has a working width of 56.3 inches when offset, and a drum width of 54.3 inches. It is driven by a 40-horsepower, four-cylinder Hatz engine. The machine's tapered front end provides optimal forward visibility, and the three-point articulation joint provides driving comfort.

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Grasan



According to Grasan, it now offers track-mounted, primary crushing plants that are designed and built to the individual user's specifications. "We'll use any crusher — impactor or jaw — that the customer wants, and go from there," says Grasan. The plant pictured uses a Hazemag 1515 APPH primary horizontal impact crusher, which has a 32-inch-cube maximum recommended feed size and an estimated capacity of 700 tons per hour of shot limestone.

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Kasi

With its compact cab-over design, the Patriot is designed to deliver the equipment and functionality associated with larger infrared truck systems. On one chassis is provided a 48-square-foot infrared pavement heater, 2- or 4-ton-capacity asToro Dingo TX 525 Wide Track compact track loader offers extra torque, compared to other Dingo models, which the company says provides increased pulling and digging force when using attachments in aggressive conditions. Powered by a 25-hp Kubota diesel, the machine weighs 2,217 pounds and has a rated operating capacity of 553 pounds. The machine measures 92





Pettibone

Model RM9 Coil Handler is designed for material handling at industrial wire mills. It has a lift capacity of 8,000 pounds and a lift height of 17 feet. Forward reach measures 12 feet 10 inches and side reach is 13 feet. With a 270-degree rotating boom, the unit can quickly unload material from flatbed trucks or railcars. It is powered by a 139-hp, Tier III John Deere engine.

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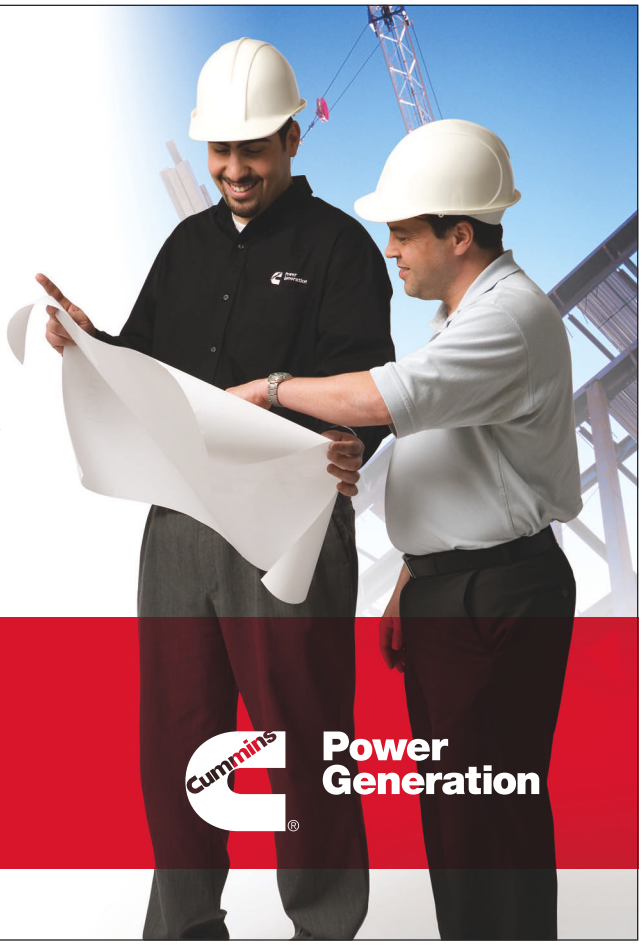

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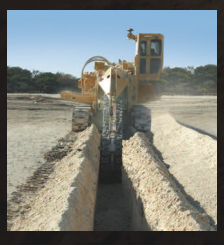

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EXCLUSIVE RESEARCH

Contractors Shift to ¾-Ton Pickups

Construction Equipment's 2007 Pickup Truck Usage Study followed up a benchmark study conducted nine years ago, and discovered precipitous drops in numbers of ½-ton (-37 percent), 1-ton (-59 percent), and 1½-ton (-69 percent) trucks owned by individual firms.

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Crew cab	13%	32%	(+146%)
Extended cab	37%	48%	(+30%)
Towing package	60%	76%	(+27%)
Air conditioning	70%	86%	(+23%)
Dual rear wheels	24%	29%	(+21%)

Source: Construction Equipment *Pickup Truck Studies*

About 42 percent of contractors' ¾-ton pickup trucks are powered by diesel engines — that's 10 percent more than in 1998. Across all construction pickup sizes, 87 percent have automatic transmissions (also up 10 percent).

The *Construction Equipment* Pickup Studies also discovered that construction firms are nearly 1.5 times more likely today to buy pickups with crew cabs. Nearly half of all construction pickups get an extended cab, and more than three-quarters of them are specified with a towing package.

INDUSTRY NEWS

John Deere Backs Initiative To Attract Youth to Construction

By sponsoring a team in the finals of a nationwide construction competition for high-school students, equipment manufacturer John Deere is hoping to help open more young people's eyes to the professional opportunities available in the construction industry.

"With more than a million new jobs available by 2012, our industry is booming, yet the workforce is continually shrinking with the retirement of baby boomers," says Jim Orr, director of marketing, John Deere Construction & Forestry. "Our hope is that this event will challenge these young people while conveying to them the tremendous opportunity that awaits in the world of construction."

Developed by the Association of Equipment Manufacturers (AEM), in partnership with Destination ImagiNation, the Construction Challenge focuses on three areas — awareness of construction-related jobs, construction equipment and manufacturing, and infrastructure awareness.

The challenge includes six regional events, to be held in January in California, Georgia, New Jersey, Ohio, Texas and Wisconsin. The winning teams will then advance to the Construction Challenge finals, to be held in March at CONEXPO-CON/AGG in Las Vegas, where each team will be sponsored by an AEM member.

RESOURCES

Arxcis Offers Online Safety Training

Arxcis, a safety-training firm, now offers classes online, allowing equipment operators, using the Internet, to work through multimedia courses at their own paces. Interactive diagrams, engaging formats and final tests, says Arxcis, increase content retention and mastery. Safety courses are available for forklifts, telescopic-handler forklifts, boom trucks, articulated boom trucks, RT and AT cranes, utility truck cranes, self-propelled aerial/scissor lifts, pedestal-mounted cranes, vehicle-mounted aerial lifts (bucket trucks) and overhead cranes. According to Arxcis, Hard Hat online training, available for $49 per person per class, meets OSHA standards and is continuously updated to reflect the latest standards. Supervisors or safety personnel can call 888-322-2867 or email info@arxcis.com to request a free online class for evaluation.

— Walt Moore



Using the Internet, an equipment operator can complete a safety course in one to two hours at home or at the worksite.

HEAVY EQUIPMENT FORUMS

How Many Operators Buckle Up on a Regular Basis?

User #1: How many of you fasten your seat belts when operating your equipment? I have a poor track record for this. Driving a truck, it is the first thing that I do. Grader and backhoe-loader, poor track record.

User #2: I always do. At my last company I almost got fired for not having it on, so I put it on all the time now.

User #3: Skid-steer suspension seats don't work unless you're wearing a seat belt, so running the skid I always buckle up. Same idea with the excavator, you just get trashed around if you're not wearing one. If I'm jumping in and out of the cab I'll leave it off, but for long periods of operating, especially if there's a lot of walking the excavator, I always buckle up.

User #4: A seat belt is an essential piece of safety equipment. I always wear the belt when driving or operating any equipment. My experience has been if you can stay in the seat and keep your hands on the levers, you can maintain some semblance of control. If the machine rolls over, you want to stay inside the machine; that's what ROPS are designed for. All you need to do is clean the street with a [skid-steer loader] without your seat belt on and hit that manhole cover that is buried in dirt. It was like a Warner Brothers cartoon: I saw stars dancing around my head, after it slammed against the ROPS. The silliest thing I have seen is operators wearing hard hats inside a machine with ROPS and not wearing their seat belt.

User #5: 100 percent of the time. Not only is it our policy, but I have seen it save people. I recall one time, where I was only going to move [a small] dozer about 100 feet across pretty level ground, so I didn't buckle up. I went over a 4-inch drop, and that machine pitched me out of the seat and my head into the ROPS. I thought I was going to pass out it hurt so bad.

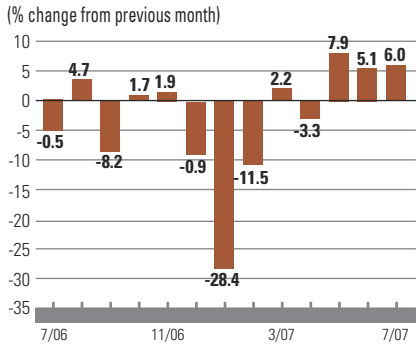
HeavyEquipmentForums.com is a user forum where professionals in the heavy-equipment industry can exchange ideas and post questions or comments. Users include owner/operators, operators, company owners, repair technicians, safety officers and others. Posts have been edited for clarity and content.

STATUS & FORECAST

CONSTRUCTION EQUIPMENT SHIPMENTS

Equipment shipments are inching higher after the abrupt one-third drop in the winter. The improvement in equipment orders received by U.S. manufacturers has been larger, including a nearly 60-percent surge in July. Shipments have been weak for small residential and for paving equipment and weakened further yet this year. Shipments remain strong for lifting, earthmoving and export equipment. This trend will also continue.

For more of October's economic analysis, see the Economic Outlook at Construction Equipment.com.



OPERATOR TRAINING

Major Manufacturer Fills Mini Equipment Need

Developed by a leading equipment manufacturer, a new computer-based operator training course is aimed at helping owners of mini-excavators both prepare a reliable crew and protect their investments.

The Caterpillar program covers the fundamentals of daily maintenance, machine controls, safe operating practices, and operating techniques for the company's excavators weighing up to 6 metric tons.

"Finding and retaining qualified operators is one of the toughest challenges faced by contractors today," says Dan Bruch, North American general construction training manager with Caterpillar. "The program incorporates video, sound, and a series of knowledge checks to ensure comprehension. We wanted an informative program that would engage the student, even if the individual isn't accustomed to spending time at a computer screen."

Available at any Caterpillar equipment dealer, the training course contains both English and Spanish narration and text. A computer with a DVD-ROM drive is required.

See Spotlight on page 69 for an overview of mini-excavators on the market today.

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SAFETY TIPS

Campaign Urges Platform Users to "Click It!"

Promotional campaigns have resulted in the overwhelming number of North Americans wearing seat belts when riding in a car. It is hoped a similar program will prompt users of boom-type platforms to always wear a full body harness with a short lanyard attached to a suitable anchor point.



Despite not officially launched in North America until the Saf-T Conference held in California in July, the Click It! sticker campaign is eagerly being adopted by equipment manufacturers, rental houses and users.

Launched by Aerial Work Platform Training (AWPT) in North America, the Click It! campaign has received the approval of the Scaffold Industry Association. The program's initiative came from companies frustrated with a number of industry fatalities stemming from people not wearing a harness that would keep them from being thrown or catapulted from the aerial platform.

To remind and encourage people to wear a harness, AWPT has that message printed on stickers to be placed on the boom lift where they can be seen by all occupants. In addition, AWPT has made available a document that provides information on the proper use of harnesses and lanyards on different types of aerial platforms. Details on both can be found at www.awpt.org.

Known as Clunk Click! in the United Kingdom where the campaign was first introduced, it is being promoted worldwide by the International Powered Access Federation (IPAF), parent organization to AWPT.

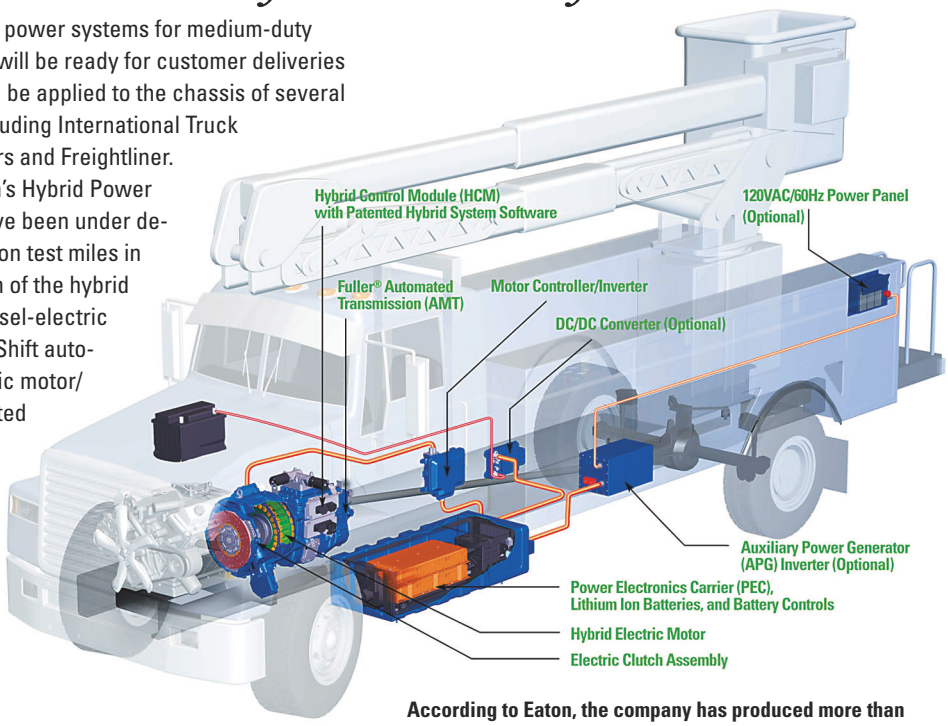
"These simple stickers," says IPAF managing director Tim Whiteman, "can save lives."

MANUFACTURER NEWS

Eaton Produces Commercial Hybrid Power Systems

Eaton recently announced that its hybrid power systems for medium-duty trucks are now commercially available and will be ready for customer deliveries in 2008. The hybrid systems, says Eaton, can be applied to the chassis of several North American vehicle manufacturers, including International Truck and Engine, Kenworth Truck, Peterbilt Motors and Freightliner. According to Kevin Beaty, manager of Eaton's Hybrid Power Systems business unit, the new systems have been under development for four years, including two million test miles in North America, Europe and Asia. The design of the hybrid power systems employs a "parallel-type diesel-electric hybrid architecture with Eaton's Fuller UltraShift automated transmission, incorporating an electric motor/generator between the output of an automated clutch and the input of the transmission. The system recovers energy normally lost during braking and stores the energy in batteries. When electric torque is blended with engine torque, the stored energy is used to improve fuel economy and vehicle performance for a given speed, or used to operate the vehicle with electric power only."

— Walt Moore



According to Eaton, the company has produced more than 220 hybrid-powered vehicles for test and evaluation.

POWER PLAYER



"Being from a smaller market and a specialty trade, CONEXPO-CON/AGG gives me the opportunity to see new ideas and technologies as they are introduced that I wouldn't otherwise get the opportunity to see. We attend the show to stay at the forefront of the construction industry. CONEXPO/CON-AGG 2005 was my first show, and I definitely won't be missing it in 2008."

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Project Manager/Estimator
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By TOM BERG, Truck Editor

Business Deals

Tie Together Truck Components

Vertical integration as practiced in Europe and Asia gains ground here, for better or worse

Not many years ago, makers of heavy trucks bragged that they were "custom builders." They had to be, as the business grew up in North America with outside companies supplying components and subsystems to the original equipment manufacturers that assembled them. That's changed, and OEMs are not nearly as willing to customize their vehicles to suit customers' demands or whims. Vertical integration, where the OEM decides what goes into its trucks, is gaining ground as heavy truck builders advance their component manufacturing plans or strike new supplier agreements.

Vertical integration is how it's done overseas. In Europe and Asia, most OEMs decide what's best for their customers. OEMs themselves build some components — most notably, engines and transmissions — and obtain other items from select suppliers. Some very good and technologically advanced trucks are built this way, and they reliably move cargo down the road.

In North America, light- and medium-duty trucks have been built this way for many years, and though midrange customers sometimes have choices of engines and transmissions, the choices now aren't nearly as great. The heavy-duty market is edging closer to that practice as OEMs — many with ties to Europe — assume the role of component spec'ing that used to be played by fleet managers.

Out with the oddballs

For the past 10 to 15 years, the OEMs have been paring down their options lists to the most popular items and eliminating the oddball stuff. OEMs argued that it simply costs too much to offer things that few customers want and that don't do a job better, only differently.

Fleet managers complain that they've learned over the years what works and doesn't work in their operations and what suppliers satisfactorily back their products, and they order accordingly. This tends to make managers conservative — reluctant to accept new products and new technology until they're proven absolutely reliable by large fleets with the resources to experiment. Fleet managers resent having their choices taken away by OEM executives who think they know better, but OEM execs are winning.

Engines comprise the primary example of how choices have shrunk, but the trend toward vertical integration is also evident in transmissions, drivelines, axles and suspensions. They are among the still spec'able heavy-duty drive

A modern truck has hundreds of feet of wiring and thousands of electrical circuits, which can be complex and confusing for technicians. An alternative is multiplexed wiring, now used on certain Internationals and Freightliners. We describe their advantages and a few watch-outs in our expanded online story found at Construction Equipment.com.



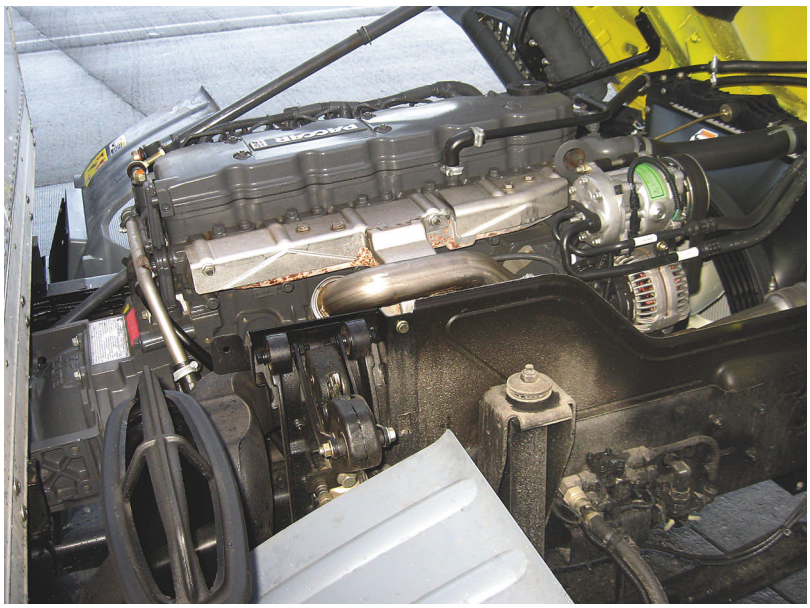
International Truck and Engine, one of the more vertically integrated manufacturers, also enables upfitters to easily hook up specialty equipment with its Diamond Logic multiplexed wiring system. Read a full description in the extended article online at ConstructionEquipment.com.

train components, but most OEMs analyzed their options lists and identified the most popular parts, then eliminated the rest. This greatly simplified their ordering and engineering costs and increased their potential profits; OEMs have also argued that it helped them to hold the line on vehicle prices.

Marketing agreements between component makers and OEMs are another major factor. In medium- and heavy-duty trucks, all OEMs offer certain Eaton transmissions, Spicer drivelines, Spicer or Meritor axles, and Hendrickson, Chalmers, Watson-Chalin and certain other suspensions. Some OEMs developed their own tandem-axle suspensions that compete with those of outside suppliers. But they also emphasize private-branded components built for them by those same suppliers, often with features exclusive to that builder but sometimes all but identical to those still carrying vendor names.

An example is Hendrickson, which says it is now the preferred suspension supplier to International Truck. Hendrickson executives explain that for years they have done "pull-through" marketing — trying to convince truck users to spec Hendrickson products based on superior design, performance and durability. They still do this, but have found that a supplier agreement with a volume truck builder yields more business.

Usually OEMs have the upper hand in such deals, and can force price concessions in return for steady, guaranteed business. But sometimes a vendor has considerable clout. Eaton Fuller manual transmissions have become so popular that its only competitor, ArvinMeritor, has quit the manual transmission business. ArvinMeritor says it was forced



The PX-6, a rebadged Cummins ISB with grey paint and different accessories, is the only engine in Kenworth and Peterbilt LCF trucks. That and the PX-8, a/k/a Cummins ISC, will also be exclusive to the two Paccar-owned OEMs' conventional-cab trucks. Paccar has dropped the Cat C7.

out by predatory practices. A former fleet manager told us that Eaton required at least one OEM to place hefty price premiums on Meritor transmissions, forcing him to accept Eaton gearboxes. ArvinMeritor is suing Eaton, but still markets the ZF-made FreedomLine automated mechanical transmission.

OEM engines

Many engines — the most expensive component in a truck — are still obtained from outside suppliers, primarily Caterpillar and Cummins. But an increasing number are built by OEMs themselves, and two have plans to build more of their own. The trend is for an OEM to be standard with its own engines, if it has them, and offer one vendor's series, often through preferred-supplier agreements. Here's the current situation:

■ Freightliner's ownership of Detroit Diesel causes it and its sister companies, Sterling and Western Star, to be standard with Detroit or, because they're all owned by DaimlerChrysler, Mercedes-Benz diesels. These OEMs offer Cat and Cummins engines in heavy trucks, with some restrictions, as we'll see. Cat is gone from the Freightliner family's medium-duty models, though Cummins ISB and ISC engines are still available.

M-B's German-built medium-duty 900 engines gained enough sales volume that the 900 series has been assembled by Detroit Diesel in Michigan since last January. A new heavy-duty series, with models eventually replacing the Detroit Series 60 and M-B 4000, are being announced this month.

■ Volvo Powertrain in Hagerstown, Md., is building D series diesels for Volvo and a similar MP series for sister company Mack. Volvo still offers the Cummins ISX in two truck series, but Mack has dropped the ISX and lightweight ISL altogether because it sold very few of them. Mack's Granite vocational truck can be ordered with a 10.8-liter MP7 and a 12.8-liter MP8.

Volvo's VHD vocational truck comes only with the 12.8-liter D13, while highway trucks can also be had with that and the 10.8-liter D11, along with the 15-liter Cummins ISX. The heavy VT series comes with Volvo's 16.1-liter D16 or the ISX.

■ International Truck and Engine, which has long built its own midrange engines, is close to offering its own heavy-duty diesels. Based on designs from MAN of Germany, these will have advanced features along with simplicity that will lower manufacturing costs and allow them to sell for less than the Cat and Cummins big-bore diesels International now offers.

For instance, the upcoming MaxxForce 11 and 13 big-bore diesels will have high-tech fuel injection, but each will mount a pair of simple turbochargers instead of a complex and costly variable-geometry turbo. And by building the engines itself, International will better control each unit's profit potential. The engines will be assembled in a new plant at Tuscaloosa, Ala., with blocks cast in Brazil. The move suggests that vendor engines might eventually be removed from International's heavy trucks, but marketers insist that Cat and Cummins power will remain optional.

International's medium- and medium-heavy-duty engines, like those of competitors, have all been upgraded to meet EPA '07 emissions limits. And they've been renamed MaxxForce, with numerical suffixes that approximate their displacements in liters. The lineup includes V-6, V-8 and in-line-6 models called MaxxForce 5, 6, 7, 9 and 10; what would be



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the "8" model is called MaxxForce DT, based on the DT 466, whose excellent reputation over the years caused marketers to retain the DT moniker. Horsepower ratings in the various models range from 200 to 350.

■ Paccar has begun equipping its mid-range trucks with private branded engines made by Cummins, a long-standing partner, while dropping Caterpillar's C7. And Paccar has begun building a plant in the South which will assemble big-bore diesels for its heavy-duty trucks. For now, Paccar's domestic OEMs, Kenworth and Peterbilt, offer Cummins' ISM and ISX and Cat's C13 and C15.

The PX-6 and PX-8 engines will be used exclusively by Kenworth and Peterbilt in their conventional- and low-cab-forward medium-duty trucks. The PX-6 is Cummins' 6.7-liter ISB while the PX-8 is the 8.3-liter ISC. PXs will not differ technically from their Cummins counterparts, but are painted dark grey instead of Cummins red and use Paccar-branded accessories.

The prices paid by Paccar for PXs might be less than what it would pay for Cummins-branded engines, allowing higher profit potential for Paccar and perhaps lower selling prices for customers. And the Paccar-chosen accessories, including alternators and starters, will guarantee more parts business for KW and Pete dealers, who will also be the primary servicing centers for the PXs.

Kenworth and Peterbilt executives are enthusiastic about the PXs' ratings (from 200 to

Business Developments Could Affect Some Truck Content

Several recent developments and situations will affect certain trucks, and perhaps how their various systems are assembled. These include business deals and lawsuits:

■ General Motors, following top executives' previously announced intentions to raise cash and concentrate on automobiles and light trucks, has sold Allison Transmission to an investment group. Announced in June, the $5.6 billion deal closed quickly on Aug. 7. Allison, based in Indianapolis, claims an 80 percent share of sales of commercial-truck automatic transmissions, and makes powershift transmissions and other components for military and off-road vehicles. It grossed $2 billion last year.

Observers feel Allison's business can grow because it will be free to approach vehicle builders who have avoided buying the transmissions because they don't want to contribute any revenues to GM. Allison's buyers, Onex Corp. of Toronto and Carlyle Group of Washington, D.C., said they would sell part of Allison to public investors through stock offerings. But they will probably keep the operation intact because, says Carlyle's managing director, Greg Ledford, "I think it's the best automotive industrial company that I've ever seen."

■ GM was rumored to be trying to sell off its Class 4 through 7 and light-8 truck business, but an alternate plan — having an outside company build the trucks for GM and its dealers — might also work. Rumors during the summer identified International Truck and Engine as a serious would-be buyer. However, International might instead agree to make the trucks under contract or a joint venture, like it now does for Ford. Neither GM nor International will comment on such speculation, and something may or may not happen.



"For Sale"? GM is rumored to be seeking a buyer for its Class 4 through 7 medium-duty truck line. An alternate plan might be to farm out their assembly, like International now does for Ford's F-650/750 and LCF trucks.

■ GM and Isuzu Commercial Truck of America dissolved their joint venture, GM-Isuzu Commercial Truck, on August 1st.. The

330 horsepower) and high performance, and say that they are overcoming dealers' and customers' unhappiness over the loss of Cat power. Executives even claim that a few Cat distributors are considering the buying of Kenworth and Peterbilt midrange trucks because they like their premium features and might overlook the Cummins-built power.

Paccar's upcoming big-bore diesels will be built at Columbus, Miss., based on MX diesels designed by Paccar's European subsidiary, DAF. One is a 12.9-liter model with 410 to 510 horsepower in Euro-emissions versions. Paccar says the plant will be completed in 2009, in time to equip 2010-model trucks with the engines. Paccar is not saying if it will cut out Caterpillar or Cummins big-bore engines at that time, but it's possible that one might go.

Caterpillar sliding?

Cat's fortunes in the medium-duty truck market seem to be sliding, as Freightliner and Sterling have also dropped the C7. They offer Cummins ISB and ISC as options in their midrange models, along with the standard M-B 900 series. The two remaining customers for the C7 are Ford, in its F-650/750, and General Motors, in its Chevrolet Kodiak and GMC TopKick C6500/7500/8500 trucks. In all cases, the C7 will be the premium engine, as a Cummins ISB will be standard in the Fords and the Isuzu 6H will be standard in the Chevys and GMCs.

The Cat's popularity has slipped among Chevy and GMC customers, GM managers say. As recently as three years ago, 80 percent of buyers chose the C7, and now about 33 percent spec it. Price is one reason: The C7 cur-

joint venture managed the distribution of medium-duty LCF trucks for both participants, something that is now being handled separately by the two companies.

The joint venture worked fine, sources at both ends said, but it was an obstacle to Isuzu of Japan's ambitious plans to expand its sales in North America and other markets outside Japan. The dissolution also frees GM to do whatever it wants with its medium-duty line.

Although GM last year sold its remaining stake in Isuzu, which once was as high as 49 percent, the two remain engaged in alliances that include Class 3 through 8 LCF trucks that are made in Japan and the United States. Coincidently, Isuzu has dropped a GM-built midrange conventional from its lineup.

■ DaimlerChrysler on August 3rd sold 80.1 percent of the Chrysler Group to a subsidiary of Cerburus Capital Management. The much-publicized move splits up the troubled German-American corporation, but Daimler AG (its possible new name) retains the other 19.9 percent. That will ensure continued cooperation in commercial truck ventures involving Chrysler LLC's Dodge Truck operations.

Thus, Mercedes will still supply Sprinter vans and chassis-cab trucks for sale by Dodge dealers, and Dodge will still supply Ram 4500 and 5500 cab-chassis trucks which Sterling dealers sell as Bullets. The sale otherwise does not involve Freightliner, Sterling, Western Star, Detroit Diesel or any of Daimler's other North American companies.

■ Ford Motor Co. might be thinking about returning to the Class 8 market, which top management quit when it sold its heavy truck business to Freightliner LLC in late '97. The deal was effective a few months later, when Freightliner acquired the products which became the Sterling A and L Lines. Ford agreed not to market any Class 8 trucks for 10 years, and hasn't; its heaviest truck is still the Class 7 F-750.

The prohibition expires early next year, and Ford could conceivably roll over the 33,000-pound limit by adding tandem rear axles and heavier frames to the F-750 and perhaps revive the F-850 model. Ford executives won't say whether they will.

Meanwhile, there's both cooperation and conflict between Ford and International Truck and Engine. The two continue their Blue Diamond joint venture under which International assembles Ford's F-650 and F-750 at a plant in Mexico, using International frames, Ford cabs and wiring harnesses, and vendor engines. That plant also makes the Class 3-4 Ford LCF and International CF low-cab-forward trucks that are clones.

The two builders also continue their legal battles over warranty costs for the International-built 6-liter '04-06 Power Stroke V-8 diesel, which suffered mechanical problems. Ford claims International should pay more for warranty repairs, and when it wouldn't, Ford began withholding partial payments for newer series Power Strokes. International stopped delivering those engines, but a judge ordered it to resume, pending outcome of the suit.

International meanwhile sued Ford, claiming Ford is developing its own smaller V-8 diesel in violation of their supplier agreement (outside sources say Cummins is developing the engine for use in the F-150). Will the hard feelings ruin the long-time relationship between the companies? We'll see.



Cat's C7, displayed in a Ford F-650 at an industry meeting, is more tricky to package because its CGI piping emerges from the diesel particulate filter (at right, looking like a muffler) and runs back to the engine.

rently costs $1,500 to $2,000 more than the 6H, and dealers point that out to customers.

And, GM says, the 6H (formerly called Duramax 7800) has also proven itself through performance and reliability, with a claimed B10 life of 481,000 miles (which means 90 percent of all 6Hs will still be running at that point). Dealers are proud to sell it, and they also like the idea that they'll get parts and service business while C7 users can choose instead to go to Cat distributors.

Caterpillar will still supply heavy-duty diesels to several high-volume OEMs. The C13 and C15 will be optional in certain Freightliner, Sterling, Western Star, Kenworth, Peterbilt, and International trucks. Cat lost market share earlier this year with a relatively slow start in production of EPA '07-spec engines (though not many '07 diesels of any make have actually been built or sold). But Cat's insistence that its products are premium in quality and deserving of their premium prices is costing it some sales.

Among the premium features of current Cat diesels, in the view of the builder's marketers, is its Clean Gas Induction system. Other builders send cooled but raw exhaust gas into combustion chambers to reduce formation of NOx. But Cat's version of exhaust-gas recirculation takes filtered gas from the rear of the particulate filter and sends it to the engine's air-induction system in a separate pipe that parallels the exhaust system. Thus only clean air goes into its engines, and Cat marketers have torn down competitors' diesels to show that their innards are indeed dirtier. That, marketers say, will probably make them wear out faster.

Competitors wonder why it's harmful to put raw exhaust gases into the cylinders that produced them in the first place. And they counter-argue that Cat CGI's filtered exhaust gas still contains acids that can attack turbos and charge-air coolers, causing worse problems. Fitting the CGI piping into a chassis can be troublesome, and Sterling gave that as a reason to exclude Cats from a recently introduced L Line model. Is this a valid reason, or another way to push customers toward Detroit and M-B "family" engines? What will happen to the big yellow engines come 2010 when engines become even more complex?

SCR coming

Another round of EPA emissions tightening is scheduled for January 2010. This will require further reduction of oxides of nitrogen (NOx), and engine builders are preparing to do it with technology that'll be new to North America. Detroit Diesel-Mercedes-Benz and Volvo Powertrain have announced that they'll employ Selective Catalytic Reduction, along with cooled exhaust-gas recirculation already used. SCR injects a urea solution whose active ingredient, ammonia, causes chemical reactions in exhaust that breaks down NOx into non-harmful gases, including water vapor.

SCR is now successfully used by most builders in Europe and Japan. Japanese builders have not said they'll use SCR in trucks destined for the United States in 2010, but they almost certainly will. Caterpillar, Cummins and International say they are close to deciding how they'll meet the '10 regs, and will announce their approaches by year's end. Greater complexity adds expense, especially if OEMs have to deal with different aftertreatment types. This could push them toward greater simplification in their engine offerings and even more vertical integration.



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By LARRY STEWART, Executive Editor

Artic Trucks

Produce for Those Who Are Prepared

Anticipating retarder need, gear changes and differential lock-up moves an all-terrain-hauler's loads at the fastest overall speeds

Their automatic transmissions might suggest that anyone who drove to the jobsite can operate an articulated dump truck, and it may be true. But in order to make the machine that's most like our cars produce reliably, operators need to know how to use the retarders, differential locks, and dump functions, and respect the limits of these outwardly Herculean haulers.

The obvious differences between an off-road haul truck and the vehicles with which people are most familiar are size and weight. A loaded ADT weighs something like 10 times more than a personal vehicle and typically operates on undeveloped roads. Operating it safely and efficiently calls for the foresight to properly engage things like retarders and differential locks in plenty of time to control the load.

Operators who regularly use a truck's axle or service brakes rather than retarders to slow the truck can cut brake life in half.

"Inexperienced operators like the positive reinforcement of service brakes — the instant feeling of stopping power," says Dan Snedecor, director of Volvo Construction Equipment's operator training program. "Using retarders is a bit more difficult because they need to be applied ahead of where the truck needs to slow down. They don't produce instant slowing power."

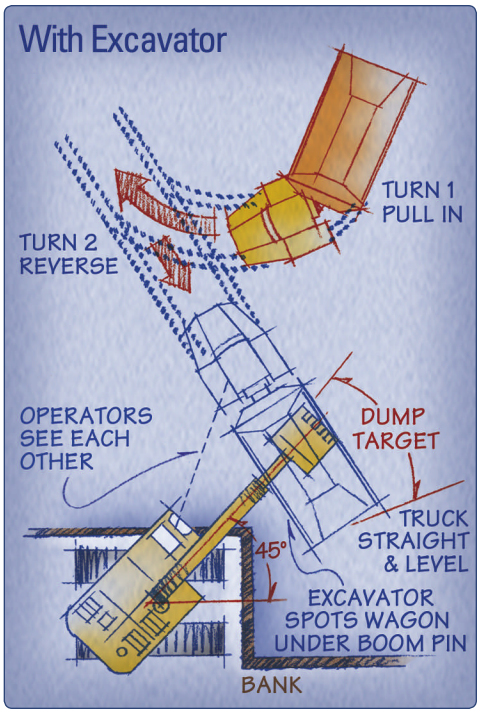
Truck features vary from brand to brand, but most have some automatic modes for retarders — either to retard speed as soon as the operator lets up on the throttle, or applies the retarder with the first travel of the brake pedal. Volvo articulated trucks have an independent pedal that allows the operator to vary the power of the hydraulic transmission retarder, but the most reliable way to use their systems is in their automatic modes.

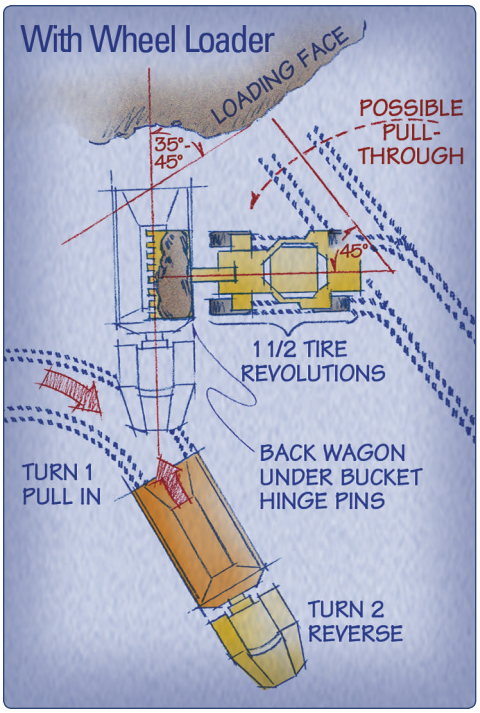
"The only time you should use the hard service brakes, other than in an emergency stop, is when you bring the machine to a complete stop after the retarders have slowed it down," says Snedecor.

Anticipating the need to slow down, and applying the retarders early, gives the trucks' automatic transmissions a chance to find a gear and speed necessary to deal with an upcoming hill or turn.

Today's automatic transmissions are remarkably efficient, and manufacturers say most operators just select "D" with the transmission lever and go. But there are conditions that call for human gear selection.

"When an operator selects "D" for drive, machine operation is fully automatic — it is meant for ease of operation, and also an economy mode for light to medium applications," says Michael Stec, one of Volvo's training specialists. "Gear shifting runs in the range be-





Loading Tips

For fast truck exchanges, approach the loading zone with minimal turning and be able to consistently back the truck into place under the stick or bucket-hinge pins of the loader's spot. Watch for opportunities to pull through into position. Production is best when an excavator can swing 45 degrees or less, and the loading target is biggest when it can swing through the truck's tailgate. Wheel loaders should be able to back away from the loading face no more than 1½ wheel revolutions, and reach dump position by advancing the same distance or less.

tween 700 and 1,800 rpm, minimizing fuel consumption while negotiating haul roads with limited grades. The truck's not putting too much fuel through the engine, but it's also not suited for climbing steep grades or for muddy conditions.

"When haul conditions worsen with mud, grades more than 15 percent, diff locks needing engagement, and/or other unique challenges, an operator may want to pre-select gears. You do three things by pre-selecting a gear or switching on our shift inhibitor," Stec explains. "The engine can wind up to 2,200 rpm and provide maximum rimpull when climbing hills. Also, it provides maximum engine and transmission retarder force when traveling down steep slopes, which saves brake life. Lastly, it cuts down on gear hunting — when the transmission is continually shifting between two gears on a changing slope. Gear hunting wears out the drive train and you're losing momentum, going back and forth between gears, increasing cycle time."

The first rule of shifting gears in one of these big off-road trucks is to do it before you need a different gear. The grade and gear-selection labels inside the cabs of most trucks will tell you which gear is appropriate.

As a rule of thumb, Caterpillar recommends noting the gear and speed that the transmission picks when climbing a hill unloaded. Before starting down that same hill with a full load, choose one gear lower than what the truck used to climb it.

Keep an eye on brake temperature, especially when choosing gears.

"Heat build-up on brake discs dictates how fast a truck can safely come down a grade," says John Hymbaugh, senior marketing training consultant at Caterpillar. "If brake temperature is too high, you have to come down in a lower gear and slow down."

"You need to respect the grade chart (we put it in the upper right-hand corner of the windshield of every truck)," says Volvo's Stec. "The slope chart is designed to keep retarder-oil temperature in the green. If you use a bigger gear and overheat the retarder, then you're going to reduce retarder force and you're putting heat back into transmission."

Cat's artic trucks use an engine-compression retarder in lieu of a transmission device. Overheating is similarly hard on the engine.

It's also critical to know when to use differential locks on trucks equipped with the feature.

"The vast majority of the time operators of our trucks should use either 6x4 or 6x6 mode, occasionally pushing the button to lock all of the differentials when the going gets really tough," says Volvo's Snedecor. "But we see guys

operating in the most aggressive traction mode all the time. It can slow the machine down, particularly if there's a lot of turning involved, and wear and tear on tires and drive train increases.

"The key is to get them switching the modes on and off at appropriate times based on the demands of the changing terrain," he adds, "because there's always a tradeoff with efficiency and component life."

Locked differentials actually work against the truck when it is operated on hard, dry surfaces. With very little wheel slippage, the truck wastes a lot of energy trying to twist drive shafts and strip gear teeth when cornering.

Cat's Hymbaugh points out that good operators learn to coax their trucks through some challenging underfoot conditions without locking up differentials at all (after all, more than half of the trucks on the market today don't even offer the option).

"If you can use technique and speed to get through some tough stuff without locking differentials, you increase fuel efficiency," says Hymbaugh, "and there's less wear and tear on the truck's gearing."

Volvo and Cat operating instruction agree, the logical progression for using differential locks is typically to start with longitudinal locks — those that lock power delivery from axle to axle — at the first suggestion of wheel slippage. Only use full lockup — the button on the floor that adds transverse lockup across each axle — as necessary in really tough situations.

"The switch on the steering column which will engage the inter-axle differentials," says Ken Karpuleon, another of Cat's senior marketing training consultants. "If you think of it in terms of a four-wheel-drive pickup truck, that's like four-wheel high. The button on the floor, when you step on it, is like putting the truck into four-wheel low."

Haul roads are a controversial topic when ADTs are doing the hauling. Manufacturers recommend no change in haul-road maintenance from rigid-framed to articulated trucks, and in the same breath acknowledge that haul-road diligence drops off considerably with ADTs on site. Saving money on road maintenance comes with a cycle-time penalty, though.

Yes, ADTs can traverse less-manicured roads, but they can't cover the same distance nearly as quickly. To make matters worse, managers who can't slow operators down will likely incur high workers-compensation expenses when soft spots in the road deteriorate and their NASCAR hopefuls get bounced around the cab like a bean in a maraca.

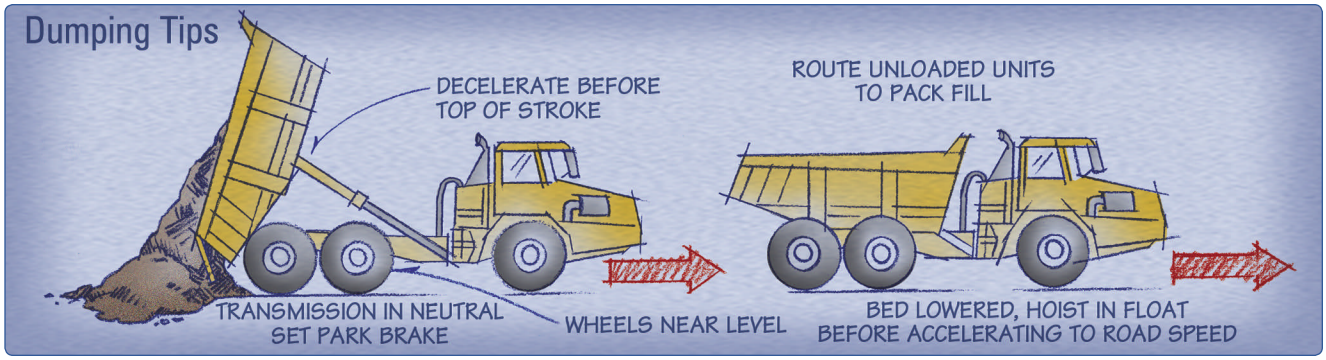
Watch speed and ground conditions especially carefully when returning to the loading zone with an empty truck. Heavy-truck suspensions are tuned for carrying a load. They're very stiff when the box is empty, and the truck's center of gravity is high. It's a problem that Volvo's forthcoming Full Suspension, or FS, Series trucks are designed to combat. Suspension won't make the trucks invincible, but it will allow them to get back to the loader faster over rough terrain.

On the loading floor, truck operators should let the loader operator spot their wagon. Top operators get good at moving efficiently into place, using a minimum number of turns and backing, if necessary, one of their sideboards directly under the loader bucket's hinge pins or the excavator's boom-to-stick pin.

Quantity of each load should be the hauler-operator's responsibility. It can be a touchy call because it can cut across the loader and the foreman's orders and/or egos. But overloaded trucks are not only hard on the equipment and fuel efficiency, they're unsafe. Over-

Dump Safely

Make sure the articulation joint is as straight as possible, and tires are on level ground. As the bed raises, rear tires may squat and any soft fill under them may compact. Operators who sense the wagon shifting should stop, reposition the truck, and try again. Confirm surface stability before dumping near an edge. The bed should be fully lowered and the hoist in the float position before accelerating to travel speed.



Toolbox Tips

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October 2007

No. 28 in a Series

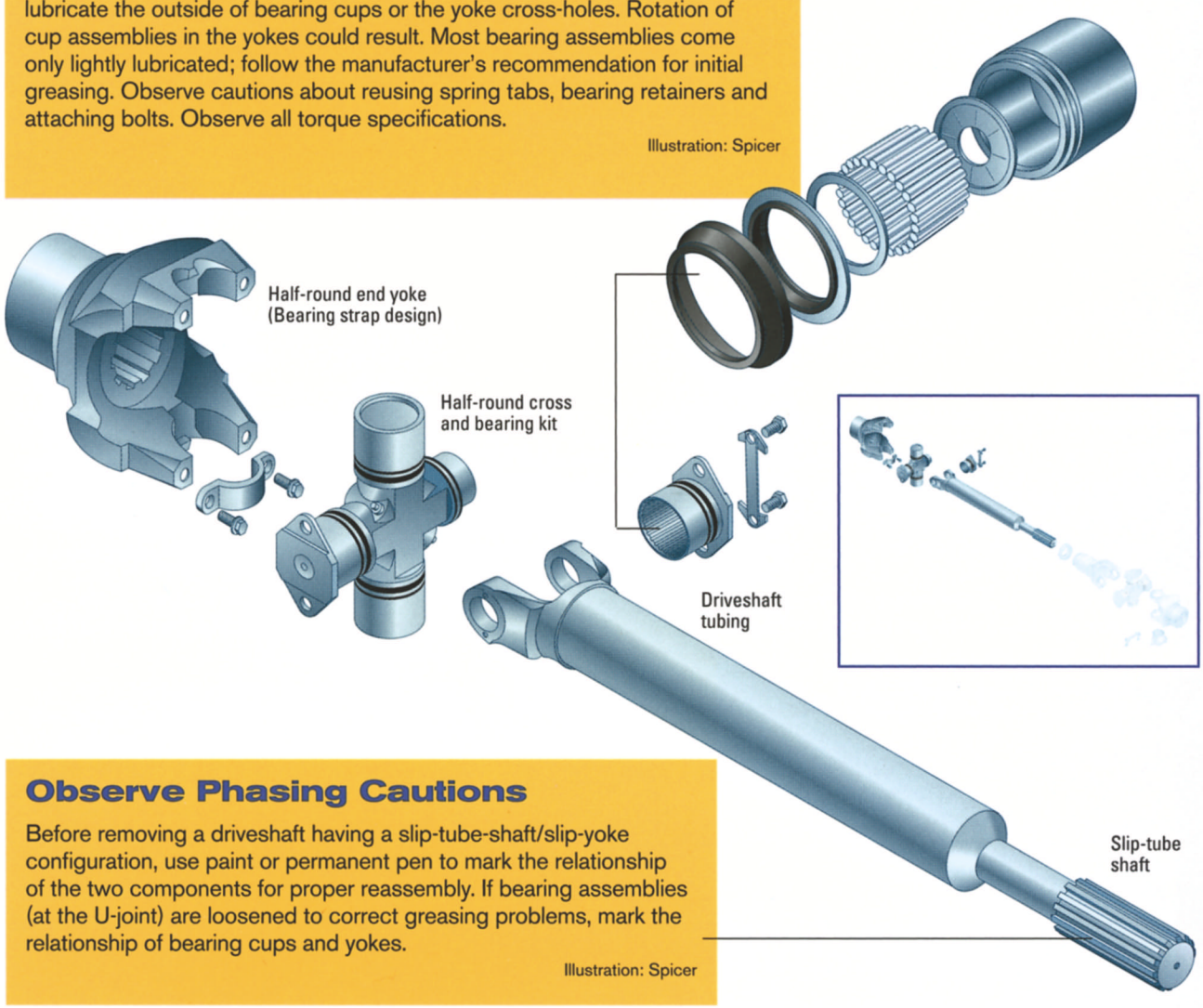
Read the complete story at **www.ConstructionEquipment.com/TBT28**

Driveshaft Care Promotes Reliability, Safety

Replacing Bearing Kits

When replacing the journal cross and bearing assemblies in a U-joint, don't lubricate the outside of bearing cups or the yoke cross-holes. Rotation of cup assemblies in the yokes could result. Most bearing assemblies come only lightly lubricated; follow the manufacturer's recommendation for initial greasing. Observe cautions about reusing spring tabs, bearing retainers and attaching bolts. Observe all torque specifications.

Illustration: Spicer



Observe Phasing Cautions

Before removing a driveshaft having a slip-tube-shaft/slip-yoke configuration, use paint or permanent pen to mark the relationship of the two components for proper reassembly. If bearing assemblies (at the U-joint) are loosened to correct greasing problems, mark the relationship of bearing cups and yokes.

Illustration: Spicer

Tool Box Tips are not to be used in lieu of the manufacturer's manuals.

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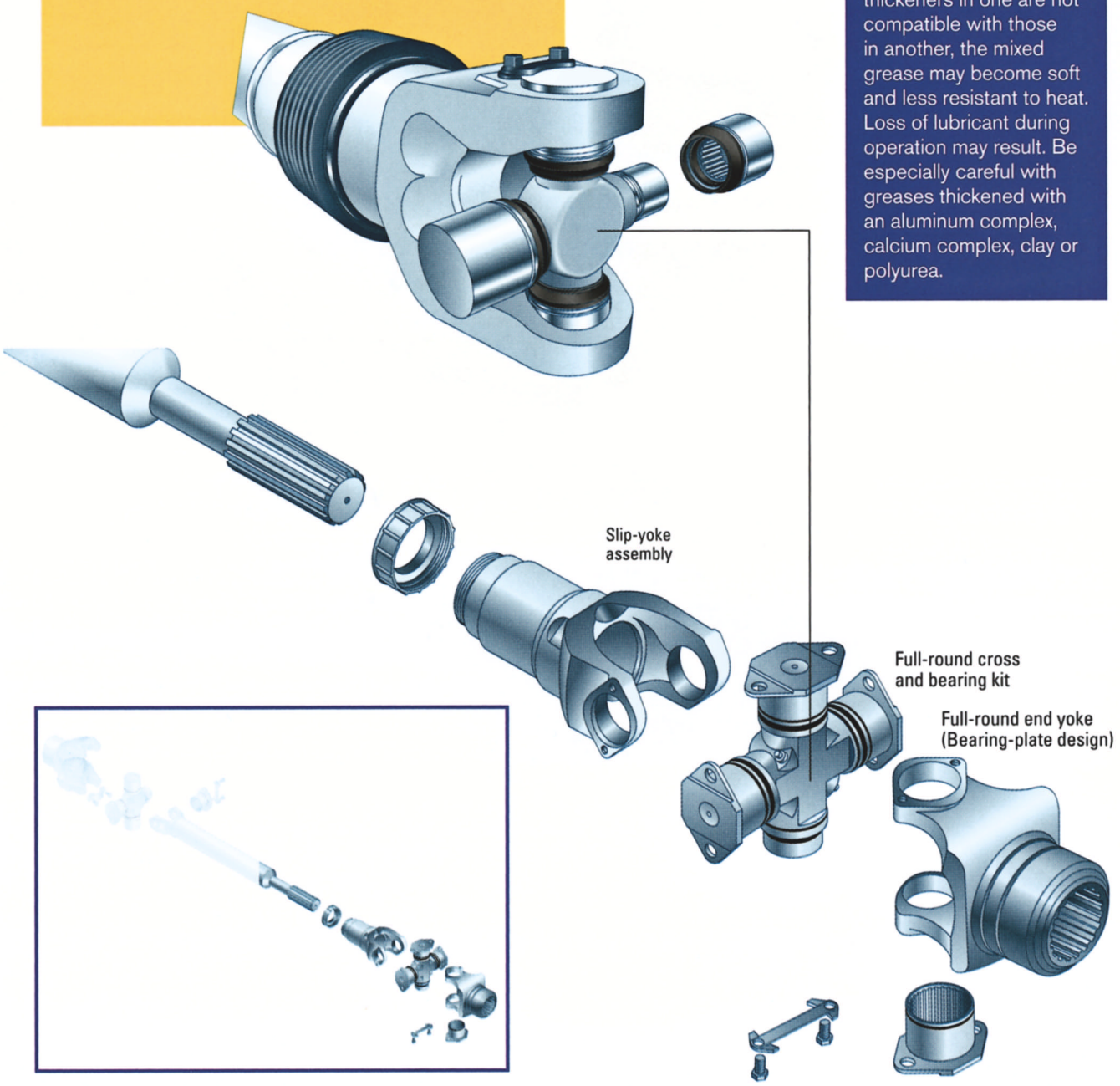
Aluminum-Shaft Bearing Kits

When replacing bearing kits in an aluminum driveshaft, carefully remove any raised metal at the yoke cross-holes, then inspect the cross-holes for distortion. The bearing kit should be specifically designed for use with aluminum in order to protect the yoke from undue wear and galvanic corrosion.

Illustration: Spicer



QUICK TIP

Grease Incompatibility

When lubricating U-joint bearings and slip-tube/slip-yoke joints, consistently use the same type of grease. Grease formulations vary; and if oils, additives and thickeners in one are not compatible with those in another, the mixed grease may become soft and less resistant to heat. Loss of lubricant during operation may result. Be especially careful with greases thickened with an aluminum complex, calcium complex, clay or polyurea.

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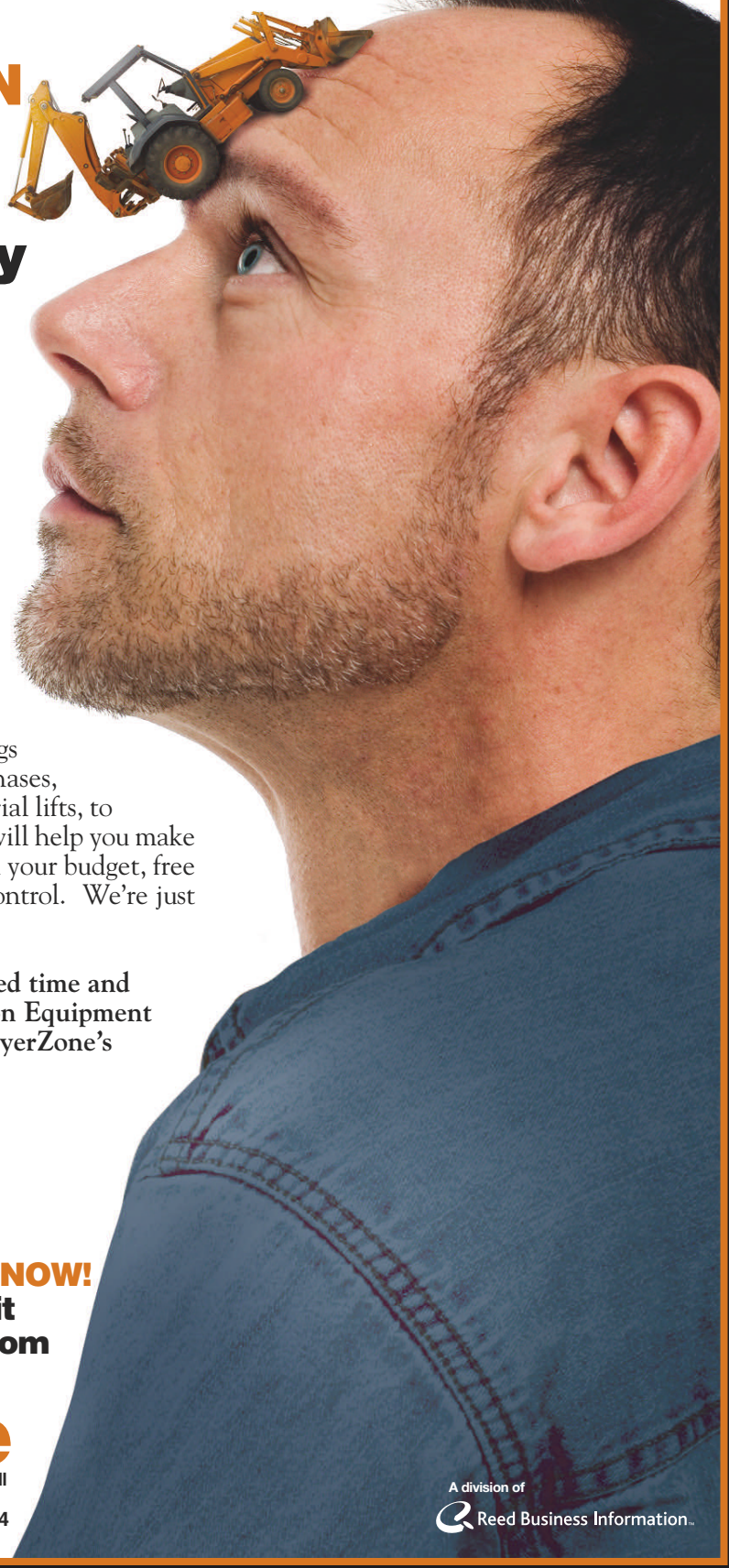

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loading reduces the truck's stability and exceeds its brake, steering, and tire capacity.

Side slopes are another challenge to ADT stability and safety. Volvo training materials say its OK to traverse side slopes of up to 15 percent, but the company's lawyers add that it's only OK under specific conditions established by jobsite management.

"If you can keep perpendicular to the slope, do it," says Cat's Hymbaugh. "You probably wouldn't want to dump on a cross slope. That's why we have an ejector model."

The truck's wheels should be near level when the loaded body is raised. If they're not, the truck's center of gravity will shift laterally as it rises and the wagon can easily roll onto its side. For the same reason, stay tuned to the wagon whenever engaging the hoist lever because the wheels on one side may settle as the full load is transferred to the tandems.

Position the truck to unload — wheels level and articulation joint as straight as possible — where the pit boss or the fill-tractor operator directs before moving the hoist lever. Put the transmission in neutral, set the parking brake, and make sure the area is clear of people.

It's OK to bring the engine speed up to medium or high idle for a faster dump cycle, but remember to slow down as the cylinders reach the top of their stroke. No good can come from testing their seals by repeatedly slamming the cylinders all the way to the top.

Dumping sticky materials, large items like boulders or tree stumps, or dumping downhill or with a tailgate should pique an operator's caution. If part of the load gets stuck in the bed as it is raised, the center of gravity can shift far enough to the rear to raise the tractor off the ground. Tractors are seldom perfectly balanced, and with nothing but an articulation joint hitching them to their wagons and tires lifted clear of the ground, they tend to roll on their sides. (Pay attention. You can get a wet, sticky load in otherwise non-threatening conditions by failing to dump a bed partially filled with rainwater.) In these situations, raise the bed more slowly and pay careful attention to the attitude of the body and wagon.

The bed should be fully lowered and the hoist in the float position before accelerating to travel speed.

"Those body-tilt cylinders are pretty long — they can get damaged, operating the truck with the bed up in the air," says Hymbaugh. "And the truck is top heavy with the bed raised. I've seen trailers tip over sideways with the bed raised, running over a huge stump or rock in the fill."

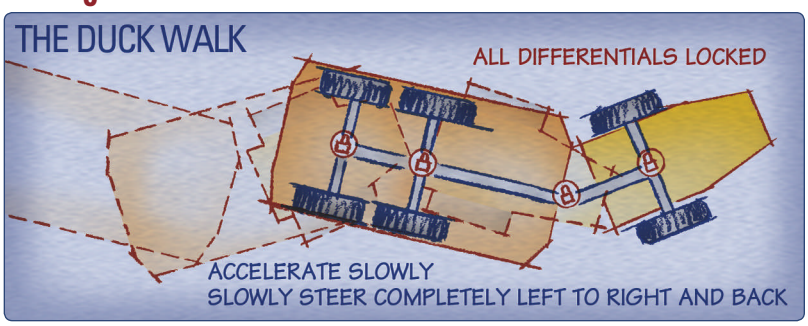
If conditions are smooth and stable, an articulated truck can dump on the roll to spread material or build a berm. But that's a call that should be made with caution, as the chances of a mistake tend to increase the longer an operator is working on a site.

"Operator fatigue and human arrogance can contribute to truck instability," says Stec. "Guys get too comfortable with a site after they've been working on it for a while, and they can make mistakes like going around curves too fast and test beyond the machine's limitations, or go too fast down-hill and overspeed the engine."

There's a time for speed, but a dedicated operator knows how to meter it out safely, and realizes that maximum productivity is not always the same as perpetual acceleration.

"The operator's goal isn't to achieve a high top speed for a route, but over the course of the day, the highest average speed — to keep production high and cycle times predictable," says Volvo's Snedecor. "The more you accelerate and have to brake, the more often you're going to have to stop for fuel, and the more likely the machine is to need maintenance. The best operators are ones that perform predictably, reliably and with a low amount of service needs."

Getting Unstuck



To duck-walk a truck out of a sticky situation, engage all differential locks (if equipped) and accelerate slowly, trying to prevent wheel spin. Slowly steer to the left steering stop and back to the right three or four times. If you can't get free, try rocking the truck out of mud. If that fails, the next option is to dump the load and try again. The last resort should be to hook a tractor up to the towing points and pull the unloaded truck from the mud.



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Sneak Peek at ICUEE



Deere Backhoe Loaders

New John Deere J-Series backhoe-loaders have all new power-train components and numerous structural and electrical enhancements. All models provide exclusive, standard power shift transmission for fast, smooth, on-the fly, clutch-free gear shifts. Key features include a completely redesigned outboard planetary rear axle with improved lubrication and larger differential components, enhancements to the electrical system, new single-radiator cooling system, new top-hook, single-pin backhoe coupler, and updated structural areas to improve productivity and uptime.

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Ditch Witch JT3020 Mach 1 HDD unit

The new Ditch Witch JT3020 Mach 1 is a self-contained horizontal directional drilling machine rack-and-pinion thrust drive with a double rack that is welded on to prevent misalignment with the pinion. Powered by a quiet-running 148-horsepower engine, the JT3020 develops 30,000 pounds of thrust, 4,000 foot-pounds of torque, and spindle speeds to 225 rpm. Features include a new cooling system; redesigned anchor system; state-of-the-art operator station; field-proven wrenches, pipe loader and stabilizers; and efficient drilling fluid pumping system.

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Ingersoll Rand Compressors

Ingersoll Rand has introduced two Onboard Power Solutions reciprocating air compressors. The VHP40RMD is a diesel-powered air compressor and the VHP40RMG is gasoline-powered. Both units are designed to fit on standard-sized utility trucks, and both are powered by three-cylinder, four-stroke Kubota engines equipped with glow plugs for cold-weather operation.

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Komatsu Compact Track Loaders

Komatsu offers two new compact rubber-tracked loaders — the CK30-1 with a 2,385-pound operating capacity and the CK35-1 with an operating capacity of 2,755 pounds. Both units are powered by an 84-horsepower Komatsu high-torque, turbocharged diesel engine. The CK30-1 loader utilizes radial lift path technology for ground-engaging applications, and the CK35-1 is a vertical lift-path loader more suited to material handling and truck-loading operations. Low 4- to 5-psi ground pressure of the machines make them ideal for many jobs, but especially in soft conditions or where minimum soil compaction is desired.

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Astec DD-2024 Directional Drill

The new Astec EarthPro Series DD-2024 horizontal directional drill from Astec offers 20,000 pounds of thrust and pullback force with up to 2,400 foot-pounds of rotary torque. Powered by an 85-horsepower B3.3C Cummins diesel engine, it features field-proven dual rack-and-pinion drive with adjustable force limiter. The DD-2024 offers independent rear stabilizers and a dual stake-down system. Equipped with a tethered travel control unit to improve operator visibility during tramming and transport, it has a front-drive track system for traction and balance. The patented Es!Lok system is integrated into the drill controls for added safety.

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Bobcat Remote Control for Loaders

The new Bobcat radio remote-control system for loaders allows operators to start the loader engine and operate the drive, lift, tilt and auxiliary hydraulic functions from about 1,500 feet away. The joystick on the radio remote control transmitter activates the loader's joystick controls in the ISO control pattern. The system is usable for up to 15 hours on a rechargeable battery. In addition to being able to operate the remote system in various climate conditions, operators can easily switch between "remote" control mode and "machine/direct" control mode.

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Case CX B Series Excavators

Case Construction Equipment has introduced the first models in its new CX B series line of full-sized excavators. Case says the new models feature measurable increases in fuel efficiency and productivity, noticeable improvements to operator comfort, easier maintenance, and enhancements to durability and reliability with 17 percent more horsepower than earlier models of comparable sizes and 20 percent better fuel efficiency. More hydraulic horsepower and faster cycle times increase productivity. Cabs are quieter inside and designed to be more comfortable, and have been modified to provide more convenient access to key functions.

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Caterpillar Small Wheel Loaders

Caterpillar introduced three H-series small wheel loaders — the 128-horsepower 924H and 149-horsepower 928Hz and 930H models. They comply with EPA Tier III and EC Stage 3 emissions regulations. Notable features on the 924H and 930H are 3-inch valve hydraulics, 95-amp brushless alternator, and heavy-duty hydraulic oil cooler. In addition to the 95-amp brushless alternator and new hydraulic oil cooler, horsepower on the 928 Hz has been increased. New instrument panels have white-faced gauges and incorporate large LED ground speed and hour meter display.

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IMT Electric Telescopic Cranes

Iowa Mold Tooling (IMT) has added the 5005i crane to its lineup of electric telescopic cranes. The unit has a lifting capacity of 5,000 pounds (25,000 foot-pounds) and a maximum horizontal reach of 16 to 20 feet, depending on options. It joins the other IMT electric crane models specifically designed for lighter lifting applications in the construction, utility, public works, energy and railroad markets, as well as for equipment dealers and rental-equipment providers. IMT electric cranes have reach capabilities from 7 to 22 feet and lift capacities from 2,000 pounds (7,000 foot-pounds) to 6,000 pounds (36,000 foot-pounds).

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JCB Midi CX Backhoe-Loader

JCB has introduced the Midi CX mid-size backhoe-loader with 10-foot digging depth. The Midi CX is positioned between the Mini CX and 2CX. The 50-horsepower unit has two-speed hydrostatic drive and permanent four-wheel drive. Designed primarily for backhoe-loader work, it has the versatility of a compact industrial tractor with optional three-point hitch and power take off. Other key features include its compact size, mobility and durability. Auxiliary hydraulics power a six-in-one loader bucket and other attachments. A spacious cab offers excellent visibility and easy access to controls.

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Lincoln Electric Vantage 400 Welder/Generator

Lincoln Electric's Vantage 400 is one of the most compact 400 amp welder/generators on the market. The rugged unit features Chopper Technology to deliver great starts and a smooth arc for stick, downhill pipe, TIG or wire welding, as well as arc gouging. Its 1,800-rpm water-cooled, four-cylinder Perkins diesel engine delivers 400 amps, 36 volts and up to 450 amps, 32 volts of rated DC welding output at 100 percent duty cycle; and it generates 19,000 watts (peak) of 3-Phase 240V AC generator power for industrial equipment, such as a plasma cutter, pump, or an inverter welder.

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Vermeer RTX1250 Tractor

Lower ground pressure, increased traction, less ground disturbance, and greater stability are some of the benefits offered by the RTX1250 ride-on tractor. It features an exclusive quad-track design, which has virtually no break-over point, and maximizes tractive effort and stability with constant four-point ground contact. The RTX1250 design allows switching between rubber tires or quad tracks to match the unit to the job application and ground conditions. A 120-horsepower turbocharged Cummins engine provides an aggressive power curve resulting in a 5-horsepower power bulge allowing for maximum horsepower in the work mode.

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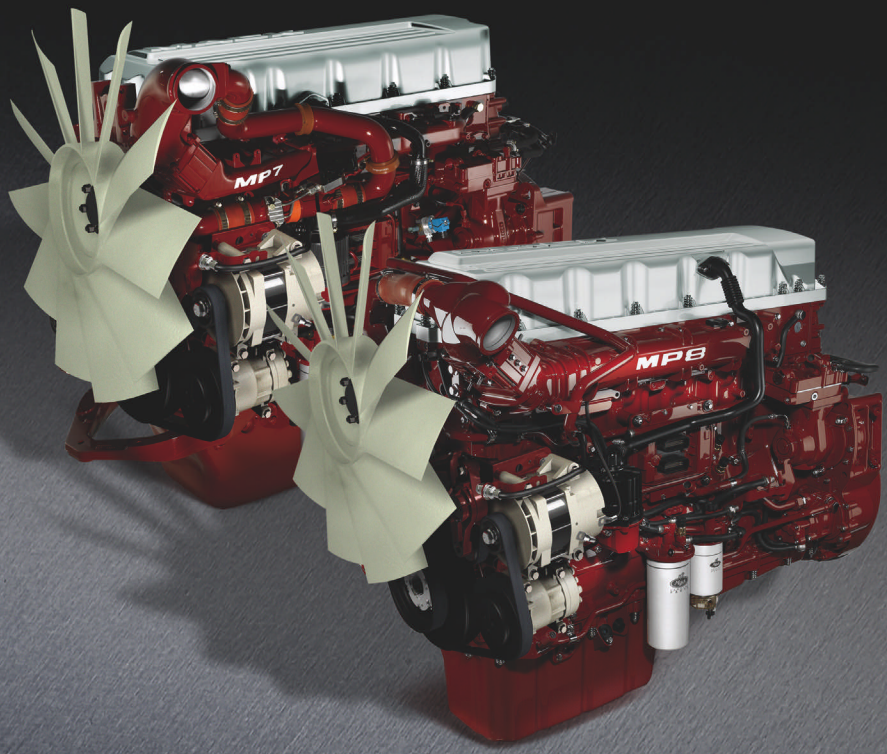

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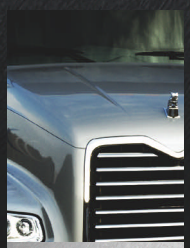

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By WALT MOORE, Senior Editor



Undercarriage Basics

A quick review of design, wear factors, maintenance practices, and operating techniques might help you extend track life for your crawler machines

Considered individually, the various components of a crawler undercarriage — links, pins, bushings, sprockets, rollers, idlers, shoes and frames — seem relatively simple, straightforward parts. But make no mistake; when these components are assembled into a system that supports and propels a track-type machine, the crawler undercarriage becomes a complex mechanism, which, experts tell us, might account for half (or more) of a crawler dozer's lifetime repair bill.

A publication from Intertractor America (and its parent company, the Passini Group) illustrates the complexity of the crawler undercarriage, devoting more than 50 pages to identifying causes of undercarriage wear and how to measure wear. If you'd benefit from such a detailed treatment of the subject, you can find the publication on the website of a Passini dealer, Crawler Tractor Parts & Rebuilding, Delta, BC, at http://undercarriage.ca/, then click Undercarriage Wear and Measuring.

Obviously, we can't address the crawler undercarriage in as much detail here. But we can review some basics about design, wear factors (for chains and sprockets, in particular), maintenance practices and operating techniques, which, taken together, might help you curb undercarriage wear and, consequently, trim undercarriage costs.

And regarding undercarriage costs, we'd highly recommend your reading an analysis by *CE* contributing editor Mike Vorster (Three Ways to Account for Undercarriage Costs). You can find Mike's analysis at www.ConstructionEquipment.com, Magazine Archives, Mike Vorster's Equipment Executive, 1/1/2006.

Basic chains and chain wear

In broadest terms, crawler undercarriages can be categorized by how the pins and bushings are lubricated — or not lubricated. The pins and bushings, of course, create the hinges in the track chain that allow the chain's links to bend around the crawler's sprockets and idlers.

The "dry chain," which is assembled with no lubrication between the pin and

Checking Chain Tension

To check chain tension on either an oval-type or elevated-sprocket undercarriage, place the machine in its work environment and allow it to roll to a natural stop in forward. Don't brake, because the track may bunch up and not yield a true indication of track sag.

Place a straight edge across the highest grousers on the upper portion of the track, and then, at the approximate midpoint between the components that are supporting the chain, measure perpendicularly from the straight edge to the top of the grouser below. The optimum measurement should be 2 inches.

If either chain uses a carrier roller, make two such measurements. Chances are the measurements will be close, but if not, you're probably best off adjusting the tightest section of track to the optimum sag dimension.

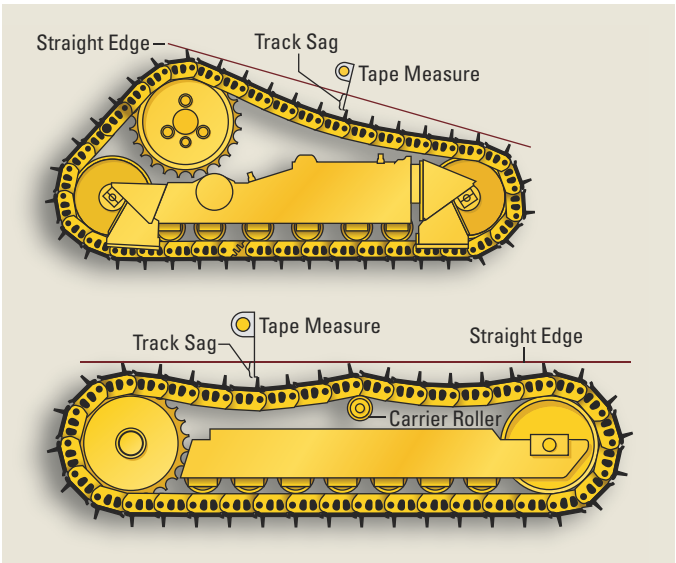


Illustration: Deere (top); Caterpillar (bottom).

bushing, is today not used much on mainline crawler machines, such as dozers, loaders and excavators — although some very large excavators might use dry chains if sales volume doesn't justify development of a more expensive version. Dry chains are available in the aftermarket, however, and may be a good choice when cost is paramount or when servicing an older machine that has been relegated to back-up service.

Contrasting with the dry chain are lubricated chains, including the "greased chain," which is assembled with a heavy lubricant between pin and bushing. The greased chain typically is used for hydraulic excavators, except, as noted, for some larger models, and among its benefits is quiet operation, compared with dry chains.

A third type of chain, commonly called a "sealed-and-lubricated track" (SALT), uses a pin having an internal oil reservoir. A small radial hole in the pin allows the enclosed oil to fill the annular space between pin and bushing. During assembly, a self-sealing rubber plug is pushed into a small hole in the end of the pin, and a "needle" inserted into the plug allows a vacuum pump to evacuate air from voids in the pin-and-bushing assembly, into which oil is then drawn.

Pins and bushings

Although the greased track chain is more expensive than the dry, and the sealed-and-lubricated chain more expensive still, the latter two designs are widely used, because they significantly reduce a primary source of undercarriage wear, namely, that between the outer diameter of the pin and inner diameter of the bushing. The longer life afforded by the lubricated designs, say manufacturers, more than compensates for their added cost.

With all chain types, the pins rotate within the bushings as the chain moves around the sprocket and idlers. When a machine travels forward, the pin rotates in the bushing under considerable load at about the sprocket's six-o'clock position. The pin realigns at the top of the sprocket, but load is

Sealed-and-Lubricated Track Chain

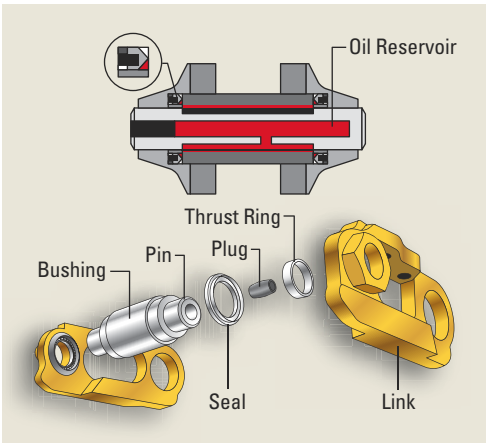


Illustration: Deere

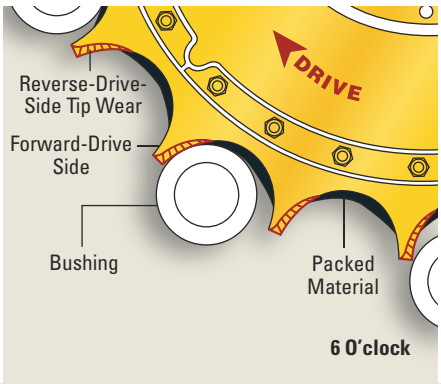
The sealed-and-lubricated track chain assembly is designed to all but eliminate internal pin and bushing wear.

minimal. In reverse, however, relative motion between the pin and bushing occurs, under load, at the bottom of the front idler, at the top of the front idler, to a degree as the chain passes over the carrier roller, and then at the sprocket's 12-o'clock position.

Packed Sprockets

When a machine operates in material that packs into the root of the sprocket's teeth, the sprocket, in effect, becomes larger in diameter. As a result, the chain becomes tighter and exerts greater pressure on the sprocket teeth, idlers and rollers, resulting in accelerated general wear.

When a machine with severely packed sprockets moves forward, the chain's bushings can be forced into initial contact with the reverse-drive side of the sprocket tooth (near the tip), causing accelerated wear on the tooth and the sprocket. As the bushing slides across the tooth to engage the forward-drive side, added wear can occur.



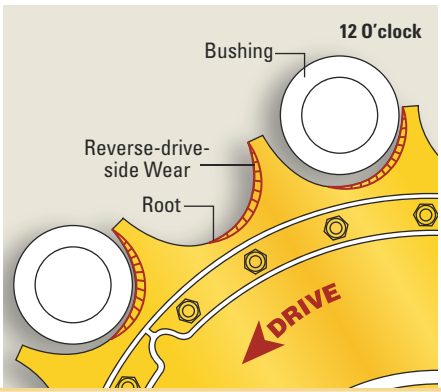
When the same machine operates in reverse, bushings are picked up more on the forward-drive side of the tooth and will slide under load to the reverse-drive side.

Packed sprockets, therefore, can result in abnormal wear on both sides of the sprocket tooth and on both sides of the bushing.

Illustration: Case

Sprocket Wear in Reverse

When a crawler is operated in reverse, the bushing at about the 12 o'clock position rotates and slides against the sprocket tooth's reverse-drive side, just when the bushing is under maximum load. As a result, the reverse-drive side of sprocket teeth will wear, as will the corresponding surfaces on the bushings.



Eventually, wear will progress to form a pocket in the root of the tooth. Directional changes also contribute to root wear, since the bushings slide across the bottom of the sprocket teeth when the machine changes its direction of travel. Elevated-sprocket machines exhibit less of this wear, because fewer bushings are engaged in the sprocket.

Illustration: Case

Within a dry chain, this relative motion between pin and bushing eventually wears down one side of the pin and the corresponding inner-diameter surface of the bushing. The resulting change in pin/bushing geometry allows the track's pitch to extend, that is, the distance between pin centers becomes greater as wear progresses.

Pitch extension allows the track to elongate, becoming loose and "snaky," that is, the portion of the track on the ground can move back-and-forth like a snake on the move. Pitch extension also results in the bushings no longer contacting the sprocket teeth at the correct spot, resulting in accelerated wear of both the sprocket tooth and the bushing's outer diameter.

Given the way in which wear occurs in a dry chain on the pin and on the bushing (both internally and externally), these parts can be turned 180 degrees to bring new surfaces (both internally and externally) to the working area. Thus, proper pitch is restored. Replacing the sprockets when turning pins and bushings can yield a relatively restored system, assuming that other undercarriage components have not worn abnormally.

Although the same relative pin-to-bushing motion is occurring in the greased and SALT chains, the lubricant within virtually eliminates internal wear and, subsequently, eliminates the harmful effects of pitch extension on the sprocket teeth and the outer diameter of the bushings.

But, that said, normal wear does occur on the sprocket teeth and on the outer diameter of the bushings in lubricated chains. As the sprocket wears, its diameter essentially becomes smaller, and a "pitch mismatch" results, even though the distance between pin centers has not changed. The pitch mismatch causes a sliding motion of the bushing across the tooth, and eventually, external wear on the bushing will dictate a pin-and-bushing turn.

On greased chains, some would say, a significant number of seals may have failed by the time outer-diameter-bushing wear indicates that a turn might be in order, and as a result, a degree of internal wear may have oc-

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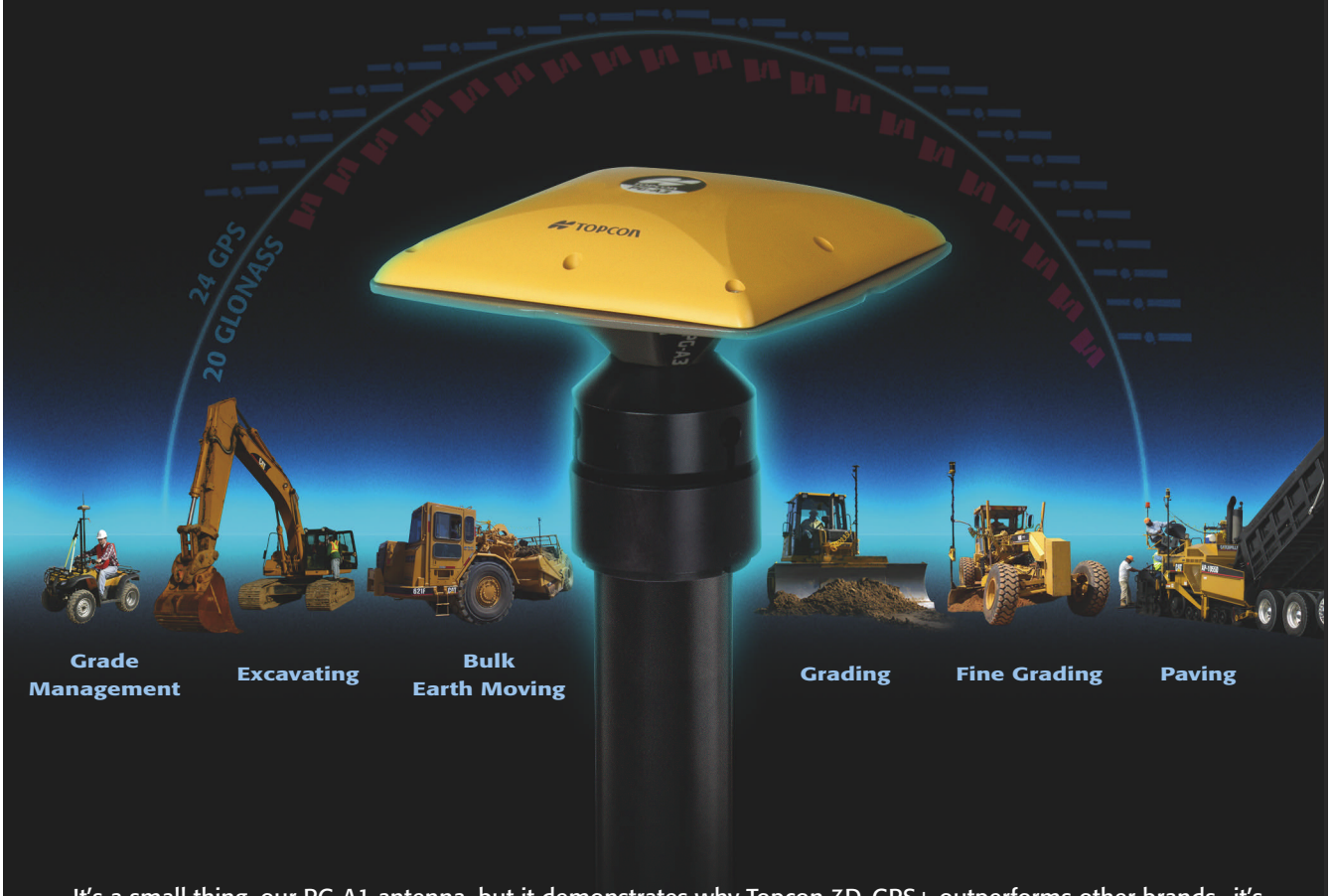

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Undercarriage Technology

Deere's Extended-Life Undercarriage uses bushings that are treated with the company's proprietary SC-2 alloy coating, which, says Deere, provides an optimum combination of properties — hardness, toughness, wear-resistance and corrosion-resistance. According to the company, an undercarriage using SC-2 coated bushings need not have its bushings turned to hold up over the long term.

According to Deere, the SC-2 process results in a surface 25 percent harder than chrome plating. And because the SC-2 bushings resist wear, says the company, chain-to-sprocket geometry is maintained longer, thus preserving and extending sprocket life.

curred. Nonetheless, the lubricant has probably greatly retarded internal wear, and in so doing has minimized abnormal wear on the sprocket and bushings.

Because the SALT chain uses superior seals, estimates are that fewer than 10 percent of the pin-and-bushing assemblies typically have problems when outer-diameter-bushing wear indicates that a pin-and-bushing turn could be beneficial. Thus, sprocket and bushing life have been considerably extended, and turning pins and bushings could give the chain a second long life.

Experts seem to disagree, however, on specifically how to renew the SALT chain. Some are of the opinion that installing new seals and thrust rings, and then refilling the oil reservoir in the pin, basically restores the chain for capitalizing on the life remaining in the link rails. Others, though, caution that thrust rings in the link counter bores may have distorted the ends of the bushings, affecting a new seal's ability to function effectively. If so, they say, a more economical fix may be to simply reassemble the pin and bushing with grease.

Even though we've gone on for a while about turning pins and bushings, do keep in mind that the decision to do so (or not to do so) is always predicated on the overall condition of the undercarriage. In some instances, simply allowing the chain to run to destruction might be the most economical strategy. It's good advice always to consult with an undercarriage expert about repair options, and even better advice to have an expert monitor the undercarriage at regular intervals.

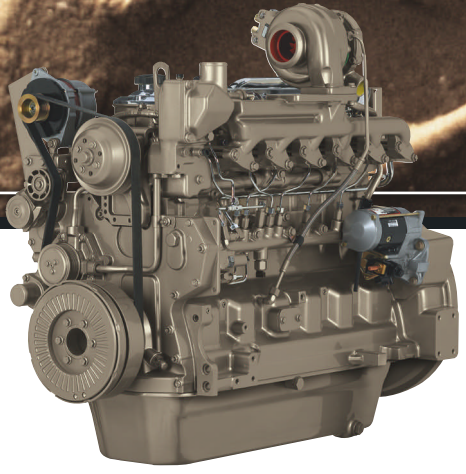
Sprocket/bushing wear

It's inevitable. The first time you place your new crawler machine in the dirt, the undercarriage begins to wear. As the machine's sprocket levers the chain via its bushings, and as the rails formed by the chain's links contact the rollers and idlers, small bits of metal are relentlessly ground away. Add in the abrasive nature of many materials, and the process accelerates, as it does also when track-shoe grousers slam against unyielding ground and intensify loads on undercarriage parts. And the faster you operate the machine, the faster the undercarriage wears, simply because the relative load between components increases.

But of particular interest is the wear between the sprocket's teeth and the outer diameter of the bushings.

When a crawler machine is moving forward, little wear occurs on these components — at least as the direct result of relative motion between the two, assuming that the chain is properly adjusted. In forward, the only point at which the bushing rotates or slides in the sprocket tooth is at about the 12 o'clock position, just before exiting the sprocket. But at this point, the bushing is

When you're going beyond the boundaries, go with someone who knows the territory.



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under virtually no load, and the significance of the relative motion between the two parts is minimal. In forward, most of the load is on the few bushings between the six and eight o'clock positions at the bottom of the sprocket, where no relative motion occurs between the two parts.

When the machine moves in reverse, however, 85 percent of the load on the track chain is concentrated near the top of the sprocket, just where the bushing must rotate against the sprocket tooth. As a result, more wear normally will occur on the reverse-drive side of the sprocket tooth.

Keep in mind, too, that wear on the reverse-drive side of the sprocket tooth (as well as on the forward-drive side) can be greatly accelerated by chains that are too tight, whether because of improper adjustment, or because material from the jobsite has packed into the sprocket's teeth. For example, a conventional oval chain exhibiting 1/2 inch of sag will be running with nearly seven times the tension, compared with the same track running with the recommended 2 inches of sag.

When a chain that is overly tight is operated in forward, the bushings actually are forced into initial contact with the reverse-drive side of the sprocket tooth, and then slide through the tooth until engaging the forward-drive side. In similar fashion, the bushings in a too-tight track running in reverse tend to make first contact with the forward-drive side of the sprocket tooth, and then slide under load to the reverse-drive side. This latter action results in wear on both the forward-drive side of the tooth and the bushing.

Perhaps the greatest wear-saving practice you can employ is to frequently visually check track tension when working in material that packs in the sprocket teeth. If the chains are tightening, readjust them on the spot. Considering the wear you'll save — and the fuel you'll save by relieving the engine of this extra load — it'll be like putting money in your pocket.

For contributing their expertise to the preparation of this report, Construction Equipment *thanks the following individuals and companies: Tom Neeley, Undercarriage Products, Caterpillar; Tim Wodrich, Senior Engineer, Crawler Operations, Deere; Scott Schumacher, Intertractor America; and Case.*

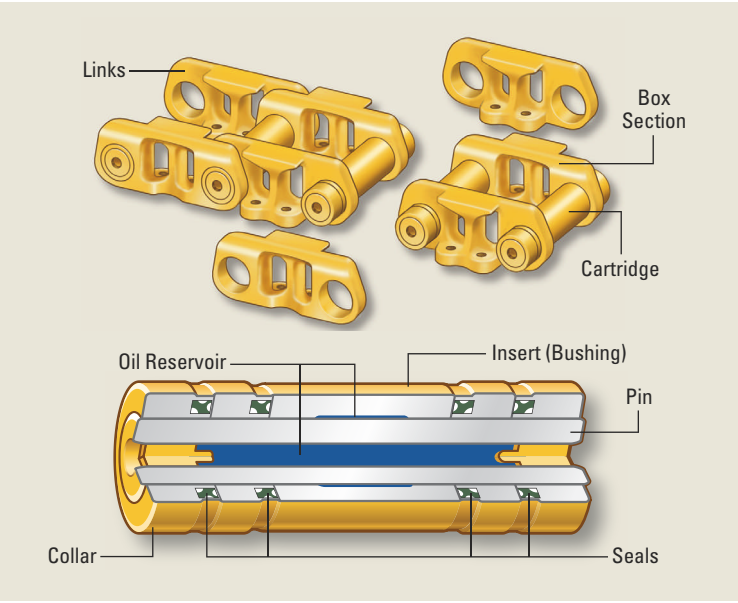

Illustration: Caterpillar

Undercarriage Technology

Caterpillar's SystemOne undercarriage takes much of the friction (and subsequent wear) out of the track-chain assembly by lubricating the pin-and-bushing joint and by allowing the bushing to turn while under load in the sprocket tooth. The pin and bushing in the SystemOne undercarriage actually form a sealed, internally lubricated cartridge.

The SystemOne chain is composed of box sections — two links turned in and pinned together by two cartridges. Each box section is attached to the next by a pair of links facing out. (All the links are identical.) The inner links are pressed on to the inner portion of the cartridge (the "insert"), and the outer links are pressed on to the cartridge's outer ends ("the collars"). The outer links hinge around the inner links, effectively eliminating any relative motion between the insert (bushing) and the sprocket tooth. Wear that does occur, says Caterpillar, results from abrasives in the soil.

Compared with machines running with a conventional SALT undercarriage, says Cat, many of the 7,000-plus machines now running with SystemOne have exhibited a 50-percent improvement in undercarriage life. According to the company, this improvement results not just from the new cartridge/link assemblies, but also from a redesign of other undercarriage components, such as the Center-Tread Idler, which contacts only the center (insert) of the System One cartridge — not the link rails — and thus avoids a critical source of wear in conventional undercarriages.



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By MIKE ANDERSON, Senior Editor



Trenchers

Still Deliver the Straight Goods

Although other equipment types can meet digging tasks, dedicated trenchers continue to shine, say manufacturers

With the dip in the new-housing market, trencher manufacturers have felt a pinch from belt-tightening rental houses in 2007.

But leading OEMs concede the cyclical buying nature of the rental market may have been in play regardless of the housing slowdown. And, with or without the rental houses buying, there's still considerable work for which sub-100-horsepower trenchers are positioned best.

"Even though the housing is down, we see a lot of work in the telecom industry going on," says Brent Bolay, trencher product manager with The Charles Machine Works, manufacturer of the Ditch Witch equipment brand. "There's the routine need for regular telephone, but then there's the additional need of fiber and trying to take that fiber on to the home user for voice and data and video. There's actually quite a bit of work going on in that sector right now."

As with its fellow leaders in the sub-100-horsepower market, Ditch Witch offers a full range of dedicated walk-behind and ride-on trenching machines. The RT Series of ride-on machines was introduced in 2004, and was recently joined by a 42-horsepower 420sx, "a higher-end" vibratory cable plow addition to the general product family.

"We have always been focused on providing a compact package, but enough horsepower to really do the kind of work that the job is in front of you," says Bolay.

With or without the rental houses buying, there's still considerable work for which sub-100-horsepower trenchers are positioned best.

"A trencher can outproduce anything else on the market as far as getting that ditch dug for you and getting the line in efficiently."

That sentiment reigns at Vermeer Manufacturing, where director of sales Tony Briggs says that while the housing market has softened, trenchers are actually providing new application solutions. This is especially so with Vermeer's introduction of two ride-on tracked models, including the 46-horsepower RTX450.

"I'm seeing it doing a lot of silt-fence type of work in California on slopes that we've not been able to work on before with a tired machine," says Jim Reeves, solutions specialist at Vermeer. "It's got a lower center of gravity and it has a much more stable platform for them to work on the 2:1 slopes."

North of San Francisco, the machine is taking on vineyard work formerly "trenched with a manual machine that could be manhandled onto those slopes." Or, of greater concern from an environmental standpoint, the lines were simply hung above the ground.

"Again, because of the slopes, we have not been able to do that type of work before with the ride-on trencher," says Reeves. "We're now single-line-plowing in irrigation into the vineyards, and we're doing 28 acres this fall as a test bed. If that works out, there's a huge market there for us."

Beyond 100 horsepower, Vermeer turned heads at World of Concrete 2007 last January with the introduction of a 120-horsepower quad-track machine, RTX1250, the result of an exclusive agreement with undercarriage specialist Loegering Manufacturing.

"It really opened the eyes to some of the contractors who weren't necessarily thinking trenchers were as productive as they could be today," says Briggs. "So, I think it's opened up some doors for us."

"The 'oval' tracks on the RTX450 and the quad-track system on the RTX1250 have really increased the value proposition for purchasing our machines, but it's also allowed the contractors to be much more productive. For the increase in cost that they have to pay for some of these technological advancements, they are getting that back in productivity gains and more."



Other leading OEMs do offer compact tracked units, from 25 horsepower down.

History lives

As the advancements continue, the heritage of the trencher is neither lost nor without relevance today.

Astec Underground, which in 2002 purchased what was once the Davis line and then the Case line, marked the 35th anniversary of the Maxi Sneaker compact ride-on model with the 2007 introduction of the Series D model, featuring a more powerful and heavier engine.

"Even though the housing is down, we see a lot of work in the telecom industry going on," says Brent Bolay, trencher product manager with The Charles Machine Works, manufacturer of the Ditch Witch brand.

The Cost of Ownership

Size	List Price	Hourly Rate
GAS		
Up to 39 hp	$22,393	$15.46
DIESEL		
Up to 39 hp	$30,373	$18.42
40-59 hp	$44,520	$26.71
60-75 hp	$57,787	$34.42
76-130 hp	$72,452	$47.87

* Hourly rate is the monthly ownership costs divided by 176, plus operating costs. Unit rates used are gasoline at $2.96 per gallon, diesel at $2.83 per gallon, mechanic's wage at $43.07 per hour, and money costs at 5.75 percent.

Source: EquipmentWatch.com, phone 800/669-3282



According to Tony Briggs, Vermeer's director of sales, "the 'oval' tracks on the RTX450 and the quad-track system on the RTX1250 have really increased the value proposition for purchasing our machines, but it's also allowed the contractors to be much more productive."

Developing new models to both meet industry needs and fill gaps in the acquired product line, Astec also recently introduced two walk-behind models, bringing its total of sub-100-horsepower trenchers to 10.

"The RT460, RT560, RT660, and RT960 are the only ride-on trenchers that are equipped with a flywheel, torsion shaft and double-reduction planetary drive system," says Astec. "This system protects the hydrostatic pump and motor, and provides the necessary torque to work in varying ground conditions.

"The flywheel is mounted to the motor and stores energy to power through tough spots, prevent stalling in hard or frozen soil, and protect the hydrostat from shock loads. The torsion shaft drive between the flywheel and final drives absorbs chain-line shock loads, reducing stress on drive components. The planetaries multiply motor torque for excellent digging power."

Trenchers retain their selling points, say the manufacturers.

While "we would be ignorant to think that excavators aren't taking some of that business from the pedestrian lines right up into the ride-ons," says Vermeer's Briggs, "the contractors who have them in their fleets understand the niche they provide."

That, says Ditch Witch's Bolay, is because these products remain focused on underground construction, specifically the tidy placement of a utility into the ground.

"Probably the thing that helps sell a trencher as much as anything to anybody is that, when you're placing small-diameter pipe or cable in the ground, it can just do it much more efficiently than an excavator, or a backhoe, or any other type of machine that is digging in the dirt," says Bolay.

For a job beyond 75 feet, the excavator operator will quickly fall back, says Vermeer's Reeves.

"Up to that point, he can dig his start pit, he can dig his exit pit and he can open up 75 feet of ground in a reasonable amount of time," says the irrigation-application specialist. "But if he's going much farther than that, or if he needs a clean trench or a straight-wall trench, or if he needs to re-use that spoil as backfill material, I can win hands-down there.

"If I'm doing 20 to 25 feet per minute and I'm only going 75 feet, the time difference isn't that great," says Reeves. "If we've got to do a water line and we have to do 300 feet of it, I'll be off the trailer, dig the trench, and be back on before he's a third of the way done."

It's on those long runs, concludes Ditch Witch's Bolay, "where a trencher really does shine."



Astec Underground marks the 35th anniversary of the Maxi Sneaker compact ride-on model with the 2007 introduction of the Series D model, featuring a more powerful and heavier engine.

Trencher Specifications (per horsepower up to 100)

Model	Style	Operating Weight (lb.)	Max. Cutting Depth	Cutting Width (in.)	Gross Engine Power (hp)	Wheels or Track
Pow-R-Spade 2000	Pedestrian	275	2'0"	3-4	5	Track
Ground Hog T-4	Pedestrian	230	1'0"	3-3.5	6	2WD
Vermeer RT60	Pedestrian	270	1'0"	3	6	2WD
Parsons T80	Pedestrian	640	2'6"	4-6	8	2WD
Barreto 912M	Pedestrian	620	1'0"	4	9	2WD
Ditch Witch 1030	Pedestrian	900	2'6"	4.3-7	11	2WD
Parsons T120	Pedestrian	640	3'0"	4-6	11	2WD
Astec RT60	Pedestrian	720	3'0"	4-6	13	2WD
Astec RT130	Pedestrian	903	3'0"	4-6	13	2WD
Barreto 1318D	Pedestrian	860	2'6"	4-6	13	2WD
Barreto 1324D	Pedestrian	1,025	3'0"	4-6	13	2WD
Barreto 1324D4	Pedestrian	1,075	3'0"	4-6	13	4WD
Ditch Witch 1230	Pedestrian	905	3'0"	4.3-6	13	2WD
Ditch Witch 1330	Pedestrian	920	3'0"	4.3-6	13	2WD
Parsons T130	Pedestrian	700	3'0"	4-6	13	2WD
Vermeer RT100	Pedestrian	1,030	3'0"	4-6	15	2WD
Barreto 1624D	Pedestrian	1,025	3'0"	4-6	16	2WD
Barreto 1624D4	Pedestrian	1,075	3'0"	4-6	16	4WD
Ditch Witch 1820	Pedestrian	1,300	4'0"	3.3-16	18	2WD
Astec TF300B	Ride-On	2,315	3'9"	4-16	19	Track
Vermeer RT200	Pedestrian	1,485	4'0"	4-8	23	2WD
Astec RT160	Pedestrian	1,530	4'0"	4-8	24	2WD
Ditch Witch HT25	Ride-On	4,080	3'3"	4-16	25	Track
Vermeer LM25	Pedestrian	2,385	3'0"	4-6	25	4WD
Astec RT360	Ride-On	3,906	5'0"	6-12	32	4WD
Ditch Witch RT36	Ride-On	n/a	5'0"	16	36	4WD
Astec RT460	Ride-On	5,660	5'0"	6-16	37	4WD
Vermeer RT350	Ride-On	n/a	4'0"	5-12	37	4WD
Ditch Witch RT40	Ride-On	4,810	5'3"	6-12	42	4WD
Vermeer LM42	Pedestrian	3,335	3'6"	4-6	45	4WD
Vermeer RT450	Ride-On	n/a	5'0"	5-12	46	4WD
Vermeer RTX450	Ride-On	n/a	5'0"	5-12	46	Track
Astec RT560	Ride-On	7,000	6'0"	6-16	51	4WD
Ditch Witch RT55	Ride-On	7,560	5'2"	6-12	60	4WD
Astec RT660	Ride-On	11,219	6'0"	6-16	67	4WD
Ditch Witch RT75*	Ride-On	11,645	8'4"	6-24	74	4WD
Vermeer RT650	Ride-On	n/a	5'0"	6-16	76	4WD
Astec RT960	Ride-On	16,000	7'0"	7-18	99	4WD
Ditch Witch RT95*	Ride-On	13,630	7'10"	6-24	99	4WD

* Specs shown for hydrostatic model. Also available with powershift.

Source: Spec-Check.com Xpanded Specs (as of August / 07)

Gallery of Trenchers (less than 100 hp)

ASTEC UNDERGROUND

Product Line Staple Achieves Milestone



The 35th anniversary of the renowned Maxi Sneaker compact ride-on trencher was marked by Astec with the introduction of the Series D, featuring a Deutz D2009L3 four-stroke, three-cylinder engine providing 37 horsepower. This power plant is 300 pounds heavier than the previous model's, resulting in more traction while trenching and plowing.

Number of models: Seven ride-on, three walk-behind

New models: Maxi Sneaker Series D, RT130 and RT160

Product-line features: Astec recently introduced two walk-behind units, including the 13-horsepower RT130 (pictured). Featuring a reversible digging boom, the RT130 is described as the first walk-behind trencher to also feature automatic differential lock.

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DITCH WITCH

Full Trencher Product Line Available

Ranging from the 36-gross-horsepower RT36 up to the 99-horsepower RT95, each of the five current Ditch Witch RT Series ride-on trencher models under 100 horsepower was introduced in 2004. With the RT55, the gap between mid-size and compact trenching is bridged with a 60-horsepower machine featuring the sloped roof and maintenance-friendly two-piece RT Series design. The larger RT75 and RT95 models come standard with enhanced cruise control, can be equipped with either hydrostatic or power shift transmission, and can accommodate the Ditch Witch trench depth meter.

Number of models: Six ride-on, four walk-behind

Product-line features: Along with the HT25 compact ride-on tracked trencher, Ditch Witch also offers a line of pedestrian trenchers, ranging from the 10-horsepower 1030 to the 18-horsepower 1820.

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VERMEER

Tracked Model Joins Trencher Family

Vermeer added a rubber-tracked model to its compact ride-on trencher lineup with the 2006 introduction of the 46-horsepower RTX450. This design allows the customer to increase machine utilization, putting it to work both in soil conditions not suited to traditional rubber-tired designs and longer into the season. As with all Vermeer riding trenchers, controls are located on the right side of the operator station. Larger models, from the RT650 up, feature 90-degree rotating seats.

Number of models: Five ride-on, three walk-behind

New model: RTX450

Product-line features: In addition to the RTX450, Vermeer recently launched a 120-horsepower crawler model, but with an innovative four-track design. The RTX1250 introduces the interchangeable quad-track system to the Vermeer product line.

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BARRETO

Walk-Behind Specialty



A steerable walk-behind trencher with zero-tail-swing is the latest member of Barreto's trencher family. The 1324ST, with its precise wheel control cutting drift, is suited to the trenching of uneven terrain. Long, arching curves are now possible and easy on the operator, who can steer this model with one hand. The 1324ST is powered by a 13-horsepower Honda GX390 engine. A 16-horsepower Briggs and Stratton-powered unit, the 1624ST, is also available.

Number of models: Nine walk-behind

New model: 1324ST

Product-line features: The Barreto compact trencher family also includes the 1324D and 1624D standard hydraulic models; the 1324D4, 1624D4 and 1824D4 four-wheel-drive models; and the 912HM/RM self-propelled mini-trenchers.

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Trenching Solutions

While dedicated trenching contractors continue to look to dedicated trenching machines, the use of attachments on multipurpose carriers is also meeting an industry demand

Caterpillar



Designed to work with standard flow hydraulics, the new direct-drive Caterpillar T6B trencher attachment has an adjustable boom offering cutting widths of 6, 8, 10 and 12 inches. The T6B offers optional manual or hydraulic side-shift — up to 22 inches to the right of center — for trenching near structures. A large, adjustable auger handles spoil removal; and an optional, bolt-on crumber bar guides loose spoil away from the trench. Two optional skid shoes can aid in cleaning the trench.

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Ingersoll Rand



Ingersoll Rand added two new product types to its compact-equipment attachment line, including a trencher. Eight different trencher models are available for digging depths of 36 or 48 inches. Standard chain-style units are ideal for medium- to high-production trenching of sand, clay, loam and Class 5 fill material. Carbide-chain models penetrate frozen soil, rocks and asphalt up to six inches thick. With the IR trenchers, large-diameter drive sprocket increases clearance to the carrier, and a grease cylinder provides the ability to adjust chain tension.

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Bobcat



Offering digging depths ranging from 24 to 60 inches, the Bobcat trenching attachment product line was designed and built specifically for Bobcat compact equipment. Eight models are available for Bobcat mini track loaders, skid-steer loaders, compact track loaders, all-wheel-steer loaders, utility work machines and compact excavators. With hydraulic side-shift capability, operators are able to trench close to buildings, fences or other objects. For get even closer work, the auger can be removed.

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John Deere



Among the nearly 100 Worksite Pro attachments for skid-steers, John Deere offers five different trencher models — two lengths with standard-flow hydraulics and three with high-flow hydraulics. As well as a heavy-duty direct-drive system that eliminates the need for a chain reduction, all trenchers feature a skid shoe to ensure auger depth control and a 60-degree angle indicator for proper digging angle. Manual side-shift allows trenching close to structures, and a standard heavy-duty crumber shoe removes loose soil. A replaceable spoil auger moves most spoil to one side of the trench.

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CEAttachments



Among the trenching attachments available from CEAttachments, the Edge product line suits compact utility tractors from 20 to 45 horsepower. With heavy-duty slip clutch driveline protection, these trenchers use a 24-inch clearing auger to clear dirt away from the trench. The double standard chain will efficiently dig trenches 6 inches wide to a depth up to 60 inches. For skid-steer loaders, trencher attachments are available in a width range of 6 to 12 inches. In addition, the Edge trench filler, suited to any standard skid-steer mount, can cover 60 feet of trench in 60 seconds.

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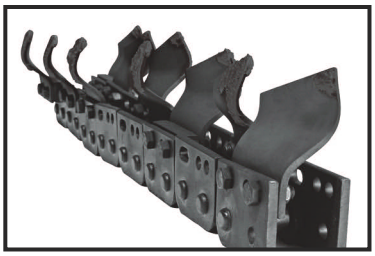
UTI



Underground Tools Inc. (UTI) offers such trencher parts as chains, cutting systems and sprockets, all backed by the company's DirtSmart technical service. Available for all makes and models of trenchers, UTI parts are made with the best-grade steel and carbide available, and are heat-treated for strength. UTI trencher parts are lab-tested and field-proven for durability, meeting or exceeding manufacturer specifications.

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Ramrod

Trenchers available for mounting on Ramrod Taskmaster mini-skid loaders come with a hydraulic motor drive unit, a 36-inch cutting depth, and a choice of 4- or 6-inch chain width. An optional 4-inch crumber can clean out the debris from the bottom of the trench. The trencher attachments are among more than 60 quick-attach products available for Ramrod Taskmaster mini-skid loaders.

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ASV

Equipped with its hydraulically driven chain trencher attachment, ASV's RC-30 compact rubber track loader allows for the installation of underground wiring and gas lines with little disturbance to lawns. The RC-30's low ground pressure and rubber tracks combine with the trencher attachment's single-side auger discharge and standard crumber to the benefit of utility companies, communications services, landscapers and general contractors. The attachment offers a trench width of 4 inches and trench depth of 30 inches.

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By MIKE ANDERSON, Senior Editor

Mini-Excavators

BOBCAT

Joining the established 430, 435 and 442 zero-tail-swing compact excavators in the Bobcat line, the 425 ZTS model answers an increasing market demand, says the manufacturer. More customers in the rental, construction, utility and landscaping markets want a 2- to 3-metric-ton excavator with zero tail overhang, says Bobcat, because it optimizes spoil placement and reduces the chance of contact with surrounding objects. Calling on 26 horsepower, the 425 has a standard digging depth of 8 feet 4 inches, which extends to 9 feet 4 inches with the long-arm option.

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CASE

With operating weights ranging from 3,240 to 10,261 pounds, Case offers a line of five CX Series compact excavators. At 11.9 net horsepower, the smallest CX14 model offers a dig depth of 6 feet 11 inches and a dig radius of 12 feet 1 inch. Updated to B Series in 2005, the larger CX27B, CX31B, CX36B and CX50B models offer overall increases of 19 percent in engine horsepower, 15 percent in hydraulic flow and 14 percent in hydraulic horsepower. The product line tops off with the 40.8-horsepower CX50B, offering a dig depth of 11 feet 9 inches and a dig radius of 18 feet 10 inches.

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CATERPILLAR

One of Caterpillar's newest mini-excavator introductions, the 303.5C CR offers a new size option between the 7,537-pound 303C CR and 10,847-pound 304C CR zero-tail-swing models rolled out in early 2006. Powered by a Mitsubishi S3Q2-T engine rated at 39 net horsepower, the 303.5C CR weighs in at 8,620 pounds equipped with a cab. With an optional long stick, the model offers a maximum dig depth of 11 feet 4 inches and a maximum horizontal reach of 18 feet 1 inch. As with the other Cat zero-tail-swing mini-excavators, the 303.5C CR has a swing boom for digging next to walls.

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DOOSAN

The latest addition to the Doosan compact excavator line, the zero-tail-swing DX35z introduces electronic optimization of the hydraulic system and the 27-horsepower Tier 3 engine. With an operating weight of 7,937 pounds, the DX35z offers a maximum digging depth of 10 feet 4 inches with bucket digging force of 6,636 pounds and arm force of 4,321 pounds. The use of rubber tracks offers greater non-slip and grip capabilities, as well as better protection of surfaces, says Doosan.

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GEHL

A 3-metric-ton model recently added to the Gehl compact excavator line features a design that, despite the machine's small size, enhances operator space and machine serviceability. With the Gehl 383Z zero-tail-swing excavator, the 29-horsepower Yanmar diesel engine is mounted on the side, and the hydraulic and fuel tanks are at the rear. Weighing about 8,000 pounds when equipped with a cab, the Gehl 383Z features a drive motor load-sensing system that automatically shifts between low and high range.

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HYUNDAI

New for 2007, the R35Z-7 is the first zero-tail-swing mini-excavator developed and manufactured by Hyundai. Powered by a 28.6-horsepower Yanmar engine, the 8,047-pound excavator offers maximum bucket digging force of 7,059 pounds and traction force of 8,048 pounds. An offset boom facilitates working in confined spaces, both directly in front and parallel along walls. At the same time, the R35Z-7 achieves a digging depth of 10 feet 4 inches and a dumping height of 11 feet 4 inches for the loading of high-sided trucks.



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HITACHI

By using the adjustable-width tracks of the undercarriage and the foldable end-sections of the backfill blade, operators of Hitachi's new 1.7-metric-ton Zaxis 17U-2 compact excavator can reduce machine width to 40 inches for easy passage through standard doors. When fully extended to 50 inches, the ZX17U-2's undercarriage provides stability to put the machine's mechanical quick coupler/hydraulic attachment package to full use on the job. An upgrade of the Hitachi EX17U, the ZX17U-2 joins the ZX27U-2, ZX35U-2 and ZX50U-2 in the Hitachi compact excavator family.

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IHI

With a 12-model product line, IHI offers a wide range of mini-excavators, providing digging depths from 5 feet 2 inches up to 14 feet 1 inch, and bucket forces from 2,160 to 14,730 pounds. IHI offers smaller units to appeal to the utility contractor and the homeowner with a yard project. Even with their compact designs, these excavators have all the features of a larger mini-excavator. The larger IHI units are correspondingly designed to meet the deeper digging depth and power requests of the general contractor.



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2,200 lbs. of bucket breakout force



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JCB

Completing a full mini-excavator product range featuring models at half-ton intervals, JCB has introduced three new models. With operating weights of 5,919, 7,092 and 8,049 pounds, respectively, the new 8025, 8030 and 8035 are true zero-tail-swing excavators. While the 8025 has a footprint suited for tight turning, the 8030 and 8035 have increased undercarriages that allow these machines to accommodate larger dippers for increased digging envelopes. Two-speed track motors are standard on each machine.

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JOHN DEERE

Having introduced the 35D and 50D zero-tail-swing mini-excavators in 2005, followed by the 27D one year later, John Deere completed the updating of its sub-six-metric-ton excavator product line this year with the 17D. With the tracks retracted and the backfill blade's two end sections folded, the machine will fit through a 40-inch opening. Compared to the predecessor model, the 17D offers 20 percent more horsepower, 19 percent more bucket dig force, 9 percent more arm force, and 10 percent more hydraulic flow.

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KOMATSU

Ranging from the 4,090-pound PC18MR-2 to the 11,110-pound PC50MR-2, the six-model MR-2 compact excavator series by Komatsu offers high lifting capacity and stability in a tight-tail machine design. As shown here with the PC35MR-2, there is only a 3.2-inch protrusion over the tracks during swing operations. With automatic two-speed travel, the speed of MR-2 machines is automatically shifted from high to low according to travel load. With large drawbar pull, the operator can efficiently fill trenches with the backfill blade.

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KUBOTA

Featuring a hydraulic track gauge that can be adjusted from 39 to 49 inches with the touch of a single lever, the U15 is the smallest of the four models comprising Kubota's U-Series of zero-tail-swing compact excavators. With an operating weight of 3,704 pounds, the U15 still produces a breakout force of more than 3,417 pounds to handle heavy loads. The combination of maneuverability and strength is put to work with a digging radius of 12 feet 7 inches, a digging depth of 7 feet 7 inches, and a dumping height of 8 feet.

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MUSTANG

The latest addition to the 10-model Mustang compact excavator line, the zero-tail-swing 3803ZT takes advantage of a longer undercarriage to enhance stability and, according to Mustang, perform equal to a conventional excavator. With a canopy-equipped operating weight of 7,826 pounds, the 3803ZT provides a maximum drawbar pull of 6,614 pounds with a digging depth of 11 feet, vertical wall depth of 8 feet 9 inches, and reach at ground level of 17 feet 10 inches. The side-mounted engine and rear-mounted hydraulic and fuel tanks maximize operator work space.

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TAKEUCHI

A patented side-to-side offset boom, combined with the zero-tail-swing design of Takeuchi's FR compact excavators, allows the new TB138FR to slew 360 degrees only inches beyond its track width. A low center of gravity adds the stability and craning capabilities of a conventional excavator to the ability of a zero-tail-swing unit to work in confined areas. The smallest of three FR machines, the 8,316-pound TB138FR offers bucket breakout force of 8,995 pounds, digging depth of 11 feet 3 inches, and reach at ground level of 17 feet 9 inches.

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TEREX

A load-sensing and load-independent flow division hydraulics system, matched precisely to the 5-metric-ton excavator, gives operators of the new Terex TC50 greater power ratio and smooth, simultaneous operation. Powered by a 39.4-horsepower Yanmar engine, the Terex TC50 offers a maximum dig depth of 12 feet 1 inch and reach of 20 feet 4 inches. Available with an optional quick-attach coupler, the TC50 comes standard with a 78-inch-wide dozer blade, independently controlled from the track drive for uninterrupted operation.

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VOLVO

The nine-model Volvo compact excavator line is topped off by a compact wheeled unit, the EW55B. With an operating weight of 11,552 pounds and a digging depth of 11 feet 2 inches, the EW55B matches the 9,149 pounds of breakout force of the tracked EC55B model, which has a digging depth of 12 feet 6 inches. The Volvo product line starts with the EC15BXR — at a standard operating weight of 3,261 pounds — and includes two models with variable-width undercarriages, the EC15BXTV and EC20BXTV.

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YANMAR

Featuring a new universal boom design with sidewalls 1.5 times thicker than on predecessor models, Yanmar recently introduced "true" zero-tail-swing mini-excavators to compete in the 6,300- and 7,700-pound weight classes. The Vi027-5 and Vi035-5 models combine increased breakout forces with new dig depths of 9 feet 6 inches and 11 feet 4 inches, respectively. In addition to foot controls, a PTO switch is now mounted on the wrist control. In total, Yanmar offers a line of 10 mini- and mid-size excavators, from the track-width-adjustable SV08 Super Mini at 2,348 pounds to the SV100 at 20,950 pounds.

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KOBELCO

Each of the Kobelco 27SR-3, 30SR-3, 35SR-3 and 50SR-3 compact excavators features an independent boom swing mechanism. One pump is dedicated to the swing circuit, which enables simultaneous operation of the boom, arm or bucket without any affect on swing operation. Ranging from 21.3 to 40.8 net horsepower, the zero-tail-swing SR-3 Series excavators weigh from 5,490 to 10,384 pounds and provide maximum dig depths from 8 feet 4 inches to 11 feet 9 inches.

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NEW HOLLAND

Zero tail swing, combined with center boom swing, allows New Holland compact excavator operators to dig anywhere around the machine and deposit material precisely without repositioning. With each model featuring an independent boom swing mechanism, the E15, E25, E30, E35 and E50 range from 3,240 to 10,275 pounds in operating weight, 11.9 to 40.8 in net horsepower, and 6 feet 11 inches to 11 feet 9 inches in maximum digging depth. Telescoping tracks allow the E15 to be narrowed to 35 inches.

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FARM PRO

As part of the Trak King by Farm Pro line of construction equipment, three sizes of mini-excavators are offered by the Farm Pro division of Homier Distributing Co., ranging from the 3,156-pound ME15 to the 11,489-pound ME60. The Trak King ME15 is powered by a Laidong engine generating 18.23 horsepower, while the ME42 and ME60 models call on Cummins engines providing 42.9 and 60.3 horsepower, respectively. Maximum digging depths range from 6 feet up to 12 feet 10 inches for the Trak King machines, which originate from the Yuchai brand.

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By LARRY STEWART, Executive Editor

Absence Makes Fowler Fonder of Warranties

Living without extended warranties confirmed the contractor prefers living with them

Extended warranties create extra value for customers on the front side of the equipment purchase," says Leigh Dennis, CEM, heavy equipment service manager with Fowler Contracting in Cary, N.C. The Fowler equipment team realized just how much value they create in the absence of extended warranties on about 100 units.

"Steve Fowler, our company's owner, has always been a big believer in buying extended warranties," says Robbie Martin, CEM, heavy-equipment general manager. "They only cost a percent or two of the purchase price of the machine, but for a lot of years we never needed them, so we decided not to buy warranties."

A company expansion plan had Fowler buying 150 machines between January 2004 and May 2005. Nearly 100 of them had no extended warranty.

"We were relying on the manufacturers' promised quality," says Dennis. "We thought we could force the issue with dealers if our record keeping was good enough to spot problem trends."

"Problem is, that kind of thinking tends to put us at odds with the dealer," says Martin, "and we really need to be on the same page with them."

"We started to feel the sting as the basic warranties expired on most of the machines we bought without extended warranty," says Dennis.

"We've already paid dearly for those units," Martin adds. "The downtime was just staggering. It just kept coming and coming and coming."



Photos: Charles Brown

Robbie Martin reviews oil-analysis results and maintenance histories on equipment to retain extended-warranty coverage.

Equipment-buying policy quickly reverted to include extended warranties on everything.

Martin and Dennis suggest the problem Fowler faced reflects the pace of technology adoption in off-road equipment, pushed largely by diesel-emissions regulations.

"Manufacturers have had to develop technologies quickly — they don't have time to test them on all the different applications," Dennis explains. "It really doesn't matter which manufacturer — there's only so much they can do to get an engine ready to go to market.

"Take Cummins, for example. They have so many different applications for one basic engine block. The 8.3-liter they have goes into excavators, rollers, loaders, trucks, and boats. The engine manufacturer can't test all of those different applications under all conditions. But I guarantee you that such an engine is going to be tested to the max in one of our compaction rollers because of the intense vibration."

Martin and Dennis consider Fowler's investment in extended warranties to be part of the price the industry collectively is paying for the transition to new technologies.

"We started to notice the need for extended warranties at about the same time the manufacturers cut their product development time," Dennis says. "Where it used to take years to take a machine from the drawing board to putting it in field, now it can be done in months. Applied technologies change

PROFILE



Leigh Dennis, CEM, Heavy Equipment Service Manager

Fowler Contracting

Headquarters:
Cary, NC

Specialty:
Turnkey site prep – clearing, grading, utilities, paving, cover

Equipment Value:
$80 million

Fleet Makeup:
351 off-road pieces, mostly earthmovers.
280 licensed trucks

Support Staff:
13 heavy-equipment technicians and staff, four parts people, 10 transportation technicians and staff, two administrators

Facilities:
Seven mechanics trucks, two lube trucks, one pressure-washing truck

Market Range:
60-mile radius within the Raleigh-Durham-Chapel Hill triangle



Fowler's accurate machine record-keeping is a tangible asset. Intimate knowledge of the wear and performance trends common to machine models within specific serial-number ranges, and documented evidence, gives the company credibility and negotiating power that local competitors lack.

so rapidly that as new models are introduced, system upgrades are already available.

"Some manufacturers can no longer afford to employ journeymen technicians to assemble components into the final product," says Dennis. "Short-term contract laborers are employed in order to help keep the price of the product in the price range of the target market. This is another important reason to strongly consider extended warranty."

One of Fowler Contracting's advantages is that the firm puts a lot of hours on multiples of some key machines so Martin and Dennis can identify trends. For example, the company fields 37 35-metric-ton excavators, 22 20-metric-ton excavators, 16 Caterpillar D6R dozers, and 61 soil-compaction rollers all closely configured to achieve fleet standardization.

"We're seeing repeated problems with the machine and power-train ECMs in conflict with each other," Dennis says. "Things don't always integrate like they should after two or three years of hard work. All these electronics haven't withstood the test of time yet."

"There are just so many problems with all new integrated technologies that the manufacturers can't see coming, and with the added GPS monitoring systems and grade controls, there is more opportunity for something to go wrong."

Trends aren't limited to electronic problems, though.

"There's a certain fan-hub assembly that we know the fan bearing is going to go out on between 500 and 4,000 hours," Dennis says. "And when it does, that fan takes off like a propeller and flies right through the oil coolers, radiator, and air-conditioning condenser."

Fowler added a preventive-maintenance manager, a field-service technician, a welder, and two service trucks to help maintain and keep track of the expanded fleet. The company had no shop facility for its off-road fleet so they leased one, but they continue to service and repair most machines in the field. With the firm's repair and maintenance resources thoroughly utilized, extended warranties on the machines added since then have been crucial to managing service labor.

"When you have that many machines out in the field, if you didn't purchase extended warranties, your mechanics' time might all be used diagnosing and correcting minor bugs or premature failures instead of preventing longer-term problems," Dennis says. "If the whole service crew is doing repairs, the opportunity cost is huge.

Complying with manufacturers' maintenance expectations is essential to preserving warranty coverage. Dennis says you also have to be able to document and retrieve information from inspections, fluid analysis and repairs.

"Identify the trends — both good and bad," Dennis says. "This does several things: First; it follows the terms of the extended-warranty agreement. Second; it builds your history and provides the data you need when repair/replace decision-making time arrives. Third; it helps identify trends in both normal wear and tear and premature component failure."

Fowler's record-keeping is an asset. It helps pass technicians' understanding of machines and machine histories to other members of the firm's equipment team so that information can be used to negotiate the best deal for Fowler.

"Intimate knowledge of machines, models, serial number ranges, and their common attributes is one thing that sets us apart from the rest," Dennis claims. "Our combination of documented hard evidence, credibility, and purchase of extended warranty gives us formidable negotiating power amongst dealers and manufacturers.

Dennis says the extended warranties alone improve Fowler's relationship with dealers.

"When you call the dealer with a problem, the first thing they ask is: 'Is the machine under warranty?'" he explains. "If you have an extended warranty, you often get put on top of the dealer's repair list, and they're willing to work with you on a loaner machine or a low-cost rental if you need a replacement." CE

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By MIKE VORSTER, Contributing Editor

When Oil Analysis Isn't Worth Analyzing

Skimping on this diagnostic tool handcuffs managers, so go beyond the basics to ascertain true machine condition

I speak to a lot of managers about their ability to predict and prevent equipment failures. We agree that it is wise to act according to a fixed schedule or to invest in the tools needed to base your decisions on the actual condition of individual components. It is easy when you discuss tires or tracks, but much more difficult when it comes to engines or hydraulic systems. When we discuss these systems, most managers say, "We use oil analysis."

But what exactly do they mean by oil analysis and how exactly do they use it? Answering these two questions will help us benefit from a powerful but poorly understood and often misused tool.

What managers mean by oil analysis covers a broad spectrum. You could perform oil analysis by pulling out the dip stick, looking at the oil, and saying, "Mmm, it's black." At the other end of the spectrum, you could take a sample, carefully transport it to a sophisticated chemical laboratory, and perform a full spectrographic analysis. We need to know where we are on this spectrum and understand the difference between services that provide minimum information for minimum cost and those that charge too much to produce reports that require a Ph.D. in chemistry to interpret.

Minimum levels of analysis will provide information on the presence of wear particles and contaminants to give broad warnings about impending failure. They will improve your ability to prevent failures and will not break the budget. This is missing the point of oil analysis, however. Implementing a comprehensive program provides actionable information in at least four areas.

1. The integrity of the oil. Oil levels are checked and, if necessary, topped off daily. Every top off creates an opportunity for things to go wrong, and adding the incorrect oil destroys the carefully formulated product you selected in the first place. You can argue about the merits of type X versus type Y, but there is no doubt that type XY is inferior. Knowing that mixing has taken place casts serious doubt on the validity of the oil-analysis results and is a clear indicator that you need to improve your field maintenance operations.

2.The age of the oil. Oils exhibit certain physical properties such as viscosity, acidity and oxidation that change with time and use. These must be analyzed and tracked to determine if the oil has exceeded its life and needs to be changed. The information can be used to plan oil changes or alter pre-set intervals that maximize the use and value of the oil.

3. The presence of contaminants from outside the compartment. This is the classic perception of oil analysis: to look for dirt and other unwanted material that should not be in the compartment. The analysis should identify the presence of elements such as silicon as well as fluids that have entered the compartment from outside. Contaminants contribute to the presence of unwanted particles of various sizes, and therefore a particle-count analysis is important for tight-tolerance components such as hydraulic systems.

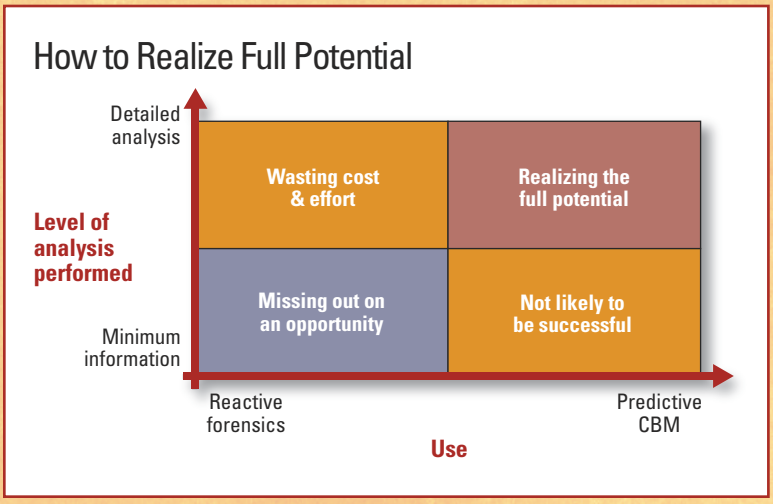
Knowing the type and quantity of the contaminants that have entered the compartment from outside enables you to focus on and take action in three areas. First is the cleanliness of the oil used. This is the primary source of contamination, and if you start with dirty oil, it can only get worse. Second is cleanliness during daily services and checks. How much dirt is introduced during daily checks; how clean is the service truck, the reels and the hoses? Third is leaks, loose



Mike Vorster

David H. Burrows Professor of Construction Engineering and Management at Virginia Tech. See ConstructionEquipment.com for full archives of "Equipment Executive."

Minimal analysis provides basic information, but this is missing the point of oil analysis. A comprehensive program provides actionable information.



As the sophistication of oil analysis and the way it is used increases, the more likely the manager is to reap its full potential. Conversely, not taking advantage of the tool will create frustration or even missed opportunities for effective maintenance practices.

clamps and breathers that permit contaminants to enter the compartment.

4.The presence of wear particles generated within the compartment. This is the second typical reason for oil sampling: to detect and measure the presence and rate of growth of particles generated by moving parts inside the compartment. Knowing the chemical composition of the wear metals gives an indication of where to look; knowing the rate of growth in concentration and the particle count gives an indication of the seriousness of the problem. Action can vary from filtering or changing the oil to immediate component replacement.

Once you determine what you mean by oil analysis, you can determine how you use it. Oil analysis reports, especially those that give minimum information at minimum cost, are often used by a relatively small number of individuals in the company to perform forensic analysis or take specific action on demand when threshold limits for either contaminants or wear particles are exceeded. Companies that do this miss a great opportunity. They think they are saving costs, but the cost of processing is only a small part of the total cost of taking the sample, labeling it competently, transporting it to the laboratory, and reviewing the information produced.

Companies that understand the potential of oil analysis and truly mean it when they say, "we use oil analysis," perform a detailed analysis and obtain information in the four areas described above. They use the oil-analysis information as a fundamental building block in a proactive condition-based maintenance (CBM) program. For example, a sample that shows evidence of silica ingress is seen as reason to fix the specific problem as well as reason to examine maintenance and inspection practices across the fleet as a whole.

The accompanying figure shows the relationship between the level of analysis performed and the way the information is used. It clearly shows how you can realize the full potential of oil analysis by performing a detailed analysis and using the information to support a predictive CBM program.

It also shows two areas where companies experience frustration and disillusion. The first occurs when they perform a detailed analysis of their samples, but then only use the information to perform reactive forensic studies. The second occurs when companies do not perform detailed analyses, but try to use the minimum information they obtain to support a predictive CBM program. There is simply not enough actionable information to do the job and everyone leaves frustrated. (We've created a graphic to help managers use oil analysis to its greatest extent. It is available at the online version of this article at ConstructionEquipment.com.)

Success comes from matching the information you have with the way it is used. The benefits of moving from reactive, failure-crisis management to proactive, condition-based maintenance is such that you simply cannot afford to neglect the full potential of detailed oil analysis. CE

I have the benefit of sharing time with and learning from many bright folk who have dedicated their talents to improving the art and science of equipment management. I acknowledge their help in preparing this article.

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By WALT MOORE, Senior Editor

Cat Overhauls Wheel-Excavator Design

D-Series models get new engines, refined hydraulics and more digging capacity



To simplify maintenance chores, Caterpillar's new wheel excavators have an engine-oil change interval of 500 hours and a 12,000-hour coolant-change interval (with Cat extended-life coolant).

The design of the new Caterpillar D-Series wheel excavators — models M313D, M315D, M316D and M322D — has been considerably enhanced, compared with that of their C-Series predecessors. According to Caterpillar, the new machines deliver increased lift capacity, faster cycle times, expanded versatility and enhanced control. Overall, the new models range in net horsepower from 127 to 165, in operating weight from 30,865 to 48,502 pounds, and in maximum digging depth from 18 feet 11 inches to 21 feet 11 inches.

The four new models are equipped with Caterpillar ACERT diesel engines, with the two smallest models using the C4.4, and the three larger models using the C6.6. The new engines are said to not only provide significant increases in horsepower and torque, but also deliver fuel-efficiency gains on the order of 7 to 8 percent. Electronic controls built into the new excavators recognize "roading applications," says Cat, and adjust engine parameters "to the most efficient operating point to save fuel without compromising road performance." Also, hydraulically driven, variable-speed cooling fans are designed to further boost fuel efficiency — and promote quiet operation.

Hydraulic refinement of the new excavators includes the use of a dedicated pump to power the swing function. The purpose of this design, says the company, is to maximize swing performance without reducing power to other hydraulic functions — resulting in smoother combined-function operation and more efficient use of hydraulic flow. Also, at the touch of a button, the operator can activate a heavy-lift mode to boost lifting force by 7 percent.

The versatility of these new models can be expanded, says Cat, with a variety of auxiliary-hydraulic control circuit options. At the heart of the machines' Tool Control System is the multi-combined valve, which allows the operator to use the monitor in the cab to select pre-programmed hydraulic parameters for as many as 10 work tools. In addition, a hydraulic-breaker circuit is available, as is a medium-pressure-function valve for controlling tilting buckets or rotating tools.

The monitor in the cab, by the way, is in color and newly designed to be easier to read. In fact, the entire cab is new, sealed and pressurized to keep out dust. It is also designed to enhance visibility and promote overall operator comfort and safety with such amenities as a deluxe seat that is ventilated and heated and cooled, fully automatic climate control, and an optional rear-view camera that displays on the monitor.

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ITT

By LARRY STEWART, Executive Editor

Moxy MT51 ADT Totes 51 Tons

Boundary-stretching articulated dump truck weighs less than some 40-tonners

Moxy challenged conventional articulated-hauler wisdom by taking the capacity of its new MT51 to nearly 51 tons. The articulated truck's 68,900-pound unladen weight is lighter than three competitors in the 40-ton class.

The truck is surprisingly compact, matching the wheelbase of the MT41. Overall length, height (bed down), and width are about the same as Caterpillar's 740. The MT51's 11 foot-8 inch loading height, however, is higher than any ADT on the market — even that of Bell's new 50 tonner, the B50D.

The Cummins QSX15 six-cylinder diesel engine rated at 510 horsepower, an Allison 4600 ORS automatic transmission, and a two-speed drop box deliver power to the axles.

Moxy's unconventional rear frame slopes down toward the articulation joint. Combined with a wide stance, it lowers the truck's center of gravity. The result, the company claims, is stability that eliminates temptation to invest in costly wide, low profile tires.

A new cab, and the company's nitrogen-charged independent front suspension keep the driver comfortable. All Moxy artic dumps have permanent six-wheel drive for equal power distribution, with limited-slip differentials (maximum 45 percent lockup) on each axle.

Moxy believes strongly that its unique articulation joint, which places the hinge behind the turning ring, distributes weight to each wheel more equally in tight turns and rough terrain than competitive hinges that place the hinge in front of the ring.

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Moxy vs. The Biggest ADTs

	Engine	Net Horsepower	Payload (lb.)	Turn radius	Unladen weight (lb.)
Caterpillar 740	Cat C15 ACERT	436	83,775	28′ 2″	72,400
Volvo A 40 EFS	Volvo D16	464	85,800	n/a	67,320
Bell B 50 D	Mercedes Benz OM502LA	506	100,090	31′ 7″	79,704
Moxy MT 51	Cummins QSX15	503	101,794	29′ 2″	68,860

Source: SpecCheck.com



Bauma visitors were the first to see Moxy's 68,900-pound MT51 articulated hauler, a 40-ton-sized truck that can move nearly 51 tons.

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By MIKE ANDERSON, Senior Editor

Efficiency Key to Hitachi Power

Four-cylinder Isuzu engine powers new 20-metric-ton excavators

When it comes to powering Hitachi's new Zaxis Dash-3 utility-sized excavators, less is more.

Less, in terms of engine cylinders, still results in more horsepower, fuel efficiency and environmental responsibility.

Initially introduced to members of the trade press gathered in March at a Deere-Hitachi training and demonstration site near Phoenix, Ariz., the Hitachi ZX200LC-3 and its reduced-tail-swing cousin, the ZX225USLC-3, began arriving at North American dealerships in late summer. Each is powered by an Isuzu Tier 3 engine generating 159 net peak horsepower in normal operating mode, up from 147 horsepower in the previous series.

"These have the Isuzu four-cylinder engines, which is quite unique because not too many excavators this size have a four-cylinder engine," says Brian Mace, Manager, Mining Product Marketing and Applications, Hitachi Construction Products.

"It's going to cost less to operate, because you're going to use less engine oil. Compared to the previous six-cylinder engine that was in this model, we're about 2 liters less of engine oil in the pan."

At first glance, customers may be taken aback by the thought of a four-cylinder engine in a 20-metric-ton machine, but "the engine's just as big," says Mace.

The introduction this year of Zaxis 225USLC-3, 200LC-3, and the smaller 160LC-3 models continues a rollout that began in 2006 with the first six Dash-3 upgrades, covering the 24- to 85-metric-ton range. Hitachi introduced the inaugural Zaxis excavators in 2002.

As with larger Dash-3 machines, the ZX200LC-3 comes with the larger CRES II cab, featuring a wider seatback, more legroom, and 47-percent more glass on the right side.

"The new multi-language monitor inside is pretty impressive as well," he says. "You can go through it and change your attachment settings, you can set up countdown clocks for your maintenance items, and it's all on a LCD screen, so there are no more gauges, or lights, or buzzers."

Due to its reduced-tail-swing configuration, the ZX225USLC-3 has a "squeezed" version of the new cab, but with the same larger seat and shorter control levers for operator comfort.

Suited for working closer to buildings, the heavier ZX225USLC-3 has a rear-end swing radius and minimum swing radius that are 42 and 32 inches, respectively, shorter than the standard-configuration ZX200LC-3. Many production specs are the same, the exceptions being some slightly longer reach specs for the reduced-tail-swing model.

The new Dash-3 machines use the regenerative HIOS III hydraulic system, which Hitachi says results in increased swing torque, faster arm and boom movements, and smoother multi-function operations.

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The Zaxis 225USLC-3 is the reduced-tail-swing cousin of the 20-metric-ton ZX200LC-3 excavator. Both have a four-cylinder Isuzu engine providing more horsepower than the six-cylinder plant of earlier models.

Key Specs: Hitachi Dash-3 Excavators

	ZX200LC-3	ZX225USLC-3
Operating Weight	47,015 lb.	53,440 lb.
Net Peak Power	159 hp	159 hp
Drawbar Pull	45,620 lb.	45,636 lb.
Digging Reach	32'7"	32'10"
Digging Depth	21'11"	22'
Dumping Height	23'7"	26'5"
Rear Swing Radius	9'	5'6"
Min. Swing Radius	10'5"	7'9"
Arm Force	22,924 lb.	22,924 lb.
Bucket Dig Force	29,099 lb.	29,099 lb.
Lifting Capacity*	20,308 lb.	22,077 lb.

* Over front, on ground, at 15 feet

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By KATIE WEILER, Managing Editor

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Western Products

The Wide-Out adjustable-wing snowplow is designed to hydraulically extend its width and to adjust its configuration in order to carry or windrow more snow. The movable-wing design allows independent hydraulic control of each wing to transform the plow from an 8-foot straight blade, to a 10-foot straight blade, to a scoop-position width of nearly 9 feet.

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Lincoln Electric

Pro-Cut Plasma Cutting Systems (Pro-Cut 25, Pro-Cut 55 and Pro-Cut 80) are designed to cut any conductive material, the company says. Pro-Cut 25 weighs 29.5 pounds, generates 25 amps of cutting power and can cut 3/8-inch-thick materials. Pro-Cut 55, weighing 55 pounds, generates 60 amps of power and can cut 3/4-inch materials. Pro-Cut 80, weighing 95 pounds, has 85 amps of cutting power and can slice through 1-1/4-inch materials.

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Magnum Systems

Five models of tree and brush mulching attachments from Magnum Systems marketed by Paladin Brands fit skid-steers, loaders, and excavators with sizes ranging from 165 to 500 horsepower. Magnum's fixed-tooth cutter/mulcher heads have a patented hammer design that is compatible across the model line. The attachments mount close to the base machine, with a low-profile design for better visibility. The design is also good for machine balance.

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DBI-SALA

Used like a tie-off fall protection lanyard for high-rise workers, DBI-SALA's new inertia-activated, self-retracting, 100-percent Tie-Off Talon allows the lines to extend and retract as needed while limiting the fall distances and reducing the maximum arresting forces. DBI-SALA developed a self-retracting lifeline system that features two independent lines, allowing one to be connected to an anchorage at all times. The 100-percent Tie-Off Talon is available with standard or large throat opening hooks for attachment to various anchorage points.

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Michelin

Michelin introduced Axiobib tires with Ultraflex radial technology that promise better traction and longer life to harness the power of four-wheel-drive ag tractors like those used to pull towed scrapers. Ultraflex Technology enlarges the area in the tire sidewall that flexes under load. Combined with a flatter cross-section, it extends the Axiobib footprint 22 percent longer than that of standard radials. The new Axiobibs can operate at inflation pressures as much as 20 percent lower than other radials, or carry up to 20 percent more load at the same inflation pressures. Michelin's AxioBibs will be available in seven sizes.



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TT Technologies

Grundoburst 400S pulling unit is for Tight-In-Pipe (TIP) trenchless pipe replacement. With a TIP method, new pipe is pulled inside existing pipe; 400S pulls the new pipe.

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Market Watch Lite

Nilfisk-Advance America



The CFM A15 and CFM A17 pneumatically powered vacuums connect to any compressed-air source and channel air through a venturi to create what the manufacturer calls "a powerful suction." The 6.6-gallon-capacity A15 can be used in confined spaces, and the larger, 26-gallon-capacity A17 is designed for heavy-duty applications.

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Diamond Products

Core Bore CB50 electric power unit features a 50-horsepower "electric engine" and is designed to power wall saws, chain saws, hand saws or core-drilling units. The power unit, says the manufacturer, features variable flow (from 0 to 22 gpm) at pressures from 500 to 3,900 for saw motors; delivers 4 gpm at 150 to 2,300 psi for travel and blade-depth functions; uses a hydraulic pump that "pulses the pressure" to assist with smooth operation of the travel function; and provides for automatic shut-off.

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American Compaction Equipment

Diamond Compaction Wheels are engineered to withstand impact and thrust loads applied by excavators, backhoes and skid-steer loaders and come in widths from 4 to 72 inches. They're equipped with Rexnord Triple seal bearings, rockguards, mount adapter, pins, leveling plates, and include a choice of sheepsfoot or wedgepad foot styles.

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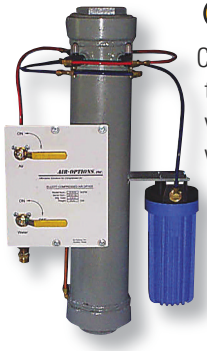

Air Options

Compressed-air dryers use a simple two-stage, water-evaporation process to extract water from the compressed-air stream by cooling the air, causing the water vapor to condense out. These systems, says Air Options, can function routinely with input temperatures as high as 250F, and can accommodate temperatures as high as 350F with no damage. They can be mounted directly to the compressor or to the receiver, depending on the size of the compressed-air system. The air dryers have a maximum operating pressure of 200 psi, and are available in sizes from 8 to 1,500 scfm.

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Trico

Designed for filtering higher-viscosity fluids, Trico's latest product for gear and lube oil filtration offers a high flow capacity of 4 gallons per minute with a maximum viscosity capability of 10,000 SUS at 100F. Available as a hand-held or portable cart configuration, the Trico system utilizes a multi-stage filtration process. For added utility, the system features differential pressure gauges that indicate when each of the elements needs to be changed.

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Daniel Manufacturing

The Beak skid-steer attachment is designed for concrete removal. Its crow-bar fork design multiplies the breakout force of the skid-steer, and the grapple jaw holds the load in place, according to the company. The Beak hooks up to the skid-steer's auxiliary hydraulic circuit using quick-connect fittings and does not require high-flow hydraulics.

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Market Watch Lite



Cummins

The QuickCheck 5100 puts the power of a portable computer and proprietary engine-monitoring software, capable of reporting data on many computerized engines, into one handheld device. It connects to any electronic diesel engine. A USB cable allows users to link their QuickCheck 5100 to a desktop PC. Its Windows CE operating system is preloaded with QuickCheck CE and PowerSpec CE. QuickCheck 5100 reads and captures fault codes, parameter values, lifetime trip data as well as the data plate. PowerSpec CE software is a proprietary application for Cummins engines that allows users to download and customize engine parameter settings on their own PC.

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Hilti

For the drilling of holes up to one inch in diameter to accommodate the installation of rebar dowels or anchor bolts in concrete and stone, the new TE 50 Combihammer utilizes a 1,050-watt motor. Equipped with constant motor electronics, the TE 50 provides a constant drilling speed — despite power source fluctuations — for full performance under all conditions. An efficient cooling system and robust hammering mechanism help reduce unexpected downtime on the jobsite. For operating comfort, the lightweight, compact tool incorporates a balanced ergonomic design with D-grip.

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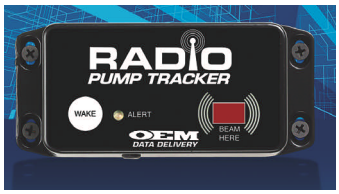

The Radio Pump Tracker is a wireless, paperless system that identifies each vehicle and the fuel dispensed to it, in real time. After dispensing, a hand-held device or personal computer captures the vehicle hours, odometer readings and gallons. The technology facilitates calculations and analyses for audits and resource planning, and because it stores each machine's history, it's also a tool for scheduling maintenance based on fuel consumed or hours in service.

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Ingersoll Rand

Ingersoll Rand now has PAC-Series compactor attachments for carriers weighing from 3,000 to 60,000 pounds. In addition to compacting soil and other building materials by direct contact, the compactors also have a vibrating force that can be used to drive sheet pile or to drive sign posts into granular soil. Seven models are available, both in side- and top-mount versions, and are said to have an operating pressure of 2,300 psi. Plate dimensions range from 12x18 inches, to 23.5x41 inches.

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Multiquip

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Leica Geosystems

The GMX902 GG is designed as a high-performance GPS + GLONASS receiver, specially developed to monitor sensitive structures, such as bridges or mines, as well as crucial topographies, such as land slides or volcanoes. According to Leica, the instrument provides precise data capture as the basis for highly accurate position calculation and motion analysis.

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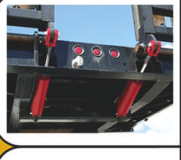

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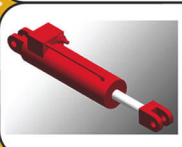

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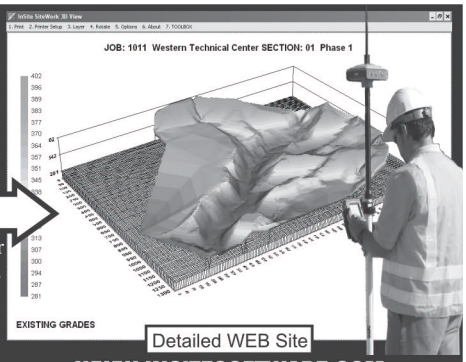

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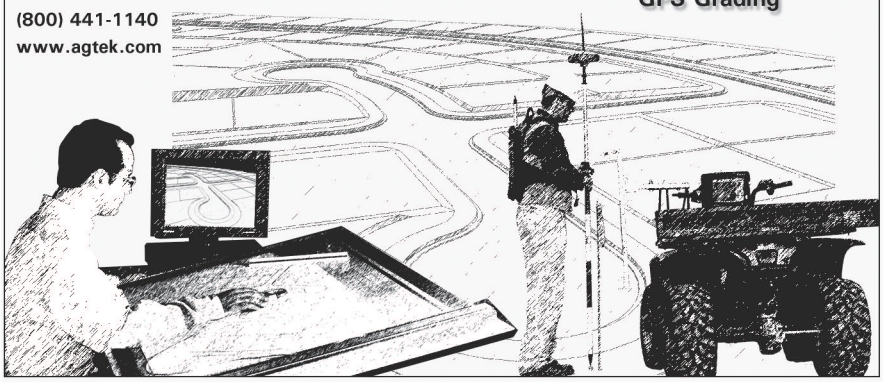

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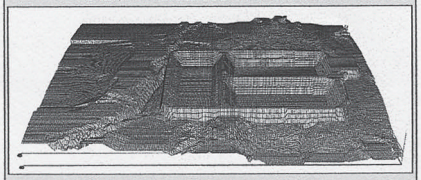

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By KEITH HADDOCK, Contributing Editor

Koehring Steam Concrete Mixer

As construction equipment mechanization began, the famous steam shovel was not the only machine making its mark on the industry. Concrete mixing was also steam powered and the Koehring mixer did it the right way.

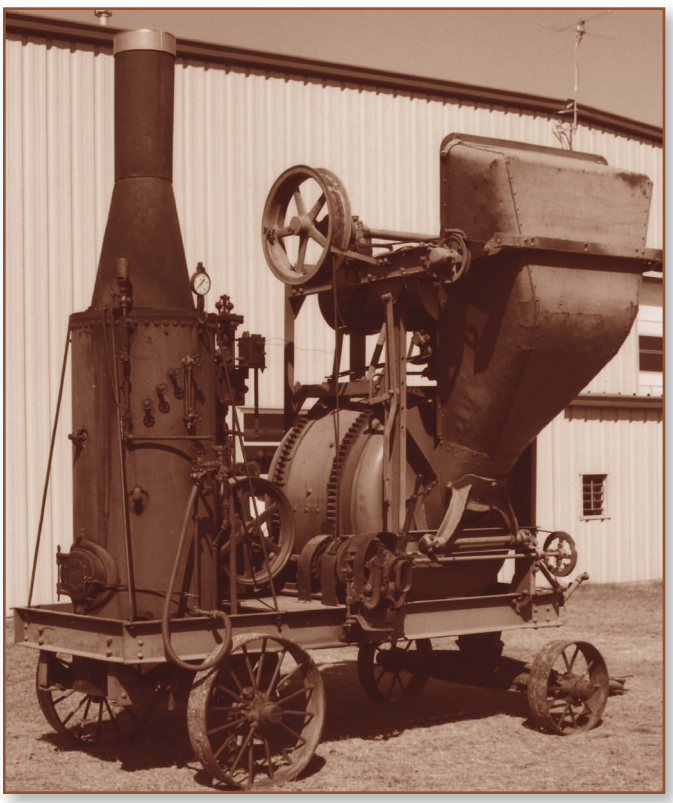
When construction equipment mechanization took over from horse power and manual labor, steam power reigned supreme. The famous steam shovel led the way, but all kinds of other equipment used steam as its motive power to increase productivity and lower costs. One of the pioneers of steam-powered concrete mixing and placing equipment was the Koehring Machine Co. of Milwaukee, Wisc., founded in 1907. Although Koehring later found fame and fortune with its well-known line of cranes and excavators introduced in 1921, the concrete mixer was actually Koehring's first product.

Key to Koehring's success with its early concrete mixers was the design and placement of the baffle blades and discharge chute within the drum. In the Koehring mixer, several distinct mixing actions occurred within the drum because it was fitted with two sets of baffle blades. In addition, the discharge chute — reaching well inside the drum — could move 90 degrees on a horizontal axis, so in one position it discharged the drum contents or, in the opposite position, aided the mixing process by directing the rotating material to the opposite side of the drum. This chute position, combined with the two sets of baffle blades, caused the material to move continually from front to back of the drum, as well as being rotated and showered to the bottom of the drum at each rotation.

According to Koehring's advertising, this double baffle design avoided separation of aggregates into its different sizes, which would occur in mixing systems that depended on a single series of baffle blades.

In the 1910s, Koehring marketed a line of six models of portable concrete mixers with capacities from 10 to 30 cubic feet based on dry batched material. Steam engines furnished on these models ranged from 5 to 12 horsepower and operating weights from 7,300 to 15,000 pounds. Before the end of the decade, gasoline and electric power was offered, and requests for steam machines began to decline.

A popular steam-driven mixer was the Koehring No.15 with 15 cubic feet dry batch capacity. According to specifications, it was equipped with a 30-inch-diameter vertical boiler 6 feet 6 inches high, and a vertical steam engine with 5½-inch bore and 7-inch stroke, developing 7 horsepower at 253 rpm. The side loader bucket could be raised in 8 seconds and the mixer emptied of "sloppy" concrete in 18 seconds. Koehring claimed the No. 15 could produce 180 cubic yards of concrete in a 10-hour day.



Koehring No.15 steam-driven portable concrete mixer was restored by owner Dave Geis of Seward, Neb.

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