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INTICINETY Workday shows

Our first-ever Workday shows that despite their size, these mini skid-steers pack a powerful punch

b-22

Shown in front of their trenches in the early-morning sunshine, these mini skid-steers were put through their paces during a two-day session last fall. Construction Equipment editors gathered seven manufacturers and their machines for a series of field exercises designed to determine just how much work a mini skid-steer can do.

Although the machine category is growing in popularity, application and performance were not common knowledge. After Workday, though, we can say the mini skid-steer is a serious construction machine.

See page 22 for our exclusive report.



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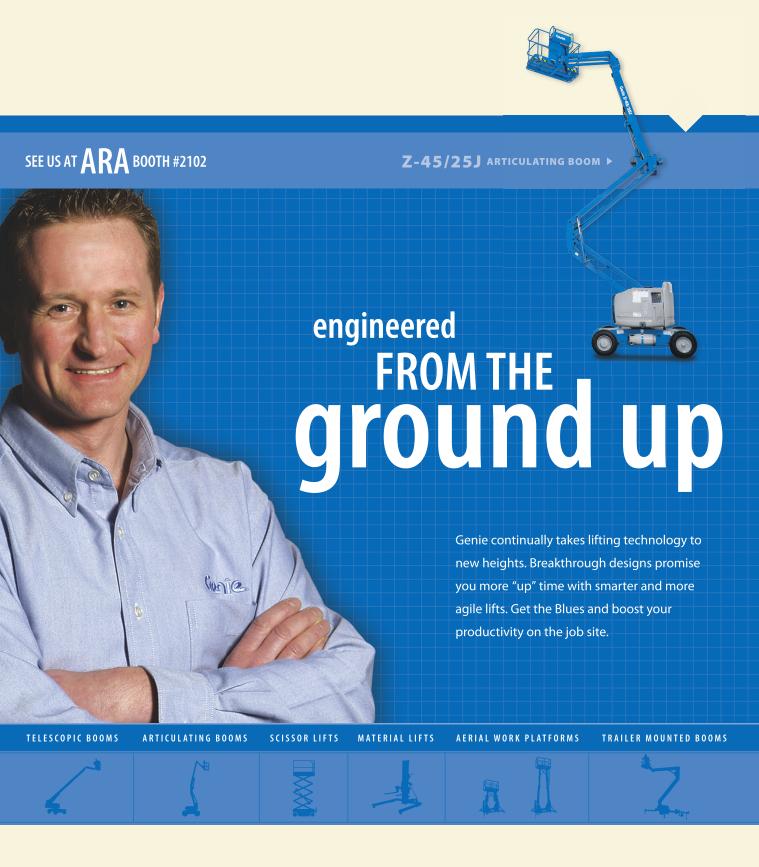
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FEATURES

EXCLUSIVE: Mini-Skid Workdays

22 Pound-for-Pound, the Mightiest Around



Shown in front of their trenches, these mini skid-steers were put through their paces during a two-day session last fall. *Construction Equipment* editors gathered seven manufacturers and their machines for a series of field exercises designed to determine how much work a mini skid-steer can do. Although the machine category is growing in popularity, application and performance were not common knowledge. After Workdays, we can say the mini skid-steer is a serious construction machine.

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More than 45 excavators between 20,000 and 40,000 pounds compete for your purchase dollars. Enough money is being spent on machines this size that the scent of cash and desire to supply the big rental houses attracted no less than four manufacturers to field their first excavators in the size class over the past 30 months.



YOUR SKIDSTEER: A. is overdue for maintenance B. was used for 6 hours on Sunday C. is on its way to parts unknown For more information, visit www.ConstructionEquipment.com/RS and enter 4

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Reprints

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Sutton Report

A Buyer's Site

Last fall, we discovered that 91 percent of equipment managers use the Internet to access product information and specifications. Five years ago, that number was only 57 percent. We weren't completely surprised, because our website, ConstructionEquipment.com, operates around that assumption. We wanted to build the best site for equipment buyers intent on doing online research for the machines they acquire and manage.

We relaunched ConstructionEquipment.com last month to better meet the needs of equipment managers. We still have the industry's most complete listing of manufacturers and their distributors in our Buyer's Guide

database, but we now have deep archives containing all the new-product coverage and evaluative journalism published in *Construction Equipment* since 2002. Users of the site can search by machine type and find all of our articles on that machine as well as a link to our Buyer's Guide. Another link will take users to our specifications database, Spec Check.

We purchased Spec Check U.S. last month, and this database contains the industry's most upto-date and deepest listing of specifications for almost 10,000 models in 60 separate categories. The link at ConstructionEquipment.com will take equipment managers to a rich source of machine specification data where they can sort by attribute and compare model specifications side by side. In addition, Spec-Check. com offers an even richer treasure trove of machine specifications.

We want ConstructionEquipment.com to be an equipment-buyer's web-based resource. Equipment managers can access three powerful data-



Rod Sutton, Editor in Chief

bases: articles, manufacturer and dealer listings, and machine specifications. But acquisition is but a portion of an equipment-manager's responsibility. Machine management (maintenance, cost control, repair-replace decisions to name a few) takes a considerable amount of time, too.

That's why we've included a section on management, with archived articles from *Construction Equipment*. Equipment managers will find Prevention Illustrated, Great Managers stories, and the entire collection of Equipment Executive, written by Mike Vorster.

Much has changed on the Internet since 2000, and the new ConstructionEquipment.com provides today's equipment managers with a data-rich resource suitable for the challenges of 2006 and beyond.

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MARKET WATCH

By KATIE WEILER, Managing Editor

We're making it quicker for you to obtain more information on products by going to ConstructionEquipment.com/info. Once there, you'll be in our Buyer's Guide, where you can find manufacturer information as well as distributor listings.



Vermeer

Three Navigator horizontal directional drills offer upgraded performance and features. D36x50 Series II has increased horsepower to 140, and an optional onboard mud pump offers 70 gpm variable flow. The HDD has 36,000 pounds pullback force; and 5,000 ft.-lbs. torque. D20x22 replaces the D18x22 and has double the carriage speed. D10x14 has 1,400 ft.-lbs. of torque and 9,600 pounds of push/pull. For more information, visit ConstructionEquipment.com/info

K-Series compact loaders offer an enhanced cooling system, strengthened chain-case design and increased loading heights on large-frame, vertical-lift-path units. A new hydraulic cooling fan provides efficient temperature control and turns only as fast as necessary, producing less noise. Chain case features a 38 percent increase in durability and a two-year driveline warranty. For jobs that require lifting and loading materials into trucks, an additional two feet of maximum reach is available

For more information, visit Construction Equipment.com/info

with models S250, S300, T300 and



Rogers

A300.

Ultima Series lowboy trailers now include a 55-ton-capacity model. With a 20-inch loaded deck height, the trailer features 25 feet of deck length and a 98-inch swing clearance. As standard equipment, the No Foot self-lifting gooseneck quickly raises or lowers the front of the deck under full load without a ram foot contacting the ground. For more information, visit ConstructionEquipment.com/info



Granite vocational trucks offer roomier cabs and updated interiors. The new cab is 4 inches longer than current Granite cabs for more leg and belly room, and has a wrap-around in-

strument panel, suspended pedals, better noise insulation, enhanced lighting and more storage. The new Granite will come with forward and rearward steer-axle settings, but will use only a new MP series of engines.

For more information, visit ConstructionEquipment.com/info

Construction Equipment | February 2006

Market Watch



Kubota

Super Series U15, U25 and U45 mini-excavators keep to themselves, because all are zero-tail-swing machines. The model designation signifies the metric-ton weight class in which the new models compete. Actual operating weights are 3,704, 5,625 and 11,465 pounds, respectively. Horsepower ratings are 13, 21 and 42, respectively, and maximum digging depths follow suit at 7.6, 9.3 and 11.8 feet.

For more information, visit ConstructionEquipment.com/info

Terex Roadbuilding

The E225P counter-flow drum mixer, with a production capacity of 225 tph, is billed as "super-portable." Designed for five-load transport, the plant breaks down into the drum mixer, baghouse, self-erect silo, four cold-feed bins with scalping screen and liquid-asphalt tank/control house/fuel tank. It is capable of producing a variety of mix designs.

For more information, visit ConstructionEquipment.com/info





▼ Trail-Eze

Models TE70XT and TE70TXT provide features to assist users in loading both large and small equipment. The TE70XT has a low loading angle, but no moving axles. It is designed to meet the "lowest of low angles" and yet keep the axles in the same position. The TE70TXT offers the same feature, but also has the capability to lift the entire bed to assist in unloading without the use of a hydraulic upper deck ramp.

For more information, visit ConstructionEquipment.com/info





Mustang

Two new skid-steers, models 2026 and 2041, will replace the 2022 and 2032, respectively. Operating loads are 1,050 and 1,350 pounds. The 2026 delivers 35 horsepower at 2,600 rpm and has an operating weight of 4,000 pounds. The 2041 offers 46 horsepower at 2,600 rpm. New features include new air cleaner and hydraulic filter systems, improved drive control, new engine cover and rear door, and larger-capacity fuel tanks. Base prices are \$22,588 and \$24,189, respectively. For more information, visit ConstructionEquipment.com/info

Cummins

Eight new low-emissions diesel generator models range from 750 to 2,000 kW and are Tier 2 certified. Designed to meet quick-start capabilities, the units provide low-fuel consumption, optimal electrical performance and low maintenance, says Cummins. The modular common-rail fuel-injection system is fully integrated with a new electronic-control module. For more information, visit ConstructionEquipment.com/info





Morbark

The 7600B Wood Hog features many enhancements. It has production rates as high as 600 yards per hour, with power options up to 1,000 horsepower. The Igan system automatically adjusts feed rates, pressures and feed wheel positions. A satellite modem option is now available for all Morbark equipment fitted with its Igan system. Other improvements include a larger discharge area, and an internal drive on the feed yoke has replaced the external drive.

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Managers Digest

For more headlines: ConstructionEquipment.com

Crowded Skies May Benefit Contractors

7hen we talk about the "global positioning system" or GPS, we usually mean the NAVSTAR-GPS satellite constellation — the NAVigation System with Timing and Ranging — Global Positioning System. NAV-STAR-GPS belongs to the U.S. Department of Defense, has 24 working satellites and is used by all satellite-based earthmoving systems.

Orbiting some 4,000 miles farther out in space, however, at an altitude of about 16,000

miles, is the GLONASS constellation. The GLObal NAvigation Satellite System is being established by the

Russian government, which, on Christmas Day 2005, launched three additional satellites to bring the present GLONASS system to 17 working units. The plan is to complete the system with a total of 24 satellites within the next two years.

Three days after the GLONASS launch, the Russian Federal Space

Agency lent a hand to the European Union (EU) by launching that organization's first satellite in what will be

the 30-satellite Galileo

constellation. The EU

an initial \$1.2 billion

reportedly will allocate

during the next several

ment of the new global

years to fund deploy-

positioning system,

which is designed to be compatible with the NAVSTAR system.

How might all these additional satellites affect machine-control systems installed on earthmover machines?

> According to Ray O'Connor, CEO of Topcon Positioning Systems, more satellites are

the means to more precise, more reliable machine-control systems. Constant access to a minimum of five satellites is critical for precise operation of

these systems, he says, and the more satellites available to the user, then the less downtime and signal degradation that will be incurred and the more work that can be completed without interruption.

Topcon presently sells machine-control systems that can utilize both the NAVSTAR and GLONASS constellations, and recently announced a new Paradigm-G3 chip that will have the capability to process signals from all three constellations.

CONSTRUCTION **EQUIPMENT.COM**



Equipment Info **Treasure** Trove

The new website at Construction Equipment.com has

become the industry's most complete source of information for researching equipment purchases, maintenance and management. New functionality puts you within a click of Construction Equipment's award-winning equipment evaluations, new product reviews, and maintenance and management insights. The website has become an archive of new-machine introductions, and offers the specifications source that major equipment manufacturers use to research competitors' machines. It's all cross-referenced to the industry's most complete guide to equipment manufacturers and their dealers.

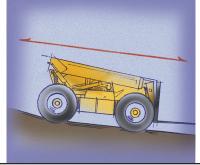
OPERATING TIPS

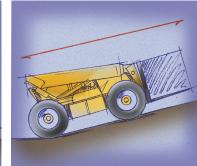
Heavy End Up

Telehandlers are designed to handle rough terrain, but that doesn't mean they can be driven without regard for the terrain. Risk of tipping or load loss is great when traveling on slopes. If you must drive on a slope, keep the load low and proceed slowly, with great care. Before you get on the slope, downshift to a lower gear and four-wheel drive so you get engine braking to help control the telehandler's speed.

Avoid turning on a slope, but if you must turn, make the turn as wide as possible and use extreme caution. Never drive across steep slopes.

Ascend and descend slopes with the heavy end of the telehandler pointing up the incline. When there's no load on the forks, the counterweighted rear of the machine is the heavy end, so you should back up slopes. When the telehandler is loaded, the front of the machine is the heavy end, so you should back down slopes.





Managers Digest

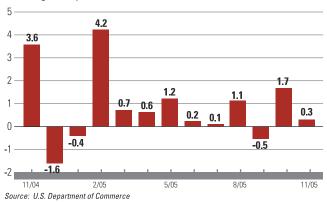
Status & Forecast

By JIM HAUGHEY, Director of Economics

←→ PUBLIC CONSTRUCTION SPENDING

Spending increased steadily during 2005, and the November total was up 7.8 percent from 2004. More than half of this gain was due to higher project costs, especially for concrete products. Spending for water and sewer projects is up 24 percent, fueled by the development of new neighborhoods and higher government budget balances. Highway spending is up 8 percent, but transportation, communication and conservation spending is essentially unchanged.

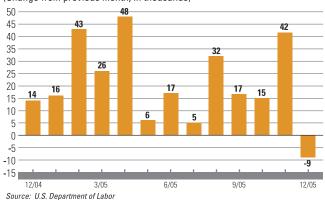
(% change from previous month)



↓ CONSTRUCTION EMPLOYMENT

Contractors laid off 9,000 workers in December, the first decline in jobs in 23 months. Some 491,000 construction workers have been hired since February 2004. Cold and wet weather during December contributed to the decline; the cuts were concentrated in heavy construction and building subcontract work. About 150,000 new construction jobs are expected in the next 12 months, down sharply from the 258,000 jobs added in the last 12 months.

(Change from previous month, in thousands)



CONSTRUCTION EQUIPMENT SHIPMENTS

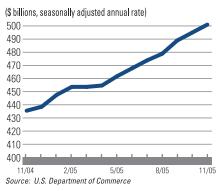
Monthly equipment shipments have been steady at \$2.9 billion for four months. Factory orders have averaged \$3.1 billion a month since early summer, so manufacturers' order backlog continues to expand with delivery lead times now stretched to 15 weeks. Equipment imports account for a steady 40 percent of U.S. equipment supply. The recent starts surge for highways and nonresidential buildings will keep monthly shipments near the recent level through '06.

(% change from previous month)



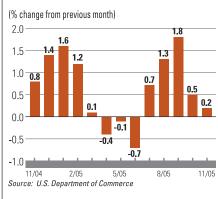
T NEW RESIDENTIAL CONSTRUCTION SPENDING

Housing starts have peaked, but newresidential construction spending continued to inch higher through November.
Homebuilders are building out their order backlogs. Recent monthly gains in
residential construction spending were
largely due to higher materials prices
rather than more homes under construction. Homebuilders are now reducing speculative-housing starts because they have a five-month inventory
of unsold homes.

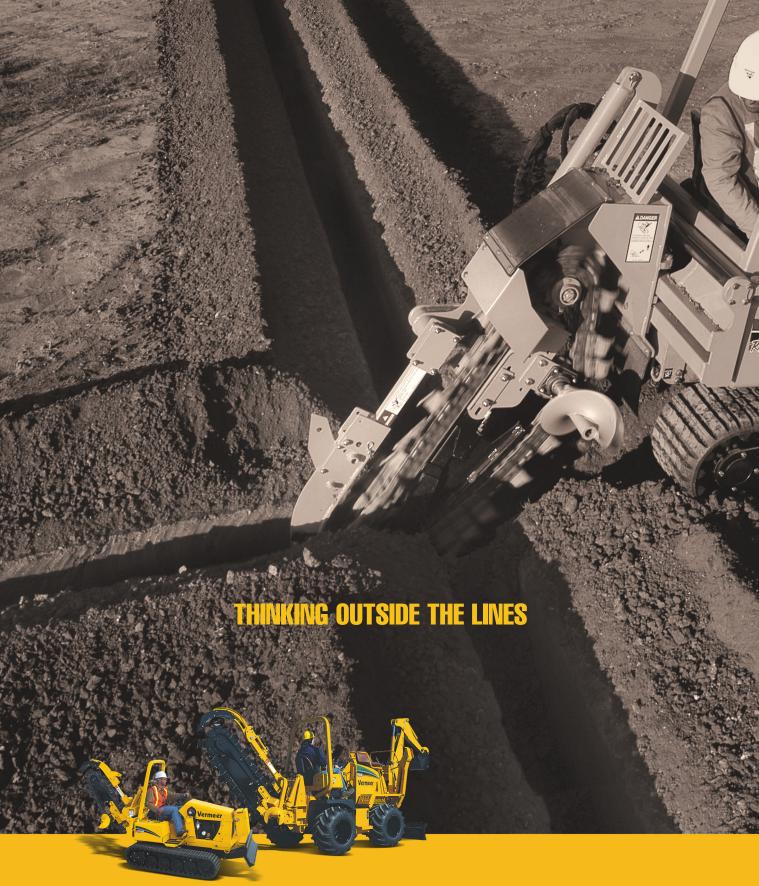


→ PRIVATE CONSTRUCTION SPENDING

Spending was 7.8 percent higher in November vs. last year. But real market expansion, after inflation, was slightly higher than in the public market because private projects use relatively less concrete and more lumber. All of the gain over the past year has been in new-home construction. Nonresidential buildings will provide the increase in private construction spending in 2006-07. Leading sectors will be shopping malls, hotels, high schools, college facilities and hospitals.



For the full text of this month's economic analysis, check Economic Outlook at **ConstructionEquipment.com**



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By CE Staff

Pound-for-Pound, The LIGHTES!

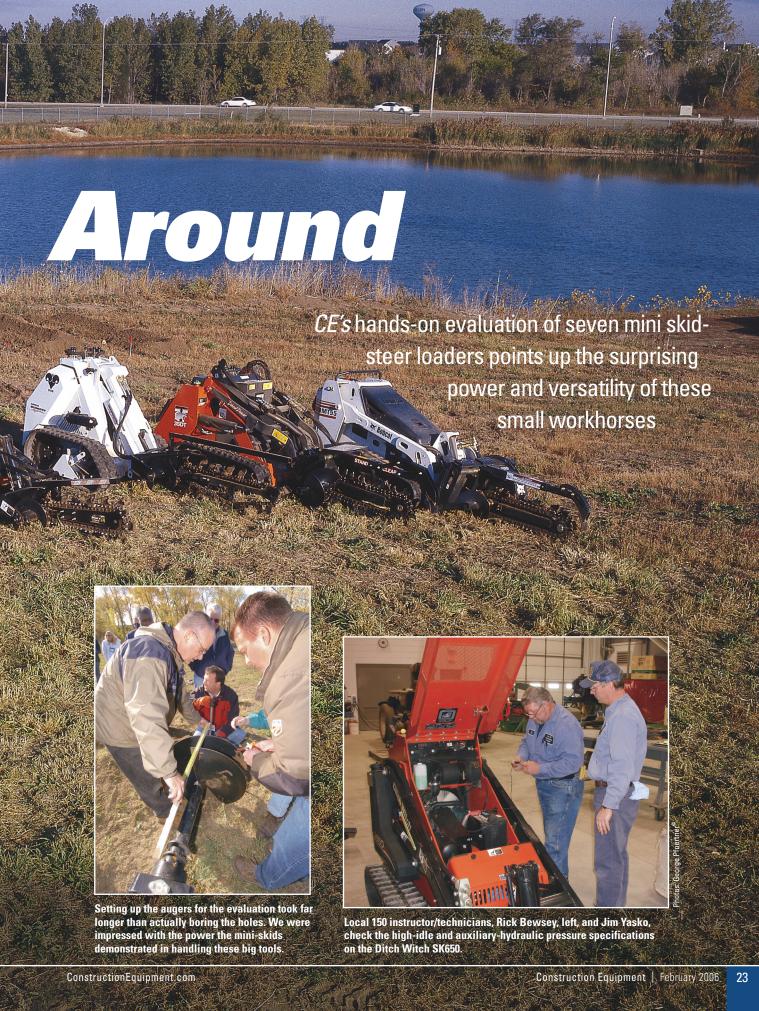




The Thomas 35DT begins its first trenching run as Thomas' Michael Twumasi-Boateng and CE's Katie Weiler start their watches



Local 150 operator/instructor Marty Turek assists operator/instructor Tom Rush (at the controls) in keeping the auger plumb during the evaluation.



y the end of the day on Oct. 27, 2005, Construction Equipment's editorial staff collectively reached this conclusion: The rubber-tracked mini skid-steer loader, despite its small size, is a serious construction machine that is sure to find wider application as contractors continue to discover its unique capabilities. We base our opinion on observations during a two-day, in-the-dirt evaluation of seven of these diminutive workhorses, all top-of-the-line models with familiar brand names: Bobcat, Boxer, Dingo, Ditch Witch, Ramrod, Thomas and Vermeer.

We called the event "Mini-Skid Workdays," and asked these seven manufacturers — Bobcat, Compact Power (Boxer), Toro (Dingo), Ditch Witch, Leon's Manufacturing (Ramrod), Thomas and Vermeer — to come to Illinois with their largest machine, along with its standard dirt bucket, a 24-inch trencher and a 30-inch-diameter auger. And they all came, convening on an 80-acre site in Plainfield, Ill., some 30 miles southwest of Chicago.

If you're a regular *CE* reader, you may recognize the site as Local 150's (International Union of Operating Engineers) Apprenticeship and Skill Improvement (ASIP) facility, where IUOE members are trained as operators and service technicians. *Construction Equipment* is greatly indebted to Local 150's staff for sharing its facility, its resources and its expertise to assist with this project. Our

thanks go, also, to the manufacturers who participated in the event.

CE's purpose in bringing the seven machines and their manufacturers together on Oct. 26 and 27 was to collect information that would provide potential buyers a close look at what CE's staff considers a significant emerging equipment category, which is presently identified with various labels, including mini skid-steer loaders, mini track loaders, compact skid-steer loaders, compact utility loaders or just "mini-skids." Bringing the major players together gave us the opportunity to review each machine's basic design and features, as well as to determine, in average terms, the kind of performance you might reasonably expect from these machines.

Of course, the mini-skid, like its larger skidsteer-loader or compact-track-loader counterparts, is, at heart, a "tool carrier," and we were impressed by the broad selection of attachments offered for these machines. That selection may include specialty buckets, pallet forks, grapple forks, hydraulic breakers, backfill blades, trenchers, augers, rotary brooms, stump grinders, vibratory plows, concrete-mixing barrels, rippers, ground-conditioning tools, snow throwers and backhoes.

Attempting to give you an idea of how the mini-skid might handle each of these attachments would be an impractical task, so we selected the three basic tools noted above for evaluation. To investigate the work capabilities of these machines

Load-and-Carry Performance Averages

Bucket Size	Bucket Fill	Cycle Time	Production Rate
(cu. ft.)	Ratio (%)*	(min.)	(cu. yd./hr.)
4.5	93.3	1.7	5.5

In the load-and-carry evaluation, the machines loaded from a stockpile of crushed limestone that weighed 2,600 pounds per cubic yard (Boxer 237), carried the load approximately 125 feet (Toro Dingo TX 425), ending at the top of a ramp and dumping into a single-axle truck (Bobcat MT55). Cycle time includes return to the stockpile. The truck was weighed on electronic scale pads to determine payload. Local 150 operator/instructor Tom Rush is shown at the controls of the example



machines.

with the selected tools, we kept records as two Local 150 instructor/operators put the machines to work in three specific applications.

Mini-Skid Workdays

As the mini-skids arrived at the ASIP facility, Local 150 instructor/technicians Jim Yasko and Rick Bewsey checked each machine's high-idle speed and auxiliary-hydraulic pressure against specifications. Then, on Wednesday morning, Oct. 26, we began the Mini-Skid Workdays event day with brief walk-around presentations, in which each manufacturer informed "the buyer" (the CE editorial staff) about the machine's salient features.

At the first worksite, Local 150 operator/instructors Tom Rush and Martin Turek used each machine in a load-and-carry application. We'd erected an 80-foot x 40-foot tent at the site, thinking that even if it rained, the event could go on as scheduled. But the day was dry and bright, so the operators loaded crushed limestone from a stockpile just outside one end of the tent, traveled outdoors along the 80-foot side, maneuvered up a 25-foot ramp just outside the other end of the tent, dumped into a waiting truck and returned to the stockpile.

The first operator made four cycles with a particular machine, followed by the second operator, who duplicated the process. We timed the operators as they worked, then weighed the truck on electronic scale pads to determine its payload.

At the next worksite, we traded the buckets for trenchers and asked each operator to use each machine to open 10 linear feet of trench, at an approximate 2-foot depth. The soil was well-compacted, clean fill having a fair amount of clay and

a few rocks. Because some of the machines had trencher attachments with booms in excess of 24 inches, we asked Doug Amerman, director of OEM sales for Paladin Light Construction, to help us uniformly establish a 24-inch cut for each machine before it began its trenching runs.

With the mini-skids so positioned, we placed a stake adjacent to a forward reference point on each machine, measured back 10 feet and set a second stake, then measured off another 10 feet and set a third. When the reference point on the machine indexed with the second stake, the first operator stopped, and the second then opened another 10 feet of trench. We timed the operators as they worked, then measured each trench at several points to establish an average depth and average width, which we used to calculate the volume of earth excavated. Most of the trencher chains used a combination of shark teeth and cup cutters, but not all.

For the third evaluation, boring, we moved back a bit from the trenching site and asked each operator to use each machine to drill a 36-inch-deep hole with a 30-inch-diameter auger. To set up this evaluation, we placed each machine's auger horizontally on the ground, measured back from the tip 36 inches, then used a level as a straightedge to transfer that point to the auger shank, which we marked with tape. Our method was to start the watch when the auger began to spin, then to stop timing when the tape disappeared into the spoil.

Results in perspective

In a typical CE field test, the machines involved are worked until all concerned are satisfied







that data samples have stabilized and that sufficient samples have been collected to provide a valid look at machine performance. With the miniskid evaluation, however, given the number of machines involved and practical time constraints, we could observe a specific machine's capabilities only for a short time and under a particular set of conditions.

Of course, we designed the tests to eliminate as many variables as possible — for example, loading crushed limestone, instead of soil, which could vary in moisture content and degree of compaction. But when all was said and done, we looked at the numbers for individual machine performance and concluded, in fairness to all concerned, including potential buyers, that the production samples were too small to use as a basis for confidently projecting a specific machine's capabilities in a given application.

But, that said, we further reasoned that with a broad *range* of such samples — we now had seven sets of production numbers, one from each machine — uncontrollable variables (different soil conditions when trenching, for instance, or cycleto-cycle variation in bucket-fill ratios or encountering rocks when boring) would tend to even out over the wider sample base.

Thus, we concluded that we could, without too seriously mangling the laws of statistics, legit-imately average the samples to project typical performance for the group of mini-skids in the specific applications involved. These numbers, we trust, will give you at least a glimpse into the

work potential of the mini-skid, and may help you decide whether a mini-skid would benefit your operation.

Design variation

If you consider the mini-skid a potentially valuable addition to your fleet, then you have an expanding number of choices to investigate. The seven manufacturers at our event, for example, collectively have 19 models of rubber-tracked mini-skids, many diesel-powered, and most running with surprisingly generous auxiliary flows and pressures.

Among the seven units on our site, six were diesel-powered, five had an integral ride-on platform, one used an optional trailing platform and one was a walk-behind. List prices with a bucket ranged from \$17,500 to \$24,000. And we were impressed, as you might be, with the different approaches manufacturers have taken in the design of their machines — especially in the areas of hydraulics, controls and undercarriage configuration.

The basic design of these machines, of course, is similar to that of a conventional skid-steer loader (closer, actually, to a compact track loader) in that the engine is essentially a means for driving hydraulic pumps. The pumps, in turn, create the oil flow to perform several functions: turn the hydraulic drive motors at the sprockets, which power the tracks; activate the boom and bucket cylinders; and power hydraulically driven attachments (such as trenchers and augers) via an auxil-

Trenching Performance Averages *

Trench	Trench	Trench	Trenching	Production
Length	Depth	Width	Time	Rate**
(ft.)	(in.)	(in.)	(min./20 ft.)	(ft./hr.)
20	25.3	5.9	6.1	197

*All numbers reported, except Trench Length and Production Rate, are averages calculated from actual test samples **Linear feet per hour based on average depth of 25.3 inches and width of 5.9 inches

Our photographer, George Pfoertner, captured serious faces as (right to left) *CE*'s Katie Weiler, Leon's Manufacturing's Dwight Turta, and *CE*'s editor-in-chief, Rod Sutton, time Local 150's Marty Turek as he makes a trenching run with the Ramrod 1150.





In the beginning there was the SK500, the original workhorse that launched the Ditch Witch "compact utility line. This family of highly versatile, extraordinarily reliable machines now includes a complete range of mini skid steers, mini excavators, and the revolutionary Ditch Witch XT850 excavator-tool carrier. Limited space is no match for the unlimited imagination of Ditch Witch engineering. For more information about our full line of equipment, call 1-800-654-6481 or visit www.ditchwitch.com.



iary-hydraulic system.

Hydraulic-flow rates in the auxiliary circuits of the machines we had on site ranged from 11.2 to 14 gpm, and relief pressures were between 2,900 and 3,000 psi. These combinations of flow and pressure produce considerable hydraulic horsepower, thus giving the mini-skid the capacity to competently handle an increasing array of powered attachments, which are quickly attached via a cam-type or "universal-type" coupler.

Final thoughts

After observing these machines in action for a couple of days, we think that, pound-for-pound, they're among the most powerful, agile and versatile machines around. We were impressed by their overall heavy-duty construction, which was evident especially in the frame, undercarriage and loader mechanism. (Operating weight averaged 2,500 pounds for these small machines.)

We were also impressed with the capability of their auxiliary-hydraulic systems, which rival those of small, conventional skid-steer loaders. When we saw the size of the 30-inch-diameter augers that manufacturers brought to the event, for example, our first thought was that these small units would struggle with these large tools. Not so; every one of the machines capably handled the assignment.

And with their trencher attachments, the mini-skids proved their mettle as potentially very valuable machines in such varied applications as curb-to-house utility installations, drainage projects or small-structure footings. Judging from the competent manner in which these units excavated a 2-foot-deep trench, we'd guess that they could dig considerably deeper with absolutely no problem.

And, too, we were impressed with the mechanical and hydraulic sophistication of these machines. Their engines, for instance, whether gas or diesel, reflected efficient, durable designs — as did the range of hydraulic pumps and motors (and hydraulic controls) employed. In general, we noted extraordinary attention to detail that one might not expect in machines of this size. Added to that is an evident emphasis on safety of operation, with various operator-presence and lockout devices to help keep operators from harm's way.

On average, based on the list prices furnished by the manufacturers, you can expect to pay around \$20,000 list for a mini-skid, a price that usually includes a basic dirt bucket. Your total investment, of course, will vary with the specific attachments chosen. But, that said, we think an investment in a rubber-tracked mini skid-steer loader may pay dividends in any operation that could benefit from a serious machine that can han-

dle a wide range of utility chores — especially when confined or weight-sensitive work areas are an issue.

In the pages that follow, we look specifically at the machines on site at the Mini-Skid Work Days, and the features and benefits cited are based primarily on the walk-around orientation given by each manufacturer. To learn more about these machines and other models in the manufacturers' range, we encourage you to visit their websites.

Boring Performance Averages

Average time to sink a 36-inch-deep bore with a standard-bit, 30-inch-diameter auger: **50.2 sec.**



Local 150's Tom Rush (left) attracts a crowd as he uses the Vermeer S600TX with its 30inch-diameter auger. Actually, so did Local 150's Marty Turek with the Ditch Witch SK650; the crowd is just out of the frame.



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Dingo TX 425

The Dingo TX 425 uses a bail-type steering/direction controller that is tilted fore and aft against a stationary center bar for direction control, and rotated to provide steering. A joystick controller (with lockout) is used for implement functions. The large lever on the left controls auxiliary-hydraulic engagement. For safety, all controls return to neutral when released, and a reverse-stop panel, when pushed forward, stops the machine.



Dingo TX 425
Engine

The Dingo's undercarriage — with large drive sprockets, large front idlers and five track-roller assemblies (per side) — uses 9.5-inch-wide tracks that yield a ground pressure of 3.4 psi. Lift height under the bucket hinge pin is 66 inches.

Additional Mini-Skid Models

Model	Fuel	НР	Undercarriage
TX 413	G	13	Track
TX 420	G	20	Track
220	G	20	Wheel
320D	D	20	Wheel
323	G	23	Wheel

ccording to Toro, which has been building mini track loaders since 1997, the Dingo TX 425 is designed as a tool carrier and engineered for ease of operation and productivity. The machine, says the company, can be fitted with more than 35 quick-change attachments, which are powered by a four-pump hydraulic system that produces 11.2 gpm of auxiliary-hydraulic flow at 3,000 psi. The TX 425, says Toro, can trench to depths of 3 feet and spin a 30-inch-diameter auger with ease, break concrete effectively, and work productively with a backhoe attachment.

The Dingo's Kohler Command Pro engine is a V-twin, air-cooled, horizontal-shaft model that uses cast-iron cylinder liners and an aluminum block. The 25-hp (gross @ 3,600 rpm), 44-cubic-inch-displacement, gasoline-fueled engine features Kohler's "Smart-Choke" carburetor, oil cooler, hydraulic valve lifters, full-pressure lubrication and a heavy-duty air cleaner.

Designed for ease of routine service, the TX 425 features a tilt-up hood that provides

ready access to maintenance points such as the engine-oil dipstick and hydraulic filter. Pull-up side panels on each side of the engine compartment allow additional access to service points, such as the engine-oil filter.

Engine	Kohler
Fuel	Gas
Horsepower (gross)	25
ROC (lb.)*	500
Operating weight (lb.)	1,996
Hydraulic flow, auxiliary (gpm)	11.2
Hydraulic pressure (psi)	3,000
Bucket volume (cu. ft.)	4.3
Bucket hinge-pin height (in.)	66
Travel speed, fwd (mph)	4.5
Track width (in.)	9.5
Track-on-ground (in.)	31.1
List price w/std. bucket	\$19,268
* Poted Operating Capacity @ 25% of tipping	ı load



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Boxer TD-327



The operator controls the Boxer's steering levers, located between the handgrips, with thumbs and forefingers. Similarly controlled are the boom lever (forward of left handgrip) and bucket lever (forward of right handgrip). The auxiliary-hydraulic-circuit lever is at the upper left, and the track-width controller at top center.

ompact Power's Boxer TD-327 was unique among the seven machines at the Mini-Skid Workdays in that it was equipped with an adjustable-gauge track system. A control lever on the dash allows the operator to vary the width across the tracks from 34.5 to 43.5 inches. According to Compact Power, the adjustable-gauge feature allows the Boxer to maneuver through narrow areas, such as gates and paths, yet allows a wide stance for operating stability.

The TD-327 also features a speed-control system that can be used when trenching, or when using an attachment that must be operated slowly, but with high hydraulic power. To activate the system, the operator engages the "crawl valve" with a rotary controller at the upper right of the dash. The operator then selects low-speed travel with the switch under the left handgrip, sets the throttle to the desired engine speed, then fine-tunes ground speed with the rotary "crawl-speed" controller at the lower right of the dash.

The Boxer is equipped with a three-pump hydraulic system and can produce 14 gpm of

hydraulic flow in its auxiliary circuit at a relief pressure of 3,000 psi. Powering the machine is a Perkins diesel engine rated at 26 horsepower. The TD-327 has a rated operating capacity of 600 pounds at 35 percent of its tipping load.



The Boxer TD-327 has a bucket-hinge-pin height of 75 inches and a dump height (at 45 degrees) of 59 inches.

Additional		Mini-S	Skid Models
Model	Fuel	НР	Undercarriage
TL-224	G	24	Track
Brute	G	27	Wheel

NOTE: Compact Power's Kanga range of mini-skid machines includes eight wheeled models and three new tracked models.

Engine	Perkins
Fuel	Diesel
Horsepower (net)	26
ROC (lb.)*	600
Operating weight (lb.)	2,300
Hydraulic flow, auxiliary (gpm)	14
Hydraulic pressure (psi)	3,000
Bucket volume (cu. ft.)	
Bucket hinge-pin height (in.)	75
Travel speed, fwd (mph)	3.0
Track width (in.)	9.0
Track-on-ground (in.)	
List price w/std. bucket	\$21,798

^{*}Rated Operating Capacity @ 35% of tipping load.

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Vermeer S600TX

Vermeer makes the point that S600TX controls are both easy to use and can be manipulated while the operator maintains a firm grip on the surrounding handrail, thus allowing for smooth actuation of controls even when traversing rough terrain. Note the operator-console pads below the dash.

Vermeer S600TX

The S600TX design, says Vermeer, allows the operator to stand well within the confines of the frame, providing a safe workspace and keeping overall machine length to 71 inches (rear of the frame to coupler plate) for enhanced maneuverability. Two fuel tanks, with a total 16-gallon capacity, flank the operator's station. Integral tie-down lugs facilitate transport.

Additional Mini-Skid Models

Model	Fuel	НР	Undercarriage
S600	G/D	25	Wheel

by a 25-hp, liquid-cooled Kubota D905 diesel engine, but an air-cooled gasoline engine, the Kohler Command Pro, also rated at 25 horsepower, is available as well. The S600TX features a tandem hydraulic pump in its ground-drive system, and a third (gear-type) pump for powering auxiliary functions. The auxiliary circuit is equipped with a bypass switch, which allows the operator to safely engage the system when using a backhoe, coresaw or vacuum attachment at the front of the machine.

he Vermeer S600TX on site was powered

Major controls for the S600TX include a large pilot-operated joystick for steering, a similar control for implement functions and a friction-positioned lever to activate the auxiliaryhydraulic system. The lower control panel houses the plunger-type throttle and a glowplug actuator. For operator convenience, an electrical power port is included on the dash, and for comfort, cushioned pads for the operator's torso and thighs line the ride-on compartment.

Loader-arm geometry is designed to move

attachments up and away from the front of the machine, thus eliminating inadvertent contact with large tools. Loader-arm lift height (80 inches under the bucket hinge pin) is designed to allow comfortable loading of 1-ton trucks. The S600TX has 4.5 inches of straight through ground clearance, and may be equipped with either 7or 9-inch-wide tracks.

	Gas	Diesel
Engine	Kohler	Kubota
Horsepower (gross)	25	25
ROC (lb.)*	500	500
Operating weight (lb.)	2,530	2,775
Hydraulic flow, auxiliary (gpm)	13	13
Hydraulic pressure (psi)	3,000	3,000
Bucket volume (cu. ft.)	4.0	4.0
Bucket hinge-pin height (in.)	80	80
Travel speed, fwd (mph)	4.5	4.5
Track width (in.)	7/9	7/9
Track-on-ground (in.)	39	39
List price range w/std. buc	ket \$19,40	0-\$22,500

* Rated Operating Capacity @ 35% of tipping load.



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Ditch Witch SK650



The SK650 control console uses two pilot-operated travel levers (left), a joystick-type controller for lift and tilt (green) and an auxiliary-hydraulic-system engagement lever (yellow), which is linked to a foot pedal in order to allow hands-free operation of the auxiliary system.

Ditch Witch SK650

The SK650 is equipped with a "level indicator" bar that allows the operator to assess the position of the attachment. Large fuel and hydraulicoil tanks are externally mounted. A parkingbrake lever on the left side of the machine can be applied to prevent the machine from rolling on slopes.

Additional Mini-Skid Models

Model	Fuel	НР	Undercarriage
SK300	G	13	Track
SK350	G	20	Track
SK500	G	24	Track

he Ditch Witch SK650, available since fall 2005, is the company's newest mini-skid. Powering the machine is a three-cylinder, turbocharged Kubota diesel engine, developing 31 net horsepower at 3,000 rpm. The SK650 features four hydraulic pumps: two variable-displacement types for powering the travel system, and two gear types for the implement circuits. The travel-system control levers are pilot operated (electric-over-hydraulic) and, according to Ditch Witch, the design results in precise, low-effort control with minimal vibration.

The implement control lever is a joystick type, operating the loader's lift-and-tilt functions, and an adjacent lever engages the machine's auxiliary hydraulic system. Linkage between the auxiliary lever and a foot pedal on the platform allows the operator to control auxiliary flow to powered attachments with the pedal, thus freeing hands for maneuvering the machine and adjusting the work tool. The

machine's auxiliaryhydraulic system, says Ditch Witch, delivers 20.9 hydraulic horsepower.

Ditch Witch also calls attention to a couple of the SK650's generous dimensions, such as its 81-inch lift height, and its 43-inch track-onground measurement, which, says the company, contributes to stability and low ground pressure. Supporting the track is the SK650's eight-roller undercar-

riage, which is maintenance-free. In fact, the machine has no grease fittings, using instead permanently lubricated bushings.

Engine	Kubota
Fuel	Diesel
Horsepower (net)	31.0
ROC (lb.)*	650
Operating weight (lb.)	2,630
Hydraulic flow, auxiliary (gpm)	13.5
Hydraulic pressure (psi)	3,000
Bucket volume (cu. ft.)	4.2
Bucket hinge-pin height (in.)	81
Travel speed, fwd (mph)	4
Track width (in.)	9
Track-on-ground (in.)	43
List price w/std. bucket	\$21,200

*Rated Operating Capacity @ 35% of tipping load.



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Ramrod 1150 TD

Ramrod 1150 TD

Engine	Kubota/Kawasaki
Fuel	Diesel/Gas
Horsepower (gross)	27
ROC (lb.)*	475
Operating weight (lb.)	2,400
Hydraulic flow, auxiliary (gpm)	12
Hydraulic pressure (psi)	3,000
Bucket volume (cu. ft.)	4.2
Bucket hinge-pin height (in.)	72
Travel speed, fwd (mph)	3.5
Track width (in.)	8
Track-on-ground (in.)	30.5
List price w/std. bucket	\$24,039

^{*} Rated Operating Capacity @ 35% of tipping load.

The Ramrod 1150 TD Taskmaster features a self-leveling loader mechanism that keeps the bucket level throughout the loader-arm arc. The bucket's rollback angle is 30 degrees, and its dump angle is pounds of pushing or pulling capability.

85 degrees. The 1150 TD, says the manufacturer, has 1,600

Additional Mini-Skid Models

Model	Fuel	НР	Undercarriage
910	G/D	23	Track
550T	G	16	Wheel
750	G/D	16	Wheel
800	G/D	16	Wheel
900	G/D	23/20	Wheel
944T	G/D	23	Wheel
950	G/D	24-27	Wheel

he Ramrod 1150 TD is built by Leon's Manufacturing, and the company lays claim to 20-plus years of building mini skid-steer loaders. The 1150 TD is available with a gasoline engine (27 horsepower, liquid-cooled Kawasaki) or a diesel engine (27-hp, liquid-cooled Kubota).

> The diesel powered the machine on our Workday site.

The 1150 TD's undercarriage, which uses steel reinforcement in its rubber tracks, employs large drive sprockets and a six-wheel bogie assembly that spreads the machine's weight over the bottom of the track. The bogie frame also supports a large front idler and a two-wheel top idler that doubles as the track-tension adjuster. The sloped front of the tracks, says Ramrod, allows a better view to the bucket or work tool.

The 1150 TD is a recent addition to the Ramrod line (along with models 800 and 950), and compared with pre-

> vious designs, says the company, features 35 percent more hydraulic performance from its twopump system, stronger loader mechanism (40 percent more strength in the loader-arm pins and lift-cylinder cross tube), heavier ("gusseted") frame and larger oil cooler.



The Ramrod 1150 TD's console is designed for "palm steering" with the right hand, and auxiliary-hydraulicsystem controls allow directing either 6 or 12 gpm into the system, depending on the attachment. Steel tanks that flank the operator's station — hydraulic oil (right) and fuel (left) — swing out to allow engine access.

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Thomas 35DT

The two steering levers on the left of the panel allow the machine to be "palm steered," says Thomas. To the right of the steering levers are the auxiliary-hydraulic circuit selector (flow direction is controlled by the upper-panel lever) and the joystick implement controller. The



green button on the dash must be pushed to unlock all machine functions. The fuel tank (right) and hydraulic tank (left) are integral with the machine's frame.

Thomas 35DT

The 35DT's attachment coupler is a universal (skidsteer) type. The machine's side-by-side radiator and hydraulic oil cooler (at the front of the frame) is designed for efficient cooling, says Thomas. The company also makes the point that the loader linkage is self-leveling and that the transmission housings are built into the frames and completely enclosed.

Additional Mini-Skid Models

Model	Fuel	НР	Undercarriage
25GT	G	25	Track
25G	G	25	Wheel

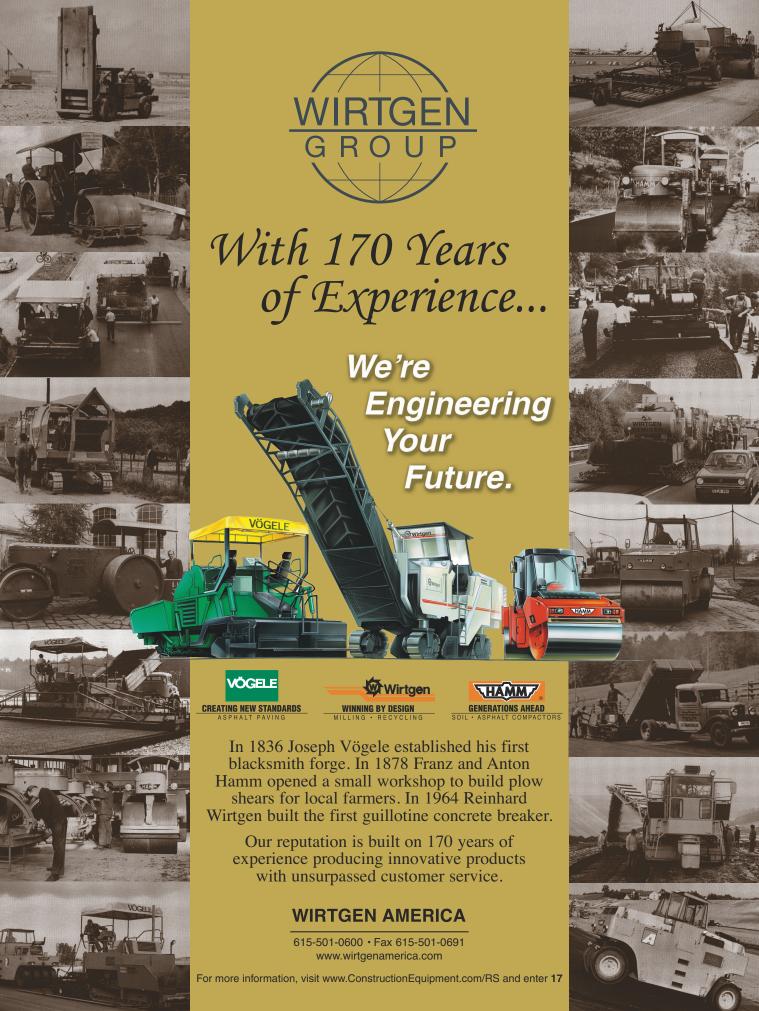
distinctive feature of the Thomas 35DT is the design of its hydraulic system. Three hydraulic valves (a selector valve, combined valve and flow-control valve) allow the operator, says Thomas, to precisely apportion hydraulic flow from the machine's two pumps between the drive system and implement/auxiliary system. The valves are positioned by two switches on the panel and a rotary-type controller.

The 35DT also provides two auxiliary-hydraulic circuits, complete with two sets of quick-connect fittings. One circuit is controlled by a cylinder spool and used for such functions as grapple operation. The second circuit is controlled by a motor spool, which allows gradual slow-down of powered attachments to protect drive motors.

The Thomas machine uses a 12-volt electrical system, with a full-size skid-steer battery, which is accessed from a panel on the lower front frame. Working lights are standard equipment, as is a 12-volt control circuit for operating electrically actuated attachment functions, such as a snow-blower chute.

A panel at the top of the operator's station folds downward to allow access to daily service checkpoints, as well as to electrical and hydraulic components. A removable lower panel gives access to the engine. To assist in positioning the machine where it needs to work (perhaps on a roof or below grade), lifting lugs are built into the top ends of the loader mechanism.

ingine	Kubota
uel	Diesel
Horsepower (net)	25
ROC (lb.)*	420
perating weight (lb.)	2,350
lydraulic flow, auxiliary (gpm)	14
lydraulic pressure (psi)	3,000
Bucket volume (cu. ft.)	3.8
Bucket hinge-pin height (in.)	68.75
ravel speed, fwd (mph)	4.4
rack width (in.)	9.05
rack-on-ground (in.)	30.25
ist price w/std. bucket	\$18,490



Cover Story: Mini-Skid Workdays

Bobcat MT55

The Bobcat MT55 control panel is designed to keep one hand on the drive/steering controls, and the other on the work-group controller. The center bar within the rectangular handrail is squeezed fore and aft to control direction, and the entire handrail assembly rotates to provide steering. The auxiliary-hydraulics lever



has a detent in each position for convenience. For safety, a button on the dash allows controlled lowering of the lift arms if the machine is disabled.

he Bobcat line of mini track loaders includes two models, both diesel powered: the MT52, rated at 18.8 horsepower and 36 inches wide; and the MT55, rated at 23.5 horsepower and 44 inches wide. The MT55, designed primarily for construction applications, can be used as a walk-behind, or can be fitted quickly with a pivoting, swiveling rideon platform.

The MT55 borrows technology from its larger track-loader counterparts in the Bobcat range, using, for example, the same type of elevated-sprocket undercarriage. The elevated sprocket, says the company, keeps the drive motors out of the dirt and provides a more efficient, less stressful transfer of power from the sprocket to the track. The MT55 also uses the same Bob-Tach coupler as larger Bobcat models, facilitating the use of Bobcat attachments.

> The MT55 powers its attachments with an auxiliaryhydraulic system that produces 12 gpm at 2,900 psi.

> The MT55 also features a reverse-speed limiter, a sliding control that can be adjusted to desired reverse speed (0-1.5 mph) to avoid having to continually

feather the drive controls — for example, when trenching. And when operating in reverse, a reverse-stop panel protects the operator from unseen obstacles behind.

Bobcat MT55

Engine	Kubota
Fuel	Diesel
Horsepower (net)	23.5
ROC (lb.)*	550
Operating weight (lb.)	2,696
Hydraulic flow, auxiliary (gpm)	12
Hydraulic pressure (psi)	2,900
Bucket volume (cu. ft.)	6.7
Bucket hinge-pin height (in.)	71.3
Travel speed, fwd (mph)	3.5
Track width (in.)	10
Track-on-ground (in.)	34
List price w/std. bucket	\$17,331

MT55 has a ground pressure of 4.1 psi. The ride-on platform *Rated Operating Capacity @ 35% of tipping load. that the machine on site used can be quickly attached with

Equipped with its standard 10-inch-wide tracks, the Bobcat

two pins.

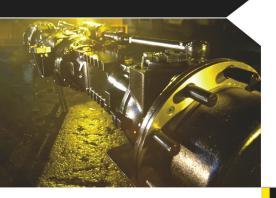
Additional Mini-Skid Models

Model	Fuel	HP	Undercarriage
MT52	D	20	Track





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Production Heroes: Telehandlers

By LARRY STEWART, Executive Editor

Stability Triangle Determines if Telehandlers Tip

There are many facets to safe operation, but keeping them upright is key to keeping them productive

n the late 1990s, OSHA required that telehandler operators be trained, but didn't specify what that training should include. Mike Popovich, training director at JLG, uses an all-encompassing five-step approach to teaching accident avoidance that asks five important questions:

ive Steps

- **1) Walk-around inspection** Is the unit safe, visually?
- **2) Worksite assessment** Is the worksite safe to operate in?
- **3) Function test** Is the unit safe, functionally?
- **4) Proper operation** Am I operating safely?
- **5) Proper shutdown** Is the unit in a safe place and shut down properly?

At the center of this regulation, and the five steps, is a machine that stands on a triangular footprint and lifts heavy weights to impressive heights. Of course, there are other dangers, but the key objective is to keep the telehandler upright.

The two front wheels and the rear-axle pivot point form a telehandler's triangular base. The rear wheels are not part of the base because the rear axle typically oscillates. As long as the machine's center of gravity (the point in three dimensions around which the machine's weight is balanced) remains oriented inside this stability triangle, the telehandler remains upright.

Adding a load to the forks while the boom is down moves the center of gravity forward and down. Raising the load will move the center of gravity up and to the rear, while at the same time causing the stability triangle to shrink. The higher you lift a load, the less margin for error you have because the stability triangle becomes smaller.

A small stability triangle leaves less room for the center of gravity to wander left or right if the frame is not per-

fectly level. Imagine the center of gravity as a plumb bob hanging from the boom. You'll always find the center of gravity somewhere on a perfectly vertical line between a point on the boom and the center of the Earth. If the frame's not level, the center of gravity will not be oriented over the machine's centerline. But the stability triangle is always aligned with the telehandler centerline.

With the boom raised and extended (the stability triangle very small), the frame only has to be slightly out of level to make the center of gravity drift to either side of the triangle. The laws of physics are as certain as gravity. The moment the machine's center of gravity moves beyond the boundaries of the stability triangle, the telehandler begins to tip.

At any jobsite, there are things affecting the stability of a telehandler other than where you put the boom. You may be on a 1-degree side slope, in a 5-mile-per-hour wind. There may be a little ice under your wheels, and one tire a little low on air pressure. If the machine goes over, there may be no single cause. It was a combination of factors that are all things you can catch and correct or avoid if you do all of the Five Steps.

A safe lift starts well before putting the boom in motion, or even before the operator assesses the site for hazards. Most of today's telehandlers are designed with a quick-attach coupler at the end of the boom. Before installing an attachment, be sure it's approved by the telehandler manufacturer and that its specific capacity chart is in the operator's station.

"It's an OSHA violation to run a machine if the proper load chart for that particular combination of machine and attachment isn't in the machine," Popovich says.

Make sure forks haven't been tampered with. Other than block forks, all forks should be used in matched pairs. Block forks are used in matched sets.

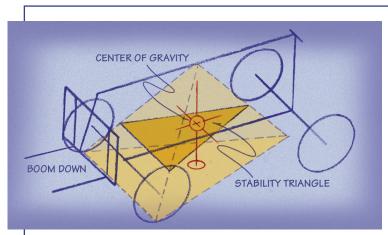
"Putting on and taking off attachments is critical,"

adds Marty Turek, curriculum developer/instructor, Operating Engineers Local 150. "You have to make sure it's secure."

The maximum capacity of a telehandler-and-attachment combination will be the lightest of these: capacity stamped on the attachment identification plate, the fork

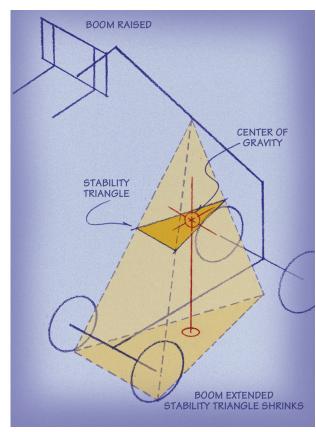
capacities stamped on the side of each fork (fork capacity is multiplied by the number of forks on the attachment, not to exceed the maximum on the attachment ID plate), maximum capacity indicated on the proper load chart, or the load rating of the telehandler.

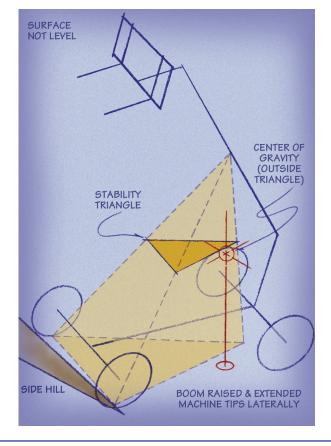
Referring operators to the capacity chart can be eas-



Shrinking Stability Triangle

Telehandlers stand on a triangular base formed by the two front wheels and the pivot point on the rear axle. As long as the machine's center of gravity remains within the stability triangle, the telehandler is stable. Loading the forks moves the center of gravity forward and down. Raising the load will move the center of gravity up and to the rear, while at the same time causing the stability triangle to shrink. The greater the boom angle and extension, the smaller the stability triangle. If the frame's not level, the center of gravity wanders toward the edge of the triangle. If the machine is far enough out of level, the center of gravity drifts beyond the boundaries of the stability triangle and the telehandler begins to tip.

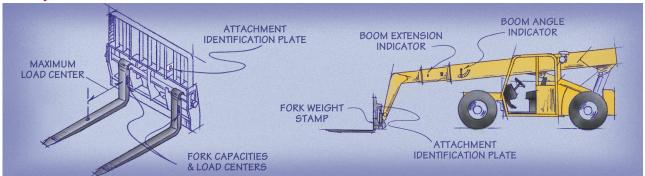




Construction Equipment.com Construction Equipment | February 2006

Production Heroes: Telehandlers

Always a Perfect Match



Before installing an attachment, verify that it is approved and the telehandler is equipped with the proper capacity chart (NOTE: Never use an attachment without the appropriate capacity chart installed on the telehandler.) To determine the maximum capacity of the telehandler and attachment, use the lightest of the following capacities:

- Capacity stamped on the attachment identification plate
- Fork capacities stamped on the side of each fork. Fork capacity is multiplied by the number of forks on the attachment (not to exceed the max. capacity stamped on the attachment ID plate)
- . Maximum capacity as indicated on the proper capacity chart
- Load rating of the telehandler and the capacity of the forks or attachment

The boom angle indicator and boom extension indicators will be crucial to determining that the lift remains within the load zone identified on the capacity chart.

ier said than done on many jobsites because the weight of the load is not always known. Construction sites require a lot of general lifting that obviously doesn't approach a telehandler's limits, though — miscellaneous materials and tools that need to be unloaded and kept out of the way. As long as the telehandler is properly equipped and maintained, the operator assesses the site for hazards and makes these lifts carefully, work can continue without knowing the exact weight of each load.

"But every experienced operator knows when they're about to lift something that's going to test a machine's limits," Popovich says. "The key is to find out how much loads weigh."

Truckers can be a reasonable source of information, as can project supervisors, and sometimes the subcontractor or crew chief that will be working with whatever's on the pallet. If general inquiry fails, though, there are few options for determining the safe boundaries for a lift.

Equipment manufacturers can't recommend picking up the load and extending the boom forward until you feel the rear wheels getting light. It is intentionally destabilizing the machine. It's not likely to result in immediately recognizable damage, but the practice is discouraged because if the machine tips forward and lands on the pallet, it can damage the load and accelerate boom wear.

But by extending the load to the point where it reaches the machine's stability limit, you can use the load chart to estimate its weight. Find the boom angle on the chart on the following page and follow it out to the zone matching the boom extension. The load weighs more than the weight limit printed in that load zone.

Handle this estimate with extreme caution. You've exceeded the safety factors built into the load chart, so the margin for error becomes very slight. Don't plan a lift at the furthest reaches of the stability range using this estimate, and observe sta-

bility-enhancing procedures dealing with frame level, tire pressure, load center and the like meticulously.

"Whenever you test the limits of the load chart you should do a test pick without a load on the forks — position the telehandler as you plan for the actual lift and run the forks up to where you plan to place the load," Popovich says. By noting the boom extension and boom angle at the extreme point of the lift, this exercise confirms the vertical height from ground level where the load is to be placed, and the horizontal distance from the front tires to where the load will be placed.

On the capacity chart, find the horizontal line for the height of the lift and follow it over to where it intersects the line for the distance. The point where the two lines meet should fall within a load zone marked on the chart. If it doesn't, the machine and attachment can't complete this lift. The weight indicated in the zone where the height and distance lines intersect is the maximum capacity for this lift. If the two lines meet on a boundary between zones, use the lighter of the two weights for this lift's limit.

Check the boom-extension and boom-angle limits of this load zone on the capacity chart. When the load is in the air, no matter what happens, do not exceed those boom-extension and angle limits or the machine will tip.

All of the loads shown on capacity charts are



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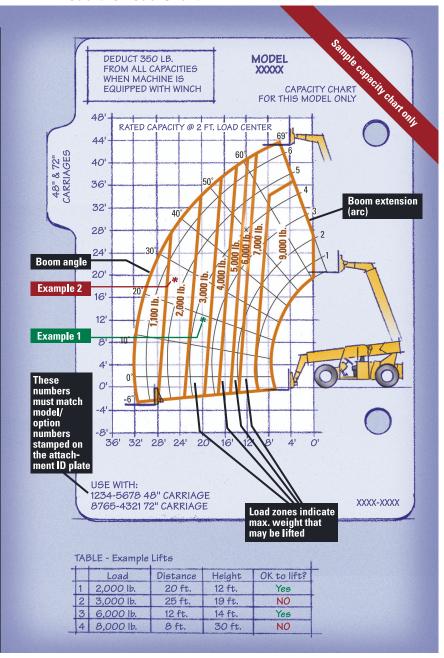
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Production Heroes: Telehandlers

Read the Load Chart



To use a capacity chart, the operator needs:

- An attachment approved by the telehandler manufacturer
- The right capacity chart for that telehandler model and attachment
- . Weight of the load to be lifted
- · Vertical height from the ground where the load is to be placed
- Horizontal distance from the front tires to where the load will be placed

On the chart, find the horizontal line for the height of the lift and follow it over to where it intersects the line for the distance. The weight indicated in the load zone where the two lines meet is the maximum capacity for this lift. Determine the boom-extension and boom-angle limit.

assigned with the assumption that the machine is on firm ground with the frame level; forks positioned evenly on the carriage; load centered on the forks; proper size tires properly inflated, and the telehandler in good operating condition. Failing to comply with any of these conditions could tip the machine over.

Once you've determined that the lift is within the telehandler's and attachment's capabilities, it's time to set up the machine. Never engage a load or lift a load more than four feet above ground unless the telehandler is level.

"One of the things we always emphasize in our training classes is, when you get ready to place a load: Park Brake; Neutral; Level," Popovich says. "We drill it into people just like that."

Stop the machine on a stable surface in the best place to lift and place the load, set the parking brake and shift the transmission into neutral. Before raising the boom, check the level indicator to see if the frame needs to be leveled from side to side. Many telehandlers have hydraulically tilting main frames that allow you to compensate for uneven terrain. Some have outriggers. Set the boom in the "carry" position — forks less than four feet off the ground — and level the machine. The machine should be ready to make the lift.

Never use the leveling system (sometimes called "frame sway") or outriggers to level the telehandler after the load is more than four feet off the ground. After the load is in the air, if you discover that the telehandler is not level, bring the load back down before leveling the frame.

"We instruct operators not to use the frame sway to position the load with the boom elevated," Popovich says.

The higher up you go, the closer the sides of the stability triangle are — you don't have to go very far to move the center of gravity outside the triangle. If you use the frame sway with a load high in the air, the boom only has to move a couple of degrees right or left and the machine may tip over.

If the telehandler isn't level when you reach the limits of the frame-leveling system, don't attempt the lift until the problem is solved. Reposition the telehandler on more-level ground, or have the surface where it is standing

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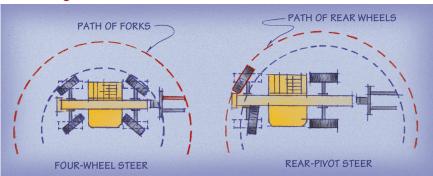
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Production Heroes: Telehandlers

Watching Front or Rear?



On front-wheel- and four-wheel-steer telehandlers, the forks cut the widest circle when turning, so you have to keep an eye forward to avoid obstacles. But the rear wheels of a pivot-steer Gradall telehandler turn the widest circle on those machines, so you have to look to the rear to be sure the wheels and counterweight don't collide with anything.

leveled.

Always lift the load slowly, watching closely for changes in the footing or other conditions that could cause the frame to shift out of level. Don't move the machine once the load is more than four feet off the ground.

Placing a load at height requires a careful combination of multiple functions — boom down, boom out, while holding the forks level.

"One of the most important things to remember is to maintain constant engine rpm so the hydraulic flow remains the same," says Turek, from the Operating Engineers. "People in tense situations often want to let off the throttle, but the change in engine speed slows down the hydraulic flow, which changes what the levers do. You want to run at a high rpm all the time so the hydraulic performance is predictable, and feather the controls to control the lift."

Machines with the carriage-transfer feature, which

Training Resources

For more information about the range of operator training available from the sources in this story contact:

Bobcat Co. - (701) 241-8700 www.bobcat.com/training/index.html

International Union of Operating Engineers Local 150 - (815) 436-4150 www.asiplocal150.org

JLG Industries - (877) 554-5438 www.jlg.com

VISTA Training - (800) 942-2886 www.vista-start-smart.com slides the entire boom forward hydraulically, simplify the procedure. But the machine's load capacity is derated for any carriage position forward of the rear-most position.

Turek says most of Local 150's telehandler operators take the OSHA 10hour safety awareness training and learn a lot about their job from the section on scaffolding. He recommends that program or any of OSHA's scaffolding-specific programs to all telehandler operators.

Once the lift is complete, the boom should be retracted and lowered to the carry position before the telehandler is moved.

Telehandlers are designed to handle rough terrain, but that doesn't mean they can be driven without regard for the terrain. Risk of tipping or load loss is much greater when traveling on slopes. If you must drive on a slope, keep the load low and proceed

slowly, with great care. Before you get on the slope, downshift to a lower gear and four-wheel drive. Engine braking will help control the telehandler's speed. Avoid turning on a slope, but if you must turn, make the turn as wide as possible and use extreme caution.

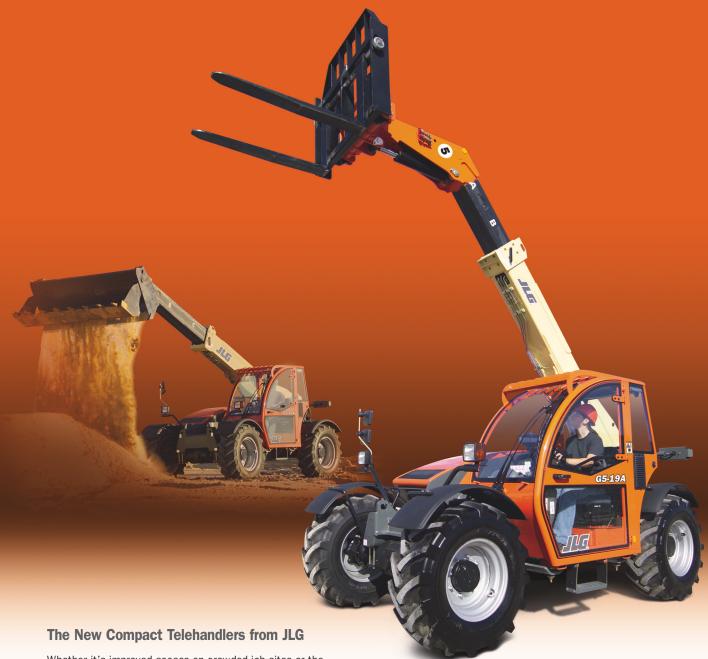
Never drive across excessively steep slopes under any circumstances. Ascend and descend slopes with the heavy end of the telehandler pointing up the incline. When there's no load on the forks, the counterweighted rear of the machine is the heavy end, so you should back up slopes. When the telehandler is loaded, the front of the machine is the heavy end, so you should back down slopes

Operator training becomes very important on a mixed jobsite — with rear-pivot machines and coordinated-steering machines on the same jobsite where everyone is allowed to run all the equipment. Someone accustomed to operating a coordinated-steer machine jumps on a rear-pivot machine. One really significant difference between the way those two machines operate has to do with what part of the machine extends outside the turning radius.

The load or the forks cut the widest swath in a tight turn on a four-wheel-steer machine. But on the rear-pivot machine, it's the counterweight or the outermost rear wheel that's at the edge of the turning radius. In either case, the operator has to look in the direction of travel to be sure the path is clear. But in cases where the operator is using a machine with rear-pivot steering, it's especially important to be aware of the counterweight.

The things an operator does to ensure safe telehandler use don't take a lot of time. Accidents tend to happen when people neglect basic safety requirements in the name of speed.

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The Power To Do More

Buying File: 10- to 20-Ton Excavators

By LARRY STEWART, Executive Editor

Wringing Huge Work Out of Compact Excavators

Tag-trailered crawler excavators can expand a contractor into big-production jobs

ore than 45 hydraulic-excavator models between 20,000 and 40,000 pounds compete for your purchase dollars. Enough money is being spent on machines this size that the scent of cash and desire to supply the big rental houses attracted no less than four manufacturers to field their first excavators in the size class over the past 30 months.

Four of the six models brought to market by new competitors Ingersoll Rand, Takeuchi, Terex, and Yanmar combine features in a way that's indicative of why the excavators in this size class can be King Kong compacts. They're nearly-100-hp machines with features common to compacts such as swinging (or articulated) booms, minimum swing radius, and options for rubber or steel tracks.

Takeuchi's 31,500-pound TB1140, for example, is the largest excavator in the North American market whose standard equipment list includes a boom mounted to the upper frame at a hinge point like so many compact excavators. The swinging boom impinges on the machine's power somewhat (its lifting

capacity over the idlers at a 20-foot radius with the load at ground level is comparable to machines that weigh a ton less). But a swinging boom allows the machine to dig a hole with sides parallel to its tracks the entire width of the machine without need for repositioning.

Caterpillar, Komatsu, and Kobelco offer alternatives to the swing boom usually called offset boom machines. These units will also excavate parallel to the tracks the full width of the machine, but accomplish it with a boom that has two joints rather than mounting a rigid boom with a hinge to the frame. Optional offset booms on Cat's 314C and Kobelco's 135SRLC actually push the feature up to the 33,000-pound size range.

Nineteen of the 10- to 20-ton excavators available today — nearly half — are reduced-swing-radius, or zero-swing-radius machines. The counterweight and boom on these machines extend only inches beyond the track width so they can work effectively in very small or congested areas without risk of swinging into obstacles. Manufacturers produce reduced-radius machines by installing a larger counter-

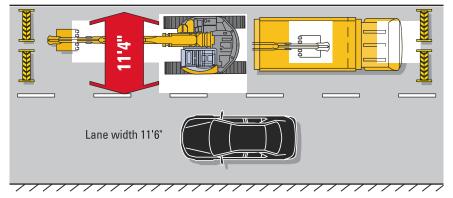
weight and changing frame geometry to preserve lifting and digging capacity.

Most machines in the class were upgraded to the latest technology in 2003 and 2004 when they had to comply with EPA's Tier 2 emissions regulations. Reduced-swing-radius machines have dominated new introductions since then.

"There is increasing demand in certain applications for zero swing machines to work in smaller and smaller spaces, while maintaining high outputs," says

Changes in frame design, boom mounting and weight distribution keep the boom and counterweight on reducedswing-radius machines from extending more than a few inches beyond the track width. These machines can work within a single lane of traffic or up against buildings or road banks.

Source: Komatsu





Nineteen of the 10- to 20ton excavators available today — nearly half — are reduced-swing-radius, or zero-swing-radius machines like Hitachi's Zaxis. Recent innovation in this class of excavators has been dominated by introduction of reduced-radius machines.

Dave Hardwick, excavator product manager at JCB. "The push to constantly reduce the build time on developments has increased the need for high output, high efficiency machines that can carry out large amounts of ground works and utility works every day."

The heaviest reduced-radius excavator in this class is Komatsu's 36,400-pound PC158USLC-2. With an 8 foot-2 inch stick, it can pick up 8,700 pounds at a 20-foot lift radius. But reduced-radius excavators do sacrifice some digging and lifting leverage in order to get a shorter upper frame.

Comparisons are telling. Komatsu's reduced-radius PC138USLC-2, at an operating weight just under 31,000 pounds, develops stick-digging force of 13,670 pounds. The conventional PC120LC-6 (3,200 pounds lighter) applies 13,890 pounds of stick-digging force.

John Deere's reduced-radius 135C RTS, with an operating weight of 30,400 pounds, moves the stick with 12,800 pounds of force. The 28,800-pound 120C (1,600 pounds lighter) develops 13,172 pounds of stick force.

"As customers continue to look for improved efficiencies in their business, smaller machines are asked to do more demanding jobs in a wider variety of applications," says Jason

Williamson, excavator product manager at Caterpillar. "Machines in this size class are easy to transport and very maneuverable. They can be general purpose or dedicated machines and can be used in many different digging and tool applications."

This dichotomy of expectations for 10- to 20-ton excavators — compact machines that

transport on a tag trailer behind a dump truck but are capable of significant productivity — is underscored by a marketing emphasis on the efficient productivity of the current generation.

"The data shows that even though Tier 2 machines were updated and power output was increased, fuel efficiency also increased," says Dave Pooley, excavator product manager at Hyundai. As an example, he notes that the R160LC-7 has 11 percent more horsepower than the Dash-3 machine

Web Resources

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Specifications ConstructionEquipment.com Case www.casece.com Caterpillar www.cat.com Doosan Daewoo www.dhiac.com www.gehl.com Gehl Hitachi www.hitachiconstruction.com Hyundai www.hceusa.com Ingersoll Rand www.irutilityequipment.irco.com/ **JCB** www.jcbna.com John Deere www.deere.com Kobelco www.kobelcoamerica.com Komatsu www.komatsuamerica.com Link-Belt www.lbxco.com Mustang www.mustangmfg.com New Holland www.newhollandconstruction.com Takeuchi www.takeuchi-us.com Terex Construction www.terexca.com

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Buying File: 10- to 20-Ton Excavators

it replaced, but its rated fuel consumption is 1.6 percent less. Horsepower didn't change in the R140LC with the Dash-7 version, but fuel economy improved 4.5 percent.

As with most diesel-powered equipment, emissions regulations and the computer control of fuel injection necessary to meet exhaust limits paved the way for this sort of advancement in all excavator brands. Excavators squeeze all the benefit from digital control by coordinating a controller on the engine with one in command of the hydraulic pumps and motors.

To illustrate how far control technology has come, consider Komatsu's PC160LC-7 compared to its predecessor, a nearly 3,000-pound-heavier PC150LC-6. The PC160 deliv-

ers 29 percent more bucket digging power and its arm-digging force and lifting capacity are both 11 percent greater.

Electronic systems are also providing an unprecedented amount of quality information about the recent history of a machine's performance and operating problems.

"The Deere Machine Information Center (MIC) is a data logger integrated into each machine," says Mark Wall, John Deere excavator product manager. "This data logger records machine information such as engine rpm, hydraulic oil and engine coolant temperature, pump pressures, machine alarms and codes, time spent traveling, time spent swinging, and idle time. The information can be transferred to

a customer's computer via a Palm Pilot. Reviewing this information, the customer can make important decisions concerning his machine and application."

Technology has not advanced effort-lessly, however.

"Most people agree the laws to improve the air quality are necessary, but we have seen in the past few years that the technology [necessary to satisfy air-quality laws] is outrunning the trained engine specialists and all too often the engine suppliers are not keeping on top of the distributor network to bring [training] standards up to where they should be," says Dave Pooley, excavator product manager at Hyundai. "Engines with computer control are the way of today and the future. Manufacturers have to cope with that and increase training programs and simplify the way information in the computer is downloaded and disseminated."

Tier 3 will apply to the 100-hp and larger engines in this size class in 2007, so look for a spate of new-machine introductions and major line renovations later this year. Only a third of the excavators in the class have engines 100 horsepower or larger, though.

Machines up to 100 horsepower will have to comply with Tier 3 emissions limits in 2008, so most of the excavators between 10 and 20 tons that have not yet been upgraded will likely get a major facelift before the end of next year.

Specifications: 15- to 20-Ton Excavators (by weight)

Operating Model	Arm (stick) Weight (lb.)	Max. Dig Length	Lift Over Depth	Net End (lb.)*	НР
Hitachi Zaxis 135US	30,424	9′ 11″	19′ 9″	5,830	88
John Deere 135C RTS	30,441	9′ 11″	19′ 9″	5,830	88
Doosan Daewoo Solar 140LCV	30,644	8' 2.4"	18′ 6″	6,940	95
Terex TXC 140LC-1	30,644	8' 2.4"	18′ 6″	8,740	95
Hyundai R140LC-7	30,821	8′ 2″	18′ 4″	7,280	105
Kobelco 135SRLC	30,865	9′ 8″	19′ 7″	6,200	94
Komatsu PC138USLC-2	30,975	8′ 2″	18′ 0″	6,960	86
Takeuchi TB1140	31,484	8′ 5″	18′ 0″	5,789	83
Kobelco 115SRDZ	31,747	8′ 0″	18′ 1″	8,300	84
JCB JS130LC	32,143	8' 2.4"	18′ 3″	7,606	94
New Holland EH130LC	32,187	9′ 8″	19′ 7″	6,700	94
JCB JZ140	32,291	8' 2.4"	18′ 3″	6,680	98
Caterpillar 314C LCR	32,650	9′ 10″	19′ 6″	7,950	90
Hitachi Zaxis 160LC	35,494	8′ 6″	19′ 2″	8,496	110
John Deere 160C LC	35,620	10′ 2″	20′ 10″	8,413	109
Kobelco ED150 Blade Runner	35,715	9′ 8″	19′ 2″	7,070	94
Link-Belt 160LX	36,156	8′ 10″	20′ 1″	8,380	101
Case CX160	36,226	8′ 10″	20′ 1″	8,389	106
Komatsu PC158USLC-2	36,381	8′ 2″	17′ 6″	8,700	99
Komatsu PC160LC-7	36,740	8′ 7″	19′ 7″	9,300	110
Kobelco SK160LC-DA	36,817	10′ 2″	21′ 7″	9,550	112
New Holland EH160 LC	36,817	10′ 2″	21′ 7″	9,550	112
Caterpillar 315C L	36,927	10′ 2″	21′ 6″	9,050	110
Volvo EC160B LC	37,920	8′ 6″	19′ 10″	10,510	109
JCB JS160LC	38,173	10′ 0″	20′ 7″	9,612	109
Doosan Daewoo Solar 175LCV	38,360	8′ 6″	20′ 5″	9,750	118
Hyundai R160LC-7	38,360	8' 6.4"	19′ 11″	9,940	116
Terex TXC 175LC-1	38,360	8′ 6″	20′ 5″	9,760	118

^{* 20-}foot radius at ground level (Bucket sizes range from 0.3 to 1.5 cubic yards.)

To compare specifications on the full range of excavators, click on "Specifications" at ConstructionEquipment.com.

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Gallery of 10- to 20-ton Excavators

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Number of models: 2

Product-line features: The Breaker mode provides in-cab flow control for attachments like the corresponding Kobelco models. With only 9 inches of counterweight overhang, the EH130 LC can work within a 13 foot-8 inch width.

For more information, visit ConstructionEquipment.com/info





DOOSAN INFRACORE Computer Coordinates Power and Pumps

Doosan Daewoo improved its EPOS electronic controller for excavators in this size range. The system coordinates engine and hydraulic efforts to match the horsepower, hydraulic flow and operating pressure to the demands of each job. Upgraded electronics also simplify selection of work modes.

Number of models: 2

New models: Solar 140LC-V and 175LC-V

Product-line features: A hydraulic diagnostic system can be accessed via laptop to display work history as well as real-time performance data in graphed or numeric format. The system stores fault-code history in memory for later analysis.

For more information, visit Construction Equipment.com/info

V O L V O

Engines Claim Top Fuel Economy

The turbocharged and intercooled, six-cylinder Volvo engine introduced with the B Series excavators is designed specifically for excavation work. "With high torque at low revs, it gives the lowest fuel consumption on the market," says Lars-Inge Larsson, Volvo's excavator product manager. The EC140B meets emissions limits with a turbocharged four-cylinder diesel. A heated, air-suspension seat and electronic cab-climate control keep the operator productive.

Number of models: 2

Product-line features: The standard auxiliary hydraulic circuit supplies one-way or twoway flow for use with a thumb, hammer or other powered attachments.

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Gallery of 10- to 20-ton Excavators



CATERPILLAR Largest with Offset Boom

A power-offset boom is available for the 314C CR (minimum-swing-radius model), giving it the ability to dig parallel with the edge of the tracks. Unlike the articulating boom, or swinging boom, which hinges at the base of the boom only, Cat's power offset boom is a custom option with two hinge points built into the boom. The 32,600-pound unit is one of the largest excavators with the capacity to excavate the entire width of the machine with walls parallel to its tracks. Cat's electronic-control system automatically selects boom and swing priority and delivers full engine power as needed.

Number of models: 4

Product-line features: Cat's Pin Grabber Plus hydraulic quick coupler for attachments is available from the factory throughout the 10- to 20-ton range, as are medium pressure circuits. These circuits increase machine compatibility with powered work tools that include tilting or rotating mechanisms.

For more information, visit ConstructionEquipment.com/info

CASE Works Within One Traffic Lane

The CX135 minimum-swing-radius excavator is able to work in confined spaces, such as a single lane of traffic. Case says the selectable cushion control on the boom and arm functions increase material retention while reducing shock loads.

Number of models: 3 New model: CX135

Product-line features: Auto work mode simplifies machine operation by automatically matching the boom, stick and swing priority to the task at hand. Bypass filtration, like the Nephron system of its LBX counterparts, protects Case hydraulic systems. For more information, visit Construction Equipment.com/info





KOMATSU Investments in Cab Silence

Komatsu installs a partition between the cab and engine compartment, an airtight valve compartment and viscous cab mounting to reduce noise levels in the cab. A hybrid oil filter with 25 percent of its media surface given over to microglass media, quadruples the hydraulic-oil-filter change interval to 1,000 hours.

Number of models: 4

Product-line features: Komatsu says it is the only excavator manufacturer that designs and produces all the major components for its own excavators. The company's variety of excavators in the 10- to 20-ton class includes two conventional machines, the PC120LC-6 and PC160LC-7 and two minimum-swing-radius machines, the PC138USLC-2 and PC158USLC-2. For more information, visit ConstructionEquipment.com/info

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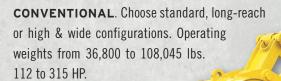


short radius. Four highly-maneuverable models designed to work in crowded spaces. Operating weights from 31,750 to 57,300 lbs. 84 to 148 HP.

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productivity of an excavator and dozer in one. Operating weight of 35,270 and 43,700 lbs.





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Gallery of 10- to 20-ton Excavators



KOBELCO

Just 5 Inches Wider Than Tracks

The counterweights on Kobelco's short-radius 115SRDZ and 135SRLC excavators never extend more than 5.1 inches beyond the tracks. Kobelco says its minimum-swing-radius Blade Runner ED150 will dig and lift more than a 14-ton excavator and push dirt like a midsize dozer. The Blade Runner has a six-way power angle tilt blade, sealed and lubricated track chain and rollers, and standard curved track shoes for precise turning like a dozer.

Number of models: 5

Product-line features: Kobelco boasts of the smooth starts and stops and more precise bucket placement with its shock-dampening swing valve. The valve dampens rebound caused by gear train backlash in the swing system. With minimum-swing-radius units, a Blade Runner, and conventional excavators, Kobelco squeezes five models into a 30,000- to 40,000-pound range. For more information, visit ConstructionEquipment.com/info

INGERSOLL RAND

Articulated Boom at 14 Tons

The ZX-125 zero-tail-swing excavator weighs 27,563 pounds and uses the same water-cooled, 94-hp Deutz diesel as Terex's HR42. Both machines are sourced from Terex Atlas in Germany. An articulated boom allows the ZX-125 to dig parallel to the tracks and excavate the entire width of the machine without repositioning.

Number of models: 1

New model: ZX-125

Product-line features: An optional open-flow return for the auxiliary hydraulic line allows a hammer or similar attachment to be installed without requiring special return lines. For more information, visit ConstructionEquipment.com/info



YANMAR

Enters a New Size Class

Yanmar breaks into the 10-ton size category with its largest excavator, trading zero tail swing for what it calls "ultra-tight tail swing" on the SV 100. The counterweight overhangs the track width by about a foot. The new machine, with more than 16 feet of dig depth, outweighs the VIO75 by about 3,000 pounds, and packs a 73.5-hp turbo diesel. Yanmar says its three-pump hydraulics increase power and fuel economy.

Number of models: 1 New model: SV 100

Product-line features: Yanmar's hydraulic bucket coupler is standard equipment, as is a dozer blade. Cab and air conditioner are also standard. For more information, visit Construction Equipment.com/info

HYUNDAI

Auto and Manual Control Choices

When Hyundai introduced the Robex Dash-7 excavators to replace the Dash-3 machines with Tier 2 compliance, they also carried a hydraulic upgrade. Mode selections offer the operator a choice of hydraulic speed and power settings. The operator can fine tune the engine speed and power using the manual throttle dial or select the automatic modes to give the computer control of engine power.

Number of models: 4

Product-line features: Hyundai upgraded the electrical systems in its Dash-7 excavators with newly designed, premium wiring made especially for oil resistance and heavy-excavator application. New insulation and a specially wound wire core strengthen the wire, and connectors are all water resistant. For more information, visit ConstructionEquipment.com/info





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Gallery of Excavators

GEHL

Compact with Big-Machine Power

Gehl changed the power source in its 25,400-pound 1202 from a Yanmar Tier 1-certified diesel to John Deere's 4045TF270 Tier 2 turbocharged engine. To find an excavator with more than the 1202's 99 horsepower, you have to start looking at machines that weigh almost 2,000 pounds more.

Number of models: 1

Product-line features: The 1202 combines compact-excavator features such as a standard dozer blade, auxiliary hydraulics, and independent boom swing with the power of larger excavators. For more information, visit ConstructionEquipment.com/info





MUSTANG

Powered Like Machines 1 Ton Heavier

Mustang puts its ME12002 model number and brand on the same excavator as Gehl's 1202, so Mustang reports the same change in diesel engines for the 25,400-pound unit from Yanmar to turbocharged Deere power. The ME12002 packs more horsepower than any other machine up to 2,000 pounds heavier.

Number of models: 1

Product-line features: The ME12002 puts compactexcavator features such as a dozer blade, auxiliary hydraulics, and independent boom swing and rubber-track option together with the power of larger excavators.

For more information, visit ConstructionEquipment.com/info

TEREX

New Entries under 20 Tons

Terex added 10- to 20-ton excavators to its product line within the last 30 months courtesy of the Terex Atlas division in Germany and a marketing agreement with Doosan Daewoo. They offer the HR42 with zero turning radius, articulating boom, and standard dozer blade at 27,563 pounds. The more conventional TXC140LC-1 at 30,600 pounds and the TXC175LC-1 at 38,360 pounds have very similar cousins being marketed by Doosan.

Number of models: 3

New models: HR42, TXC140LC-1, TXC175LC-1

Product-line features: The models are equipped with load-sensing hydraulics.

For more information, visit ConstructionEquipment.com/info





JOHN DEERE

Consistent Power

John Deere says its Powerwize II electronic system manages engine and hydraulic system to deliver predictable performance. "The hydraulics perform the desired function when the operator wants that function, every time," says Mark Wall, excavator product manager. Service intervals have been extended in the same ways as the Hitachi counterparts. Greasing interval for the boom and arm joints has been extended to 500 hours. Engines will run 500 hours between oil changes and the hydraulic-oil change interval has been increased to 4,000 hours.

Number of models: 3 New model: 135C RTS

Product-line features: All 120C and 160C LC models are built with heavy-duty, high ambient cooling systems with wide radiator-fin spacing and airfoil fan blade. For more information, visit ConstructionEquipment.com/info

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Gallery of Excavators

LBX

Return Accumulator Speeds Hydraulics

Link-Belt excavators reuse hydraulic oil returning from the arm and boom to reduce cavitation and back pressure. LBX claims a 20-percent improvement in cycle times and 10-percent improvement in 90-degree swing-and-dump operations compared to "conventional models."

Number of models: 3

Product features: The Nephron Filtration System is said to eliminate hydraulic-fluid contaminants of 1 micron or more in size and extend the service life of hydraulic components.

For more information, visit ConstructionEquipment.com/info





Zero Swing at 30,000 Pounds

The JZ140 extends JCB's zero-tail-swing line into the 30,000-pound size class. Restyled cabs upgrade the operator's view of work and the controllability of the JS130 and JS160. The AMS controller offers manual or automatic control of engine and hydraulic speed and power.

Number of models: 3

Product-line features: JCB worked to improve service access on the New Generation range. A bypass hydraulic filter, the Plexus system, extends hydraulic-oil change intervals to 5,000 hours

For more information, visit ConstructionEquipment.com/info

TAKEUCHI **Biggest Is Much Bigger**

The 31,500-pound TB1140 is 14,300 pounds heavier than the next excavator in Takeuchi's line. The excavator features independent boom swing, or an articulated boom, and its 83-hp Isuzu diesel has an emergency engine shutdown/return-to-idle system. Takeuchi claims that simultaneous operation of cab-swing and digging functions will not slow its working speed. The TB1140 is expected to

retail for less than \$130,000.

Number of mod-

New model: TB 1140

Product-line features: Primary

and secondary two-way-flow auxiliary

hydraulics are plumbed to stick.

For more information, visit ConstructionEquipment.com/info

HITACHI

Less Fuel Delivers More Power

The Zaxis excavators were introduced in 2003 with improvements measured in cycle times and digging force even with increased fuel economy. Hitachi says its Auto-Accel power mode, which varies engine speed to match hydraulic-system pressure can cut fuel use by 10 percent in light-load applications. The greasing interval in boom and stick joints increased to 500 hours with special bushings and thrust plates. Engines go 500 hours between oil changes, and the hydraulic-oil-change interval is stretched to 4,000 hours.

Number of models: 3

New models: ZX135US

Product-line features: The ZX135US introduced reduced tail swing to the Hitachi North American lineup in 2003.

For more information, visit ConstructionEquipment.com/info



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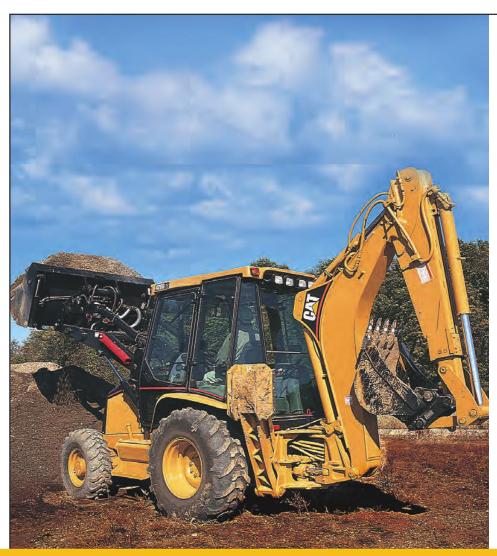




Carrier (3 models)



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Spotlight

By G.C. SKIPPER, Contributing Editor

Construction Tires

CONTINENTAL

STL2+ radial off-road tire can be used for scrapers, loaders and hauling applications. It is available in 23.5R25, 26.5R25 and 29.5R25 sizes. Three tread compounds are offered: HS for long hauls and high speeds, WS for standard applications, and CS for cut resistance in quarry usage. For more information, visit Con structionEquipment.com/info





GOODYEAR

Goodyear's off-road two-piece tire is said to significantly cut downtime required for removal and replacement. The two-piece assembly system has a steel cord tire casing that mates with a removable steel belt and tread unit that can be easily fitted to the casing in the field or in the maintenance yard. Specially constructed restrictor belts keep the centerline of the tire flatter for a larger footprint and more equal load distribution. For more information, visit ConstructionEquipment.com/info

MICHELIN

Michelin's Stabil'X XZSL tire for skid-steer loaders is a steel-belted radial with steel casing and special rubber compounds that increase resistance to cuts and abrasions for fewer flats and longer tread life. It features enhanced traction and handling and a smooth, stable ride. The radial skid-steer tire is available in three sizes: 10R16.5, 12R16.5 and 27x8.5 R15. For more information, visit ConstructionEquipment.com/info



YOKOHAMA

Y524Z is a specially designed half slick asymmetric tread pattern tire that provides superior tread and sidewall cut resistance, resulting in better tread life. Designed for use on loaders and dozers, the Y524Z is available in sizes 45/65-45, 45/64-45, 40/65-39 and 35/65-33.

For more information, visit ConstructionEquipment.com/info

Spotlight

BANDAG

The Bandag BRM is designed for use in the construction industry. It features a new tread compound that provides significant improvement in wear at the lowest possible cost per mile without sacrificing cut resistance, according to the manufacturer. With a 26/32" tread depth, the BMR is designed for long even wear.

For more information, visit Construction Equipment.com/info

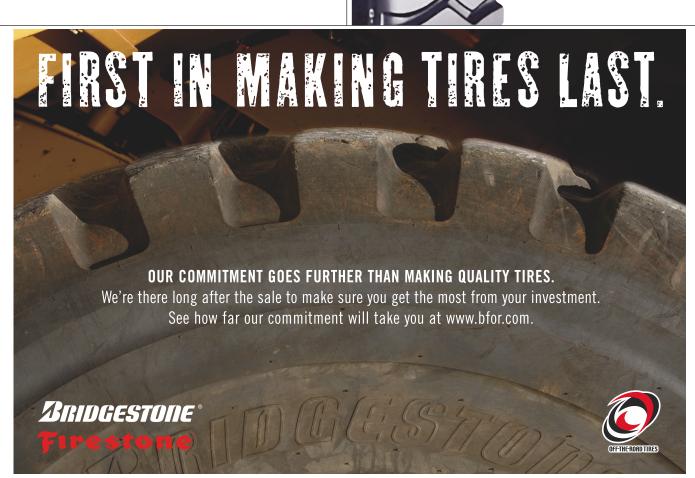


TOYO

Toyo G-18 L-3/G-3 off-road tire is designed for a variety of loader and dozer/grader applications. The G-18, a bias-ply tire, has an improved tread compound that provides optimum traction on rocky terrain. A 54mm tread depth provides long wear life, and sidewall construc-

tion resists cuts. Sizes range from a 1400-24 to a

2100-35, and 20.5-25 to 37.5-39. For more information, visit Con structionEquip ment.com/info



For more information, visit www.ConstructionEquipment.com/RS and enter 33

TITAN

Titan International will introduce the Titan MXL, its newest line of E3/L3 tires, in the spring of 2006. Designed for use on loaders, the tires come in four sizes, 17.5R25, 20.5R25, 23.5R25 and 26.5R25.

For more information, visit ConstructionEquipment.com/info



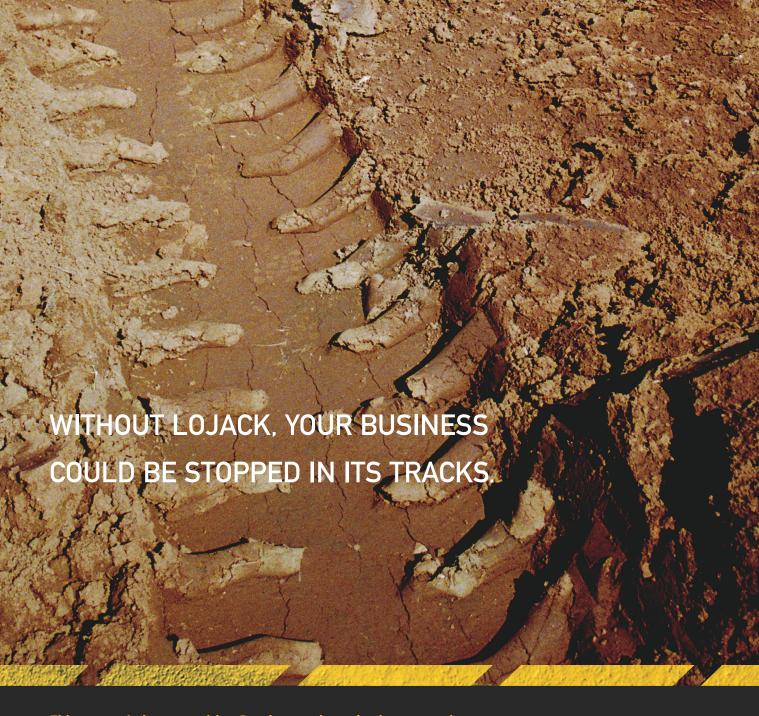
BRIDGESTONE

The newest off-road radial tire from Bridgestone is the 18.00R33 VRQP that has a new tread pattern designed for earthmovers in quarry terrain and other tough environments. The VRQP (V-steel Rock Quarry Premium) offers



extra-long life, high cut resistance and powerful traction, according to the manufacturer. For more information, visit ConstructionEquipment. com/info





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Equipment Executive

By MIKE VORSTER, Contributing Editor

Taxable Income and Equipment Acquisition I Fleet managers may know cash flow, but evaluate the

Fleet managers may know cash flow, but evaluate the after-tax cash situation to understand acquisition strategy

quipment managers must understand taxable income, its difference from net earnings, how it is calculated, and how it is affected by acquisition and disposal decisions. They do not need to know chapter and verse of the tax codes, but they must understand the principles and be able to debate issues when they occur.

This article emphasizes language and concepts. It does not replace the expertise of accountants and financial managers. Instead, the objective is to assist equipment managers in communicating with specialists and in understanding how equipment decisions affect taxable income.

Tax calculations differ from normal financial reporting in two important ways. First, the calculations are performed with only one objective in mind — to establish a basis for calculating tax due. Second, each step in the process and the amounts used in the calculation are defined by tax codes that replace the conventions, standards and procedures estab-

lished by the Financial Accounting Standards Board. Many details in the tax codes do not directly concern equipment managers. Others, especially depreciation, gain on sale, interest and loan payments, affect decisions regarding equipment finance.

Let's consider the tax implications on a machine acquired using \$180,000 in cash and \$200,000 in loan financing by calculating cash flow before and after tax. Let's assume the machine will have a residual mar-

ket value of \$50,000 after six years, during which time it will work 10,800 hours at a rental rate of \$115 per hour.

To calculate cash flow before tax, look at the transactions in each year and determine the difference between the money expected from renting the machine and that expected to be spent. In the table titled "Cash-Flow Calculation," row 3 shows expected annual rental income, rows 4 through 6 represent acquisi-



Mike Vorster

David H. Burrows Professor of Construction Engineering and Management at Virginia Tech.

Cash-Flow Calculation

1	Expected life (yr.)	0	1	2	3	4	5	6
2	Expected annual utilization (hr.)		1,900	1,900	1,900	1,800	1,700	1,600
3	Annual income		\$218,500	\$218,500	\$218,500	\$207,000	\$195,500	\$184,000
4	Cash invested	\$180,000						
5	Loan capital payments		\$40,000	\$40,000	\$40,000	\$40,000	\$40,000	
6	Loan interest payments		\$16,000	\$16,000	\$16,000	\$16,000	\$16,000	
7	Annual direct costs		\$108,262	\$118,978	\$131,518	\$137,714	\$143,043	\$146,148
8	Residual market value							\$50,000
9	Cash flow before tax	-\$180,000	\$54,238	\$43,522	\$30,982	\$13,286	-\$3,543	\$87,852

Row 3 shows the expected annual rental income based on utilization and an hourly rate of \$115. Rows 4, 5 and 6 show acquisition costs and vary with the financing chosen. Here, \$180,000 in cash is invested and the balance of the purchase price is financed with a \$200,000 fiveyear loan on which the annual interest payments are \$16,000. Row 7 gives the annual cost of operating the machine and includes the cost of repairs, fuel, wear parts, preventive maintenance licenses, insurance and other direct costs. Row 8 is the money expected from selling the machine at the end of year six. Row 9 is cash flow before tax, the net result of all the transactions.

Equipment Executive

Tax Implications

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1	Expected life (yr.)	0	1	2	3	4	5	6
2	Expected annual utilization (hr.)		1,900	1,900	1,900	1,800	1,700	1,600
3	Annual income		\$218,500	\$218,500	\$218,500	\$207,000	\$195,500	\$184,000
4	Tax depreciation %		20.00%	32.00%	19.20%	11.52%	11.52%	5.76%
5	Tax depreciation allowed		\$76,000	\$121,600	\$72,960	\$43,776	\$43,776	\$21,888
6	Loan interest allowed		\$16,000	\$16,000	\$16,000	\$16,000	\$16,000	
7	Annual direct costs allowed		\$108,262	\$118,978	\$131,518	\$137,714	\$143,043	\$146,148
8	Gain on tax book value							\$50,000
9	Taxable income		\$18,238	-\$38,078	-\$1,978	\$9,510	-\$7,319	\$65,964
10	Tax due		\$6,383	-\$13,327	-\$692	\$3,329	-\$2,562	\$23,088
11	Cash flow before tax	-\$180,000	\$54,238	\$43,522	\$30,982	\$13,286	-\$3,543	\$87,852
12	Cash flow after tax	-\$180,000	\$47,854	\$56,849	\$31,674	\$9,958	-\$982	\$64,765

Rows 4 and 5 show the tax depreciation calculations. Row 4 is the annual tax depreciation percentage allowed for construction equipment under the modified accelerated cost recovery provisions of the tax code, and row 5 is the annual percentages applied to the \$380,000 purchase price of the machine. Taxable income (row 9) is the net of row 3 and rows 5 through 8.

tion costs, row 7 shows operating cost, and row 8 gives the money we expect to receive from selling the machine for \$50,000. Cash flow before tax, the net result of all the transactions, is shown in row 9.

The table titled "Tax Implications" shows how tax codes impact how we calculate the difference between money in and money out. Three important points can be made.

First, the tax codes permit us to charge a portion of the \$380,000 capital investment against operations each year using defined annual tax depreciation percentages (see December 2003). Rows 4 and 5 show the calculations.

Second, loan capital payments do not affect the taxable income calculation (see February 2005). The tax codes do, however, permit interest payments on loans used to purchase equipment as operating costs and these are shown in row 6.

Third, the tax codes define the gain or loss on tax book value as a "taxable event" that must be added or deducted from taxable income. In this case, the tax book value is zero — we have taken the full \$380,000 purchase price as tax depreciation in row 5 — and,

thus, the whole of the residual market value (\$50,000) is a gain on tax book value as shown in row 8.

Taxable income (row 9) is the net of row 3 and rows 5 through 8. We assume that taxable income can be negative on the basis that some other aspect of the business is generating a positive taxable income able to benefit from the negative taxable income arising from this investment. Tax due is assumed to be 35 percent of taxable income, which is then deducted from cash flow before tax (row 11) to give cash flow after tax (row 12).

Rows 9, 10 and 11 clearly show the difference between cash flow before tax, taxable income, and cash flow after tax, which are strikingly different on a year-to-year basis.

Equipment managers must understand how the tax codes treat depreciation, interest, and gain on tax book value in order to select the financing option that suits their particular situation. Although we've explored cash financing, leasing is another acquisition option directly affected by tax codes. We'll tackle that subject next month.

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Earthmoving Report

By ROD SUTTON, Editor in Chief

Komatsu Enters Utility Crawler Market

The CK30, due out in February, will be followed by three more models by mid-2006

omatsu America unveiled its first utility crawler at the International Construction and Utility Equipment Exposition in September, announcing the company's entrance into this increasingly competitive market. Model CK30-1 will be available in February 2006, and three more models will be introduced within the first half of the year: CK20-1, CK25-1 and CK35-1, which is a parallel-lift version of the CK30-1.

The utility crawlers match up to the company's SK815-5, SK820-5 and SK1020-5 skid-steer loaders. Undercarriage is supplied by Berco; the tracks by Bridgestone. The front idler and No. 1 roller are mounted on the sub-frame inside the track frame. A triple idler on the front allows the load to be carried on the rubber portion of the track surfaces, "producing more stability and eliminating loaded idler wear on the pins," says product manager Robert Beesley. "The upper track carrier reduces track deflection and helps retain the track tension."

The initial machine, CK30-1, has an operating load of 3,400 pounds at 50-percent tipping load; weighs 9,590 pounds; and is powered by a Komatsu 4-cylinder, Tier II, turbo engine delivering 84 net hp at 2,500 rpm. It rests in about the middle of the range of utility crawlers in this class. The machine has a bucket breakout force of 4,978 pounds and standard two-speed transmission.

Komatsu's patented Automatic Power Control allows the operator to work at peak performance and power without worrying about engine stall out, according to the company. "Hydraulic flow is reduced in accordance with available engine torque, allowing the engine to produce its maximum power at any throttle setting," Beesley says. "Our system works at all engine speeds and can't be overcome under any condition."

The hydraulic system has, as standard equipment, an auxiliary hydraulic circuit with a flow of 21 gpm at a



Komatsu's CK30-1 utility crawler, a tracked version of its SK1020-5, is the first of four introductions in this category over the next several months.

maximum pressure of 3,046 psi.

Komatsu's Closed Load Sensing System (CLSS) also comes as a standard option. It ensures maximum bucket control during both single and simultaneous bucket movements, critical in grading, loading and digging applications where precise maneuvering is required.

For more information, visit ConstructionEquipment.com/info

Specifications Comparison

Manufacturer/ Model	Operating load, 50% of Tipping Load (lb.)	Operating Weight (lb.)	Height To Bucket Pin (in.)	Horse- power	Standard Pump Flow (gpm)
ASV Posi-Track RC-85	3,400	9,710	125	86 gross	38
Bobcat T250	3,572	9,121	122.4	81 net	21.2
Case 445CT	3,500	9,815	120.6	74 net	21
Caterpillar 287B	3,600	10,275	128	78 net	22
Gehl CTL80	3,528	10,692	126.1	97 gross	23.4
JCB Tracked Robot 1110	3,220	10,198	123.2	82 net	20
John Deere CT322	3,200	8,305	115.2	62 net	19
Komatsu CK-30	3,400	9,590	121.25	84 net	21
Mustang MTL25	3,528	10,692	126.1	97 gross	23.4
New Holland LT185.B	3,429	8,920	124.7	72 net	19.3
Takeuchi TL150	3,528	10,692	126.1	97 gross	23.4
Thomas T320	3,230	10,000	123.8	83 net	21



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Market Watch Lite

By HEATHER BURLINGAME, Senior Production Editor

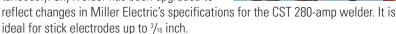
We're making it quicker for you to obtain more information on products by going to ConstructionEquipment.com/info. Once there, you'll be in our Buyer's Guide, where you can find manufacturer information as well as distributor listings.

Lincoln Electric

Lincoln Electric introduced six short-neck semiautomatic welding-gun packages for MIG and gas-shielded cored wire arc welding. The 400-amp Magnum guns are fitted with all necessary components including contact tip, gas diffuser, insulated gas nozzle, cable liner and gun connectors. Each gun is rated at 400 amps at 40-percent duty cycle with CO₂ shielding gas. The packages are configured for use with 0.035- to 0.045-inch or 0.052- to 1/16-inch MIG or Outershield (gas-shielded flux-cored) operations. For more information, visit ConstructionEquipment.com/info



SkyPower and SkyWelder systems offer improved performance. The 7,500-watt Sky-Power generator is now belt-driven. The aerial-work platform's engine powers the generator so that the engine doesn't have to support hydraulic-power alternatives and operate at higher rpm, says the company. SkyPower allows operators to run multiple tools simultaneously. SkyWelder has been upgraded to



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Leica

A new module allows the company's MC200 Digger to double as a weighbridge. The excavated material is automatically weighed and recorded simultaneously — with no intervention from the operator. The system offers several menus — including daily computations. The MC200 Digger can be upgraded without having to alter existing settings. The MC200 Digger provides detailed information on excavator range and excavation depth in real time.

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Zanetis Power Attachments

Skid-steer cold planers come in cutting widths of 16 and 18 inches. They can be equipped with an optional

lateral-milling feature that hydraulically rotates the drum 90 degrees and laterally sideshifts the drum to 46 inches for cutting corners, patches or utility cuts across roads. A removable side cover exposes the right side of the drum so the operator can cut flush against walls or standing curbs. All planers have hydraulic tilt, depth and sideshift control. A block-and-holder tooth system eases holder replacement and gives the tooth tip a 5-inch clearance. The planers come with an 18-month warranty.

For more information, visit ConstructionEquipment.com/info



The CPK40-18 four-piece 18-volt Cordless Combo Kit features Bluecore batteries and a 30-minute dual-bay charger. It also has a cordless 18-volt Brute-Tough hammer drill/driver, 6½-inch circular saw, a reciprocating saw and flashlight. Registering the product is free and grants users two years of Bluecore battery replacements in the event of failure, one-year of tool replacement, and the following two years of tool repairs for free. A one-call resolution hotline is also available.

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— Joe Schuster, Equipment Manager, Emery Sapp & Sons, Inc



Emery Sapp & Sons, Inc. is one of Missouri's largest heavy construction companies. With over 250 machines spread out over the entire state, the company faced a couple of big issues: maximizing utilization and keeping the fleet up and running at peak levels.

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With GlobalTRACS installed, Joe and his team could immediately see the "big picture" on their entire fleet — where each piece was located, how much it was being used, and whether it needed service.

Before GlobalTRACS, this data had to be captured manually. But the records were incomplete, and sometimes maintenance crews couldn't even locate equipment they were supposed to service.

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"We've now set up a much more effective preventive maintenance program at 250-hour intervals," Joe says. "We're seeing big improvements in uptime and equipment performance."

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Joe really likes how GlobalTRACS performs on the balance sheet. "The system will pay for itself very quickly in terms of the money we're saving.

"What can I say? GlobalTRACS just makes my job a whole lot easier."



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Lite



O Pro-Tech

The Switchblade reversible pusher has a rubber cutting edge and a steel cutting edge. The tool has no moving parts.

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Creative Sales Company

The Super Snap reusable grommet adds additional tie-down areas, replaces ripped-out grommets and extends the life of a tarp. To use, place the Super Snap's disc underneath the plastic or fabric tarp, start one side of the loop on the disc groove, then push the loop into place. The snap clamps the material in place for a no-slip grip, and a hook-eyelet at one end allows the user to attach a bungee cord, rope, etc. A package of four is \$2.99.

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EnerSys

The 12-volt Odyssey battery is designed for a service life of six years in construction vehicles



and has a two-year storage life at room temperature. The battery doesn't require the addition of water, and terminals need not be cleaned or tightened after installation. Other advantages include slow loss of power at the end of the battery's service life, superior construction materials and both deep-cycle operation and high cranking power with fast-charge capability.

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O John Deere

Worksite Pro RL66 and RL84 roller levels give skid-steer operators fine control to complete a final grade on smooth and sloped surfaces. Patented box blade with roller level works without hydraulics. Levels do not disturb subsoil, and cutting blade shaves the surface of the soil.

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DeWalt

The company has introduced its first 18-volt heavy-duty cordless pencil vibrator kit, the DC530KA. It is equipped with a 48-inch flex-shaft/vibrator ideal for small-scale jobs. The 1½-inch-diameter vibrator operates at 14,000 vpm. The flex-shaft attachment collar provides fast and tool-free removal, service, lubrication and replacement of the flex shaft. The tool weighs 9.3 pounds. List price is \$599. The vibrator comes with a three-year limited warranty, one year of free service, and a 90-day money-back guarantee.

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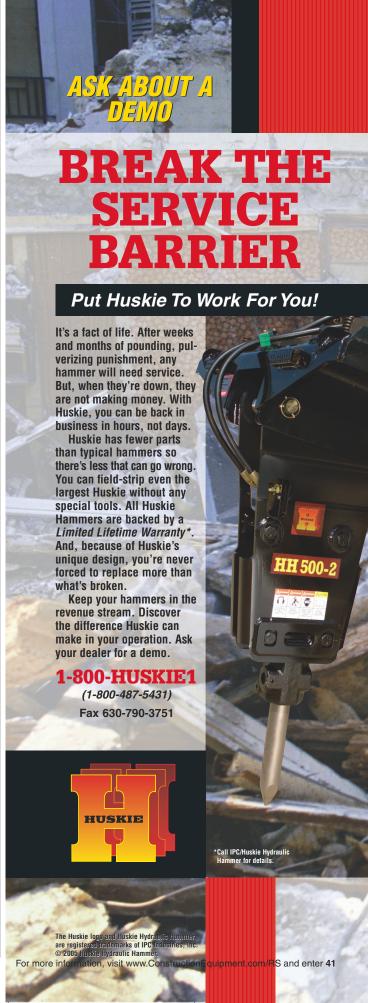


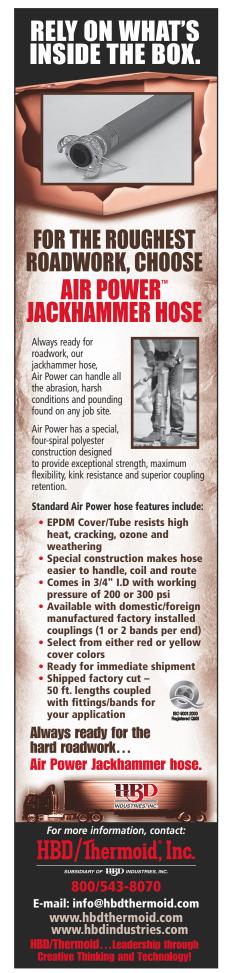
O Trimble

The Spectra Precision LL400 Laser Level for concrete and site-preparation applications features one-button operation for basic leveling and provides accurate, long-range measurements — even for machine-control applications. Features

include fast set-up, minimal training time and automatic self-leveling. A rugged design and patented lighthouse seal protect the rotor head and glass and provide drop and weather protection. The single-axis slope mode provides grade matching with self-leveling cross axis. Four customizable kits with choice of receivers are available.

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Market Watch Lite

Weldcraft

The Super Cool 18 TIG torch eliminates overheating on higher amperage, water-cooled applications, says the company. A patented water-cooling chamber allows water to flow down, around and up the length of the torch head. The unit operates to 400 amps. Available with standard WP-18 or short back caps, the torch uses standard gas lens alumina nozzles, hose and power cables.

For more information, visit ConstructionEquipment.com/info



Miller Electric

The Trailblazer 302 welding generator now offers as an option a 3cylinder Kubota diesel engine that

produces 19 horsepower at 3,600 rpm. The unit features a fully enclosed case and protective armor on the front panel for durability and reduced noise levels. A 12-gallon fuel tank provides 24 hours of operation using 1/8-inch 7018 electrodes at 125 amps with a 20-percent duty cycle. The engine automatically shuts down when oil pressure is low or coolant temperature is high. The welding generator provides a 20- to 300-amp CC/DC output for Stick and TIG welding, a CV/DC output of 100-percent duty cycle at 300 amps for MIG and flux-cored welding, and a CC/AC output of 35- to 225-amp AC output.

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Enerpac

With ZE Series 700 bar hydraulic pumps, the company says it has reduced the number of moving parts over previous models and improved flow dynamics and decreased friction. Features include high oil flow and by-pass pressure and cool running temperatures. A completely enclosed, fan-cooled electric motor provides a longer life and endures harsh industrial environments. An LCD readout is optional.

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Briggs & Stratton

Two vertical-shaft Vanguard V-Twin engines add to the Briggs & Stratton line of Big Block engines. The 895 and 993 cc feature a debris-management system that is incorporated into the air-cooling system. It allows the engine to run cooler and cleaner and enhances durability and performance, says the company. The engines are based on V-Twin/Overhead Valve technology to reduce component and equipment wear and provide optimum balance and low vibration. Steel-backed aluminum bearings increase load capacity and reduce engine noise, the company says. A lightweight aluminum block aims to increase power-to-

weight ratio by reducing overall equipment weight. For more information, visit ConstructionEquipment.com/info

Trailer Dog

For enclosed trailers, C-containers, job trailers and all other enclosed structures, the company offers three solar-charged, battery-powered security systems: the Trailer Dog, Construction/Industrial Dog and the Global Dog. Global Dog features a GPS/Cellular module and communicates with GPS systems with cellular notification. Global Dog requires a one-year service package. For more information, visit ConstructionEquipment.com/info

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Dana

Shape optimization and computeranalysis software allow Dana Spicer RS 40 and RS 46 SmartRide trailer suspensions to provide weight savings, increased payloads and improved

fuel efficiency, says the company. Major features include 5³/₄-inch-diameter axle tubes and a 30-pound weight savings per axle (when compared to a traditional 5-inch-diameter axle). The larger axle diameter decreases deflection to reduce tire wear. For more information, visit ConstructionEquipment.com/info

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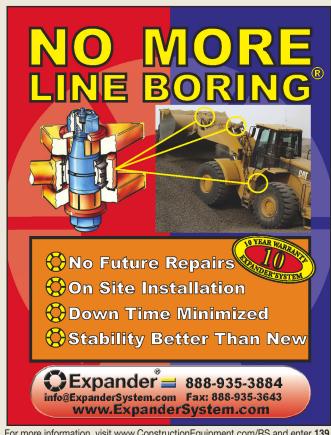
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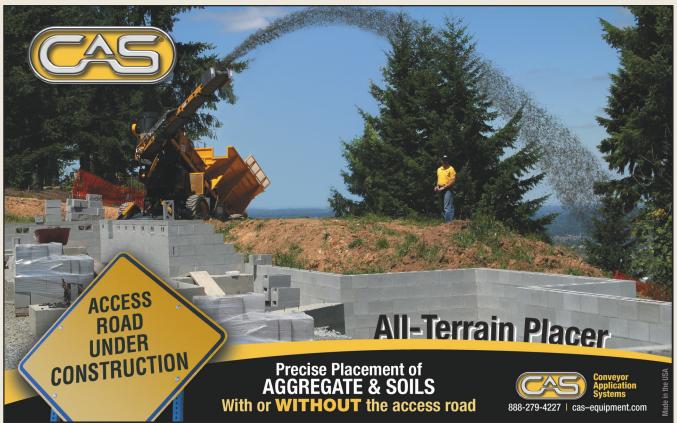
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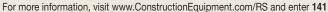


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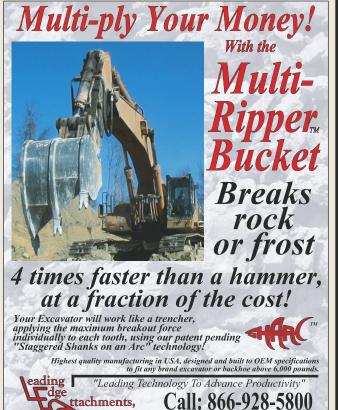
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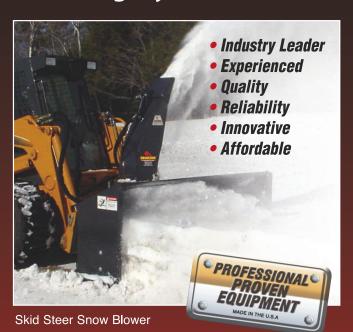
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Iron Works

By KEITH HADDOCK, Contributing Editor



ust two years after LeTourneau introduced the first rubber-tired high-speed motor scraper in 1938, the Euclid Road Machinery Co. offered an alternative way of moving dirt at high speed over long distances.

The Euclid BV loader ("BeltVeyor") scooped up material in relatively thin layers as a scraper, but instead of carrying the material inside itself, it loaded bottom-dumping wagons moving alongside by means of a conveyor. Once loaded into wagons drawn by four-wheel heavy-duty tractors, the material could be hauled more efficiently over longer distances than by employing motor scrapers. Utilizing digging and loading technology taken from earlier elevating graders, the BV loader was pulled by the largest crawler tractors available, such as the Caterpillar D8.

World War II hampered the progression of the BV loader beyond the experimental stage, but then the machine was exhibited at the 1948 Chicago Road Show, where it attracted much attention.

Categorized as a continuous excavator, the BV Loader could achieve high outputs if enough wagons were provided. As an example, when taking a 4-foot-wide cut 18 inches deep, it could load a Euclid 13-yard bottom-dump tractor/trailer unit in 30 to 85 seconds depending on the material.

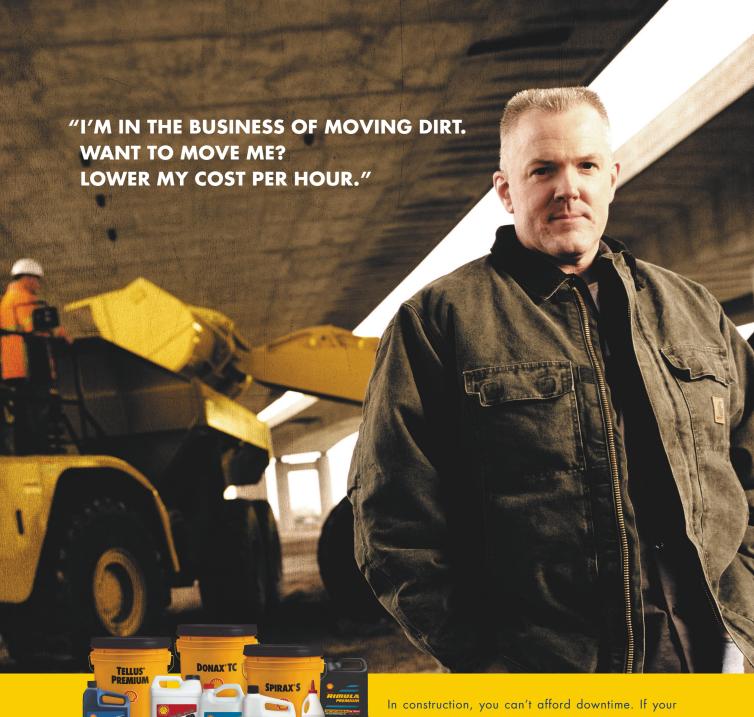
The Euclid Loader enjoyed considerable success on the big dirt-moving jobs of the era, such as the Garrison Dam in North Dakota and the Ohio Turnpike where 19 units were reported used.

The BV Loader consisted of a blade that simply cut the material and directed it onto a conveyor belt. The belt was driven by a Cummins 150-hp engine or optional GM 190-hp engine, and the conveyor speed was 450 feet per minute. The machine was mounted on a pair of nonpowered crawler tracks and weighed approximately 25 tons. The cutting depth of the machine was controlled by the tractor operator through hydraulic controls.

Although a great success in the early days of high-speed earthmoving, the Euclid BV Loader's popularity waned in the shadow of vastly improved motor scrapers entering the market. As a consequence, Euclid chose to discontinue manufacture in 1956. But the idea was not quite dead.

While under the ownership of the White Motor Corp. in 1969, Euclid took another shot at the belt-loader concept. The substantially larger "Super BV" boasted a 635-hp GM engine to drive the conveyor and four non-powered crawlers to support the machine. Although experiencing some success, including one machine that worked on the San Luis Dam in California, the Euclid loader concept once again lost ground to the more-flexible and efficient motor scraper, and only two of the Super BVs were built.

You can read more about the evolution of construction equipment in Keith Haddock's illustrated book "The Earthmover Encyclopedia" available in most bookstores. Also, consider a membership in the Historical Construction Equipment Association, www.hcea.net. Be sure to visit ConstructionEquipment.com for past Iron Works features.



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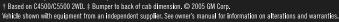
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^{*} Based on comparison of 2006 GMC Topkick C4500/C5500 2WD to 2005 Ford F-450/F-550 2WD.