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machine control



30 We look at
how Mack's SCR
engine performs



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Exclusive
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CONSTRUCTION EQUIPMENT

January 2009 • Vol. 112, Issue 1

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APPLICATION: MACHINE CONTROL

20 Rebroadcasting Links Multiple Sites to One Base

Machine control is one thing. Cost control is another, especially these days. But as technology-embracing contractors are proving, one does not have to come at the . . . well . . . expense of the other. A site-preparation and heavy-highway contractor based in Virginia Beach, Va., E.V. Williams leverages its Trimble machine control products via use of a "rebroadcast" system. Senior editor Mike Anderson explains the pros and cons of implementation and the benefits E.V. Williams has enjoyed.

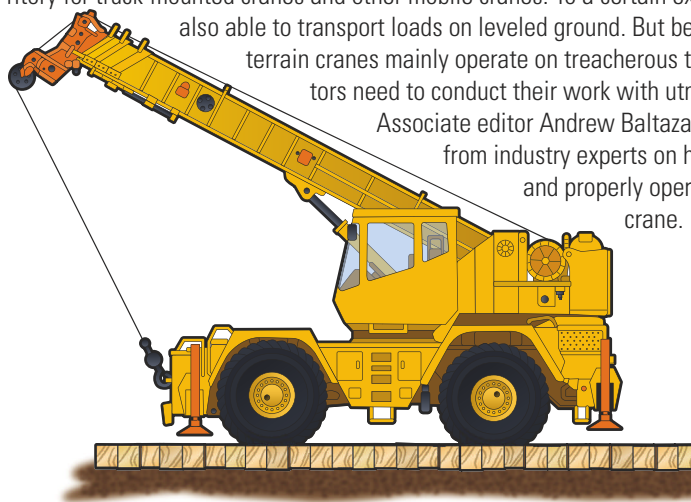


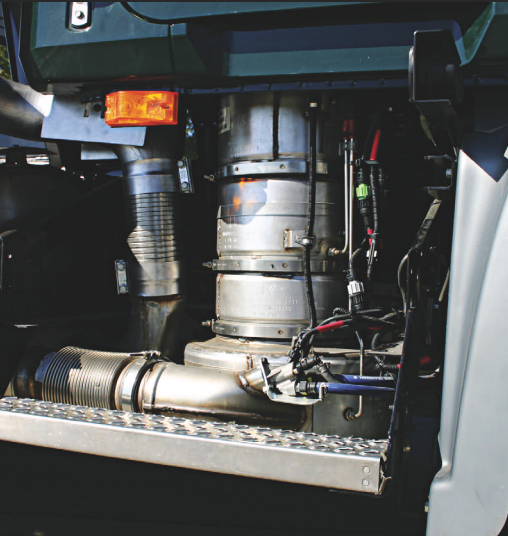
SAFETY ILLUSTRATED

24 How to Keep an RT Crane on Its Wheels

First introduced in 1959 by Grove, the rough-terrain crane was designed as a multi-purpose construction tool. Equipped with industrial-strength tires, these mobile machines can lift loads on muddy, uneven, or harsh ground, otherwise precarious territory for truck-mounted cranes and other mobile cranes. To a certain extent, they are also able to transport loads on leveled ground. But because rough-terrain cranes mainly operate on treacherous terrain, operators need to conduct their work with utmost caution.

Associate editor Andrew Baltazar gathers tips from industry experts on how to safely and properly operate an RT crane.





HANDS ON TRUCKING

30 SCR Diesel Delivers Good Fuel Economy

One year from now, in January 2010, all new diesels for sale in the United States and Canada will have to meet even tougher exhaust emissions limits than now, and many will do it with selective catalytic reduction. Haines & Kibblehouse Inc., a contractor based in eastern Pennsylvania, ran a Granite dump truck with a 2010-spec Mack Power engine in everyday service. The Granite is the very first Mack built with an SCR engine, and last April it was loaned to H&K for testing.

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BUYING FILE

34 Specialized Pavers Part of 'Total Package'

One year ago, a *Construction Equipment* headline asked rhetorically if "Curb Your Enthusiasm" was the mantra for contractors looking to curb-and-gutter pavers. Not so, we concluded. With added capabilities and options, curb-and-gutter machines had matured into more versatile, smarter pieces of equipment. Manufacturers say technological advances have created a total package for contractors.



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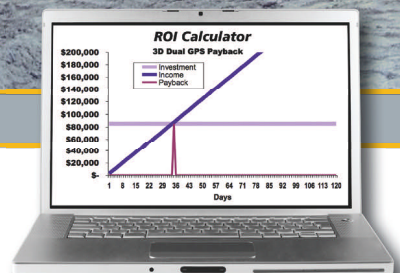
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Positive Changes for a Change

January is often the month that a magazine will introduce new features and departments or even a new look. This year, perhaps more than in others, some freshness and optimism may be a welcome way to introduce a month's issue of *Construction Equipment*. Please indulge us as we strut some new and pertinent changes.

First, we launch two new features in this issue: Digital Digest and Safety Illustrated. Digital Digest highlights the growing amount of electronic information that cannot be printed with ink and is instead posted at ConstructionEquipment.com. In addition to our video coverage of machine introductions and walk-arounds, we also have audio clips of select interviews, webinars and interactive graphics.

Safety Illustrated brings to the topic of equipment safety the illustration style we've developed over the years in Prevention Illustrated and Production Heroes. Each article will center on a specific machine type and address areas of safety associated with that machine. Our first article takes a look at rough-terrain cranes.

Our second area of change occurred last November, when we made some improvements to the way the magazine looks. We made it easier to read the text, heightened the visual impact on our pages, and added some necessary updating along the way.

Turning to the electronic side, we've added a section to our website dedicated to emissions management. In this section, we house our popular Running Green series of articles. But we don't stop there. We will also update it with news pertaining to emissions management and other environmental issues. Links to resources such as CARB and EPA provide additional intelligence on the topics. A special question-and-answer section will be monitored by our partners on the site, John Deere and Deere Power. Go to ConstructionEquipment.com/green to review the content, ask a question, or research emissions problems.



Rod Sutton, Editor in Chief

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By KATIE WEILER, Managing Editor

► Liebherr

Making its debut at World of Concrete, the R924 Compact Swing excavator sports the new Liebherr D936S Tier 3 diesel engine. Despite its compact body, the R924 is a full-size excavator rated at 163 horsepower. The 6-foot swing radius also enables it to maneuver in tight spaces. Routine maintenance can be done easily thanks to all service points being centrally located and accessible from the ground; it also has an automatic lubrication system. Hydraulic quick-coupler system accepts attachments for grading, trenching, truck loading and more.

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◀ Bobcat

The newest Toolcat utility work vehicle from Bobcat not only features a three-point hitch and hydraulic power take-off (PTO) for rear implements, but also the ability to operate more than 40 front-mounted Bobtach attachments. The 60-inch-wide, all-wheel-steer Toolcat 5610 has an available hitch that will work for customers who already own Category 1 three-point implements up to 1,775 pounds. A hydraulically driven motor and high-flow auxiliary hydraulics combine to power the available 540-rpm PTO to additionally drive other implements.

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► Caterpillar

The 938H wheel loader and IT38H with integrated tool-carrier linkage feature the 180-horsepower Cat C6.6 ACERT diesel and new differential lock system, load sensing hydraulics, and increased lift and tilt forces. Cat's Fusion Wheel Loader Coupler System moves the center of gravity closer to the machine, while enabling quick exchanges of buckets and a range of work tools. The in-cab Messenger display provides real-time performance and diagnostic data. Cat Product Link, providing two-way information flow between the machine and Caterpillar dealer and to the owner's desktop computer, is standard on the new loaders.

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Market Watch



◀ Fecon

Fecon FTX440 crawler mulcher now has remote connectivity that allows the machine's systems information to be read anywhere for monitoring real-time performance. Data are transmitted over GS cellular networks to and from the machine's IQAN controller. Testing and data collection can be done from off-site, and program updates can be uploaded without a service trip. Maintenance alerts, system alerts and other lifecycle data can be programmed to automatically transmit.

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▶ Volvo

At 37 tons, the full-swing radius FB3800C is the largest of Volvo's line of C-Series feller bunchers. Sporting the Volvo D9E Tier-3-compliant engine, load-sensing hydraulics, and Volvo Care Cabs, the machine can be configured to accommodate a feller buncher or heavy-duty harvesting/processing head. The smaller FB2800C is 30 tons with a short swing radius, and the FBR2880C is also 30 tons but with a zero swing radius.

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▲ Sellick

Sellick has expanded its S Series line of vertical mast forklifts with model S160-4. It has full-time, four-wheel drive and four equal-sized wheels, with a turning radius of 150 feet. The 16,000-pound-capacity forklift has a 114-horsepower, turbo-charged Dieselmex 444 and a fully automatic power-shift transmission. Operator platform is mounted to frame on isolators that reduce noise and vibration, the company says.

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▼ Case

Case upgraded its 750 and 850 dozers to the L Series, using an 84-horsepower, 4.5-liter, electronic four cylinder in the 750L; and a 96-horsepower, 6.7-liter, six cylinder electronic engine in the 850L. Case's exclusive PowerStat hydrostatic drive features electronic straight tracking, counter rotation and a choice of slow, normal and fast sensitivity to forward/reverse shuttle and steering input.

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CONSOLIDATION

Northern Crane Equips to Dominate

In 2006, private-equity firm Northern Capital Appreciation bought Northern Crane and supercharged the Edmonton, Alberta, petroleum services firm with cash and ambition. Northern Crane's primary market had been lift services in the Fort McMurray oil sands. Since then the firm acquired A-1 Crane in Grande Prairie, Alberta; heavy-haul specialist, TransTech; Mullen Crane, adding expertise in servicing the wind-energy industry; and Parkland Crane, extending its hold on Edmonton-area lifting.

"The organic growth of our crane fleet would not have been possible without Northwest Capital," says Ron Sims, vice president of corporate affairs for the consolidated lifting company, renamed NCSG. "NCA had the expertise to bring together investors from both



NCSG fleet expansions, like this 1,200-tonne Liebherr, signal the consolidator's market-dominance ambition.

Canada and the U.S. who see the potential in the lift and heavy haul market and provide capital to facilitate our fleet expansion."

The fleet expansion includes Manitowoc 18000, 16000, 12000, 2250 and 999 Crawler Cranes, and Liebherr's 550-tonne-capacity LG 1550 all-terrain crane. NCSG will take delivery of the 1,200-tonne LTM 11200 in April.

With a telescoping vertical boom 328 feet tall and 413 feet of lattice-boom jib, the all-terrain LTM 11200 has an operating weight just shy of 212,000 pounds.

— LARRY STEWART

INDUSTRY NEWS

CNH Capital Launches Online Equipment Auction

CNH Capital has entered the equipment-auction business with its new international Web portal, EquipmentAll.com. The site lists agricultural equipment, construction equipment and commercial trailers, in addition to other types of machinery. Because EquipmentAll.com is open to buyers around the world, the site also features a language translation tool, payment calculators and currency exchange.

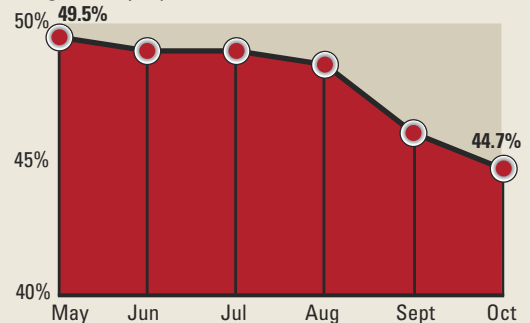
"We've tried to make sure that Web visitors can find everything they might need at a single Web site," says Brett Law, director of asset remarketing at CNH Capital. "Our users can browse through categories and look at photos and condition reports of the equipment for sale, all while keeping track of what comparable equipment is selling for."

USED EQUIPMENT

October Values Fall 2.8%

The Rouse Value Index

(Avg. orderly liquidation value as % of cost)



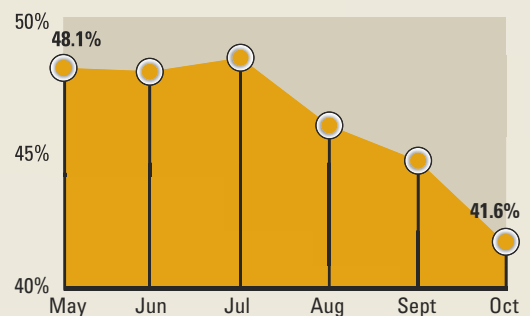
Note: Orderly liquidation value is expressed as a percentage of replacement cost (average cost paid for a new unit by large rental companies and dealers) for the average age of equipment within that category.

Includes 10 categories of equipment common to rental fleets.
Source: Rouse Asset Services

Steep declines in auction values drove orderly liquidation values down in October, dropping 2.8 percent from September. For the six months ending October, values were down 10.2 percent. Categories recording the greatest declines were excavators, skid steers, and aerial work platforms.

Excavators

(Avg. orderly liquidation value as % of cost)



Excavator values have dropped 15 percent in the six months ending October, and average selling age is 58 months.

RENTAL NEWS

Atlas Copco Expands Global Compressor Business

Atlas Copco's global efforts to supply rental markets with oil-free air compressors expanded with the November acquisition of Aggreko's European oil-free air compressor rental business.

The \$18-million deal includes about 200 compressors and dryers being integrated into Atlas Copco's existing European rental fleet.

"The acquisition of the European business of Aggreko supports the growth of Specialty Rental's core business, renting

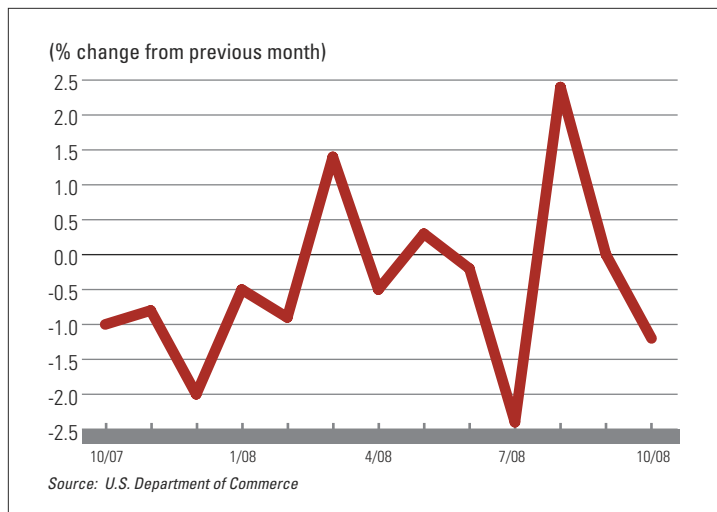
oil-free air equipment," says Ronnie Leten, business area president, Atlas Copco Compressor Technique.

In North America, Atlas Copco's Specialty Rental Division is known as Atlas Copco Prime Energy. As part of a global network of rental outlets in more than 50 countries, Atlas Copco Prime Energy rents 100-percent-oil-free portable air compressors, as well as high-pressure, oil-injected units ranging from 300 to 3,000 cfm and up to 650 psi.

STATUS & FORECAST

Total Construction Spending

Total construction spending has declined 11.6 percent since March 2006 and is expected to decline about 4 percent more by mid-2009, or about 7 percent after adjusting for inflation. Additional declines are assured by the nearly 8 percent decrease in the value of construction starts reported by Reed Construction Data for October. The largest declines will be for private commercial construction, including apartments. The smallest declines will be for public and institutional buildings and civil projects. For more analysis, visit [Economic Outlook at ConstructionEquipment.com](http://EconomicOutlook.at).



ASSOCIATION NEWS

Rental Hall of Fame Announces Inductees

The co-founder of United Rentals, Bradley S. Jacobs, is credited with bringing a new perspective to the rental-equipment industry.

And, come March, he will lead the newest class of inductees into the Rental Hall of Fame. Jacobs will be inducted alongside the late Thomas M. (Mitch) Hoxie and the late Harold (Hal) Plugge Jr. during a ceremony at the annual American Rental Association trade show in Atlanta:

- Four months after being co-founded by Brad Jacobs in 1997, United Rentals became a publicly traded company, and it grew rapidly by acquiring more than 250 rental companies. United became the North American rental industry leader in just 13 months and today is the largest rental-equipment company in the world with more than 700 locations in the United States, Canada and Mexico. Jacobs, who served as chairman of United Rentals until August 2007, was successful in attracting tens of billions of dollars in capital to the rental industry, fueling enormous expansion along with increased customer, supplier and employee-based growth.

- The late Mitch Hoxie was an industry pioneer, starting Phoenix's first rental equipment business in 1947 and remaining active in the Arizona market until his retirement in 1981. A former ARA executive vice president, he became the ARA board's first director at large when that position was created in 1975 to represent past officers and directors.

- The late Hal Plugge Jr. had a vision to start a national chain of franchised rental stores. He began working in the purchasing department of his father's hardware wholesale company, Dealer Supply, in 1958. During the next year, he anticipated the trend toward renting and developed the idea of a tool rental program for hardware and lumber dealers, and the first tool rental program for the company was introduced in 1962. The first Taylor Rental Center (Taylor was Plugge's middle name) opened in Rutland, Vt., in June 1963.

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MANUFACTURER NEWS

Volvo/Huss Retrofits Produce CARB+ Engines



Volvo Construction Equipment entered a strategic partnership with Huss, a Swiss specialist in diesel exhaust aftertreatment, to provide retrofit systems for Volvo construction equipment that will significantly reduce exhaust emissions. The Huss system is verified to meet California's CARB Level 3 requirements (minimum 85 percent particulate collection), and Volvo equipment owners using the system will be able to meet the "In-Use Off-Road Diesel Vehicle Regulation" of New York Local Law 77.

The Huss retrofit can collect 99 percent of diesel particulate matter emissions, substantially exceeding CARB requirements, with no increase of NOx or other secondary emissions. Volvo CE will begin its engine retrofit program immediately with Huss MK exhaust aftertreatment. The partnership is based on an agreement between Volvo and Huss that will make

Huss systems available for Volvo Trucks, Mack Trucks, Volvo Penta, and Volvo Bus engine retrofit globally.

The retrofit system integrates a particulate filter into the vehicle exhaust system, and a Huss control unit monitors filter function to control diesel regeneration. Active filter regeneration, using an integrated fuel burner, typically takes place

SUPPLIER WATCH

RSC Integrated Services Focuses on Industrials

RSC Equipment Rental's new Integrated Services Group assembles an array of new services that promise cost savings and improved efficiency in the unique equipment environment of many power, mining and petrochemical companies. Integrated Services includes equipment rental; Total Control, a software solution created by RSC to manage rentals; Mobile Tool Room, custom-stocked with all the tools, small equipment and hardware necessary for a specific project; on-site and off-site management services; and industrial-scale pump and power solutions.

"We are looking to become an all-inclusive supplier, tailored to the concerns that are important to our customers," says Pat Lowry, vice president, Integrated Services.

after 8 to 10 operating hours and is completed in 5 to 35 minutes. Engine exhaust backpressure is set to Volvo requirements.

Huss was one of the first to have a CARB-verified emissions-control technology and to establish sales,

technical support and components warehousing in California to serve North America. Applications of the HUSS systems include construction/mining equipment, industrial and refuse trucks, heavy-duty on-highway vehicles and more.

RUNNING GREEN

Keep Batteries from Raising Waste Liability

If you're handling them as universal waste, batteries don't count to your generation rate and there are fewer requirements for handling them," says Ed Buckner, an environmental engineer specializing in RCRA enforcement for EPA's Region 7. "You just contain and label them properly, and make sure they're handled by a registered transporter and properly recycled."

Lead-acid batteries make up one of four special waste categories — the others are pesticides, mercury-containing equipment and lamps — that EPA calls universal waste. Handling requirements acknowledge widespread recycling of these special

wastes, encouraging generators to recycle them through the retail outlets and other vendors who are set up to collect and reclaim their residual value.

"Remember you have to handle lamps — like fluorescent tubes or sodium vapor lamps — as universal waste, too, or they will be counted toward your generation rate," Buckner warns. Handling standards vary somewhat by lamp type, so check with your local environmental agencies. Typically, waste-management contractors such as Safety-Kleen will haul away and recycle used lamps.

— LARRY STEWART

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Rebroadcasting

Links Multiple Sites to One Base

In this “green” era, why not recycle the set-up work already done and paid for? Virginia contractor leverages its Trimble equipment

Machine control is one thing. Cost control is another, especially these days.

But, as technology-embracing contractors like E.V. Williams are proving, one does not have to come at the . . . well . . . expense of the other.

A site-preparation and heavy-highway contractor based in Virginia Beach, Va., E.V. Williams leverages its Trimble machine control products via use of a “rebroadcast” system.

“We stay within a 50-mile radius of our

office, so a lot of our projects are really very close,” explains Kyle Myers, project engineer and GPS manager with E.V. Williams Inc. “So what we’ll do is set up a main base station at our bigger project or at our main yard, and we’ll calibrate from there. We’ll put that base station up on the Internet; it’s got an IP address. A rebroadcast system just uses a wireless Internet card, dials up that IP address, and takes the corrections through the Internet to the site it’s on, and then you do a site localization — basically check into some control points.

Miles away from the base station set up at a centralized location, Kyle Myers of E.V. Williams is able to use a rover survey device on another jobsite to collect satellite information and correction factors via a rebroadcast system set up in his pickup truck.



Photos: Roberto Westbrook / Getty Images

"It saves the need for another \$40,000 base station, and it costs about \$5,000 for a rebroadcast system, and they're good anywhere from 12 to 15 miles with decent accuracy."

By decent accuracy, Myers means a rebroadcast system can be used well for rough grade work beyond the six or so miles recommended by the GPS equipment manufacturer for fine work.

"If you stay within 10 kilometers or six miles of that base station, your accuracy is maintained," says Joe McNamara, vice president and machine control expert with Spectra Integrated Systems, the Trimble dealer in Virginia and the Carolinas.

"With rebroadcast, the idea was: We'd plug the base station up to the Internet at one jobsite, and then we made a little suitcase, if you will, with a WiFi card, a wireless modem and a radio that the contractor could take to another jobsite to call back to the first base station, so they didn't have to push radio signals through cities or subdivisions — standard radios just don't go as far. The rebroadcast site would call to the base station back at Job #1, get the corrections, and put it out on the radio so the machines could use it again. So, in essence, we're rebroadcasting from one jobsite to another."

This is "a perfect solution for people who work close to home bases," says McNamara.

E.V. Williams has been using the system for the better part of two years now. "Spectra I.S., our local Trimble dealer, came to us and said: 'Since all of your projects are so localized, why not go ahead and try this rebroadcast system?'" says Myers. "Spectra's always been great to work with for us, and they helped us out tremendously on this in particular."

It's about being a good partner, says McNamara.

"We actually bring it to the attention of most of our users, but only once they get to a certain level of adoption of the technology," he says. "We're a very high value-add partner

to these customers of ours. This stuff is changing very fast, there's a lot of options, and they're looking to us to provide them the guidance to save them money, as well as keep them in the latest and greatest technology. We don't sell as many base stations because we went this way, but the theory in our company is that if we're saving them money on that front, that money will get plowed into bulldozers. Base stations do not make anybody any money; bulldozers, motor graders, excavators — the equipment with GPS — make you money."

E.V. Williams owns four rebroadcast systems and is able to work them all at once off its Trimble SPS 880 base station. Just think of the alternative, says McNamara — five different base stations on five different sites. "It's tough to explain to the owner," he says, "with that yellow box on that post over there, just how is that making him money?"

And, for contractors like E.V. Williams which concentrate on local projects, they're not giving up anything on fine-grade accuracy, especially within the six-mile guideline, says McNamara. "It's phenomenal. It's as if you had a base station on each of your jobsites. What happens beyond that is a parts-per-million error, with curvature of the Earth, and just over distance the error is going to compound."

It is possible to work up to a dozen rebroadcast systems off a base station, says McNamara, "but we're not going to see it in my lifetime. The virtual reference stations will come into play before that."

Within the Spectra I.S. dealership area



As project engineer and GPS manager with the major Virginia site-prep and heavy-highway contractor E.V. Williams Inc., Kyle Myers has embraced the rebroadcast system idea pitched to him by Trimble dealer Spectra Integrated Systems.

Application: Machine Control



Above: Kyle Myers, project engineer and GPS manager for E.V. Williams Inc., looks over the Trimble SPS 880 base station housed inside a large wood crate.

Below: Miles away at one of a number of jobs being served by the base station, Myers sets up the rebroadcast system inside his pickup truck.



alone, he notes, the Departments of Transportation in North and South Carolina have set up statewide networks of base stations that can be accessed by contractors.

A downside

Beyond the distance limitations created by the natural curvature of the Earth, there is an additional downside to rebroadcasting,

says McNamara.

“The biggest issue we deal with the rebroadcast is Internet. Internet’s the key,” he says. “We’re replacing the radios with an Internet connection, if you will, to get from one jobsite to the next. And most of these jobsites don’t have Internet on it because we’re moving earth, so with our systems we moved to the WiFi cards. Probably two or two-and-a-half years ago, the manufacturers came up with a wireless router that you actually stick a broadband card into it, and it’s then an Internet hub — a wireless hub. We can take that out, plug it into the cigarette lighter of a truck, and we now have Internet on the jobsite. Since the amount of data that the base station pumps out is very small, we can let it run all day long, and the cell phone companies don’t get upset that you’re a spammer or something like that.

“But the wireless connection to the Internet is the weak link, if you get into really rural areas.”

And with the Internet, signals can be blocked out, notably so for contractors in Virginia working near military bases, ports and other sensitive government locales.

As rebroadcast systems are used out beyond the six miles recommended for fine-grade accuracy, uses become more general, but not without value, says Myers, “especially if the company needs me to topo and tell them how much material is in a stockpile,” he says. “Well, I just went out there with the rebroadcast system, and I made a false point — 1,000/1,000/100 or something like that — and then I topo’d the stockpile. All the error is relative to that point, so I could give them the exact volume of that stockpile within 20 minutes. It saves a lot of time not having to set up a base at each site.

“That topo I did was something like 20 miles out, but it doesn’t matter when the error is relative to itself. If I shoot the ground and it’s two inches off, then the top of the pile is two inches off, too.”

It comes down to contractors maximizing utilization of equipment they’ve invested in, says McNamara.

“We’ve even seen them push it out 30

miles to just do a stockpile measurement, because it's all relative. We just need a volume not relative to anything else, so they can go out very long distances," says McNamara. "Some companies might say, 'Alright, we used the rebroadcast at the beginning of the project at 12 miles, because that's where the base is, and when we get into fine grading we'll bring in a local base.' It just gives them flexibility to keep all their equipment utilized and not spend more money until they have to."

Beyond the networking within a company, the technology is spreading connections externally, too.

"If need be, we'll use it in other areas beyond our immediate area," says Myers. "If we have a good relationship with a contractor, we'll use their rebroadcast system; and likewise if they come into our area, they'll use ours. It saves the need for having to set up bases in all these different projects."

McNamara has seen this throughout the Spectra I.S. coverage area.

"We have some contractors who are more dispersed, but they are friends with other contractors. One would put one base station on, let's say, their shop building, and the other one a number of miles away would put one on their shop. When they're working in the other area, they'll use the other company's base station, and when they're working in this area, they'll use their own. They begin to reciprocate. It's an innovative way to deal with the base station issue and keep the cost down.

"These guys tend to be very cooperative with other people who have taken the plunge and spent the money to invest in the technology. I doubt they're going to be real wild about, 'Hey, I just bought a machine. Can I use your base?'"

E.V. Williams has a wide variety of Trimble products, ranging "from the Jurassic yet fully functional MS 750/SNB 900 base station combo with a 13-inch zephyr antenna, to the latest SPS 880 base with Internet and GLONASS capabilities," says Myers. The company has four rovers in constant use, one of which uses the GLONASS satellites as well. All rovers use the SCS900 software.

Myers builds the majority of his company's digital terrain models in-house using Teramodel. Some more complicated models are subcontracted to Spectra I.S.

E.V. Williams uses GPS machine control on six different earthmovers, including one Caterpillar D6 and two Deere 700 dozers with dual-mast configurations. One excavator and two graders are also GPS-equipped.


Among the contractor's ongoing jobs is a \$100-million Virginia Department of Transportation contract as part of the Interstate 64-Battlefield Boulevard interchange construction in Chesapeake.

"It's amazing how much money it'll save you when you don't have to string-line a road and you can put a grader right on it, and it saves you three men and the amount of time it takes you to string-line. The fine grade costs and everything just drops way down," says Myers. "Everybody who works with the technology and understands it likes it.

"A lot of the older guys like the traditional methods, and there was a little bit of a learning curve. But we've got guys who have been doing this work 30 years running it and now they don't understand that the machines can actually run without it. As soon as it goes down, they're calling."

E.V. Williams "is one company you can pat on the back," for leveraging machine-control technology, says supplier McNamara.

"They're very progressive trying to get into this," he says, "but they are also always trying to get their utilization and knowledge of all the capabilities of it up. Kyle's getting full utilization and maximizing the ROI on this equipment."

In this regard, machine-control technology is not unlike anyone or anything else on the jobsite: If it's not working, it's not making money. 

"These guys tend to be very cooperative with other people who have taken the plunge and spent the money to invest in the technology. I doubt they're going to be real wild about, 'Hey, I just bought a machine. Can I use your base?'"

— Joe McNamara, Trimble dealer speaking about customers using machine-control rebroadcast systems.

How to Keep an *RT Crane on Its Wheels*

Rough-terrain cranes are productive but potentially dangerous machines.

Following the load chart can help you tame them.

First introduced in 1959 by Grove, the rough-terrain crane was designed as a multi-purpose construction tool. Equipped with industrial-strength tires, these mobile machines can lift loads on muddy, uneven, or harsh ground, otherwise precarious territory for truck-mounted cranes and other mobile cranes. To a certain extent, they are also able to transport loads on leveled ground. But because rough-terrain cranes mainly operate on treacherous terrain, operators need to conduct their work with utmost caution.

This was not the case in Minturn, Colo., in 2005 when a crane operator working on U.S. Forest Service land was killed after the rough-terrain crane that he was driving downhill tumbled off the road. Or in 2006, also in Colorado, when an operator died in a rough-terrain crane tip-over accident that resulted in large part because the crane was operating outside the manufacturer's load-chart specifications.

Or again in 2007 in Gilbert, Va., when a 49-year-old operator technician chose not to use the outriggers on his 20-ton rough-terrain crane to lift a section of a pipeline at an iron-ore mine, ending in yet another tip over. The man jumped or fell from the crane as it was tipping and was crushed when it landed on him.

According to Bud Wilson, president of and crane instructor at The Crane School, most rough-terrain-crane accidents occur because operators fail to scrutinize the load chart.

The Bible of cranes

There are three different methods of lifting loads with a rough-terrain crane: stationary and over the front; stationary and 360 degrees; and pick and carry.

The first method — stationary and over the front — often provides higher load capacities. For this type of lift, the boom must stay in between the front two outriggers or tires.

Take note, however: The maximum load capacities for outriggers are different with tires, so operators must make sure to study the appropriate load chart or risk tipping the crane. Also, moving the boom to the outside of the two front outriggers or tires could also make the crane unstable.

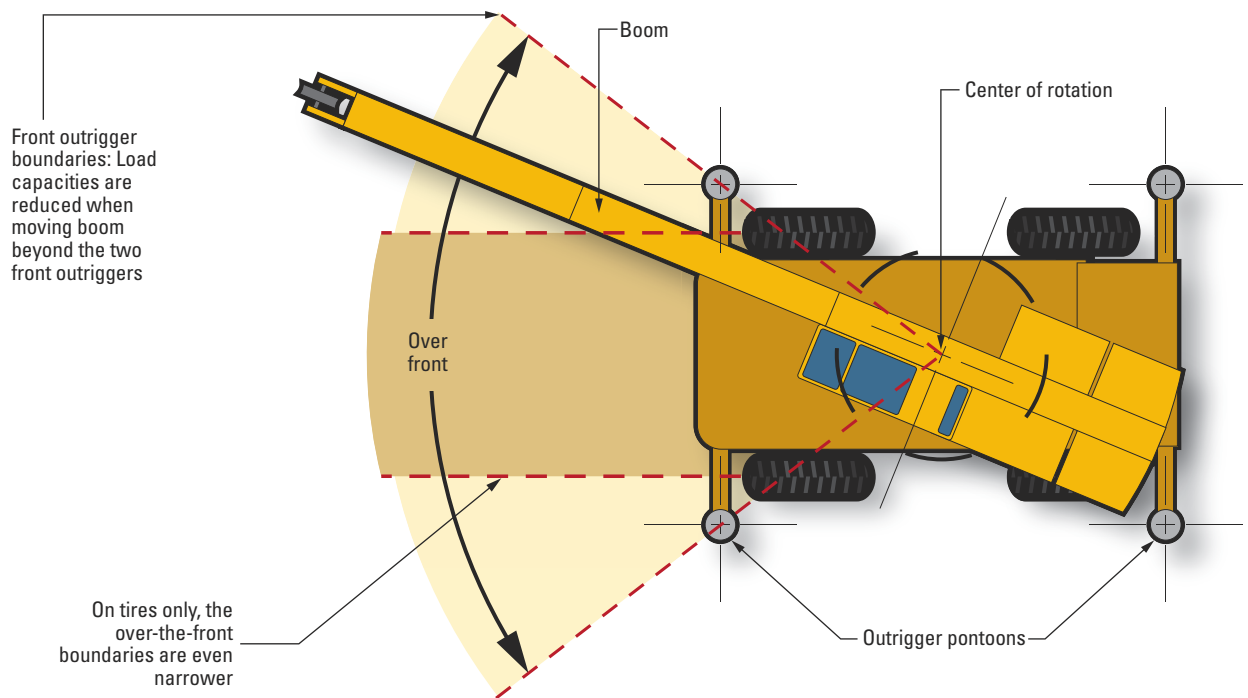
The second method — stationary and 360 degrees — means the boom can be in any load radius and can rotate around the base, while the crane itself remains motionless. The boom can move outside the two front outriggers or tires, but load capacities will be reduced compared with the over-the-front method. Again, load capacities for outriggers and tires are different.

The first two methods allow for operators to make lifts on rubber tires in addition to outriggers, provided that the appropriate load chart — either for tires or for outriggers — is used to determine maximum capacity.

Still, the crane must not be driven. The third lifting method was designed for pick-and-carry operations.

When transporting loads on a rough-terrain crane, operators must drive in "creep

Over-the-Front Boundaries



When supported by tires, rough-terrain cranes have a shorter over-the-front swing room compared with operation on outriggers. This means that there is less working area in which to make lifts using over-the-front load capacities. In order to prevent tipping or structural damage, operators must be conscious of the front-tire boundaries and use the "360 Degrees" portion of the load chart whenever the boom exits the boundaries.

mode," meaning the crane should keep below 1 mile per hour and not exceed 200 feet of movement in a 30-minute period.

Rough-terrain cranes on wheels can be so unstable at certain weights or boom angles that Link-Belt's TLL load chart, used by the National Commission for the Certification of Crane Operators to instruct operators, lists this warning: "When operating on tires, do not exceed 76-degrees maximum boom angle. Loss of backward stability will occur causing a tipping condition."

In other words, rough-terrain cranes can tip at extreme boom angles even if they are not loaded at all.

Driving with the boom too high "creates a very high center of gravity and will cause sideways and rearward stability problems," says Steve Fryer, training coordinator at Northern Crane Services. "This is especially dangerous with jib or extension erected. The ideal boom angle is as low as possible and still be able to see under the boom with the block or ball hanging free and as low as possi-

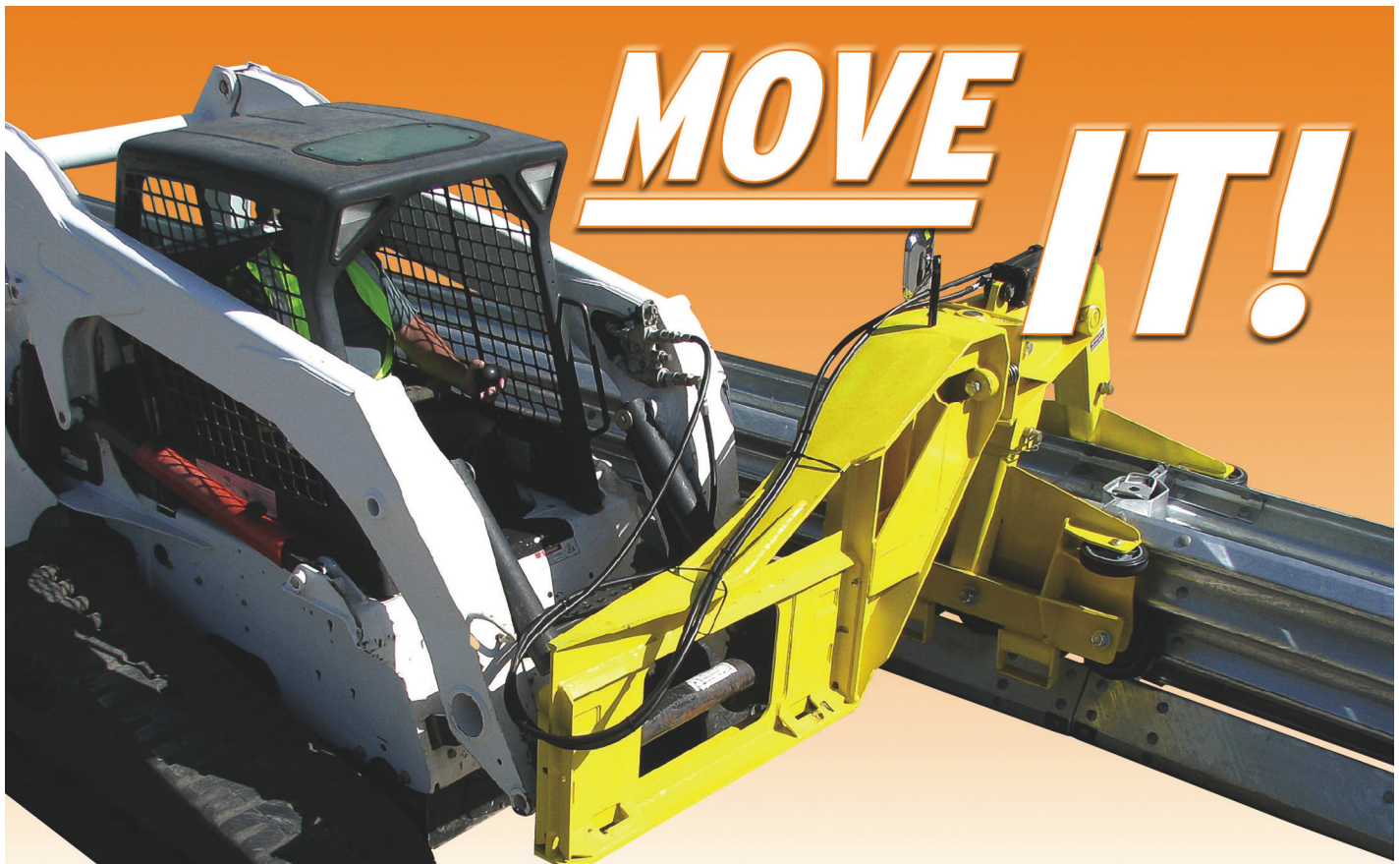
ble to prevent excess swinging."

Tipping is not the only danger when a rough-terrain crane operates outside the rated capacities. Structural damage is possible as well. But unlike tipping, operators have no warning that a section of the crane is about to break.

"When you're in the tipping range of the crane, the crane will start to get light and the operator can actually feel it," says Wilson. "It will feel like it's not stable anymore, and when that happens, then you know to stop and set the load down. It's the seat of your pants, it'll get light."

"But in structural, there is no indication of overload; it'll just fail, and that's dangerous. You can have a catastrophic failure and not have any advanced warning that you've overloaded the crane."

Determining the structural and tipping ranges of the crane is illustrated in the load chart. Under the "360 Degrees" and "Over Front" columns of the load chart, capacities below the bold line indicate tipping. So, for



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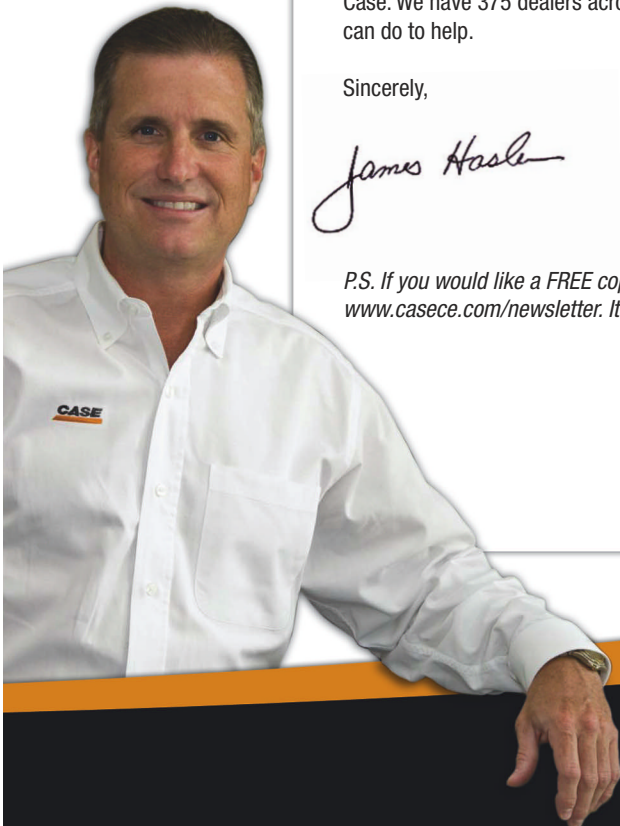
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The sub-prime mortgage mess broke wide open this year, following up 2007's blow with a crushing economic credit crisis late in 2008. Equipment manufacturers who rode a global economic boom mid-year were cutting projections as stock prices plummeted and the world talked of global recession. In North America, recession and credit slowed or stopped construction projects and had the managers of the nation's equipment fleets staring askance into 2009: Just what would this year bring?

Our annual survey of fleet managers of every vocation hit the field in the early fall, and results were in just before the government stepped in with its bank-bailout plan. There's no doubt equipment users were aware of the problems in the credit market and general economy, however, as results contained in this report show.

Construction Equipment has published its Annual Report & Forecast for more than 25 years, surveying the nation's fleets for a look on the year just ended and forecasting prospects for the new year ahead. As in years past, our own Reed Business Information economist, Jim Haughey, leads off this year's report with an analysis of the economic trends at work in the country as well as how these trends affect the construction markets in which equipment works. Haughey's report, written just before the presidential election, puts perspective on the credit crunch and other macro-economic factors.

Our report on the largest exclusive survey in the industry of equipment owners and managers follows Haughey's analysis. We once again include a look at the companies that supply construction equipment: rental dealers and distributors, partnering with two industry associations serving those suppliers. The American Rental Association and the Associated Equipment Distributors gave us access to their members, who we surveyed for this report. We are indeed grateful for their continued support.

We are also thankful for the support of Case Construction Equipment, who sponsored the Annual Report and Forecast for the sixth consecutive year. Case is a full-line manufacturer of earthmoving equipment, and its support of this project allows us to publish substantial amounts of data and analysis for the industry's use.

About 10,000 questionnaires were mailed in September, with about 2,000 usable questionnaires returned for an overall response rate of 19.8 percent. What follows are the results from these surveys, and *Construction Equipment* is pleased to publish it as a service to the industry. To those whose participation made the 2009 Annual Report & Forecast a success, we thank you.

This report is also offered online at ConstructionEquipment.com/arf2009.

OUTLOOK 2009

CREDIT CAUSES ECONOMY TO CRAWL

Construction will suffer along with the general economy through most of 2009 as the recession moves slowly through the year. Unlike other downturns, however, credit will be expensive, more difficult to obtain, and will put serious pressure on both private and public projects.

Construction spending will continue its three-year decline through the third quarter of 2009, down 9.5 percent in current dollars and more than 20 percent after adjustment for project-cost inflation. The precipitous spending declines in residential construction will finally reach bottom in 2009, albeit late in the year. Heavy and nonresidential construction spending, on the other hand, drops sharply this year after years of robust double-digit growth.

Construction-equipment users and their

suppliers will face subpar economic growth until late in 2010, which means better pricing and availability. Supply conditions loosened at the end of last summer when the world commodity price boom abruptly reversed. Materials, labor, equipment and design resources will be relatively more available and less expensive during the next two years.

Last fall's credit freeze slowed some ongoing projects when the flow of short-term credit to project owners was interrupted. Other scheduled project starts were delayed due both to delays in financing and a worsened outlook for space and facility capacity needs. Projects in the pre-start development phase were slowed for similar reasons.

Some of the delayed projects will come back on track as the credit freeze thaws, which began mid-November

2008. Most, but not all, businesses in the construction and other nonbank industries should again be able to obtain the credit needed for normal business operations. Financially marginal firms will be rationed out of the credit market for several years. In addition, firms that were able to obtain credit at the end of 2008 will need less credit in a weaker economy than they anticipated needing early last summer. And the credit will be more expensive.

Banks will move to recover their losses from defaulted home mortgages as central banks and Treasuries around the globe lower credit costs in order to enable lenders to add liquidity and restore loan availability. Actual loan rates for customers, though, will be higher than normal as banks hoard scarce capital and ask for higher spreads, or

2009 CONSTRUCTION SPENDING OUTLOOK

SPENDING TO GROW 0.7%

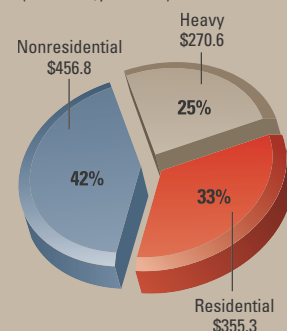
	\$ Billion	Annual % Change		
		2009	2007	2008
Total Construction Spending	\$1,082.7	-2.9	-5.3	0.7
Residential, new	\$236.1	-26.4	-16.6	-3.5
Residential improvements	\$119.2	-3.6	-11.3	-4.4
Nonresidential	\$456.8	17.6	12.2	1.2
Nonbuilding	\$270.6	10.8	12.4	6.0

Source: U.S. Department of Commerce | Forecasts: Reed Construction Data

Total construction spending will increase 0.7 percent in 2009 after a 5.3-percent fall in 2008. Spending will be declining rapidly at the beginning of the year, but will be rising slowly by the end of the year. Spending slows in all construction sectors. The major changes in 2009 are the abrupt slowdown in private commercial buildings early in the year, a direct impact of the credit freeze. Later in the year, we'll see a similar abrupt slowdown in public and institutional buildings following a year of reduced tax collections and investment earnings.

TOTAL SPENDING FOR 2009

(current \$, billions)



Forecasts: Reed Construction Data

The residential share of total construction spending will drop under 33 percent in 2009 from an unusually high peak share of 57 percent in 2005. The residential share will move back toward 50 percent in the following few years.

premiums, over their own borrowing rates. So instead of the typically cheap credit during recessions and periods of subpar economic growth, credit will be expensive in 2009.

Changes in spending in any construction sector depend on how closely its financing is connected to world financial markets and how sensitive the demand for its space or facility capacity is to changes in spending in the economy. Housing is the sector most closely connected to financial markets. But with the housing market now restricted to households

with solid credit records, new home mortgages are attractive to lenders. Housing will be little affected by the credit freeze.

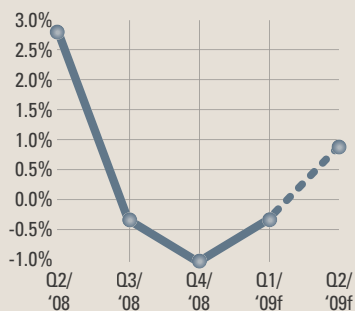
The private commercial market, however, will be negatively affected by the credit freeze. Ongoing developments are frequently financed with short-term loans intended to be rolled over frequently. Some of these loans could not be refinanced in late 2008, and others could be rolled over only with a much higher credit cost. In addition, some projects approaching the financing phase in late 2008 were stalled

when the expected credit arrangements could not be made. Public and institutional construction were less directly hit by the credit freeze. Projects funded from cash on hand or ongoing revenues were not impacted, but projects funded from bonding did suffer. Municipal bonds are typically higher quality investments for lenders than speculative commercial property.

The feedback on construction spending from the now weakened outlook for economic growth is initially largest for private commercial projects but, with

GROSS DOMESTIC PRODUCT

(annual % change, inflation-adjusted)



2008 Estimate: **1.4%**

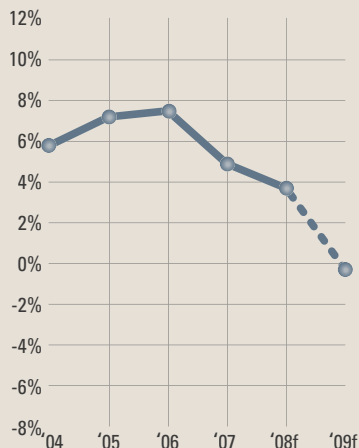
2009 Forecast: **0.4%**

Source: U.S. Department of Commerce
Forecasts: Reed Construction Data

Gross domestic product is now declining with the recession expected to extend at least through the first quarter of 2009. Assuming the credit freeze thawed early in the fall, the recession will be relatively mild, similar to 2001. Yet it could be more severe if problems persist for normal business loans into the fall. Recovery from the recession in late 2009 and in 2010 will be slower because credit will be more expensive than usual. Several years of subpar economic growth and construction activity will keep cost inflation for construction materials under 5 percent following a period of declining prices late in 2008.

BUSINESS INVESTMENT

(annual % change, inflation-adjusted)

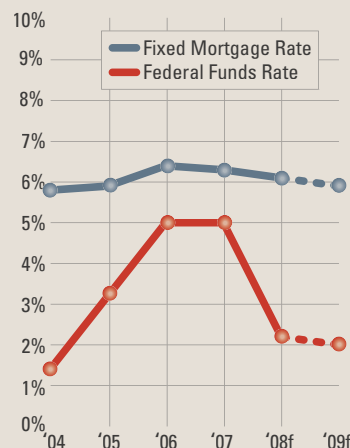


Source: U.S. Department of Commerce
Forecasts: Reed Construction Data

Business investment spending will decline for three or four quarters from late 2008 to mid-2009 after a six-year expansion of nearly 40 percent. The decline will be more substantial for motor vehicles and the metalworking and plastics processing equipment this industry uses, primarily affecting the Great Lakes states. No decline is expected for equipment related to energy production or aircraft, which is positive for Texas and California, or for farm equipment, which is positive for Illinois and Iowa.

INTEREST RATES

(Avg. annual rates)



Sources: Freddie Mac, Federal Reserve Board
Forecasts: Reed Construction Data

The credit freeze is gradually thawing. All Reed Business Information forecasts assume that the worldwide fix to the credit problem is effective enough so that by mid-November, creditworthy nonbank companies will have nearly normal access to credit for normal business operations, although at higher-than-normal rates. The trillions of dollars injected into the financial system make loan rates between banks unusually low. Loan rates will be unusually high for business loans because banks will be forced to ration credit as the financial system de-leverages, eliminating several trillion dollars of available lendable funds. A few financially marginal construction industry firms, mostly residential, will lose access to credit.

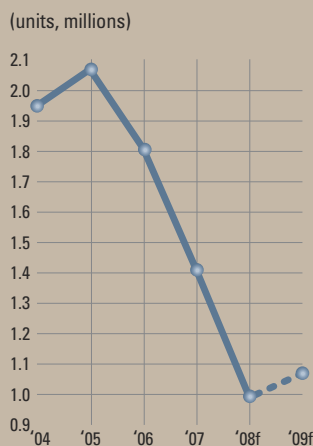
a delay, will be as large for public and institutional projects. The impact on housing, usually large, will be smaller in this recession since there was no excess home construction underway when the recession began.

The demand for commercial rental property is sensitive to economic conditions. Already, vacancy rates are rising and rental rates are declining. The expected rate of return from building a new commercial building has fallen sharply in the past few months. In an increasing number of markets, it is now more profitable to buy an empty building than build a new one.

Public and institutional construction will hold up much better during the early phase of the recession because there is no profit calculation in the calculus to make the build/not build decision. And there is no need to search for tenants. Eventually, falling tax receipts and investment earnings will force desired projects to be postponed. Already, there are widespread reports of public-spending cutbacks. This belt tightening will reach construction budgets by the middle of next year.

Regionally, the construction downturn will be the most severe in the states that experienced the most severe housing recession in 2006-08. This is because their housing recoveries will be delayed as much as a year, the need for related infrastructure has been declining, and the capacity to finance the infrastructure has also declined. This includes California, Nevada, Arizona, Florida, Michigan, Ohio and Rhode Island. Construction will be relatively stronger in the middle of the country from Texas to the Dakotas. These states have rising incomes from energy and farming industries and large enough "rainy-day funds" in their public budgets to prevent significant cutbacks in construction projects. ■

HOUSING STARTS



Source: U.S. Department of Commerce
Forecasts: Reed Construction Data

The housing recovery has been delayed by the spillover from the credit crunch. The direct impact on housing starts will be minimal since the market now consists only of creditworthy households, but the feedback from the recessionary economy will keep housing starts falling slowly into the winter. Recovery will be slow, probably not significant until late in 2009, in a market environment with two million extra, often empty, unsold existing homes. Housing starts will begin to recover several quarters before national home price indices stop declining and the residential-real-state recession ends. The surplus of new unsold homes is oppressive at the current low level of sales, but it is absolutely low so starts will turn around quickly when economic conditions permit a pickup in home buying. The housing recovery will be delayed until 2010 in California, Arizona, Nevada and Florida.

HEAVY CONSTRUCTION TRENDS & OUTLOOK

	\$ Billion	Annual % Change		
	2009	2007	2008	2009
Total Heavy Construction	\$270.6	10.8%	12.4%	6.0%
Highways & Streets	\$84.0	4.9%	4.0%	7.3%
Power	\$76.7	32.5%	29.5%	12.2%
Transportation	\$35.8	15.6%	10.0%	0.9%
Communication	\$24.6	21.2%	-3.9%	-5.0%
Water & Sewer	\$44.0	1.6%	8.2%	5.0%
Conservation & Development	\$5.5	2.3%	0.5%	4.0%

Source: U.S. Department of Commerce | Forecasts: Reed Research Group

Spending will increase 6 percent in 2009. Although this is about half the pace as in the previous three years, more than half of the gain will be due to higher cost, especially for cement, metals, energy-based products and, increasingly, skilled labor. Much of the added construction spending in 2009 will be for power generation and oil and gas field development.

NONRESIDENTIAL CONSTRUCTION TRENDS & OUTLOOK

	\$ Billion	Annual % Change		
	2009	2007	2008	2009
Total Nonresidential	\$456.8	17.6%	12.2%	1.2%
Education	\$102.7	12.9%	7.6%	-0.7%
Commercial	\$84.9	15.4%	-0.9%	-3.2%
Office	\$75.3	19.4%	12.3%	3.5%
Health Care	\$48.0	11.5%	6.2%	5.4%
Amusement & Recreation	\$20.5	13.8%	5.2%	-9.8%
Manufacturing	\$66.4	21.1%	47.4%	5.8%
Lodging	\$39.5	59.0%	31.1%	5.3%
Public Safety	\$13.2	26.5%	23.9%	7.7%
Religious	\$6.7	-3.8%	-7.7%	-6.7%

Source: U.S. Department of Commerce | Forecasts: Reed Construction Data

Spending will increase 1.2 percent in 2009, following the 75-percent rise in the previous five and a half years. The building boom is not yet complete. The market had much less excess space than at the end of the last building boom in 2000. The boom was interrupted by the credit freeze and will resume, slowly, after the current recession ends.



“The Case 1650L dozer is outstanding. It has a tremendous amount of power, and is very smooth at any speed. The hydrostatic drive is one of the best things Case has ever done.”

Dewayne Millsap, Millsap Construction



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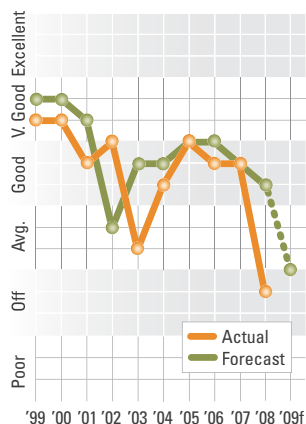
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2009 IS A MYSTERY

CONTRACTOR BUSINESS YEAR RATINGS

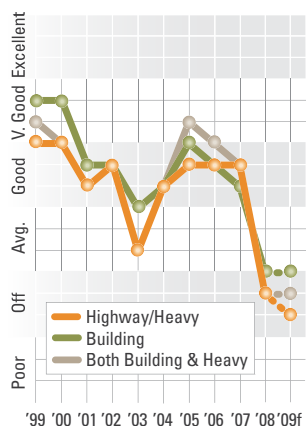
(actual vs. forecast, all contractors)



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

This indicates just how surprised contractors were by the construction contraction. Usually right on with forecast, actual ratings for 2008 weren't even close.

CONTRACTOR BUSINESS YEAR RATINGS, BY VOCATION



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

Highway/heavy contractors are playing it conservative, downgrading 2009 from the low 2008 rating. Other contractors are aligning 2009 with what they saw in 2008.

By **ROD SUTTON**, Editor in Chief

Last year we reported that contractors' conservative forecasts paid off when the residential market slowed, enabling them to meet their forecast when they rated the actual business year for 2007. But there was little to prepare contractors for what happened the following year, in 2008. And because our survey results were tabulated the week before the government announced its bank-bailout plan, this year's rating may not fully take into account the total effects of the credit crisis. Nonetheless, contractors rated 2008 as an "off" business year.

The level of uncertainty among respondents, however, kept their forecasts for 2009 prospects low. Surely, contractors were well aware of tightening credit markets before the rest of the country experienced the bailout debate. This year, contractors expect business to match 2008's rating of "off."

We categorize contractors as highway/heavy, building or diversified (engaged in both). Each rated the year similarly, with slightly higher ratings from building contractors, perhaps riding recent nonresidential strength. They, along with diversified contractors, look for identical business ratings for 2009. Highway/heavy contractors, however, look for a dip in 2009's rating.

The future of highway and other public spending is uncertain following the massive amount of public funds spent on bank bailouts and rescue plans, the details of which had not been worked out prior to the contentious presidential

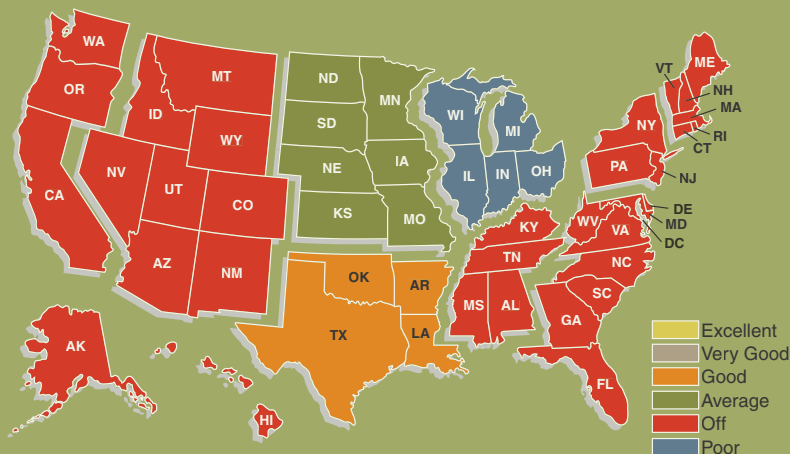
election. Add to this the expiration of the current transportation funding bill and declining tax receipts at the state and local level, and contractors can't help but be mystified by their prospects for 2009.

As contractors looked forward to 2009, contract volume trends were bleak. Last year 45 percent of contractors reported that contract volume was lower than it was in 2007. About 26 percent reported higher volume, for a net of -19 percent. This was the lowest net (percent increasing minus percent decreasing) in more than 10 years and well off the net of 19 percent projected for 2008 volume. The forecast for 2009 is also the lowest in years. Twenty-nine percent expect volume to decrease over 2008 levels, and 30 percent expect it to increase for a net of 1 percent.

Broken down by contractor type, work volume trends for 2009 differ. Both diversified and highway/heavy contractors expect volume decreases, with nets of -7 percent and -5 percent, respectively. Building contractors, however, report a net of 7 percent with 33 percent expecting volume increases minus 26 percent expecting decreases.

Regional differences are even more pronounced. Again, contractors as a whole expect 2009 volume to net at 1 percent. Only the Mid-Atlantic region is lower than that, and four of the remaining eight right around that 1 percent net. The remaining four regions (Southern Plains, Mid-South, South Atlantic, Mountain) contain more contractors forecasting growth than those forecasting

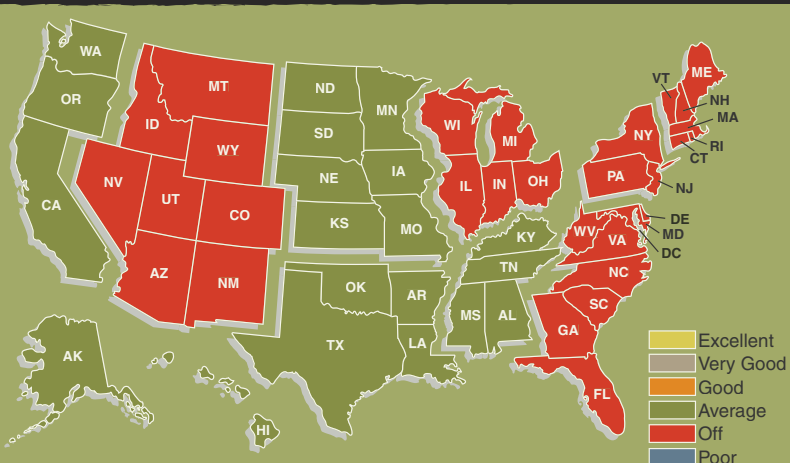
2008 CONTRACTOR BUSINESS REPORT



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

Business was "off" in two-thirds of the country's regions last year. The Plains states fared better, with Southern Plains calling 2008 "good," but the Great Lakes region registered the year as "poor," the lowest rating available.

2009 CONTRACTOR BUSINESS FORECAST



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

Forecasts missed last year, by a lot, and most regions are unwilling to indicate any improvement in 2009 vs. 2008. Mid-South, Great Lakes, and Pacific regions forecast improvements, but the rest of the country doesn't see much change.

CONTRACTOR ACQUISITION TRENDS

(% using for major equipment)

Purchase Outright	52%
Purchase by Financing	43%
Rental/Purchase	16%
Short-term Rental	16%
Lease/Purchase	13%
Lease	8%

Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

Owned equipment is the staple of the nation's fleets, whether purchased outright or financed. Rental continues as an alternative acquisition tactic, and many managers use rental/purchase or lease/purchase agreements to move machines into their permanent fleet.

volume declines. In fact, 53 percent of Mid-South contractors report growth minus 18 percent who report declines for a net of 35, by far the most positive outlook in the nation.

One in five contractors will be fighting for volume in "intensely competitive" markets this year, and an additional 55 percent in "very competitive" markets. Only 5 percent say their market is "not very" or "not at all" competitive.

On the other hand, 9 percent of contractors rank their company's overall health on the low side, choosing either "weak" or "very weak" to describe it. Some 58 percent rate company health as "very good" or "good." Highway/heavy firms are rated similarly by 65 percent of respondents, followed by 57 percent of building contractors and 55 percent of diversified contractors.

FLEET TRENDS

Fleet size did not drop as volume dropped, according to contractor respondents. About three in 10 reported fleet size growth, in terms of number of machines, in 2008. Subtract the 14 percent who reported fleet shrinkage, and the net was 13 percent. Last year was the lowest net (difference between those growing fleet minus those decreasing) in more than 10 years (including the 2002-03 recession years), and below the 20 percent net forecast, indicating that contractor equipment managers are watching cost of this substantial asset fleet. In fact, 2009's projected trend drops into the single digits, with a net of 7 percent. Some 18 percent expect to grow their fleet, but 11 percent expect to decrease the size. Of course, that leaves 72 who expect fleet size to remain the same as 2008, but there's little doubt contractors are keeping a close eye on fleet size.

Replacement rates, a measure of how fleets are updating their fleets, also dropped in 2008 to the lowest level in a long time. Fleet managers expected to replace an average of 8.9 percent of their fleets in 2008 but instead replaced only 6.9 percent. Expectations are flat for this year, too, with a replacement rate forecast of only 7.1 percent.

This slowdown in replacement rate and fleet size didn't affect fleet condition last year, according to respondents. Thirty-nine percent reported their fleets were in "excellent" or "very good" overall condition last year, comparable to the numbers reported in 2007. The low end of the scale were also comparable, with 14 percent reporting fleets in "fair" condition.

As emissions compliance continues to grow as an issue, fleet managers will

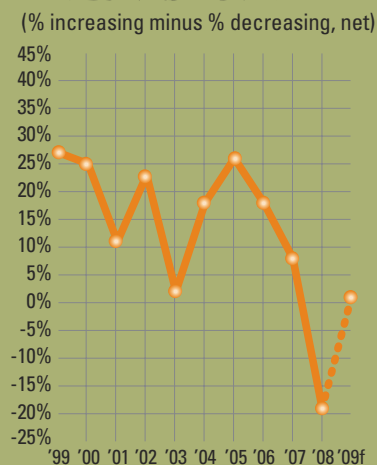
need to look more closely at replacement rates and fleet condition. California requirements, sure to move to other states, strongly favor the replacement of less-compliant machines. For about one-third of contractors who responded to our survey, the equipment manager has primary responsibility for compliance. A similar number of respondents, however, said no one has official responsibility.

Machines costing more than \$25,000 are acquired primarily by purchase, either outright or through financing, for 52 percent and 43 percent of respondents, respectively. Sixteen percent use rental/purchase agreements; 13 percent use lease/purchase. Short-term rental (defined as less than one year) is used by 16 percent of contractors to acquire these machines, too.

For equipment of any price, short-term rental is an acquisition option for 64 percent of contractors. Sixty percent of contractors rent light earthmoving equipment such as skid-steer loaders and backhoe loaders, which is by far the most popular machine category. Other machines rented by contractors are light equipment (44 percent), compaction equipment (33 percent), air compressors and generators (33 percent), and work platforms (27 percent).

Workforce trends last year were the reverse of 2007, when the net (percent increasing workforce minus percent decreasing) was 9 percent. In 2008, 32 percent of contractors reported a total workforce smaller than in 2007 and 21 percent said it was larger, for a net of -11 percent. ■

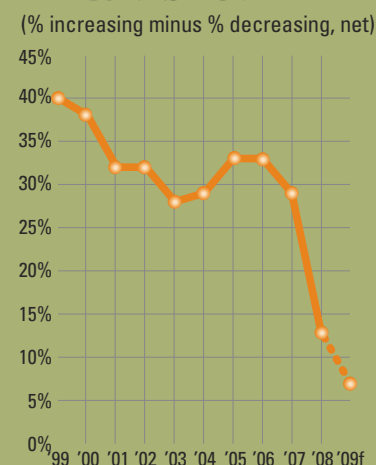
CONTRACT VOLUME TRENDS, ALL CONTRACTORS



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

The trends for contract volume fell far short of expectations last year, with the net increase of 8 percent the lowest since 2003. The forecast for 2009 is also off from historical estimates, although still fairly positive in nature.

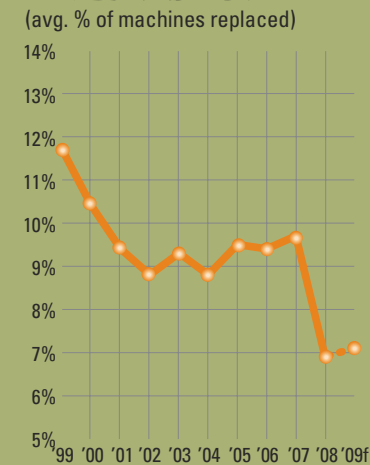
CONTRACTOR FLEET EXPANSIONS



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

Although there will be growth in overall fleet size this year, the net difference between expansions and contractions will continue to fall substantially.

CONTRACTOR FLEET REPLACEMENT RATES



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

These numbers indicate just how seriously contractors were taking fleet costs in 2008, with replacement rates at the lowest in several years. There is little this year to indicate fleet managers will be able to replace much more, either.



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Anthony Epidendio, DNA Ridge Rock



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IT'S UNANIMOUS

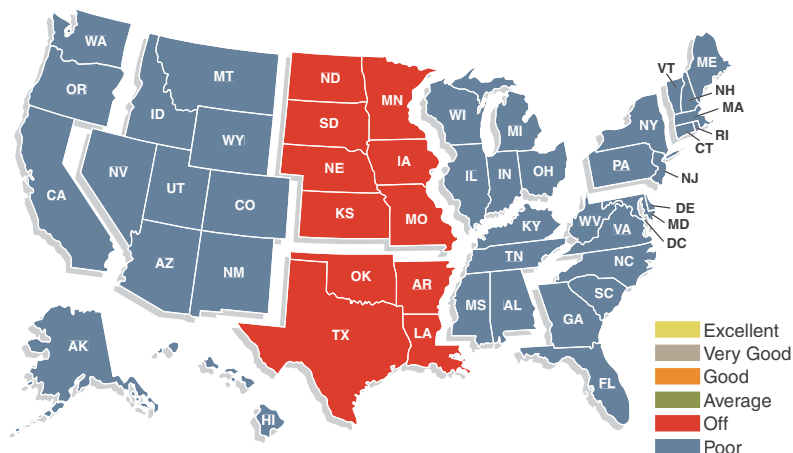
All three nonconstruction vocations were down last year, with expectations limited for 2009. Materials producers were hardest hit, but utilities reported a decent 2008 and some optimism for 2009. What follows is a detailed look at the results for each vocation.

MATERIALS PRODUCERS

In our 2008 Giants report, we noted that materials producers had been "blindsided." The results of our Annual Report & Forecast do nothing to dispel that reading. Materials producers labeled 2008 "poor," falling short of their expected "off" year. The forecast for 2009 is also "poor."

Work-volume trends have shown a precipitous decline since 2005, when the

2009 MATERIALS PRODUCER BUSINESS OUTLOOK



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

Materials-production business fortunes have fallen the past couple of years, and 2008 was another that didn't reach expectations. A sour outlook for 2009 includes an extremely negative "poor" for seven of nine regions.

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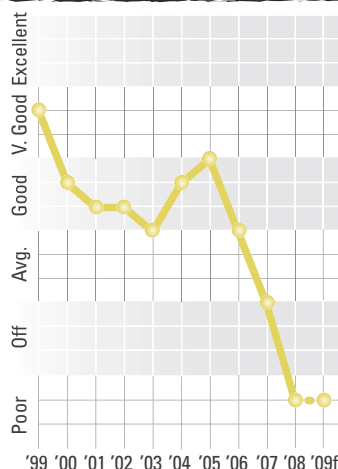
If there's one thing we know, And we want to tell the world.

net (increases in volume minus decreases) was 25 percent. For 2008, 59 percent of materials producers said volume decreased compared to the year before and 12 percent said it increased, leaving a net of -47 percent. The projection for 2008 work volume was a net of -10 percent.

For this year, materials producers project a net of -12 percent: 33 percent say volume will be below 2008 levels and 21 percent say it will be above last year. Competition within the materials production market is highly competitive, say respondents. About six out of 10 label it "very competitive," and 17 percent call it "intensely competitive."

Fleet-size trends also indicate blindsiding, following almost 10 years of consistent net numbers in the 20- and 30-percent range. In 2008, the net was -3 percent (forecast as 8 percent) as 17 percent decreased fleet size and only 14 percent

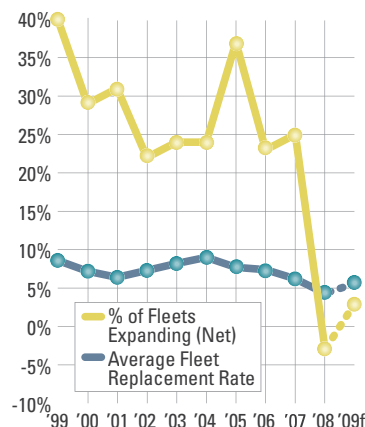
MATERIALS PRODUCER BUSINESS YEAR RATINGS



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

It's been a steady decline since 2005 for materials producers. Each year has been forecast to mirror the current, and then actuals come in even lower. It's hard to see that happening this year, though, as expectations are near the bottom.

MATERIALS PRODUCER FLEET-MANAGEMENT TRENDS



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

Replacement rates are at the lowest in more than a decade for materials producers, and a projected uptick for 2009 will still be below the 8 percent seen in the past. Fleet expansions have stopped, with the percentage saying they'll grow neutralized by those shrinking.

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increased the number of machines in their fleets compared to the previous year. This year fleet size nets out at 3 percent, with 14 percent anticipating growth in the number of machines compared to 2008 and 11 percent expecting fewer machines in the fleet.

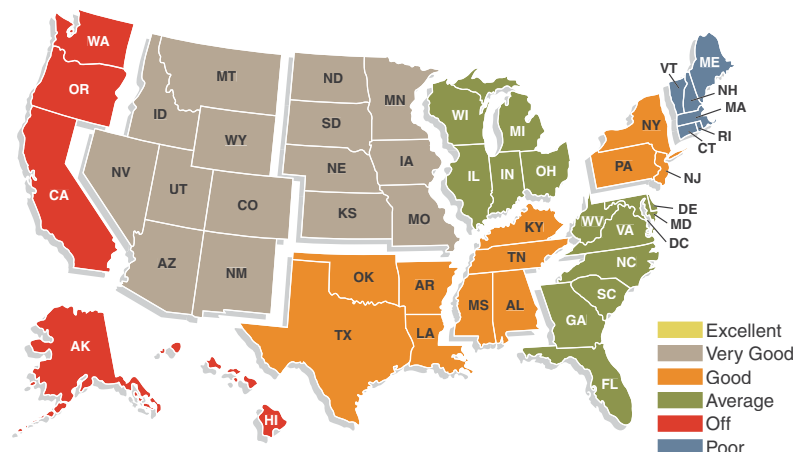
Not surprisingly, replacement rates fell in 2008. Materials producers replaced 4.7 percent of their fleet last year; they had anticipated a rate of 5.2 percent. This is down from a peak rate of 9 percent in 2004. Next year the replacement rate is forecast to increase to 5.6 percent.

Overall fleet condition, also down from 2007 numbers, was rated "excellent" by only one in 20 respondents in 2008, and "very good" by 32 percent. About 16 percent rated overall fleet condition as "fair" or "poor."

MINING AND ENERGY

Business fell off dramatically for mining and energy firms, according to their fleet managers, who rated 2008 as "off" after having projected it to be a "good" year.

2009 MINING & ENERGY FLEET BUSINESS OUTLOOK



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

Mining and energy business outlooks vary by region for 2009. Strong expectations resinate from Northern Plains and Mountain regions. Other regions are forecasting good and average years, but Pacific and New England prospects are decidedly down.

The exceptions were respondents in the Northern Plains and Mountain regions, who rated 2009 as "very good." Expectations for 2009 do not move from 2008 as managers forecast another "off" year, with

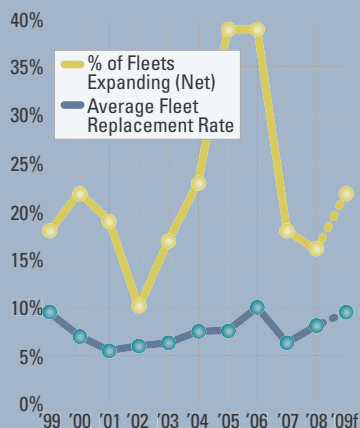
Northern Plains and Mountain regions expecting another "very good" year.

Work-volume trends provide the reality behind the rating, with 39 percent of respondents saying 2008 work volume was less than 2007. Volume, measured in total machine hours, increased 24 percent, which leaves a net of -15 percent. This was the lowest net in more than 10 years, and well off the 25 percent net forecast for 2008. For 2009, 30 percent predict work volume will be higher than in 2008. Subtract the 17 percent that project lower work volume, and 2009's net is 13 percent.

Fleet trends for mining and energy fleets were not as negative as business trends. About one in four respondents reported increasing the size of their fleets vs. 2007 levels and 10 percent said fleet size decreased for a net of 16 percent. The projection had been a net of 20 percent, and it is forecast again for that level for 2009.

Replacement rates increased last year after a dipping in 2007. In 2008, managers reported replacing about 8 percent of their fleet, which is one of the highest rates in the past 10 years but less than

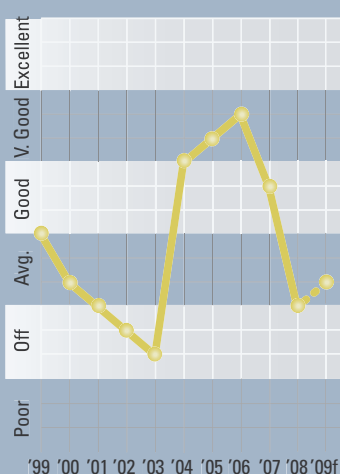
MINING & ENERGY FLEET-MANAGEMENT TRENDS



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

Fleet expansions scored the same as 2007, but replacement rates bounced upward last year. Managers of the country's mining and energy fleets want to replace at an even higher rate in 2009.

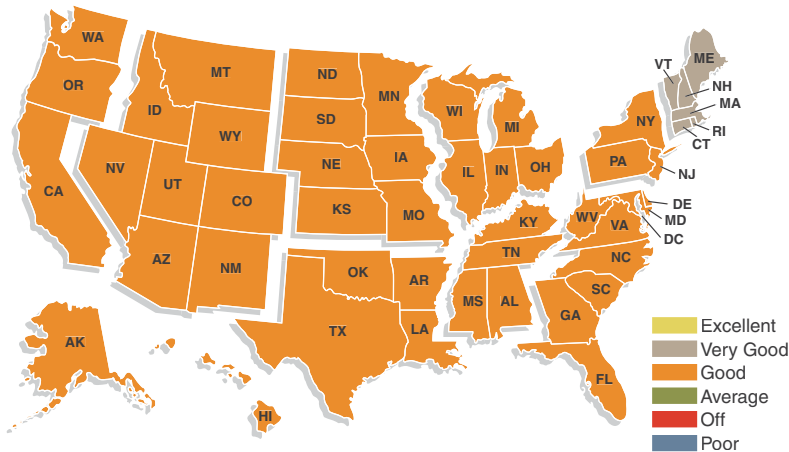
2009 MINING & ENERGY BUSINESS YEAR RATINGS



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

The forecast called for a slight decrease in business rating for 2008, but reality shifted for mining and energy firms. They're similarly skeptical about this year's business prospects.

2008 UTILITY FLEET BUSINESS OUTLOOK



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

Utility fleets just missed forecasts last year, registering a "good" year with regional "averages." Expectations for 2009 are identical to 2008 results, with the exception of New England fleets' more bullish outlook.

the predicted rate of 11 percent. For 2009, the projected replacement rate among mining and energy fleets is 9.5 percent.

Mining and energy fleets were rated in "excellent" or "very good" condition for 44 percent of respondents in 2008. This is down from 2007 levels, when 55 percent of respondents said their fleets were in similar condition. For 2008, 18 percent of managers said fleets were in "fair" or "poor" condition.

UTILITIES

Fleets in this sector are the one shining light in this report, although respondents also report trends down from 2007. For 2008, utilities fleets rated business "good," down from last year's "very good." The Mid-South region rated 2008 as "very good." Expectations for 2009 are also "good," with again one region flying above the rest. New England expects this year to be "very good."

Looking at total machine hours, 32 percent of respondents said 2008 work volume was less than 2007. Add the 29 percent who said volume was higher, and the net for 2008 was -3 percent. This was off 2007's net of 20 percent, and far

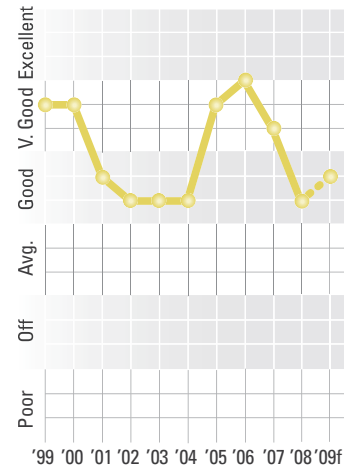
below expectations for 2008 of 26 percent net. For this year, 30 percent expect total machine hours to increase and 17 percent expect hours to decrease for a net 2009 work-volume projection of 13 percent.

Fleet size trend tapered in 2008, although the net was still in positive territory at 14 percent. One in four fleets increased the number of machines last year compared to 2007, and 11 percent said they reduced the number of machines in their fleet. The net remains the same for 2009 projections, with 23 percent expecting to increase their fleet size minus 9 percent who say they will decrease the number of machines in the fleet.

Replacement rates, however, continue to run about 10 percent. Last year the rate came in at 10.3 percent against a forecast of 10.6 percent. For 2009 the replacement rate is anticipated to stay close, at 10 percent.

Fleet condition, as a result, remains "excellent" or "very good" for more than half of the respondents. Over the past few years, this number has hovered in the 55-percent range. On the other end, only 8 percent rated their fleet condition as "fair," with none saying their fleet rated "poor." ■

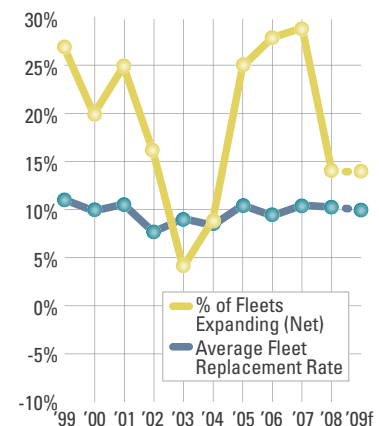
UTILITIES BUSINESS YEAR RATINGS



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

Business ratings have drifted south for utility fleets since peaking in 2006, but it's a more gradual slowdown than other vocations have seen. Expectations for 2009 buck the trend, too, indicating a slight upturn.

UTILITIES FLEET MANAGEMENT TRENDS



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

As business slowed in 2008, so did fleet expansion. This year expansion will again track with business outlook and stay stable with last year. Replacement rates, both in 2008 and 2009, continue at a steady historical level of 10 percent.

CRUNCHING BUDGETS

Fleet funding fell last year for our nation's publically owned fleets. Despite a respite in 2006 and 2007, both state and local fleets reported a net decrease in funding for 2008.

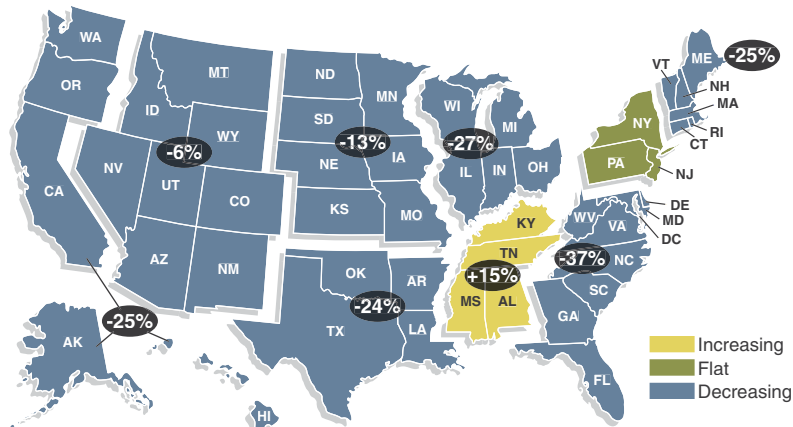
State fleets suffered most: 51 percent reported a decline in funding and only 16 percent reported an increase for a net of -35 percent. On the local side, 36 percent said funding decreased in 2008 and 23 percent said it increased, leaving a net of -13 percent. These net percentages compared to 25 percent and 2 percent, respectively, in 2007. More significant, 2008 actuals came in below the forecast, which was 18 percent net for state fleets and 7 percent for local.

Forecasts for 2009 go further south, with state fleets leading the way. Their predictions are dire. About seven in 10 say funding will decrease this year compared to 2008, and 14 percent say it will increase. That gives state fleets a net of -52 percent. Local fleets show a similar downward trend, although not nearly as drastic. Local fleets record a net of -21 percent, with 39 percent estimating that funding will decrease and 18 percent saying it will grow.

More state fleets also reported a decrease in 2008 work volume as compared to 2007. Measured in machine hours, work volume was less for 24 percent of state fleets and more for 13 percent, leaving a net of -11 percent. Local fleets were just the opposite, with a net of 11 percent, a sum derived by subtracting the 14 percent reporting less volume from the 25 percent reporting more. Forecasted work volume will increase for 19 percent of state fleets and 22 percent of locals, respectively, and decrease for 26 percent and 18 percent. The state fleet net for

2009 PUBLIC FLEET FUNDING TRENDS BY REGION

(% increasing minus % decreasing, net)

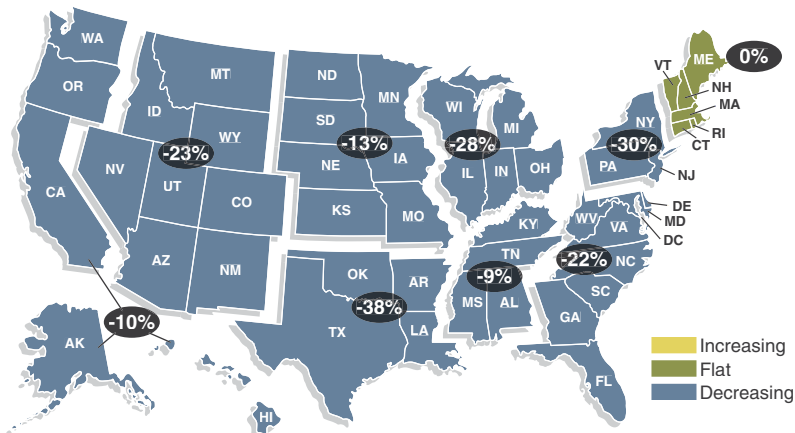


Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

Public fleet funding, overall, has more managers citing shrinking budgets than expanding. One region does not, however, as the Mid-South has more managers who experienced larger funding pies last year than those who saw decreased funding.

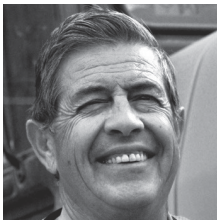
2009 PUBLIC FLEET FUNDING OUTLOOK BY REGION

(% increasing minus % decreasing, net)



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

No region escapes the knife this year, according to projections. Only New England is not in negative territory. Otherwise, every region reports a higher percentage of managers citing shrinking funding than those expecting increased funding in 2009.



“Case loader/backhoes are the backbone of my business. They are very stable when digging on steep terrain and roading is easy. Plus they're incredibly dependable. We run them 2,500 hours a year, no problem.” *Alex Herrera, H. Excavation Inc.*



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2009 volume compared to 2008 is -7 percent; local fleets net out at 4 percent.

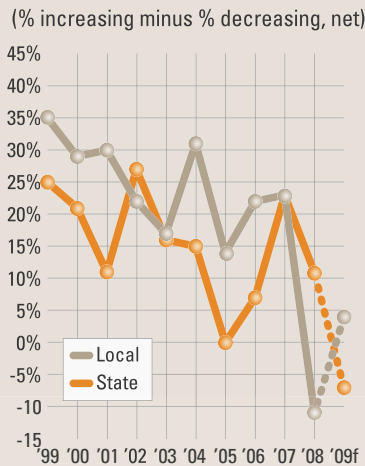
Local fleets grew in 2008, measured in number of machines, continuing a trend that's lasted for more than a decade. About two in 10 local fleets expanded in 2008 compared to 2007, and 7 percent contracted for a net of 14 percent. On the state side, 24 percent reported decreased fleet size and 15 percent increased for a net of -9 percent. State net stays negative for this year, at -7 percent, with 14 percent forecasting an increase minus 21 percent forecasting a decrease. Local fleets data indicate 13 percent reporting an increase in fleet size this year minus 11 percent who see a decrease, for a net of 2 percent.

Replacement rates increased for state fleets in 2008, to 9.5 percent compared to 8 percent in 2007. State fleets anticipate a smaller rate of replacement this year, though, down to a forecast of 8.3 percent. Local fleets reported a rate of 5.5 percent in 2008, down from 7 percent in 2007. They will hold that rate in 2009, they predict, with an estimate of 5.4 percent.

Government fleet condition slipped slightly from 2007, when 49 percent said their fleets were in "excellent" or "very good" shape. Last year 47 percent reported fleets in such shape. On the other end of the spectrum, 14 percent of government fleets are in either "fair" or "poor" condition.

Historically, government fleets use outright purchase to acquire machines valued at more than \$25,000. Last year was no exception with 81 percent indicating this acquisition strategy. Government fleet managers increased their use of short-term rental for major machines last year, with the percentage of respondents increasing from 13 percent in 2007 to 22 percent in 2008. For machines of any cost, equipment managers have stayed consistent in the use of short-term rental compared to 2007. Six of 10 reported using short-term rental in 2008, compared to 58 percent the year before. ■

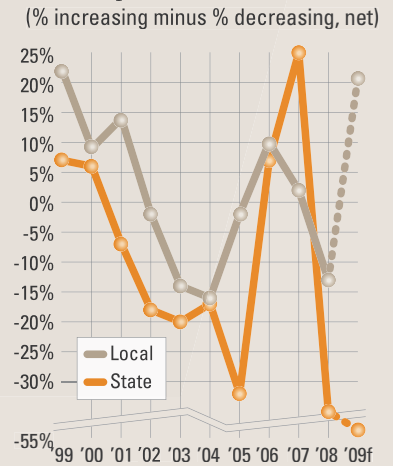
WORK VOLUME TRENDS: PUBLIC FLEETS



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

Work-volume nets were exactly opposite last year, with states reporting a net of -11 and local fleets reporting 11. Each net out closer to zero for 2009: states forecast continued decreases; locals continued positive.

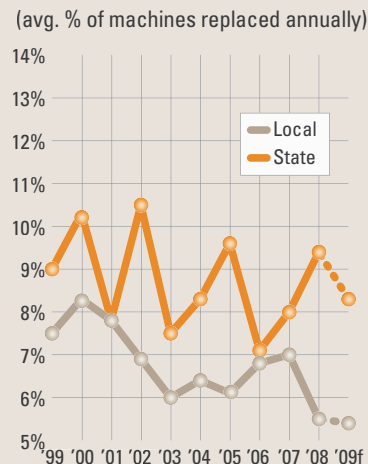
PUBLIC FLEET FUNDING TRENDS



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

The percentage of state fleets seeing funding cuts far outstripped those with increases, with local fleets reporting a slightly less negative net. Both fleet outlooks grow worse for 2009, although the state fleet forecast is twice as dire.

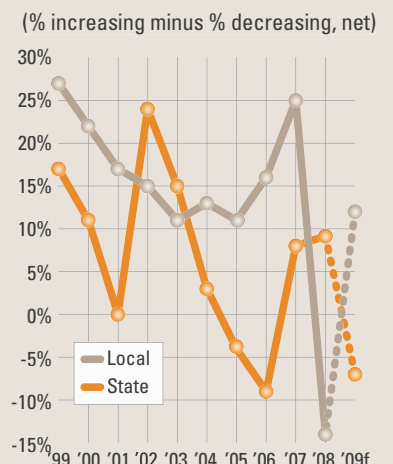
PUBLIC FLEET REPLACEMENT RATES



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

States replaced fleet at a higher rate than locals last year, but still less than expected. For 2009, local fleets anticipate a rate comparable to last year; state fleets will reduce their replacements slightly.

FLEET SIZE TRENDS: PUBLIC FLEETS



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

Fleet expansions paralleled funding last year: Locals were up; states were down. Forecasts do the same. States net out in negative territory on fleet size, and locals are in the positive side.



“We switched excavator brands, bought a Case, and cut our fuel consumption by nearly two-thirds. We went from using more than 6 gallons an hour to using only 2.3 gallons. It’s unbelievable. We’re even using a bigger bucket than before...and we’re still using way less fuel.”

Dave Goodermote, Goodermote Excavating



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Kevin Stone, Landscape Concepts Management



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FORECASTS WAY OFF

Recession weighed heavily on the minds of rental dealers as 2008 wound down, with nearly half of them citing the economic situation as the key concern for 2009. Remember, this was before the government bailout, too. As dealers waited for 2008 to end, the outlook for 2009 was flat.

Rental dealers responding to our survey were all members of the American Rental Association, who once again assisted *Construction Equipment* in gathering comprehensive data for this segment of the equipment market. Due to the events of late autumn, the 2008 business year rating was not even close to the forecast dealers had held: "very good." Instead, dealers rated 2008 as "off" and anticipate 2009 to be "average."

Sales volume fell for 39 percent of dealers last year. With 19 percent citing increases, the net was -20 percent, a substantial fall off from 2007's net of 25 percent. This year dealer forecasts net out at 14 percent, but seven of 10 respondents expect sales volume to be

the same this year as it was in 2008.

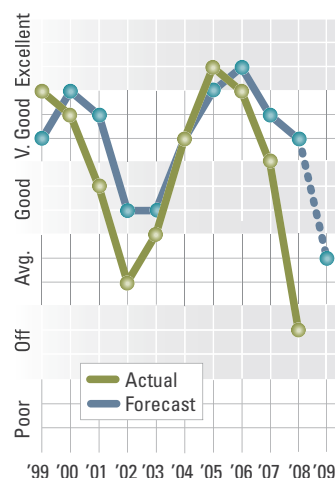
Sales volume in 2008 took its greatest hit, dealers say, in new-equipment sales. Nearly 40 percent reported significant decreases here. Other areas of the business that suffered were rent-to-buy contracts (27 percent reported decreases), short-term rentals (24 percent), and leasing (23 percent). Service volume increased significantly for 28 percent of dealers.

Not surprisingly, short-term rental margins suffered as volume decreased. Twice as many dealers reported lower margins as reported higher, and 8 percent actually reported much lower margins than in 2007. Over the previous four years, one-third of dealers had reported higher margins.

Rates, on the other hand, rose for 26 percent of dealers and decreased for 22 percent, for a net of 4. That net will grow to 32 percent if forecasts bear out. Some 93 percent of dealers say recession is of major concern, and 48 percent say it is the single most pressing concern. Declining construction markets and

inflation were the next serious concerns, cited by 60 percent and 53 percent of rental dealers, respectively. ■

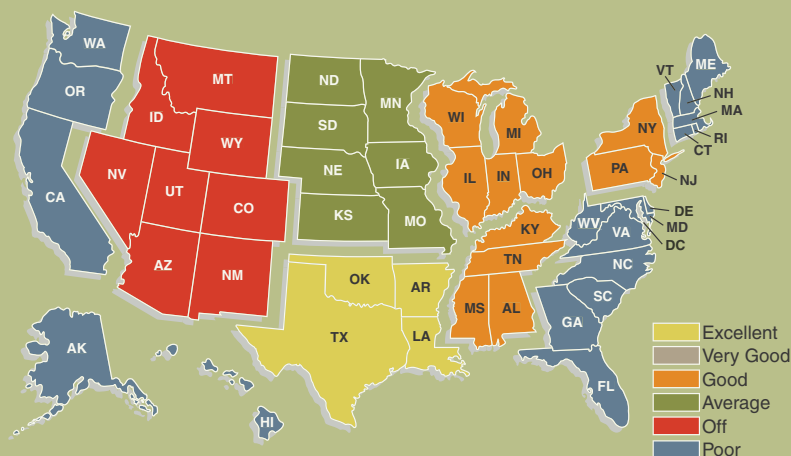
RENTAL COMPANY BUSINESS YEAR RATINGS



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

Business quickly turned for rental dealers, who projected a "very good" 2008. Instead, they came in three levels lower at "off." Expectations of a bounceback are slim, with only an "average" year forecast.

2009 RENTAL DEALER BUSINESS OUTLOOK

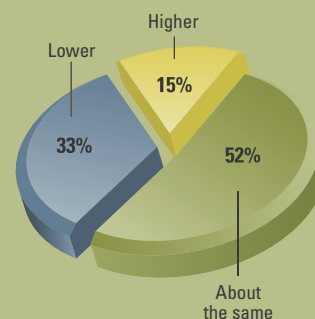


Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

Rental dealers expect to turn back from an "off" 2008 to "average" in 2009. Southern Plains dealers are especially bullish; Pacific and South Atlantic are not.

MARGINS ON RENTALS

(trends, 2008 v. 2007)



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

The percentage of dealers reporting margin increases in 2008 was half what it was in 2007 at 15 percent. Conversely, twice the percentage reported lower margins.

RETURN TO THE VALLEY

Look at the line graph below and one wonders how distributors sleep at night. It has been a ride worthy of any rollercoaster daredevil this decade, and results for 2008 harken back to the post-9/11 recession. Unlike that trough, distributors do not see an uptick for the following year.

Distributors forecast that 2008 would be "average," but the year's business rating hit the bottom of "poor." Few regions disagreed with the general consensus, and only one region expects 2009 not to be "poor."

All respondents are members of the Associated Equipment Distributors, who once again partnered with *Construction Equipment* for this report. The percentage of distributors who reported declines in sales volume negated the percentage

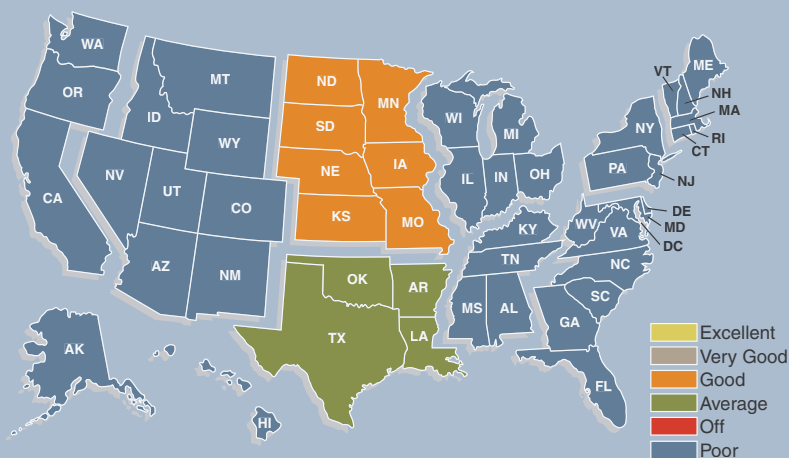
who reported gains, leaving a net of 1 percent (45 percent saw increases minus 44 percent reporting decreases). Far fewer (29 percent) forecast sales increases for 2009, which, when put against the 52 percent who anticipate sales volume to decrease this year, leaves a net of -23 percent.

Parts sales was a sales brights spot for distributors last year: 27 percent reported significant increases in volume. Rent-to-rent and service were recorded by slightly fewer distributors, 24 percent and 23 percent, respectively, as significant volume gainers. The percentage of distributors reporting volume jumps in new-equipment sales plummeted from 31 percent in 2007 to 17 percent last year.

Margin declines on new-machine sales were not as precipitous. The percentage of distributors reporting in 2008 the ability to increase margins was similar to those in 2007: 15 percent to 16 percent. On the declining margin side, 44 percent of distributors said new-machine margins were lower in 2008, compared to 39 percent in 2007. Comparing the increases to decreases provides a 2008 net of -29 percent, compared to a net of -23 percent.

Eight in 10 distributors cited recession as the top business concern for 2009, up from six in 10 last year. Other top business concerns are declining machine sales (70 percent responding), poor margins on machine sales, and decline in construction markets (each at 61 percent). ■

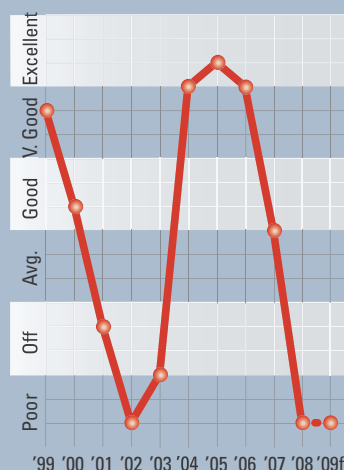
2008 DISTRIBUTOR BUSINESS REPORT



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

Last year turned "poor" for distributors, who had projected an "average" business year. Plains regions were the only bright spots, with the Northern section reporting a "good" year and Southern scoring 2008 "average."

DISTRIBUTOR BUSINESS YEAR RATINGS

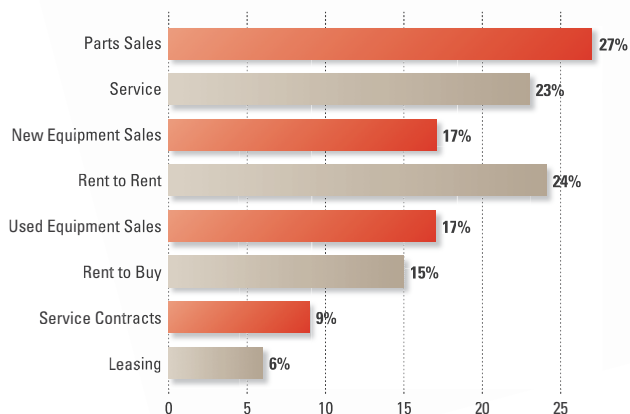


Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

It's been a decade of rollercoaster highs and lows for distributors, with 2008 hitting the same bottom seen in 2002. Unlike 2003, though, little hope is held out for a rebound of any kind this year.

DISTRIBUTORS' GROWTH AREAS

(% reporting significant increases)

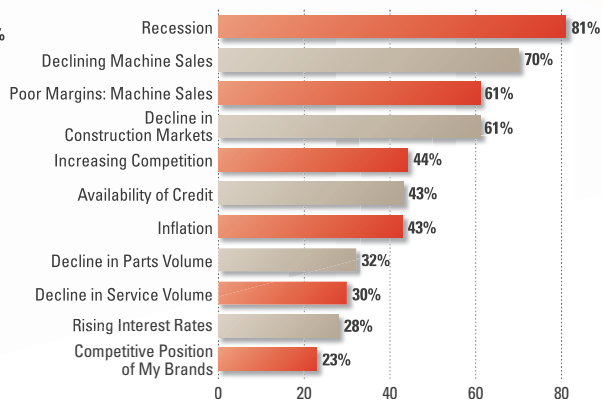


Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

Significant growth was seen in a few categories last year, led by 27 percent reporting growth in parts sales. Other areas were rent-to-rent activity and service revenues. Only 17 percent saw significant growth in new-equipment sales.

DISTRIBUTOR CONCERNS FOR '09

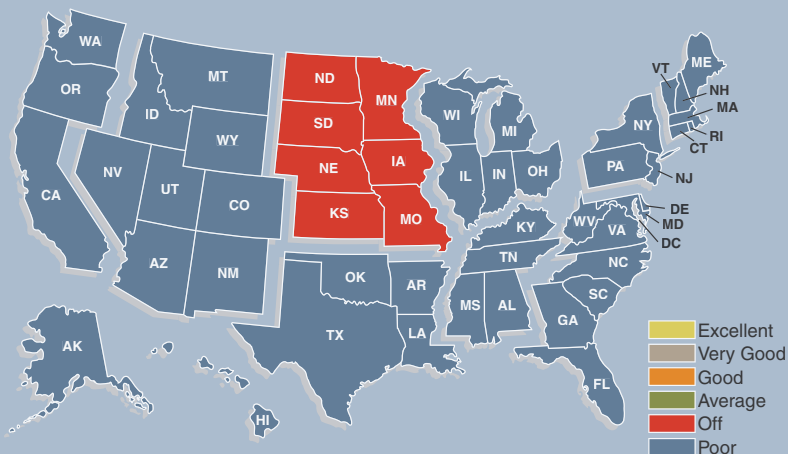
(% indicating concern)



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

The "R" word stormed back into distributors' consciousnesses late in 2008, with eight in 10 listing recession as the leading concern for this year. Declining sales and margins piggybacked onto the overall economic uncertainty.

2009 DISTRIBUTOR BUSINESS OUTLOOK

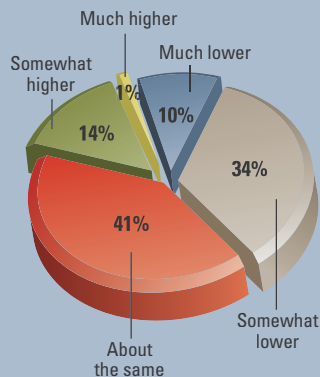


Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

This year looks bleak for distributors, with all but one region forecasting a "poor" 2009. Although Northern Plains remains the most optimistic, "off" is hardly cause for a celebration.

DISTRIBUTOR MARGINS ON NEW EQUIPMENT SALES

(trends, 2008 vs. 2007)



Source: Construction Equipment/Case Construction Equipment Annual Report & Forecast Survey

The percentage of distributors reporting margin growth on new equipment sales held last year. Fewer were able to maintain existing margins, and lower margins were reported by 44 percent of distributors, up from 39 percent in 2008.



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Maximum Allowable Lifting Capacities

(in Pounds on Fully Extended Outriggers)

Load Radius (feet)	Loaded Boom Angle (degrees)	360° (pounds)	Over Front (pounds)
10	77.0	79,700	79,700
12	75.0	72,400	72,400
15	71.5	63,500	63,500
20	66.0	52,300	52,300
25	60.0	44,200	44,200
30	53.5	37,800	38,000
35	47.0	27,900	32,300
40	39.0	21,500	24,900
45	29.0	17,000	19,700
50	14.5	13,500	15,800

Boom can move outside front outriggers and rotate around the crane

Boom must stay in between two front outriggers

Structural range: Numbers in shaded area above bold line indicate maximum weight that can be lifted before danger of crane breaking

Tipping range: Numbers below bold line indicate maximum weight that can be lifted before danger of crane tipping

Illustration adapted from Link-Belt load chart.

Maximum Allowable Lifting Capacities

(in Pounds on Tires)

Load Radius (feet)	Max. Boom Length (feet)	Stationary		Pick & Carry	
		360° (pounds)	Straight Over Front (pounds)	Creep	2.5 mph
10	35	46,600	74,000	56,300	47,600
12	35	31,200	64,400	48,800	41,100
15	35	19,800	53,600	40,200	33,600
20	35	12,800	33,000	30,300	25,000
25	50	8,900	20,800	20,800	19,200
30	50	5,200	13,300	13,300	13,300
35	50	3,300	10,300	10,300	10,300

Capacities for non-moving crane with boom over the front

Capacities for crane transporting loads with boom over the front. Load capacities and structural integrity are reduced when loaded crane on tires is driven

Illustration adapted from Terex load chart.

instance, if the load chart shows an over-the-front limit of 32,300 pounds — listed below the bold line — at a load radius of 35 feet and boom angle of 47 degrees, then exceeding that 32,300-pound limit could tip the crane.

If, however, the same load chart also shows an over-the-front limit of 38,000 pounds — listed above the bold line — at a load radius of 30 feet and a boom angle of 47 degrees, the capacity may not seem much different, but exceeding that load limit would not tip the crane. Rather, it could break the boom or another part of the crane without warning.

In addition to being listed above a bold line in the load chart, structural ranges sometimes are indicated by a shaded background.

Today, manufacturers are making rough-terrain cranes lighter by spreading out the crane base, Wilson says. It also helps to boost stability. This means, though, that the structural range is expanded, and operators who don't abide by the load chart are increasingly likely to structurally damage the crane rather than tip it.

Now, electronic load moment indicators also help operators determine load capacities,

but they should not be relied upon, as they are sometimes improperly calibrated and thus fail to shut down the crane when the real load limit is exceeded.

"LMIs are getting better and better," Wilson says. "But they are an operator aid not to be depended upon. You have to give way to actual measurement."

Furthermore, according to Fryer, crane LMIs often cannot distinguish between fully extended and slightly extended outriggers.

"Regardless of outrigger extension, out-of-level outriggers is strictly prohibited under any conditions at Northern Crane and is very dangerous," Fryer says.

Ground support

Rough-terrain crane engineers, like those at Grove Worldwide or Link-Belt, have determined exactly how much weight the materials in their cranes can handle through rigorous testing.

Grove, for example, examines and defines rough-terrain crane capacities at their test facility in Shady Grove, Pa., Wilson says. "They will hang a weight on the crane, and they will take it up until a point where the engineers say: 'That's as far as you can go. The metal itself, the internal structure, and the molecules in the steel are telling you that you can't go any further.'"


Those results are manifested in the load chart. But since rough-terrain crane operators work on none other than rough terrain, they lack the perfect conditions that engineers in a testing facility have.

"When engineers test these things, they set up on a concrete pad that is 10-feet thick and 40-feet square, solid as it gets," Wilson says. "When you take your crane out on the jobsite, set it up, and run your outriggers out, you have to know the density of what's underneath the underlying soil."

If done wrong, all of the weight could

end up on one outrigger, throwing off the load-chart capacities. Or on tires, if the ground surface has some deflection, the tires could begin to sink. Work-site supervisors are responsible for determining the condition of the ground before any lifting is done on it.

Ground support is the most important part of setting up a rough-terrain crane, Wilson says. Loss of ground support has resulted in a large number of crane turnovers.

To prevent accidents in the future, Wilson advises that site supervision research the site and study the ground to find out if there are fill areas or underground utilities, such as fiber-optic boxes. Accordingly, blocking or crane matting should be laid out underneath the crane to reduce ground pressure and even out the forces exerted on the outriggers or tires. 

Crane Matting

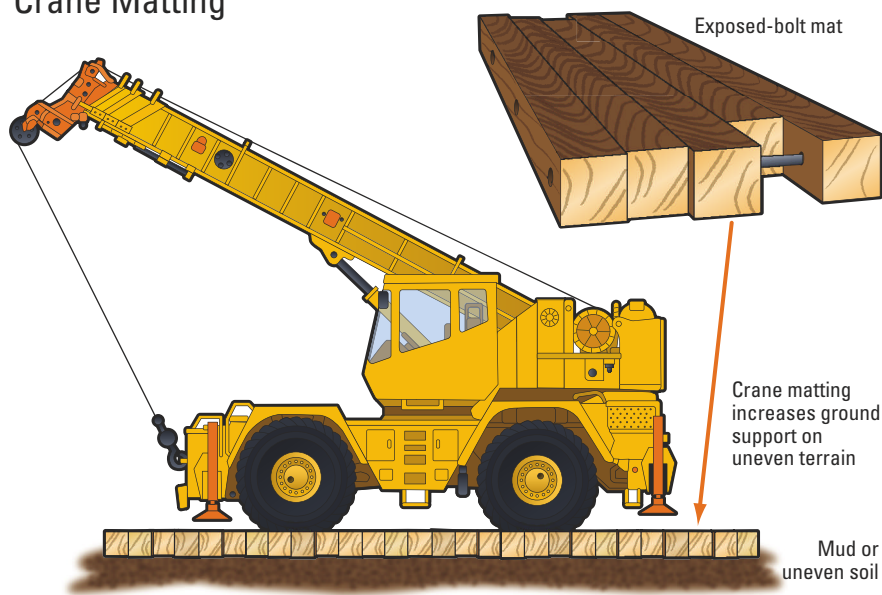


Illustration adapted from Superior Mat Co. graphic.

There are two types of crane matting: cable mats and exposed-bolt mats. In cable mats, 1-inch steel rods hold together 8- to 12-inch solid hardwood beams for easy transportation. Exposed-bolt mats are for flat surfaces that require protection from the crane. The bolts in this mat are exposed in two places so that cranes can be directly attached. "As a general rule, under ideal conditions, the minimum required matting should be three times the surface area of the crane's round float," says Steve Fryer, Northern Crane Services.

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SCR Diesel Delivers **Good Fuel Economy**

Selective catalytic reduction, to be used by Mack and others for 2010 diesels, has worked well so far in fleet testing

One year from now, in January 2010, all new diesels for sale in the United States and Canada will have to meet even tougher exhaust emissions limits than now, and many will do it with selective catalytic reduction. SCR equipment, already used in many diesels in Europe and Japan, sprays a urea solution into the exhaust stream to break down oxides of nitrogen — the NOx that causes smog — into harmless nitrogen and water vapor. SCR also promises better fuel economy.

That's about what they're finding at Haines & Kibblehouse Inc., a contractor based in eastern Pennsylvania, which ran a Granite dump truck with a 2010-spec Mack Power engine in everyday service. The Granite is the very first Mack built with an SCR engine, and last April it was loaned to H&K for testing.

By mid-September, when I visited the company's Skippack headquarters, the engine had worked well and saved a goodly amount of fuel, according to Dan Alderfer, the fleet's superintendent.

He showed me the truck early one workday morning, and Jimmy Kissling, the assigned driver, pointed out its clean-as-new exhaust stack. "It looks like it just came from the factory," he noted, because there was absolutely no soot inside, although it had been working for more than five months. Pipes on 2007-spec diesels with their special filters also look this way. A particulate filter was fitted to this truck's MP7 engine because it's part of the 2010 equipment to be used by Mack and others. Exhaust gas from these engines will be cleaner than the air they inhale in some smoggy cities, industry people have said.

The Granite MRU613 was owned by Mack but resembled 255 others in the H&K fleet, down to its Adirondack Green paint and gold company lettering. Its wheelbase of 219 inches is about a foot longer to accommodate SCR apparatus, including an injection chamber and urea tank that hang on either side of the frame beneath the cab. Kissling said there's very little work required to keep the 23-gallon tank filled with urea-water solution, also called diesel exhaust fluid, or DEF.

"I top it off maybe once or twice a week, and it only takes one and a half to four gallons each time," he said. He did it that often be-

MP7-405 Maxidyne diesel looks like a 2007, and basically is. It pulled well, except when starting from a dead stop, where a misadjusted clutch might not have been the problem. Exhaust is ultra clean.





Green Granite with its 2010 SCR diesel is owned by Mack and was loaned to Haines & Kibblehouse for testing. It has worked well and fuel economy is encouraging.

cause Mack people, including Dave McKenna, power train sales and marketing manager, were keeping close track of DEF and fuel consumption. The amount of DEF used is expected to be about 2 to 3 percent of fuel, and, of course, both are directly related to miles run. Normally, the DEF tank could therefore be topped off once every two weeks or so.

DEF in effect displaces fuel, so decent economy is a result. "It's now 3.9 low to 6.3 mpg high, with an average 5.7 miles per gallon," Alderfer reported by phone a couple of months after my visit. "Other trucks that I'm monitoring, including one with an automatic (transmission) and a newer Granite (with a 2007-spec diesel), are 4.2 to 4.8. So it's every bit of a half a gallon better" than the fleet overall. "I think we're headed in the right direction" on fuel use. Fuel savings should pay for the stiffer upfront cost of a 2010 SCR diesel in a few years of operation, Mack and other manufacturers say.

Kissling, a former over-the-road trucker

who's been with H&K for 11 years, took me on a couple of runs, and with Alderfer's OK, he let me drive as soon as I asked. This was just after we took on a load of dirt at a construction site behind the Plymouth Meeting Mall, a big shopping center north of Philadelphia.

"Now, one thing, this engine is easy to kill when you start out," he advised. "There's something with this transmission — I can't get the hang of it." It was a 10-speed Maxitorque that shouldn't have been touchy, but sure enough, a minute later I killed the engine when trying to move away from a stop light on a slight up-grade. "Don't feel bad, I do

SPECIFICATIONS

Truck: 2009 Mack Granite MRU613, conventional cab with setback steer axle, BBC 116 inches

Engine: Mack Power 7, 10.8 liters (659 cubic inches), 405 hp @ 1,500 to 1,900 rpm, 1,480 lbs.-ft. @ 1,200 rpm, w/PowerLeash engine brake, and EGR, DPF and SCR equipment

Clutch: Eaton 15.5-inch 9-spring coaxial

Transmission: Mack T-310MRL 10-speed w/multi-speed reverse

Front Axle: 20,000-lb. Mack FXL20 Uni-Max

Rear Axles: 46,000-lb. Mack SS462 w/4.17 ratio, on Mack Camelback anti-sway multi-leaf suspension

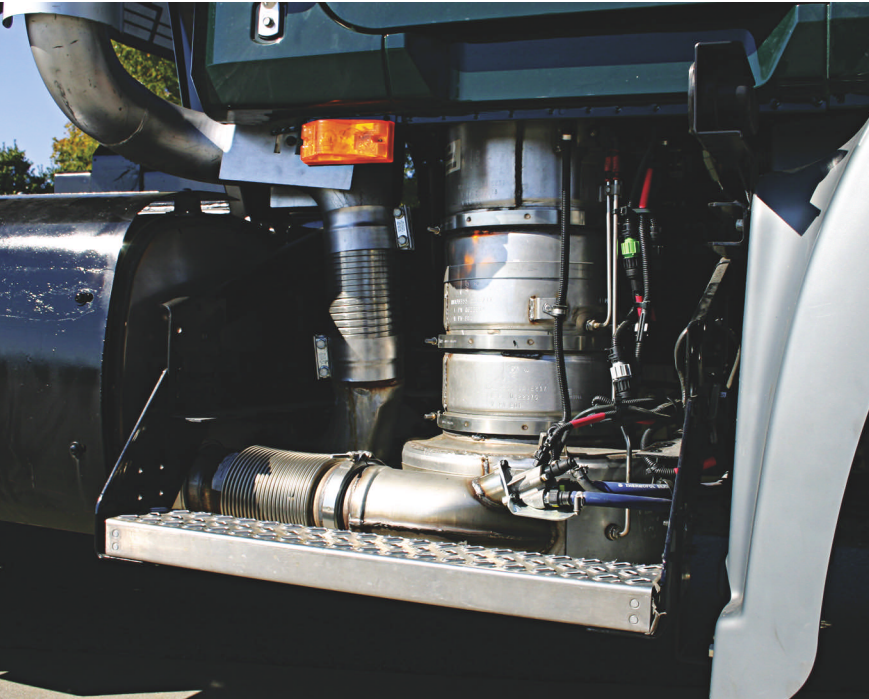
Pusher axle: 20,000-lb. Watson + Chalen, liftable and self-steering

Tires & wheels, front/rear: Bridgestone 425/65R22.5 M884F on aluminum discs/11R22.5 M726EL rear on steel discs

Fuel Tank: 116 gallon left-side

Body: Benson 17.5-foot steel dump

Hands-On Trucking



Blue lines and red wires lead to DEF injector and chamber below the exhaust system's coffee-pot-shaped diesel particulate filter. This is a prototype, and production installations will be cleaner, Mack says.

it, too,” he said as my face reddened and I restarted in Low instead of 1st gear.

Once underway, I got a feel for the clutch and gear pattern, and then had very little trouble up- or downshifting. But at stops, I chose a low enough gear and carefully modulated the clutch and accelerator pedals to keep the engine spinning. Later McKenna said the clutch was found to be out of adjustment, and both fuel filters were plugged. Either or both problems could explain the engine's behavior.

While moving, the engine — rated at 405 horsepower and 1,480 pounds-feet — was plenty gutsy. Its Maxidyne torque curve was wide and I could lug it to 1,100 and still accelerate fine, and we could easily keep up with most traffic.


Like most dump trucks in Pennsylvania, this one had a single pusher axle ahead of the tandem which lets the truck legally gross 73,280 pounds. Unlike most others, this pusher was self-steering, so I didn't have to remember to raise it in tight turns. The tandem rode on a 46,000-pound Mack Camel-back multi-leaf suspension with an anti-sway feature that seemed to do its job, as the truck was rock steady in all situations.



Dan Alderfer, H&K's fleet superintendent (left), and driver Jimmy Kissling say that topping off the blue-capped tank with diesel exhaust fluid is a minor task. The filler is too small for a diesel-fuel nozzle, so replenishment mistakes shouldn't occur.

We took the load of dirt about 20 miles over county roads and city streets to a quarry at Saratoga, near Pottstown, where we dumped it at the edge of the large pit. Here I used the tranny's multi-speed reverse function, using a thumb switch to engage reverse and choosing 2nd gear to move backward at a clip faster than most transmissions will allow. It's especially useful when backing long distances to a paver or, for a mixer truck, to a pour site.

At the quarry, we picked up a load of gravel and took it to the same construction site at the mall. As before, we passed through Norristown, where traffic lights gave me some additional practice at shifting and I didn't kill the engine anymore. We got another load of dirt, and by now it was late morning, so Kissling dropped me back at the shop where I met my Mack hosts. We chatted some more with Kissling and Alderfer, then departed.

A few weeks after my visit, the truck had been returned to Mack after running six months and about 30,000 miles. Engineers were tearing down and inspecting the engine to see what effects the SCR gear and operating conditions might be having. The truck was to be returned to H&K for more road and street testing, and we'll be watching its progress. 

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Buying File: Curb-and-Gutter Pavers

By MIKE ANDERSON, Senior Editor

Specialized Pavers Part of 'Total Package'

Curb-and-gutter paver manufacturers push forward with technologies aimed at keeping up with other equipment types

One year ago, a *Construction Equipment* headline asked rhetorically if “Curb Your Enthusiasm” was the mantra for contractors looking to curb-and-gutter pavers. Not so, we concluded, given the attention manufacturers serving this market had been affording their newest product offerings. With added capabilities and options, curb-and-gutter machines had matured into more versatile, smarter and

less labor-intensive pieces of equipment adding value to any paving contractor's fleet.

Good thing, too, given what's happened to the economy since.

“The technological advances of the past several years have created a total package for the curb-and-gutter contractor,” says Kent Godbersen, vice president of worldwide sales and marketing with industry stalwart GOMACO. “Everything that we have been working toward in curb-and-gutter paving is more important today than ever before.”

Those sentiments are echoed at competitive equipment manufacturer Power Curbers.

“With the slowdown in residential development, contractors are looking for flexibility,” says Stephen Bullock, Power Curbers vice president, sales and marketing. “The easy jobs — subdivisions — are gone. Contractors are using their machines more than ever to do tight-radius work in parking lots, street-rehab projects and barrier wall. They need a versatile machine more than ever before.”

The large curb-and-gutter market, specifically those machines over 10,000 pounds in operating weight and almost exclusively tracked, continues to be served by four companies — GOMACO, Power Curbers, Miller

With three models under 4,000 pounds, MBW offers curb-and-gutter paving solutions at “a fraction of the cost” or larger machines. That said, according to MBW, experienced crews doing an acceptable job of managing process variables can achieve 3,000 feet of curb and gutter, and up to 5,000 feet of curb over pavement per day.





GOMACO's New Generation GT-3600 curb-and-gutter paver will be displayed at World of Concrete with the exclusive G22 operating system. At the same time, leg diameter has been increased 15 percent to match the quality of the Commander III model.

Formless and Huron. The latter company offers both tired and tracked versions of its 118-horsepower, 8-foot-paving-width 880 model.

But changes have occurred in the curb-and-gutter landscape, even within the past 12 months: Plans for Terex to enter the market appear to have been delayed; Miller Spreader is focusing on its core smaller machines; the LeeBoy offering is now a product of VT Lee-Boy Inc.; and the Curb Fox brand is now also the corporate name for the former Messinger compact product line.

"While others seem to be focusing on reducing operations, at GOMACO we have redirected our resources to focus on innovation and to prepare our product line for what the customer is going to want and need when the projects break loose," says Godbersen. "We continually energize our engineering departments, and we will have some major introductions at World of Concrete."

The Cost of Ownership

Operating Weight (lb.)	List Price	*Hourly Rate
Up to 12,500	\$65,814	\$36.99
12,501 - 23,999	\$152,297	\$76.67
24,000 and up	\$231,868	\$121.36

* Hourly rate is the monthly ownership costs divided by 176, plus operating costs. Unit prices used are diesel at \$3.09 per gallon, mechanic's wage at \$45.39 per hour, and money costs at 5.125 percent.
Source: EquipmentWatch.com, phone 800/669-3282

Following up on the 15,000-pound, three-track New Generation GT-3200 model displayed at Conexpo-Con/Agg last March and the new GT-3400 unveiled a year earlier, GOMACO will display the New Generation GT-3600 at World of Concrete this February in Las Vegas. The 25,670-pound, three-track GT-3600 will be shown with the exclusive G22 operating system, featuring a graphical display with newly designed icons and screens with pictograms designed for ease of use and understanding. Advanced system diagnostics automatically pinpoint and identify electrical circuit opens, shorts and fault codes to aid in troubleshooting. Faults are identified and a full explanation of recommended actions provided.

Buying File: Curb-and-Gutter Pavers

The G22 operating system's selective steering dial provides five different modes of controlling the three tracks, and the GT-3600 can be reverse-steered on-line to a tolerance of one-eighth of an inch, says GOMACO. High-production performance through radii is accomplished with the control system's tight-radius software and the ability to toggle steering control from the lead sensor, eliminating continued manual sensor adjustments.

Smart hydraulic steering cylinders, interfaced with the G22 system, allow push-button steering set-up. The programmable cylinders also allow steering parameters of the tracks to be set with the touch of a button.

Software for the slope transition system provides automatic grade elevation correction and automatic steering correction to eliminate string-line adjustment.

"The GOMACO control system is the biggest difference between us and our competitors," says Godbersen. "Our control system is what has allowed us to make strides in string-less paving, monitoring of machine functions, and controlling one machine in various applications.

"But it is the entire package a manufacturer has to offer that is important in today's market to help ensure a contractor's profitability."

Curb-and-Gutter Pavers (1,000 pounds and up)

Model	Operating Weight (lb.)	Drive Type (No. of Units)	Max. Mold Height (in.)	Max. Paving Width	Turn Radius	Gross Power (hp)
Power Curber 440-XL	1,170	Wheel (4)	12	1'6"	4'0"	25
Curb Fox CF2000	2,000	Tire (3)	14	1'6"	1'6"	18
MBW C101	2,590	Tire (3)	18	1'0"	1'6"	26.5
GOMACO Curb Cadet	2,650	Track + Wheel (1 + 8)	14	1'0"	2'0"	24
MBW C101-18	2,725	Tire (3)	18	1'6"	1'6"	26.5
MBW CG200	3,395	Tire (4)	18	4'0"	2'0"	26.5
Curb Fox CF3000	3,400	Tire (3)	24	2'10"	2'0"	28
Miller Spreader MC1050 Curbuilder*	4,800	Tire (6)	18	4'0"	n/a	35
Curb Fox CF5000	5,000	Tire (3)	24	5'0"	2'0"	28
LeeBoy LBC-24W	7,500	Tire (n/a)	24	4'0"	2'0"	44
Huron 650B	9,900	Tire (3)	48	n/a	n/a	80
GOMACO GT-6000-78	11,700	Track (2)	18	4'0"	n/a	92
GOMACO GT-6000-90	12,500	Track (2)	18	5'0"	n/a	92
GOMACO GT-3200	15,000	Track (3)	36	5'0"	2'0"	92
Miller Formless M-1000	18,800	Track (4)	32	5'0"	2'0"	115
GOMACO Commander II	20,000	Track (2)	32	5'0"	n/a	92
Huron 880 Tire	21,900	Tire (4)	42	8'0"	9'0"	118
Power Curber 5700-C	23,600	Track (3)	50	10'0"	1'8"	130
Huron 880 Track	24,000	Track (4)	42	8'0"	9'0"	118
GOMACO GT-6300	24,400	Track (3)	n/a	12'0"	n/a	155
Miller Formless M-8100	25,000	Track (4)	84	16'0"	18'0"	173
GOMACO GT-3600	25,670	Track (3)	24	2'0"	2'0"	99
GOMACO GT-3400	27,500	Track (3)	n/a	6'0"	2'0"	127
GOMACO Commander III-3T	29,300	Track (3)	n/a	3'0"	n/a	185
Huron 1000	31,000	Track (4)	84	16'6"	15'0"	185
Miller Formless M-8800	36,000	Track (4)	96	20'0"	30'0"	173

* Manufacturer has indicated this product will be discontinued.

Source: Spec-Check.com Xpanded Specs (as of November / 08)

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Buying File: Curb-and-Gutter Pavers



The newest edition of the 5700 offered by Power Curbers, the 5700-C curb-and-gutter paver is capable of both left- and right-hand pouring. Since the 5700-C's introduction, a post-hole digger attachment has been added for use in wire rope barrier applications.

Legacies move forward

The latest generation in the 5700 Series of curb machines first launched in 1985 by Power Curbers, the 23,600-pound 5700-C was introduced two years ago at World of Concrete with a new 130-horsepower Cummins engine and the new Smart Amp control system. Since then, a post-hole digger attachment has been added for use in wire rope barrier applications.

"Technological advances in our equipment are a result of a partnership with our customers. Some of our best ideas come from our customers at our service schools," says Bullock. "Many of our machine enhancements over the years, like the quick-connect mold mount, hydraulically adjustable mold offset and mold misting kit, came from customer suggestions.

"Obviously, the development of 3D systems for curb-and-gutter machines has been a result of multiple interests working together."

With a single 5700-C machine, says Bullock, contractors have the ability to pour curb at a radius as tight as 2 feet, barrier walls up to 50 inches, and a range of jobs in between


ranging from sidewalks and v-ditches to stadium risers. Furthermore, due to the repositioning of the auger, the unit can work with a concrete truck within a single lane of traffic, "a huge benefit not only to our customers but to their customers," says Bullock. "Now, on many pours, the DOT is able to keep an additional lane of traffic open while doing a rehab project."

The Smart Amp control system, he says, provides the Power Curber operator with the advanced features of a networked digital system with the ease of an analog system. "In the always tight labor market, it's critical to make equipment operator-friendly."

With eight models serving the curb-and-gutter market, GOMACO offers a full range incorporating such features as all-track steering, "smart" steering cylinders, all-track positioning, a side-shifting trimmerhead, and the Hook-and-Go mold mount.

"We continually take our new developments and implement them across our product line to enhance both our road-building equipment and our curb-and-gutter line," says Godbersen. "Our Commander III started as a curb-and-gutter machine, and you will see at World of Concrete why it is the choice today for half-width paving. Most road builders in the United States have a Commander III in their fleet to do a variety of smaller jobs and unique applications. The Commander can pave curb and gutter, safety barrier, side-mounted zero clearance, variable width with the V2 mold, and shoulders, lane additions and ramps."

It appears, again, there is no need for paving contractors to "curb their enthusiasm," given how the major players serving the curb-and-gutter market have maintained their focus.

"Power Curbers's growth over the past decade has been a result of focus on the customer," says Bullock. "This comes not only from providing quality machinery, but more importantly from our support. Many manufacturers can build a machine that pours concrete, but our ability to provide technical expertise, troubleshooting, and readily available parts and molds sets us apart." 

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Gallery of Curb-and-Gutter Pavers

GOMACO

'New Generation' Hits Market

Following up on the introduction of the new GT-3400 a year earlier, GOMACO paved significant activity in the curb-and-gutter market in 2008 with the New Generation GT-3200 and GT-3600 models. A



15,000-pound, three-track paver, the New Generation GT-3200 is now right- and left-side pour capable, supported by a modular operator's platform designed and positioned to accommodate paving on either side of the machine. The GT-3200's new piston-style front leg, with a key-way, provides more steering control and steering torque. The 25,670-pound, three-track New Generation GT-3600, to be displayed at World of Concrete, is

available with the exclusive G22 operating system built to handle the world's languages. Leg diameter on the GT-3600 was increased by 15 percent to Commander III-type standards.

Number of models: 8

New models: New Generation GT-3200, New Generation GT-3600

Product-line features: A curb-and-gutter machine size built for maneuverability, the GT-3200 has increased its tracking and paving speeds with the New Generation model. The new GT-3600 model has a selective steering dial for five different modes of controlling its three tracks, including crab steering.

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MILLER FORMLESS

Trio of Four-Track Machines

The smallest of three four-track curb-and-gutter machines being actively offered by Miller Formless, the 18,600-pound M-1000 has been upgraded with a longer and lower auger for both easier loading from the ready-mix truck and added capacity to get the paver around tight-radius jobs without running short of concrete. On the M-1000; the 25,000-pound M-8100; and the market's largest model, the 36,000-pound M-8800; a new micro processor with updated software provides simpler set-up and more diagnostics. New higher-capacity cooling systems were recently added to each.

Number of models: 3

Product-line features: With its smaller footprint, the M-1000 is designed to pour more curb in tighter spots than other four-track curb-and-gutter machines, yet retains its ability to handle large jobs. The narrow width enables vehicles and other equipment to pass during operation.

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MBW

Entry-Level Options Available

Three variations of the compact MBW slipform paver offer curb-and-gutter application at an entry-level price and size level. The C101 model, which itself can be converted to the C101-18 and CG200 models, will slipform vertical curb to a height of 18 inches and width of 12 inches. The C101-18 produces profiles to a height and width of 18 inches, and the CG200 slipforms curb, curb and gutter, roll curb, sidewalk and similar profiles to a width up to 48 inches. With the MBW product offering, foam-filled tires help maintain consistent machine orientation, eliminate puncturing and provide traction.

Number of models: 3

Product-line features: MBW's patented "quick-attach" hopper system enables users to change pouring modes in minutes. Variable hopper width, from 12 to 48 inches, allows narrow profiles to be poured with a narrower paver, thus minimizing the amount of grading required.

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Gallery of Curb-and-Gutter Pavers



VT LEEBOY

Compact Model Still Offered

Now under the VT LeeBoy corporate entity, the LeeBoy paving product family continues to offer the LBC-24W for slipforming curb and gutter, alley ribbons and sidewalks up to 4 feet wide. The LBC-24W can pour a radius as tight as 24 inches, eliminating most hand forming. Powered by a 44-horsepower diesel, the LeeBoy curb-and-gutter machine offers operators fingertip control of all curbing functions from its front and rear control panels. Operating weight of 7,500 pounds, low-profile design, and all-wheel hydrostatic drive combine for stability, traction and maneuverability in tight spaces.

Number of models: 1

Product-line features: The Topcon System V Plus 1 electronic grade and steering control system guides the LeeBoy LBC-24W for accurate curb placement. Accessible from all directions, the hopper uses gravity flow and two hydraulic vibrators to help deliver concrete to the mold without augers.

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LIL' BUBBA

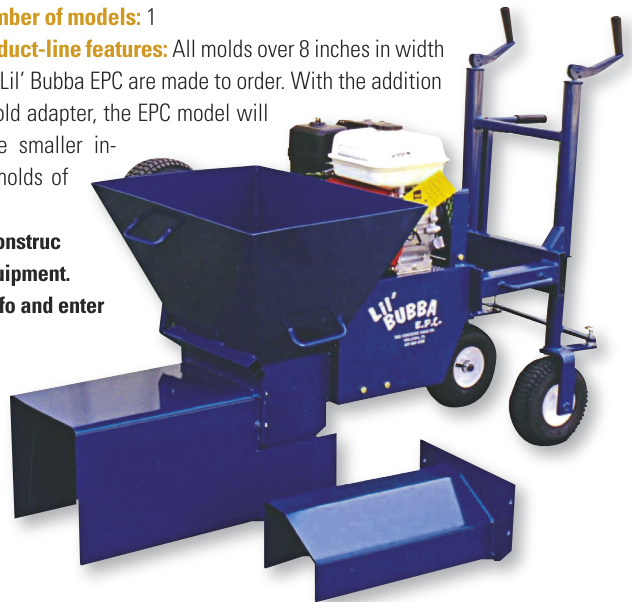
A Step Up for Walk-Behind Plunger

The largest model in the Lil' Bubba product line from The Concrete Edge Co., the EPC is a low-cost, walk-behind unit suited for up-scale residential curb-and-gutter driveway applications, landscape curbs and small retaining walls. It is marketed as a complementary product for contractors expanding to the parking-lot curb market. With an upgraded transmission in 2008, the "commercial-grade" plunger-style model will produce curb up to 12 inches in width and 12 inches in height. Compared to the smaller Lil' Bubba EP, the addition of a hand brake on the EPC allows for extruding curb on an incline.

Number of models: 1

Product-line features: All molds over 8 inches in width for the Lil' Bubba EPC are made to order. With the addition of a mold adapter, the EPC model will use the smaller in-stock molds of the EP.

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POWER CURBERS

Updated 5700 Series Continues to Add Features



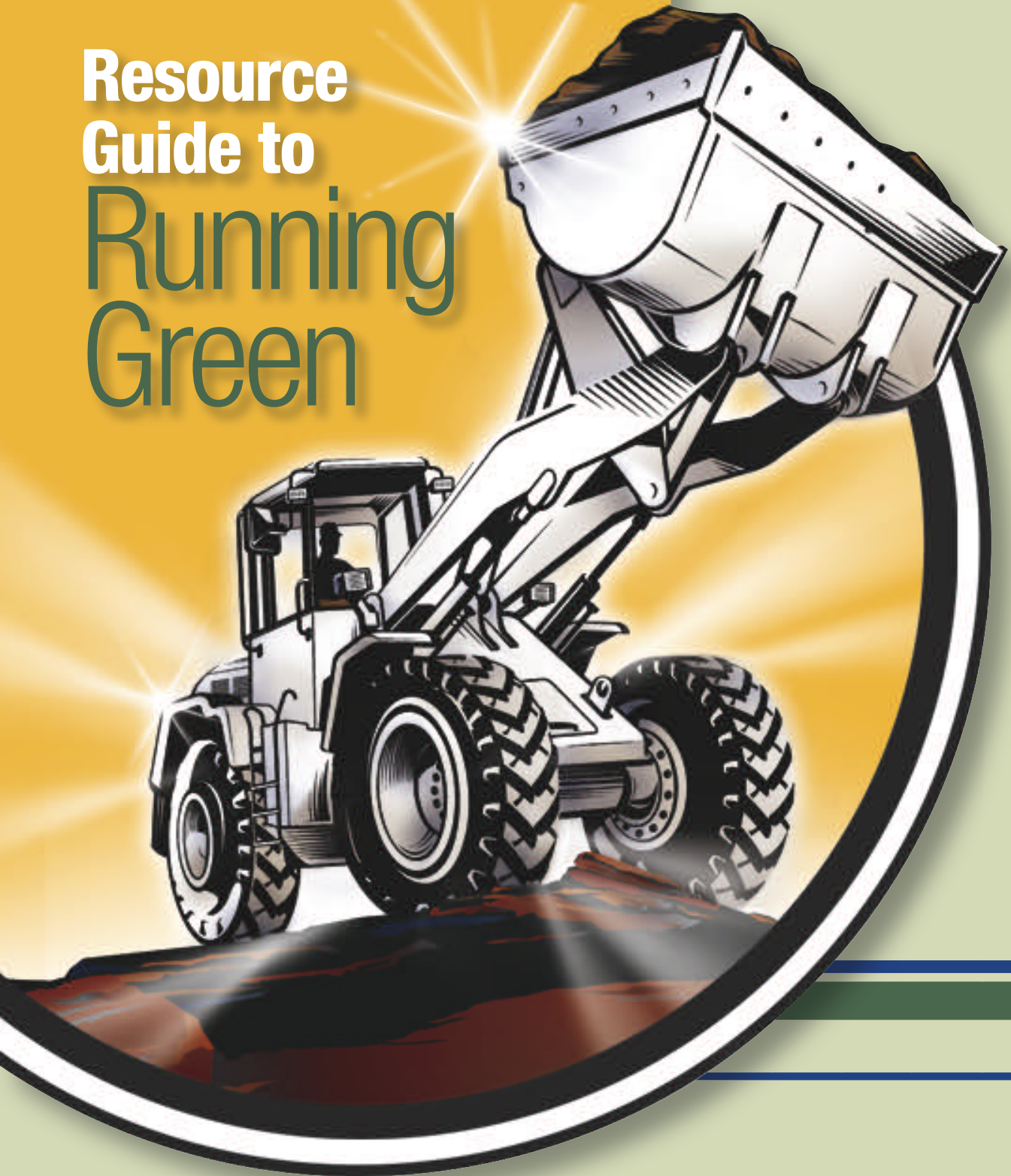
The latest generation in the 5700 Series of curb machines first launched in 1985 by Power Curbers, the 5700-C was introduced two years ago at World of Concrete with a new 130-horsepower Cummins engine and the new Smart Amp control system. Since then, a post-hole digger attachment has been added for use in wire rope barrier applications. The Power Curber 5700-C slipform paver offers contractors the ability to pour curb at a radius as tight as 2 feet, barrier walls up to 50 inches, and a range of jobs in between from sidewalks to stadium risers. Versatility is enhanced with a right-hand pour option and the repositioning of the auger conveyor to allow pouring curb or barrier in a single lane of traffic.

Number of models: 1

Product-line features: Power Curbers is "working closely with" 3D control suppliers to equip the 5700-C for string-less pouring. The machine's control system is 3D-compatible, but the company believes additional tweaking is required from 3D system manufacturers before it is willing to offer systems directly to customers.

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Editor's Letter

What you hold in your hand is a special collection of articles *Construction Equipment* has published over the previous year, a series we've called "Running Green."

This resource guide, brought to you with the partnership of John Deere, contains articles, web resources, and information that will help you come to grips with the increasingly complicated task of managing the emissions and environmental aspects of a fleet of construction equipment.

Exclusive *Construction Equipment* research shows that eight in 10 fleets do not have a formal plan for guaranteeing the emissions compliance that states such as California will be demanding in the not-too-distant future. Half of the managers surveyed do not have someone identified for official responsibility for compliance.

There is much work to be done, and most of it has just started. But *Construction Equipment* and John Deere hope this resource helps you find the information you need to do that work right.

Rod

— Rod Sutton
Editor in Chief
Construction Equipment,
ConstructionEquipment.com

Key Resources

California Air Resources Board
www.arb.ca.gov

EPA
www.epa.gov

ARB Verified Technologies List
www.arb.ca.gov/otaq/retrofit/verif-list.htm

EPA Verified Technologies List
www.epa.gov/otaq/retrofit/verif-list.htm

Texas Emissions Reduction Plan
www.tceq.state.tx.us/implementation/air/terp

Northeast States for Coordinated Air Use
Management (NESCAUM)
www.nescaum.org

Diesel Technology Forum
www.dieselforum.org

Renewable Fuels Assn.
www.ethanolrfa.org

National Biodiesel Board
www.biodiesel.org



RUNNING GREEN

By LARRY STEWART, Executive Editor

Diesel Owners' Turn to Carry the Clean-Air Ball

California's in-use diesel fleet rule will force changes to the dirtiest diesels in the field while it pushes environmental responsibility into your hands

With diesel engines lasting as long as 25 years, clean-air officials in states with the worst air are pushing to retire or upgrade older machines in order to make breathing safe for everyone. California's Air Resources Board (ARB) created a rule this summer, which environmental regulators in major metro areas throughout the United States are studying closely, that forces emissions criteria into equipment owners' repair-and-replacement decisions.

"We're not fighting the new ARB regulations; we're moving forward with the times. But the proposed regulations certainly accelerated our plans," said Lloyd Smith, senior vice president of Skanska USA Civil, after the company liquidated several million dollars worth of machines at a Ritchie Bros auction in Los Angeles last May. "We need to be updating our fleet with newer equipment and selling some of the older equipment in preparation for the regulations that are coming."

The Federal Clean Air Act describes the goal: Clean the air to protect the health of everyone, including those with weak respiratory systems such as the elderly, asthmatic, and infants. The nation's Environmental Protection Agency (EPA) sets air-quality standards limiting many pollutants to reach the goal. Particulate matter (PM) and ground-level ozone are most pertinent to diesel engine emissions. Ozone is formed when nitrogen oxides (NOx) combine with volatile organic compounds in sunlight. EPA determines compliance by sampling and analyzing air in an environment.

The PM and NOx limits EPA imposed on new diesel engines are different — strategies measured at engines' exhaust stacks intended to reach clean-air goals. EPA hasn't challenged existing fleets, but the federal agency's air-quality goals give the state agency — ARB — incentive to regulate the dirtiest diesels out of California.

The ARB rule, passed in July, affects an estimated 180,000 off-road vehicles used in construction, mining and other industries. It is intended to reduce emissions by a combination of measures, including retrofitting diesel particulate filters and encouraging the replacement of old engines with newer emission-controlled models. By 2020, diesel PM emissions from machines working in California will be reduced by 74 percent and NOx by 32 percent, compared to unregulated emissions.

Deadlines vary according to fleet size. For small fleets, which include small businesses or municipalities with a combined fleet horsepower of 2,500 or less, implementation does not begin until 2015. Medium fleets, with 2,501 to 5,000 horsepower, have until 2013; while large fleets, with over 5,000 horsepower, must begin complying in 2010.

The new rule also allows PM-nonattainment areas to opt in to stricter regional requirements as long as incentive funds are available. The air districts that could take advantage of this provision are the South Coast Air Quality Management District and the San Joaquin Valley Air Pollution Control District. This provision could as much as double the NOx-emissions reduction in these districts.

ARB asserts the rule will prevent 4,000 premature deaths statewide and avoid \$18 to \$26 billion in premature death and health costs. According to the agency's estimates, compliance will cost the industry up to \$3.5 billion. Industry analysts argue that the price to equipment owners for meeting ARB's in-use-diesel rule will be more like \$13 billion.

"Both sides are painting their own scenarios, but it is hard to project how this will play out," says Michael Coates, West Coast representative for the Diesel Technology Forum. "Everybody is in favor of clean air, but the real question is, who is going to be paying for it?"

"Regulating in-use vehicles is an extreme step," Coates adds, "but the need to clean up the air in several California regions is also extreme. Keep in mind that the Environmental Protection Agency (EPA) is moving along the same path (with emissions standards for new diesel engines) . . . just not as dramatically."

The price for noncompliance is high. EPA motivates officials like those at ARB to improve air quality with the threat of withholding federal funding for local projects if they do not move positively toward clearing the air in non-

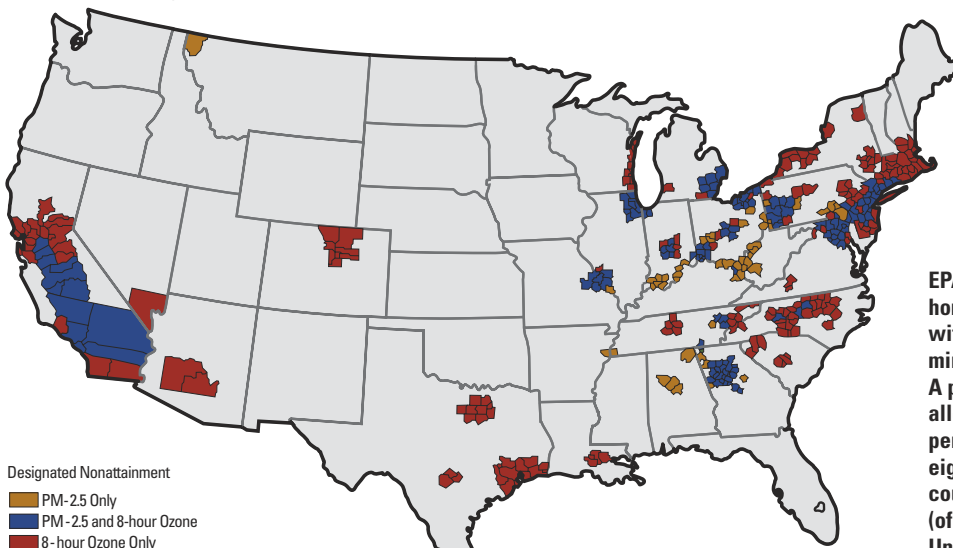
attainment areas — areas that have not yet attained air-quality standards.

Nonattainment is hardly confined to Southern California. Well before Jay Leno took over for Johnny Carson making jokes about Los Angeles smog, the Northeastern megalopolis from Washington, D.C., to New Hampshire's coast was identified as a nonattainer, as was the stretch of Lake Michigan shoreline from Gary, Ind., to Chicago and north to Milwaukee.

Add Atlanta, Phoenix, Dallas, Houston, Denver, Saint Louis, Memphis, Charlotte, and many others to the list of cities where the air is not safe for the youngest and the oldest citizens to breathe without risking illness. Virtually everywhere great populations gather, though, the air seems to sour. EPA air monitoring has identified 208 counties, home to 88.4 million people, with air that does not meet minimum quality standards. This despite all of the engineering hoops through which designers of new engines have jumped.

Today's diesel engines emit particulate matter that is at the lower limit of detection, and NOx emissions that are 80 percent cleaner than when the fleet rules were first adopted.

Counties Designated Nonattainment for PM-2.5 and/or 8-hour Ozone Standard

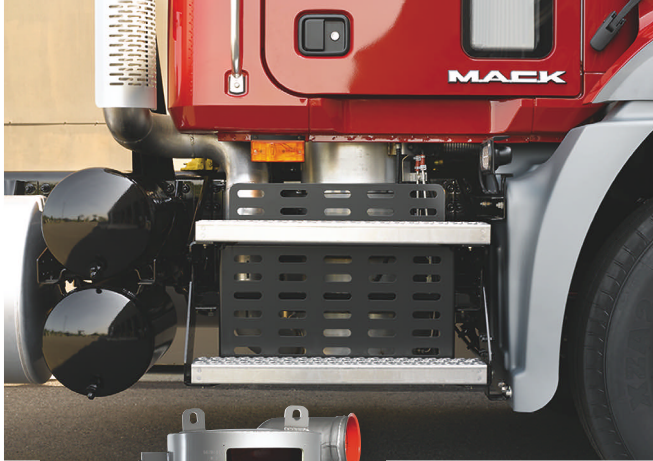


Several counties have only a portion of their county designated nonattainment. These counties are represented as whole counties on the map.

EPA identified 208 counties, home to 88.4 million people, with air that does not meet minimum quality standards. A proposal to reduce the allowable ozone from .08 parts per million averaged over eight hours to .07 or .075 ppm could add 398 to 533 counties (of 3,077 total counties in the United States) to the nonattainment list.



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Emissions regulations on new 2007 diesel engines slash allowable PM by 90 percent, requiring a regenerating diesel particulate filter like this one installed on a Mack class-8 truck. Similar kinds of filters will be required to clean up the exhaust of older diesels in California, and probably other states, starting in 2010.

But too many older, heavily polluting diesels remain in use to attain clean-air objectives. Construction is a significant generator of health-compromising NOx and PM, creating 32 percent of all mobile-source NOx emissions and 37 percent of PM emissions, according to EPA inventories.

Clean air is most urgent in California because mushrooming populations ensconced on landscapes where thermal inversion commonly traps the worst pollution raised the issue there first. Ninety percent of Californians live in areas with unhealthy air. The state's size, and the scope of its severe air-quality problem, makes ARB a leader in air-quality strategies.

Environmental jurisdictions around the country (and the world) look to ARB's rulings to decide how to improve their air. The Texas Department of Environmental Quality, for example, is spending grant money and proposing rules to reduce smog-causing NOx around the Dallas/Fort Worth Metroplex and Houston/Galveston. New Jersey has a grant program like those in California and Texas used to reimburse private industry for some of the cost to retrofit or repower machines with cleaner-burning diesels.

If the ARB ruling survives the inevitable legal challenges and actually produces cleaner air without sparking an economic revolution, other state agencies will have a responsibility to their citizens to emulate the California rule.

ARB regulations require that diesel engines not smoke. Diesel-equipment owners will be required to perform annual smoke tests to confirm that they run clean. The California agency will also put compliance officers in the field to inspect diesel vehicles. Violators face fines and must bring their vehicles into compliance. Once a vehicle or engine is in compliance, it must re-

main in compliance throughout its residence in California.

Vehicles that do not pass the smoke test must either be moved out of state or retrofit with ARB-verified diesel emission control strategies. ARB works with companies to verify diesel emission control strategies that significantly reduce diesel PM, are durable, and have a mandatory warranty.

The Carl Moyer Program uses government grants to help fund replacement of polluting diesel engines. It was established in 1999 to offset the extra cost of reducing NOx emissions below the levels called for by current standards. The state has paid about \$200 million in Moyer incentives to clean up more than 7,000 diesel engines.

Moyer retrofit-program administrators estimate rebuild cost based on the equipment specifications, dealers' parts estimates, and the users' utilization history. A grant is issued to pay the difference between the rebuild cost and the total cost of replacing the old smoker with a new engine. For example, if a replacement engine costs \$170,000, and the rebuild-cost estimate is \$50,000, the program pays \$120,000 toward the repower.

"We're also taking care of all the major preventive maintenance while the machine is in here — welding up cracks and that sort of thing," says Mike Bowman, Coburn Equipment's equipment manager. The Chino, Calif., contract scraper fleet has replaced dozens of engines under the Moyer program, and Bowman considers the investment a major uptime advantage. "We're not only reducing our emissions, but we're going to have less problems with our fleet — making these tractors like new again."

Emissions-reduction plans can also include operational modifications. For example, California imposed limits on idling time for over-the-road trucks. A draconian example of regulators gone awry occurred in Texas in 2000, when the State Implementation Plan (SIP — master plan that identifies how the state will meet federal clean-air deadlines) aimed to meet EPA air standards in the smoggy Dallas-Fort Worth and Houston-Galveston areas by prohibiting use of off-road diesel equipment before

Engine Tier Time Line

Following are California ARB and U.S. EPA off-road compression-ignition (diesel) engine standards (NMHC+NOx/CO/PM in g/bhp-hr unless otherwise indicated). When ARB and EPA standards differ, the standards shown represent the more stringent.

Maximum Horsepower	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015+
<11	See footnote ^a					7.8/6.0/0.75			5.6/6.0/0.60			5.6/6.0/0.30 ^a									
11<25						7.1/4.9/0.60			5.6/4.9/0.60			5.6/4.9/0.30									
25<50					7.1/4.1/0.60				5.6/4.1/0.45			5.6/4.1/0.22					3.5/4.1/0.02				
50<75										5.6/3.7/0.30			3.5/3.7/0.22 ^c					3.5/3.7/0.02 ^c			
75<100										-/6.9/-/- ^b			5.6/3.7/0.30			3.5/3.7/0.30			0.14/2.5/3.7/0.015 ^{b,c}		
100<175									4.9/3.7/0.22			3.0/3.7/0.22									
175<300	1.0/6.9/8.5/0.40 ^b								4.9/2.6/0.15		3.0/2.6/0.15 ^c					0.14/1.5/2.6/0.015 ^{b,c}			0.14/0.30/2.2/0.015 ^b		
300<600																					4.8/2.6/0.15
600<750																					
Mobile Machines > 750						1.0/6.9/8.5/0.40 ^b					4.8/2.6/0.15					0.30/2.6/2.6/0.07 ^b			0.14/2.6/2.6/0.03 ^b		
Generators 750<1,200																					
Generators > 1,200																					

(a) The PM standard for hand-start, air-cooled, direct-injection engines below 11 horsepower may be delayed until 2010 and be set at 0.45 g/bhp-hr.

(b) Standards given are NMHC/NOx/CO/PM in g/bhp-hr.

(c) Engine families in this power category may alternately meet Tier 3 PM standards (0.30 g/bhp-hr) from 2008 to 2011 in exchange for introducing final PM standards in 2012. The implementation schedule shown is the three-year alternate NOx approach. Other schedules are available.

Source: Justice & Associates, Long Beach, Calif.

■ Tier 1 ■ Tier 2 ■ Tier 3 ■ Tier 4 Interim/Final

Source: Justice & Associates

noon from April to October each year.

"Construction companies could not have absorbed the financial impacts of these tactics and remained viable," says Bob Lanham, vice president with Houston-area contractor, Williams Brothers Construction.

A construction coalition led by the Texas chapter of the Associated General Contractors prevailed on the state legislature to replace the rules with the Texas Emissions Reduction Plan (TERP). The voluntary grant and rebate program to support emissions retrofits is funded from a number of sources, including a 2-percent surcharge on sale and rental of construction equipment.

Austin Bridge & Road's Clay Jones, equipment operations manager, headed up the Austin-based contractor's TERP application.

"The state, through a formula based on frequency of the equipment's use and its horsepower, grants money to companies per ton of nitrogen oxide that is removed from the environment," he says.

The \$433,000 grant awarded to the contractor supported replacement of 12 pieces of equipment — six haul trucks and six off-road earthmovers.

"We were granted \$242,000 just for the trucks. If we were to sell them on the market,

we might get \$60,000 for them," Jones said.

"This grant money enables us to move forward in a much more timely manner to replace some of our older equipment," said Jim Andoga, Austin Bridge & Road president. "As a result, we can help provide much cleaner air in the Dallas-Fort Worth area. Hopefully, our children and grandchildren will see the real benefits of the program."

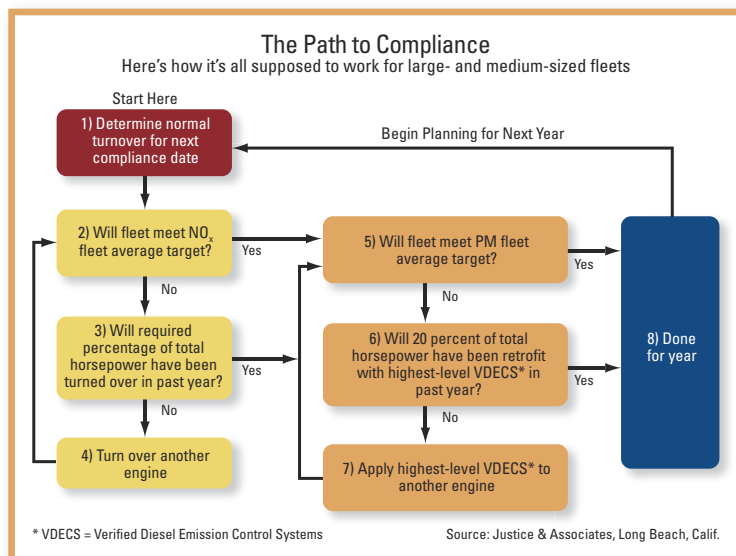
As research on the health effects of air quality deepens, acceptable pollution limits will likely tighten. EPA Administrator Stephen Johnson, acting in June under a court order to review the national ozone standard, proposed reducing the allowable level from .08 parts per million averaged over an 8-hour period to .07 to .075 ppm.

A panel of outside scientific experts advising EPA unanimously recommended that the new standard be lowered to within a range from .07 to .06 ppm.

"The science clearly shows that the current standard does not adequately protect public health from the harm caused by ozone," says Arthur Marin, executive director of Northeast States for Coordinated Air Use Management (NESCAUM). "EPA recognized this shortcoming but, unfortunately, it didn't go far enough with its proposed change."



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"There's not much else we can do at this point to get NO_x emissions from new engines down," says Joe Suchecki, a spokesman for the Engine Manufacturers Association. "We've already got regulations in place, and they call for NO_x emissions of 'near zero' by 2010."

Suchecki said EPA's revised standard "would put more pressure on states to retrofit older diesel vehicles.

"I think for most states, the major source of NO_x is now mobile sources," he says, "and if they lower the standard from .08 to .07, they'll have to look harder at those older engines."

In its proposal, EPA said "mobile sources and the electric-power industry were responsible for 78 percent of annual NO_x emissions in 2004."

Glen Kedzie, environmental counsel for American Trucking Association, says the federal government doesn't have the power to mandate retrofits of older trucks, but it can designate counties as nonattainment areas for the ozone standards, forcing the states to develop plans to reduce ozone.

"They may or may not include retrofits (to diesel engines in the field)," he adds, "but that's a tool in their toolbox."

Observers with American Road and Transportation Builders Association (ARTBA) estimate the change could result in 398 to 533 new counties designated as non-attainment areas, at

risk of losing highway funding.

Technologies for achieving ever-cleaner diesel power are hardly science fiction. Volvo Construction Equipment CEO Tony Helsham says the Volvo Group is spending "billions of Swedish Kronors every year" to develop hybrid drive systems, and claims that the construction-equipment company will roll out hybrid-driven wheel loaders that boast up to 50 percent fuel-consumption reduction in 2009. Roller applications, he notes, are also likely early candidates for the emissions-slashing technology.

Caterpillar's CEO, Jim Owens, said the company is testing unique combinations of low-emissions diesels and electric drives as hybrid fuel and emissions reducers. Large trucks, track-type tractors, and large wheel loaders are at the top of the development priorities. But he says Caterpillar has no timeline established for introduction of a product.

"We just have to get demand from customers to put them in place," he says.

NESCAUM's 2007 report — in the association's 40th year — speaks of the practical reality of clearing the air.

"This report is intended as a testament to the fact that cutting edge pollution-control programs and public-health protection in the Northeast have occurred in lockstep with economic development. Even as the region demanded and pursued clean air, its economy has grown impressively over the past four decades, challenging the myth that aggressive pollution-control programs stifle economic growth."

Engine manufacturers have been carrying the ball for clean air since the EPA's first diesel emissions limits went into effect in 1991. They will no doubt continue to stretch their engineering abilities in the name of cleaner air in the coming decades.

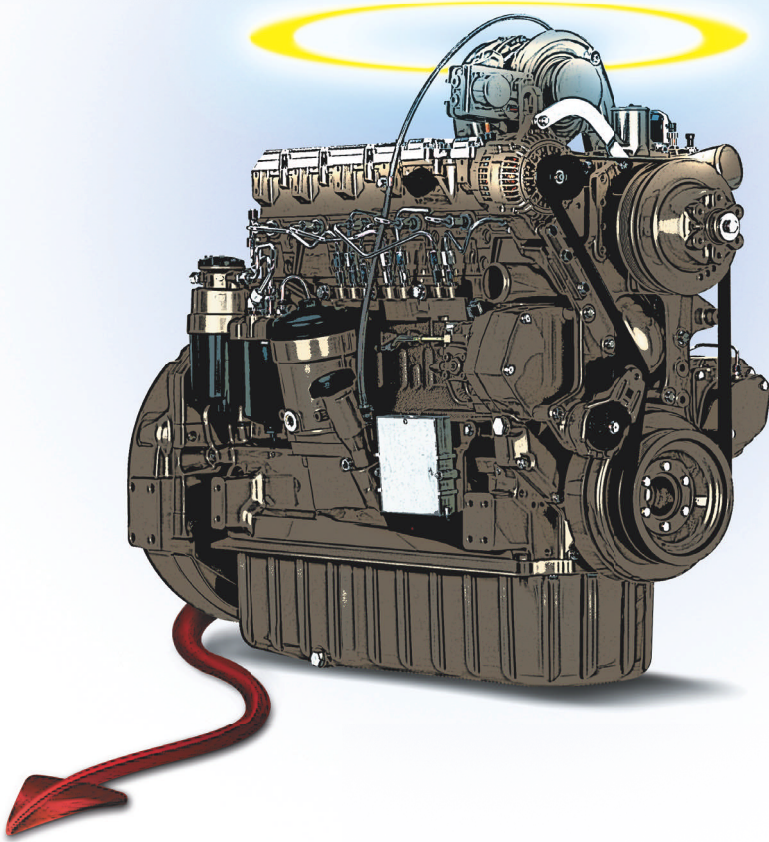
But now it is equipment professionals' turn to share the innovation load. Fleet owners have to come up with creative ways to upgrade diesel engines and reduce emissions in the field economically.

"Just as we had to change our culture and manner of thinking with regards to OSHA," says Lanham, from Williams Brothers, "the same mindset shift must occur again with the Clean Air Act."



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A proven track record and world-class fuel economy pave the way for the future

By Doug Laudick,
*product manager at
John Deere Power
Systems*

Doug Laudick is the manager, product planning, at John Deere Power Systems in Waterloo, Iowa. His 34 years of experience with John Deere includes a recent assignment as the product manager of the company's Tier 3 engine programs, where his product experience, knowledge of engine performance, and familiarity with each of the OEM market segments helped drive different technology solutions based on customer requirements.

John Deere will build on our PowerTech™ Plus experience as we move forward into a new era of ultra-low emissions engines with the upcoming Interim Tier 4 regulations in 2011.

Many new technologies have surfaced as engine manufacturers navigate the EPA's off-highway diesel emissions regulations, and one of the true success stories has been John Deere's PowerTech Plus platform.

John Deere designed PowerTech Plus engines to be the ultimate in engine efficiency and performance with such emissions-reduction technologies as cooled exhaust gas recirculation (EGR), variable geometry turbochargers (VGT), electronically controlled high-pressure fuel systems, 4-valve cylinder heads and full-authority electronic controls.

Fuel economy leadership

The result has been a powerful family of engines that sets a new benchmark for performance and fuel efficiency. Not only did we achieve best-in-class fuel economy, but we also maintained or improved other performance characteristics such as peak torque, low-speed torque, cold-weather starting, transient-response time and power bulge.

John Deere PowerTech Plus engines achieved best-in-class fuel economy and record fuel economy gains over previous John Deere models. During third-party, industry-recognized testing, a John Deere machine powered by a PowerTech Plus 9.0L engine set the record as the most fuel efficient machine of its type, consuming nearly 9 percent less fuel than its Tier 2 counterpart. During third-party and factory-observed bare engine testing at rated speed, the PowerTech Plus 9.0L engine consumed up to 17 percent less fuel, at 75 percent load, than one competitor's comparable Tier 3 engine.

Our customers have been realizing the benefits of these fuel economy gains since the start of Tier 3, while other engine manufacturers are only now planning to adopt these fuel-saving technologies for their Interim Tier 4 engines. Because John Deere will continue to build on these technologies for future emissions regulations, we expect to maintain fuel-economy leadership in the off-highway industry.

At www.JohnDeere.com/fuelsavings, you will find a calculator that puts these fuel economy figures into real dollars for you. Just type in today's diesel price and select the two engines you'd like to compare, and the calculator will tell you how much money you will save with a John Deere PowerTech Plus engine.

Innovation and experience

John Deere is an innovator in the commercial application of cooled EGR and VGT technologies for off-highway use. We have gained experience with these technologies over a wide range of applications and have established a proven record of reliability. John Deere continues to focus on the needs of our customers as we move on to future emissions regulations. This means emissions-certified products that deliver on the John Deere reputation for performance, reliability and fuel economy. We will build on the experience and successes of our Tier 3 engines to design the right engines for our diverse customers in the future.

Emissions regulations can be uncertain territory for many equipment owners and operators, but a sure source of comfort is knowing that John Deere has the experience to bring you the reliability, durability and fuel economy you have come to expect from our engines.



Breathing Easier with Aftertreatment

The basics about exhaust aftertreatment systems for original equipment and for retrofit

Engineers have been meticulously refining the diesel engine's combustion process during the past decade or so, and the result has been a spectacular reduction in the volume of pollutants exiting the exhaust stack. The design of the combustion chamber itself has been overhauled; electronic, high-pressure fuel-injection systems have evolved; variable-geometry turbochargers and charge-air coolers precisely regulate and condition intake air; and exhaust-gas recirculation retards pollutant formation at the point of combustion.

The two diesel-exhaust pollutants that engineers have had chiefly in their sights, as you may well know by now, are particulate matter (PM), which is soot resulting from incomplete combustion, and oxides of nitrogen (NOx), primarily NO (nitrogen oxide) and NO₂ (nitrogen dioxide), which have a poisoning effect on the air around us.

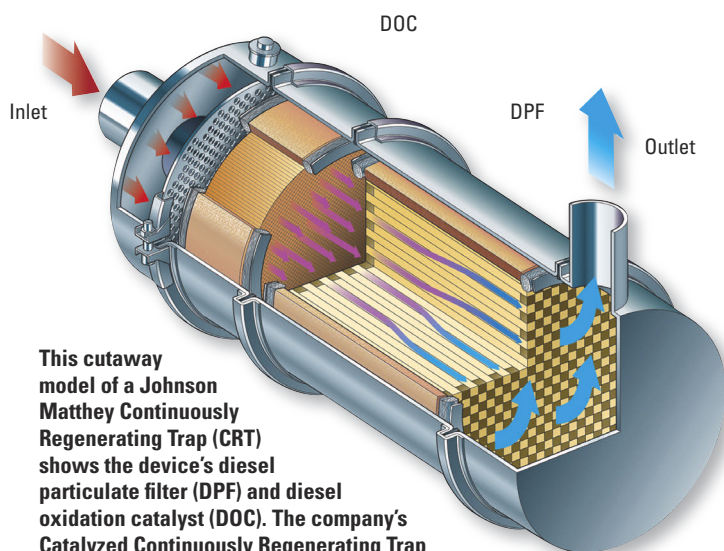
For the most part, when bringing 2007-model, heavy-duty, on-highway diesels into compliance with the ever-tightening regulations of the Environmental Protection Agency (EPA), engineers had to look beyond the combustion process in the cylinders and to the diesel's exhaust stream — that rush of hot gases from the exhaust valves — for ways to further reduce PM at the stack. The technique of cleaning the exhaust stream (versus controlling pollutants within the cylinders) is termed "after-treatment." Thus, to diminish PM, most 2007-model, heavy-duty, on-highway diesels are operating with a diesel particulate filter (DPF) in the exhaust stream.

Looking ahead, as NOx regulations become even more stringent, many engines in this category, by year 2010, will likely also be fitted with a NOx aftertreatment system. And it's possible, of course, that as off-highway diesels become subject to the EPA's Tier-4 Interim and Tier-4 Final regulations, they, too, may be equipped with similar PM and NOx aftertreatment systems.

DPFs, DOCs and regeneration

The typical diesel particulate filter is a ceramic-like cylinder — perhaps 12 inches

Johnson Matthey Continuously Regenerating Trap



This cutaway model of a Johnson Matthey Continuously Regenerating Trap (CRT) shows the device's diesel particulate filter (DPF) and diesel oxidation catalyst (DOC). The company's Catalyzed Continuously Regenerating Trap (CCRT) adds a catalyst to the DPF in order to promote enhanced passive regeneration.



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The conventional muffler on this Caterpillar motor grader has been replaced (retrofitted) with a Longview System from Cleaire Advanced Emission Controls. In separate but integrated processes, the Longview reduces oxides of nitrogen, and then removes nearly all particulate matter, carbon monoxide and hydrocarbons.

in diameter and up to 15 inches long — encased in a metal sleeve. The cylinder has row upon row of small square channels running between its two faces. Because the channels are plugged at alternate ends, exhaust gases must pass through the channel walls (where soot is deposited) and into adjacent channels to find outlet at the other face. The DPF usually is fitted with clamp-on inlet and outlet sections, which give the assembly the appearance (and typically also the function) of a large muffler.

Quite often, another piece of hardware, a diesel oxidation catalyst (DOC), is clamped into the DPF assembly between the inlet section and the filter section. The DOC is a flow-through, honeycombed, stainless-steel or ceramic structure coated with a catalyst to promote chemical reactions. When used in conjunction with a DPF, the DOC's main job is to keep the filter clean by burning away accumulated soot — a process called “regeneration.”

DPF regeneration can be either “passive” or “active.” Passive regeneration, which is used primarily with DPFs in retrofit situations, occurs continuously and automatically — assuming that the exhaust stream meets certain requirements. In the passive process, the DOC oxidizes a portion of the NO in the exhaust gases to NO₂. The NO₂, an extremely reactive gas, burns away the soot and leaves primarily NO and CO₂ (carbon dioxide).

The effectiveness of passive regeneration depends on exhaust temperatures being around 500 F for a significant portion of the engine's operating time, and also on the ratio of NO_x-to-PM being in a suitable range. On the latter point, if the engine is ef-

ficient at limiting its production of NO_x, then its exhaust stream may not support passive regeneration effectively.

In some instances, as with Johnson Matthey's Catalyzed Continuously Regenerating Trap (CCRT), the particulate filter itself has a catalyst that promotes further production of NO₂, thus supplementing the action of the DOC and potentially allowing regeneration at lower temperatures. The Donaldson Emissions Group has passively regenerated DPF units that use no DOC, only a catalyst on the filter.

Active regeneration, on the other hand, uses the DOC primarily to raise exhaust temperature. When, at the proper time, diesel fuel is injected into the exhaust stream ahead of the DOC, the catalyst becomes a “flameless heater,” says Fred Schmidt, director for Donaldson's Emissions Group, and boosts exhaust temperature to around 1,300 F. At that temperature, oxygen in the hot gases combusts the soot, leaving primarily CO₂ and water. Some passive soot burning occurs in an active system, says Schmidt, but that's not the primary purpose.

Most heavy-duty trucks rolling out of the factory today are equipped with an active regeneration system for the DPF. Even though the active system requires electronic intelligence to control the fuel-injection process and to decide when conditions are right for regeneration, it is the more reliable of the two methods, and its efficiency is not influenced by the NO_x/PM ratio. Truck manufacturers have built safeguards into the process to ensure that the vehicle and its surroundings are protected when regeneration occurs, a process that typically cleans soot from the DPF in 15 minutes or so.

Just to keep the record straight, not all active-regeneration systems employ a diesel oxidation catalyst. Notable among these non-DOC systems is that used by Caterpillar. It's our understanding that the Caterpillar system uses a separate diesel-fired burner to elevate exhaust temperatures for regeneration.

In addition to soot, however, the DPF also collects “ash,” which is primarily the

residue of additives in the engine's lubricating oil. Because ash does not burn away during regeneration, the DPF must be periodically cleaned of this substance. Unclamping the DPF assembly's sections allows relatively easy removal of the filter for cleaning.

A number of companies have developed proprietary equipment for cleaning the DPF of accumulated ash. Systems from SPX, Donaldson and Cleaire, for example, use patented techniques involving compressed air, vacuuming and ash collection. Cleaning ash from the DPF may be required at intervals ranging from 150,000 to 300,000 miles, and the process likely will take about the same time as an oil change.

Future NOx encounters

When meeting the EPA's NOx regulations for 2010-model heavy-duty, on-highway diesels, engine manufacturers may opt to comply with varying technologies. For example, according to *Construction Equipment's* truck editor, Tom Berg, Cummins will use more sophisticated in-cylinder techniques to meet 2010 NOx standards in its larger on- and off-highway diesels. The company's medium diesels, however, likely will be made compliant with a NOx after-treatment system. (See *CE's* November 2007 issue.)

For those engine manufacturers opting to meet the EPA's 2010 NOx regulations with an aftertreatment system, then vehicles using these engines may be equipped with a NOx adsorber or a selective catalytic reduction (SCR) system — most likely the latter.

The NOx adsorber uses a catalyst to initially trap and hold harmful compounds of nitrogen. Some have likened the catalyst to a "molecular sponge." But like a sponge, it can only hold so much before it must be emptied — or regenerated. Regeneration is initiated with periodic injections of diesel fuel, which reacts over the catalysts involved to first liberate the NOx, then to convert it to benign nitrogen gas (N_2). But this process is not simple, and poses technical challenges.

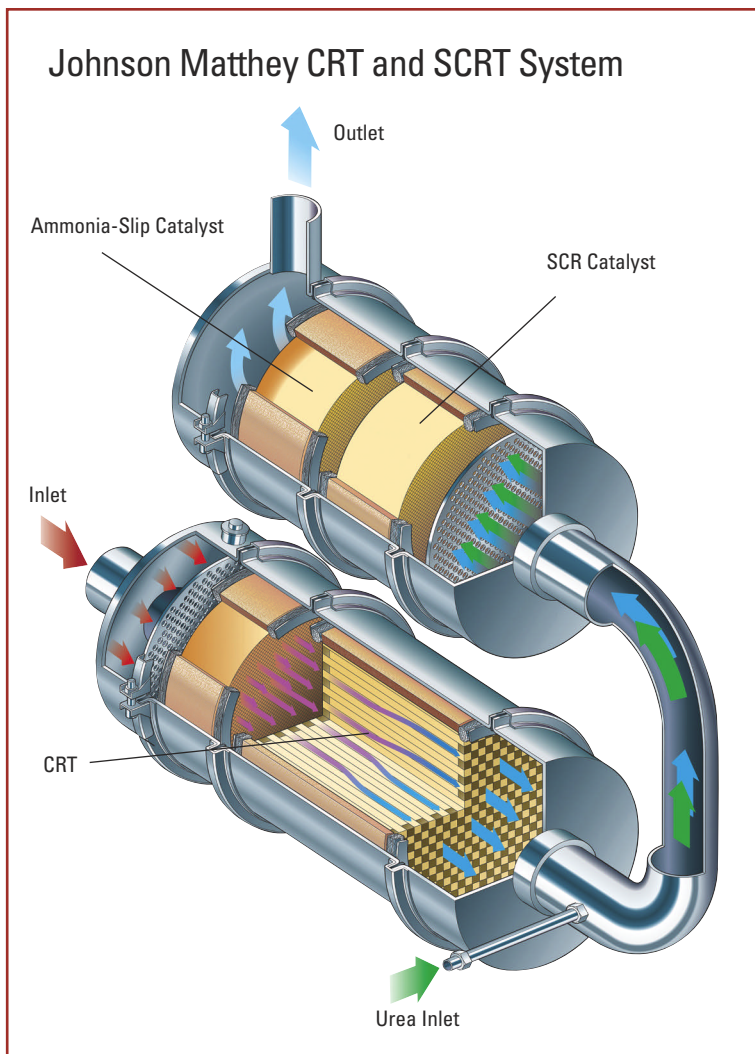
Although the NOx adsorber is ex-

tremely efficient at trapping NOx, it is finicky about its regeneration environment, requiring an oxygen-deficient exhaust stream that is difficult to achieve, thus posing a technical barrier to the NOx adsorber's practicality. In addition, the NOx adsorber is susceptible to fuel-sulfur poisoning (even with ultra-low sulfur fuels), and the temperature at which it regenerates is higher than that required by the DPF, a situation that might make the two systems incompatible.

So, at the moment, says Donaldson's Schmidt, SCR seems to be the winning technology.

The SCR process, like the NOx adsorber, uses a catalyst to trap NOx. But in-

This cutaway model shows a Johnson Matthey Continuously Regenerating Trap (CRT) — containing a DPF and a DOC — combined with a Selective Catalytic Reduction Technology (SCRT) system, which traps NOx on a catalyst and then converts it to harmless nitrogen when urea is added to the exhaust stream. An ammonia-slip catalyst reduces ammonia that gets by the SCR catalyst.





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Certain Volvo and Mack truck models use a compact DPF that resides behind the right front wheel.

stead of diesel fuel as the “reductant,” SCR employs ammonia (NH_3), which reacts with captured NOx in the presence of a catalyst to form N_2 . The favored source of ammonia at present is an aqueous solution of urea, which decomposes, when periodically injected into the exhaust stream, to form ammonia and carbon dioxide. In addition, a DOC may be used after the SCR system to neutralize excess ammonia that might slip past when exhaust temperature is too low for regeneration or when too much urea is injected.

In Europe, SCR is accepted technology. But in the United States, the EPA has expressed concerns — not about the effec-

tiveness of the technology itself — but about the possible lack of infrastructure to distribute urea and about the possibility of operating the engine without urea. Recently, the EPA issued guidelines that address the design of SCR systems to mitigate the latter concern.

Retrofitting for cleaner air

More and more governmental bodies in “non-attainment areas” (geographical regions that fall short of the EPA’s standards for clean air) are including the reduction of pollutants from older diesel engines in their clean-up strategies. Some jurisdictions, in fact, might require that machines used on public works projects meet specific emissions standards.

In some instances, incentives, such as tax credits or grants, may be offered for cleaning up an older diesel’s exhaust; and qualifying measures might include re-powering with emissions-compliant engines, rebuilding engines to include emissions controls, using ultra-low-sulfur fuel, and installing exhaust aftertreatment systems. Our scope here is to look briefly at retrofit aftertreatment systems.

When considering any type of aftertreatment for retrofit, first make sure that the system is on either the EPA’s Verified Technologies List (<http://www.epa.gov/otaq/retrofit/index.htm>), then click on “Verified Technologies List,” or on a similar list from the California Air Resources Board (CARB) (<http://www.arb.ca.gov/diesel/verdev/vt/vt.htm>), then click on “Currently Verified Technologies.”

Remember, too, that before installing a retrofit device, a qualified supplier might have to instrument and monitor your machine’s operation for several days in order to competently recommend (or not recommend) a particular system. For example, does the machine’s duty cycle allow exhaust temperatures to remain high enough for sufficient periods to passively regenerate a catalyzed DPF?

According to Schmidt, three basic retrofit technologies (“good, better and best,”

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he says) typically are available for particulate control on older diesels: the DOC, the partial filter, and the DPF.

When the diesel oxidation catalyst is used alone (not in conjunction with a DPF) as a means for reducing particulates, it uses a different catalyst than when its function is to clean the DPF. The catalyst used in the stand-alone DOC basically strips off the “soluble organic fraction” (SOF) portion of PM. The SOF consists essentially of unburned portions of diesel fuel and lubricating oil that condense on the sponge-like carbon particles.

Compared to the DPF, the stand-alone DOC is perhaps 20 to 30 percent effective at reducing total PM, but does little to reduce the volume of solid carbon particles. Reducing the SOF is a plus, however, and the stand-alone DOC does not require ultra-low-sulfur fuel. The price for a retrofit DOC might be in the neighborhood of \$2,000 to \$4,000, maybe more if a dual system is required or if installation is difficult.

Partial filters are 40 to 70 percent effective at capturing soot and may use filtering material such as metallic fleece that is laminated between layers of corrugated steel. The filter traps a portion of the carbon particles present in the exhaust stream, but usually does not trap ash. Partial filters are passively regenerated, either by using a catalyst on the filter or by employing a diesel oxidation catalyst, thus requiring ultra-low-sulfur fuel to protect the catalyst from sulfur poisoning. The partial filter might cost between \$5,000 and \$6,000.

(According to some aftertreatment specialists, particulate filters that use passive catalyzed regeneration systems are limited to 1994 and newer non-EGR [exhaust-gas-recirculation] engines. Pre-1994 engines might overwhelm a passively regenerated soot-filtering system, and [to add a twist of irony here] cooled-EGR engines may not produce enough NOx for a passive system to convert NO to sufficient quantities of NO₂ for combusting the soot.)

Older diesels also can be fitted with a full DPF, usually at a cost (depending on engine horsepower) between \$7,000 and \$10,000.


But costs can vary dramatically. Some large engines, for instance, may require dual systems to handle high exhaust flows, driving the cost to perhaps \$20,000 or more.

Retrofit DPFs typically require higher exhaust temperatures to passively regenerate, compared with temperatures required for partial filters. If temperatures are insufficient, then an active system is required, such as an integral electrical heater plugged in overnight. In theory, non-catalyzed, actively regenerated particulate filters could be retrofitted to any diesel.

“Low temperature” DPFs, which employ more catalyst to produce more NO₂, can passively regenerate at temperatures below those required for a standard DPF. But the possibility of this process resulting in excess NO₂ at the stack has the EPA and CARB concerned. (The sidebar, “DPF Passive Regeneration and NO₂ Concerns,” addresses this issue.)

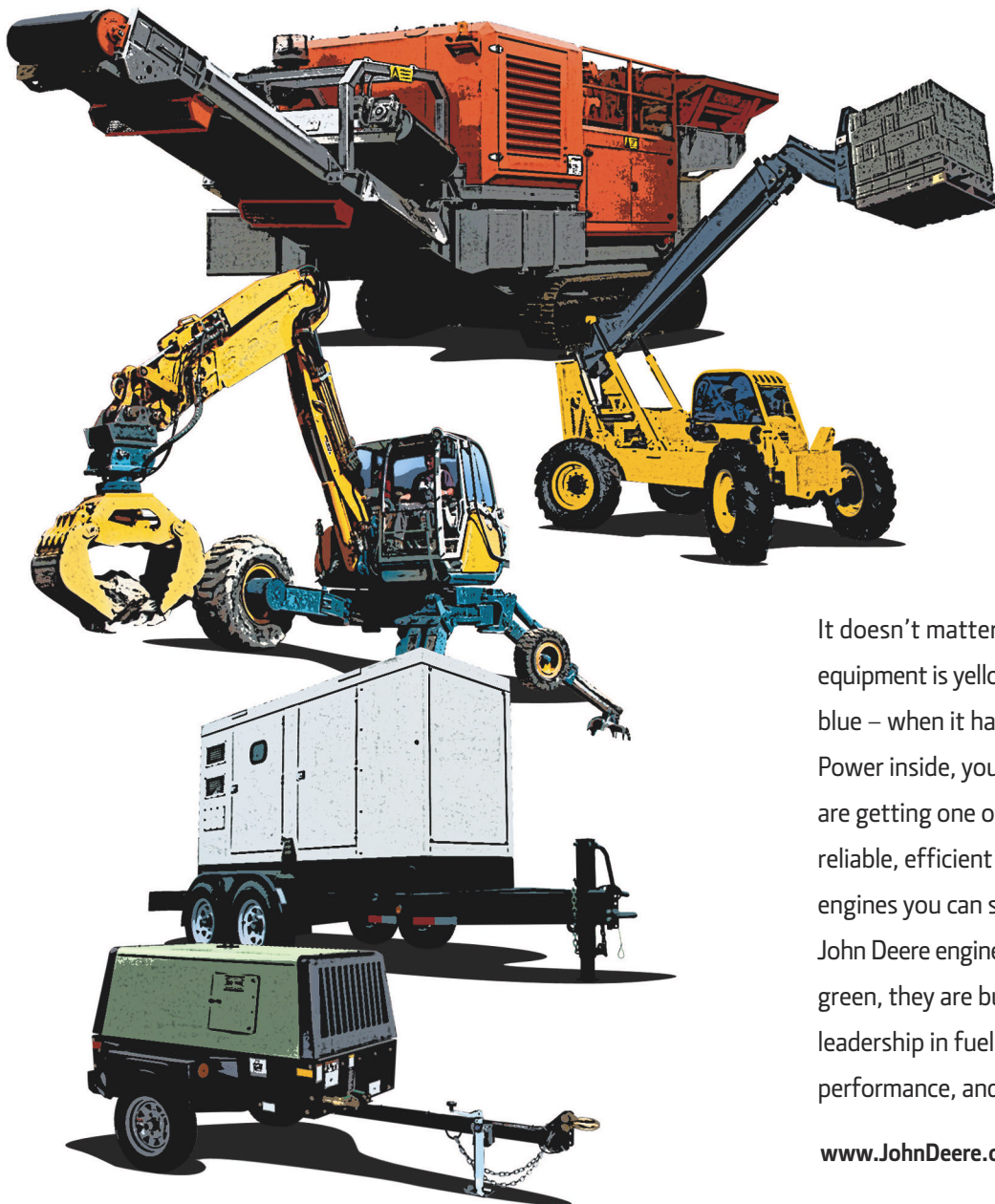
For older trucks and machines that might require both particulate and NOx control, the “lean NOx catalyst” combined with a catalyzed DPF may be a retrofit possibility. Cleaire Advanced Emission Controls, for example, manufactures a retrofit system (the Longview) that combines these two technologies.

According to Tom Swenson, director of sales and verification for Cleaire, the lean NOx catalyst uses continual injection of a small volume of diesel fuel into the exhaust stream to reduce NOx over a proprietary platinum catalyst, producing benign nitrogen gas and oxygen. Unlike the NOx adsorber, the lean-NOx catalyst works well in an oxygen-rich environment, but it is not nearly as effective at reducing NOx as the adsorber, and thus is not considered for use on new engines.

With ultra-low-sulfur fuel, the Longview has a stated NOx-reduction capability of at least 25 percent, but, says Swenson, that number might be closer to 35 to 40 percent in off-road applications, where exhaust temperatures generally are higher. Minimum particulate reduction is rated at 85 percent. The proprietary catalyst that coats the Longview’s particulate filter promotes oxidation of collected soot and also converts CO and hydrocarbons into benign gases and water. 

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RUNNING GREEN

By LARRY STEWART, Executive Editor

It's Not Too Late to Sample Diesel Retrofits

Firms that try emissions-reducing technologies now will know how to bid best in the very near future

Diesel emissions regulations that require equipment owners to clean up the exhaust stacks of their existing fleet are not coming — they're here. Firms that don't start investigating options now will forego the government's financial assistance and risk their businesses.

Last summer's news of the California Air Resources Board's plan to require investments in either retrofitting emissions-reducing technology to diesel engines or replacing them altogether had equipment professionals around the country wagging their heads and empathizing with the plight of small businesses in the Gold Rush State. Before anyone considers the California experience an isolated misfortune, however, they should consider that the West-Coast ruling, shortly after its completion, will likely be repeated in many states throughout the Union.

Several years ago, the U.S. Circuit Court of Appeals for the District of Columbia ruled that under the federal Clean Air Act, California is the only government in the United States that can initiate emissions standards for existing nonroad engines. The court stated not only that EPA has no authority to do so, but also that other states cannot enact standards except those adopted by California.

Emissions from the existing fleet of nonroad diesels represent a serious public-health problem not only in California, but also areas in 19 other states and the District of Columbia that fail to meet minimum health standards. EPA has the power to withhold federal funding for road projects in these states in order to compel them to clean up their air. They will move pretty quickly to adopt ap-

propriate elements of the California ruling.

Lest you classify this threat as merely imminent, don't forget that there are several projects around the country that are already dealing with restrictions on the kind of equipment clean enough to work on their sites.

Today on the Illinois Department of Transportation's Dan Ryan Expressway project, on the O'Hare airport modernization program, on the Wisconsin DOT's Marquette Interchange, and Massachusetts' Massport Contract, project owners have written detailed restrictions on the emissions technology that must be employed on diesel engines used on the site, the fuel injected into their cylinders, and the amount of idling time tolerated.

These projects pick up the momentum developed in diesel emissions-reduction initiatives written into the contracts for Boston's Central Artery/Tunnel Project, the I-95 New Haven Harbor Crossing in Connecticut, the World Trade Center Diesel Emissions Reduction Project, the Community Benefits Agreement of the Los Angeles Airport's Master Plan, and retrofit demonstration projects in the City of Houston, the Port of Seattle, and Sea-Tac International Airport.

Hand-wringing, complaining, or ignoring these truths is a risky waste of time. Most businesses that depend on diesel construction equipment will, sooner rather than later, find themselves with the choice of either investing in equipment to comply with emissions restrictions or working illegally. Now is the time to find out how to clean up diesel exhaust and gain some experience with the technologies.

The good news about demonstration projects and proliferating local restrictions is that the hardware for reducing diesel pollutants — and the manufacturers and dealers who sell and support the equipment — is gaining real-world experience. Government grants are supporting private industry's use of the new technologies. Accelerating use of the technologies is already drawing competitive vendors into the market, and the government continues to find ways to fund grant programs to help businesses pay for the transition.

Diesel particulate filters (DPFs), which remove unburned fuel particles, and diesel oxidation catalysts (DOCs), which remove oxides of nitrogen from exhaust have seen field use in buses and on-road trucks for 10 years or more. Demonstrations in off-road equipment since the late 1990s have taught the industry some valuable lessons.

"I'm working with some fleet managers who are changing out early DPFs," says Wade Wessells, project engineer in Donaldson's emissions group. Pioneers sometimes labored with exhaust filters that plugged early, requiring more maintenance than expected. "It was a fledgling market when these came out, though, and nobody really knew that much. Sometimes those engines didn't generate enough exhaust temperature to regenerate the filters properly, and they had to service them more frequently.

"We have thousands of products in the market now," Wessells adds. "We do the temperature data logging."

And so the industry has learned the best ways to adapt DPFs to the varied duty cycles of construction applications.

The typical DPF handles a huge volume of material, and its greatest practical challenge is that it must clean itself — or regenerate — to avoid restricting the exhaust flow and causing horsepower-robbing backpressure. Passive DPFs — the most-affordable style — rely on a minimum exhaust temperature to routinely burn captured particulate off their ceramic filter surfaces. Active DPFs add a system to the filter that fires up periodically to burn the

particulate off the media.

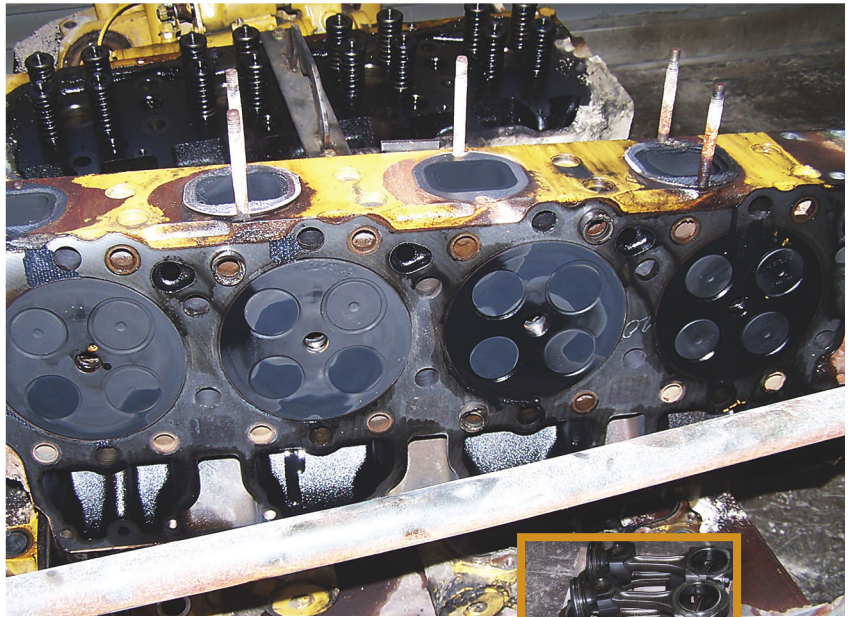
Nevertheless, both types of DPF have to be removed periodically for thorough cleaning in special ovens. Vendors of the filters typically size them for 1,000 hours of operation between services, but a great deal depends on how clean the engine runs.

"You want to do a full service on any engine before installing a DPF," says Jeff Silver, with E Global Solutions, the New York-area Clearaire and Engine Control Systems dealer. "An engine with a bad injector can plug a DPF in a week, and the filter will need to be serviced. At \$300 to \$600 each for the service, you want your engines running as clean as possible."

Silver says burning something other than ultra-low-sulfur fuel can plug the DPF in a couple of days. He does, however, claim that the filter can be cleaned with servicing, but sometimes it requires multiple cleanings.

Silver supplies Yonkers Contracting, among other New York area contractors, with DPFs. Yonkers' initiation to diesel emissions reduction came in 2002 while the company was restoring the bathtub retainage around the World Trade Center property for the New York Port Authority. Before Yonkers was finished in 2004, they were involved in demonstrations of DPFs on a couple of 966 loaders.

Yonkers recently landed a subcontract to build foundations for towers 3 and 4 of the new Trade Center development, and New York's Local Law 77 will require ultra-low-sulfur diesel and DPFs on all of Yonkers' diesel equipment (probably 15 pieces) headed to Lower Manhattan.



This 13,000-hour tear down of an engine from one of Fred Weber Corp.'s 988F wheel loaders shows the results of 7,000 hours running on Emissions Technology's diesel catalyst. Ed Moss, maintenance manager, says the evidence indicates the catalyst can extend engine life by about 5,000 hours. The catalyst cut the loader's fuel consumption by three gallons per hour.



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The nation's seven diesel collaboratives are voluntary, public/private partnerships involving leaders from federal, state and local government, the private sector and other stakeholders committed to reducing diesel emissions. Their most important functions include distributing technological and financial support for various engine clean-up initiatives. The collaboratives are part of EPA's National Clean Diesel Campaign.

"They (the New York City Department of Environmental Protection, enforcing Local Law 77) want 'best available technology,'" says Lou Marino, vice president of equipment operations for Yonkers. "We submit a list of the equipment we plan to use — make, model, engine serial numbers — to our retrofit supplier, and they come back and tell us what is required. It's typically either a DPF or DOC."

This will be Yonkers' first time back to Ground Zero since 2004, but not their first exposure to Local Law 77. Projects for the Department of Environmental Protection in Westchester and Rockland Counties also apply Local Law 77. Yonkers experience with 15 DPF-equipped machines, and three with DOCs, on those jobs keeps Marino from worrying about exhaust aftertreatment.

He says maintenance doesn't change. Machines perform like they normally do, and the company has had no problems with DPFs or a couple of DOCs they've used. Operators and the equipment staff keep an eye on the exhaust-backpressure warning lights that come with the DPF installation. And they have filters cleaned during seasonal downtime to avoid any problems when the machines are working.

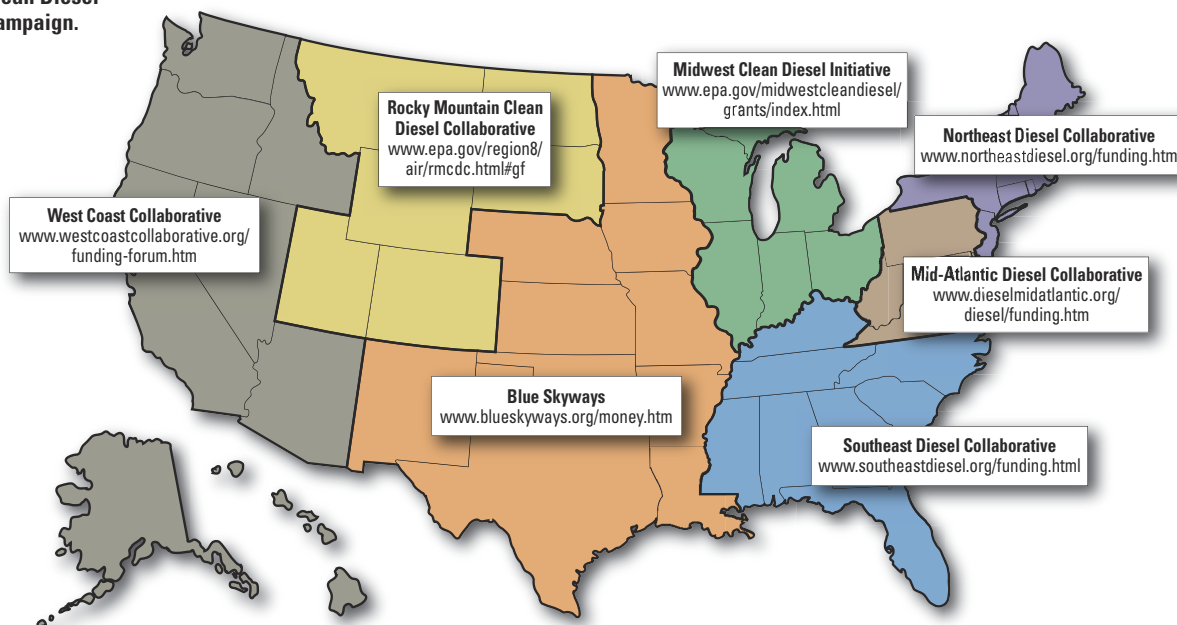
"The longest life we've seen with a DPF is

about 2,000 hours before we have them cooked and cleaned out," Marino says.

"We all want clean air and you have to do the right thing, but this is not pennies we're talking about," he says. The passive DPFs that Yonkers has bought so far have cost \$17,000 to \$25,000 each. "With all of our projects requiring retrofits, including the World Trade Center work this spring, we will have allocated about \$200,000 to retrofits."

Costs of diesel emissions retrofits are related to the scarcity of options currently available, and a function of the volume of DPFs and DOCs produced today. Certainly that will change, as CARB completes its in-use-diesel emissions reduction rulings (there is also a ruling in the works that will require on-road retrofits), and other states start applying the ruling in their own jurisdictions.

The diesel-emissions-reduction business is an evolving market made expensive by the fact that the regulators chose to verify technologies rather than test machine emissions. It's a practical move, eliminating the virtually limitless effort of field enforcement. But it makes government bureaucracy responsible to evaluate emissions-reducing technologies. Inevitably the list of approved technologies is going to be



short and grow slowly (see the ARB Verified Technologies List at www.arb.ca.gov/diesel/verdev/vt/cvt.htm and the EPA Verified Technologies List at www.epa.gov/otaq/retrofit/verif-list.htm).

Just as engine manufacturers have turned to exhaust aftertreatment to attain the greatest levels of emissions reduction, the regulators have focused on aftertreatment. It appears that California's in-use diesel rule is going to require Tier 3 engines or better, or verified retrofits.

Efforts to verify technologies continue, and as the regulation-born emissions-technology market matures, lower-cost options are knocking at verification's door. Diesel catalysts, like that from Emissions Technology or American Clean Energy Systems are working to get verified.

Benefits of a system that burns diesel fuel more thoroughly include reduced fuel consumption. Emissions benefits, while significant, are incidental enough that several contractors are buying the expensive catalysts today with little other motivation than slashing fuel bills.

Fred Weber Inc. had been testing the DC-100 catalyst from Emissions Technology (www.emissionstech.com) on a few high-horsepower quarry machines for a couple of years. After the systems consistently reduced fuel consumption 18 percent and 13,000-hour engine teardowns confirmed that it cleaned up components, the company installed the systems on about 60 machines — most of the Cat 3408 and larger engines in the fleet.

"They've made a big difference in underground mining facilities," says Ed Moss, maintenance manager with the St. Louis, Mo.-based integrated paving contractor. "The guys in our underground aggregate mines know when they're not working. They can see when the engines start smoking and smell it. They're motivated to keep the systems working, because it means they have to spend less on ventilation."

Emissions Technology claims as much as 43 percent reduction in particulate matter with more complete combustion of the diesel fuel and as much as 14-percent reduction in oxides of nitrogen. The less-than-\$2,000 systems installed on each engine atomize the catalyst and administer it through the intake air.

At about 50 cents per hour, though, the catalyst is no small investment. The 18-percent fuel savings Weber has measured more than generously offsets that cost, and its value will continue to increase as petroleum costs escalate.

Diesel/electric hybrid drive trains represent another approach to emissions reduction that, for the moment, remains outside the range of verified technologies.

Henkels & McCoy, a utility contractor based in Blue Bell, Pa., recently bought two medium-duty Peterbilt bucket trucks with Terex lifts on them and Eaton's diesel/electric hybrid power trains. The three manufacturers, in a development joint venture, offered the trucks at a 70-percent discount off of the \$60,000 incremental cost per truck of the hybrid systems.

The manufacturing JV outfitted the trucks with telematic vehicle-tracking systems so that it can easily gather operating data on the trucks. Henkels & McCoy fit some of its conventional bucket trucks with GPS black boxes so that the contractor can compare the hybrids' operating data to that of conventional trucks.

"We're interested in emissions reduction, and we want to evaluate this type of equipment for the future because we know that the pressure to reduce diesel emissions is going to come on us sooner rather than later," says Bill Koke-mor, fleet director for Henkels & McCoy.

The trucks will be deployed to Henkels' operations in eastern Pennsylvania and southern California. Kokemor points out that they will be earning their keep every minute they work.

"With fuel prices so high, there would be good reason to look into these trucks even if there weren't emissions benefits," he says. "The manufacturers claim they can save you 60 percent on fuel costs."

Henkels & McCoy operates about 300 of this class of bucket truck every day, so the company has a lot of incentive to check into hybrid-electric claims. The company bought the hybrid trucks without the financial assistance of grant money, but there is plenty of funding flowing right now to encourage contractors to try emissions-reducing hardware.

Provisions of the current highway authori-



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Grace Pacific, Hawaii's largest paving contractor, bought three Tier-2-certified Cat 3412 engines to repower a pair of 773 trucks and a 992 wheel loader in the firm's main quarry. The West Coast Collaborative showed the firm how to qualify for grant money that made up the cost difference between rebuilding the engines and the certified repower.

zation bill allow funds earmarked to reduce traffic-congestion-related pollution (Congestion Mitigation Air Quality) to be used in reducing off-road diesel emissions for the first time. This source, along with much of the money EPA brings in from air-pollution fines and out-of-court settlements and local and regional funding in air-quality nonattainment areas, is supplying millions of dollars every year to fuel the fledgling emissions-reduction market.

"About four years ago, Grace Pacific began to get sensitized to the issue of diesel emissions," says Lorne Fleming, equipment manager with Grace Pacific, a paving contractor based in Honolulu. "We were interested in looking to see what we could do to make Hawaii a little better place to live.

"Our manager of environmental compliance found out that there is a bunch of money floating around to help companies that are interested in getting on the bandwagon early and taking care of a problem that clearly is going to be more important as time goes on."

Funding and support for Grace Pacific's interest came from a public/private/environmental group called the West Coast Collaborative — an organization supported by the EPA's western region engaged in creating, and supporting emissions-reduction projects. The EPA Clean

Diesel Initiative supports seven such collaboratives that extend technical and funding support for diesel emissions reduction efforts into all 50 states (see the map on page 36).


The West Coast Collaborative helped Grace find funds to support a three-pronged investment in cleaning up Grace Pacific's equipment. The company retrofit some equipment with DPFs, repowered a large loader and two rock trucks with clean new engines, and replaced a couple of large generators that power crushing plants.

Repowers were conducted by the local Caterpillar dealer. Grant money covered the cost difference between rebuilding the old engines and replacing them with ACERT-certified new diesels.

"We got much lower-emissions pieces of equipment back," says Fleming. "We got quite a bit less fuel consumption. We got a lot more power.

"We've eliminated all the troubles of having some slow vehicles and fast vehicles on the same haul road," he adds. "These trucks run with each other now, instead of passing each other or waiting to dump. It's made it much easier to run a smooth operation, especially in the quarry."

Just as ultra-low-sulfur diesel has been required in municipal transit operations for several years, the government has figured out ways to test diesel-emissions-reducing technologies on its own fleets, and on the fleets it hires. That's why federally funded projects like Boston's Big Dig, Connecticut's I-95, Chicago's Dan Ryan and O'Hare Modernization called for emissions retrofits. These projects have served as the field verification of aftertreatment technologies like DPFs and DOCs.

Now that the technologies have proven practical in the hands of some contractors, rulings requiring their use are beginning to roll out to the broader industry. Estimating operating costs to include in a bid could be a mystery of business-breaking proportions for users who've inadequately researched the technologies. That's why now is the time to check into the grant funding available to support emissions-reducing technologies. 

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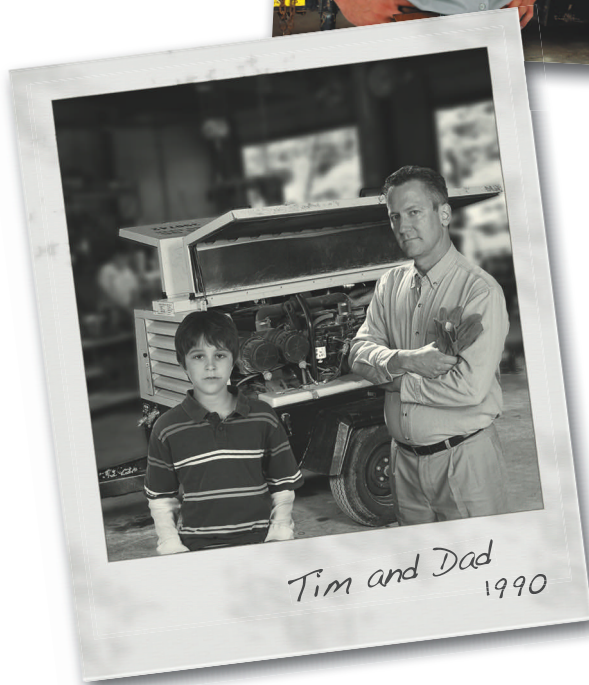
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RUNNING GREEN

By LARRY STEWART, Executive Editor

Construction Races Toward Using Biofuels

When emissions reductions of alternate-diesel/exhaust aftertreatment combos are verified, the cost of compliance with in-use diesel exhaust limits will plummet

Witness the perfect storm from which alternate fuels will emerge as viable energy sources: A barrel of OPEC crude oil selling for more than \$130 ushers pump prices of regular gasoline above \$4.00 per gallon and on-highway diesel up to \$5.00. War and saber rattling in the Middle East inflate domestic energy production to national-security status. Heavily populated regions grapple with air quality so poor that it threatens the immune systems of infants and the aged. The developed world ramps up its fight against global climate change by curbing carbon emissions.

The Energy Independence and Security Act of 2007 that President Bush signed into law in December 2007 includes the Renewable Fuels Standard, which raises the U.S. biofuels production target to 36 billion gallons by 2022 in a progression that starts at 9 billion gallons this year (about 5.3 percent of total annual gasoline and diesel consumption). Europeans are driving to meet an EU directive to replace 10 percent of the Union's fossil energy by 2020.

As 174 world governments that ratified the Kyoto Protocol work to cap greenhouse-gas emissions, world demand specifically for biofuels rises. Today's search for carbon-dioxide-neutral fuels — fuels that release no net CO₂ to the environment — leads toward biofuels because plant feedstocks remove as much or more CO₂ from the environment than burning the fuels releases.

Biofuels address energy-independence and air-quality issues most clearly. In fact, combinations of biofuels and aftertreatment

devices may be able to save some of the Tier 0 and Tier 1 diesels that otherwise would have to be replaced in order to comply with California's new off-road in-use diesel rules. But biofuels may not deliver an obvious greenhouse-gas or fuel-cost victory.

The debate over whether or not biofuels create more greenhouse gas and deepen this world's shameful inability to feed starving underprivileged people is a complex one. Both sides quote and attempt to discredit various studies of resources consumed making fuels and CO₂ production, deforestation and economic stimulus, food-price inflation and personal-income growth in Asia.

Politics notwithstanding, the amount of money already invested — more than 60 new ethanol plants currently under construction — and tax dollars promised — Congress authorized \$700 million of federal support each year until at least 2014 to develop our biofuels industry — suggests that biofuels are coming to a pump near you. The good news is that gasoline and diesel engines have little to fear.

Biofuels such as biodiesel and ethanol enjoy particular advantages in a world amending fossil-based energy systems. Biofuels can be delivered to market without creation of completely new distribution systems. Existing gasoline and diesel engines require no real modification to run on ethanol blends or biodiesel.

The Energy Security Act sets a specific target of 1 billion gallons of biodiesel produced by 2012. A diesel engine's efficiency advantage easily outweighs fuel-efficiency losses that gasoline-powered cars might experience running on lighter ethanol fuels.



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Automakers know that, and there are more than 20 models of diesel-fueled cars and light trucks planned for introduction here by the 2010 model year; six models by 2009. Increasing demand for diesel will encourage broader distribution of low-emission heavy-duty fuels.

The construction industry will be drawn to diesel-fuel alternatives at the crossroads of energy independence and air-quality regulation. Some firms are already using diesel-fuel surrogates — attracted by economics, compelled by regulation, or both. The California Air Resources Board's (CARB's) emissions rule for in-use, off-road heavy-duty diesel vehicles sets the stage for putting some veggies in heavy iron's all-fossil diet.

Owners of off-road diesels in California should already be calculating fleet-average emissions of nitrogen oxide (NOx) and particulate matter (PM), comparing their numbers to CARB's targets for a matching variety of equipment, and taking action to hit those targets. Today, the only way to reduce fleet-average emissions enough is to replace Tier 0 and Tier 1 machines — anything built before 1997 — up to a maximum of 8 percent of the fleet per year with brand-new equipment. A few larger pieces can be repowered cost effectively with Tier 3 engines. Existing Tier 2 and Tier 3 machines can be retrofit, up to a maximum of 20 percent of the fleet per year, with emissions-control devices from CARB's Verified Technologies List.

But there are combinations of fuel

modifications and exhaust aftertreatment waiting to be verified that could bring Tier 0 and Tier 1 machines into compliance so they can be retained rather than replaced.

Emissions Technology markets a platinum-based diesel-fuel catalyst and a system for introducing it into the engine's air intake that promises more complete combustion of the fuel charge in the cylinder and a 50 percent or greater reduction in soot produced by older diesels. The company is working to get the CARB to verify its catalyst in combination with an exhaust aftertreatment filter.

"Our field data show that combining the Combustion Catalyst System with a Level 2 diesel oxidation catalyst (a lower-cost exhaust aftertreatment device) gives Level 3 performance on a Tier 0 or Tier 1 engine — an 85-percent reduction in PM emissions. Plus, we see 8 to 10 percent fuel savings on a typical diesel engine," says George Malouf, vice president of technology at Emissions Technology.

Biodiesel delivers similar reductions in combustion soot, and it is also in the process of being added to CARB's verified list in combination with appropriate aftertreatment. As these fuel/exhaust treatment pairings verify for use with pre-1997 diesels, they could slash the cost of fleets' compliance with California's emissions limits for in-use diesels.

This good news won't be confined to California for long.

"I think there's an outstanding possibility we'll see this (California rulemaking ad-

The first diesel Grand Prix winner is in this Audi, which has taken LeMans two years running, fueled by Shell GTL — synthetic diesel made from gaseous feed stock. Fed with plant biomass, the process could deliver high-performance diesel and satisfy political, environmental and economic renewable-fuel imperatives.



opted) in 15 or 20 states after the EPA grants California its waiver,” says Mike Buckantz, president of Justice & Associates, a Long Beach, Calif., environmental consulting firm. Buckantz believes the Environmental Protection Agency will grant the California ARB the waiver necessary for the state to fully implement its in-use, off-road diesel rule by the first or second quarter of 2009. “You can just look at a map of areas in PM 2.5-hour nonattainment (to identify states where the California rulemaking will be adopted next).

“All these other states have to do is go through the steps required by state law to adopt a new regulation,” says Buckantz. He suggests they could begin enforcing off-road diesel rules in mid-2010. Deadlines are likely to be pushed back to reflect the later start date, but the working provisions of the rulings will, by law, be identical to the California regs.

It’s prudent to wait until some alternate fuels are CARB verified to buy them, but now’s the time to get educated on the technology and politics of biofuels. At this stage in their development, your economic and political actions may influence local availability of certain fuel types.

Biodiesel is made by processing vegetable oils or animal fats. The most common

feed stocks in the United States are soybeans or corn. Biodiesel mixes readily with conventional diesel, and today is available mostly as B5 (5 percent biodiesel) and B20 (20 percent biodiesel). Virtually all engine manufacturers approve the use of B5, and most support engines run on B20.

Biodiesel is said to have slightly less energy than fossil diesel, but an aggregates producer with operations using B99 for three years reports no significant reduction in material moved per gallon of fuel burned in 150 pieces of its equipment that have been running in Iowa, Nebraska, Illinois and Indiana.

Biodiesel acts as a solvent, which cleaned out the quarry equipment’s fuel systems and required fuel-filter changes as often as every other day for the first 500 or 600 hours of use, but caused no long-term problems. The 15,000-hour teardown of a Cat C18 engine powering an underground mining truck showed a hint of sludging in the head, but at acceptable levels. Main bearings looked good, and there were no fuel-system problems.

Biodiesel helps the quarry meet the Mine Safety and Health Administration’s (MSHA) more stringent air-quality standards for underground mines without having to invest in additional ventilation shafts.

The construction industry will be drawn to diesel-fuel alternatives at the crossroads of energy independence and air-quality regulation

Volvo’s designers chose hybrid power for the Centaur concept hauler which, when powered with a downsized engine and fueled with high-cetane synthetic diesel, seems certain to slash emissions to near zero and produce significantly improved performance.





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The company is also buying B99 at lower cost than fossil diesel.

Biodiesel is an ester, and esters tend to attract water, so biodiesel tank farms and dispensing systems require careful attention to housekeeping practices. Well-maintained fuel-water separators on machines are also critical.

Raw biodiesel also tends to have a higher cloud point than conventional diesel, although it varies with the quality of feed stock, processing and additives. The National Biodiesel Board (NBB), the biodiesel industry's trade association, claims that additives and blending with the right kinds of conventional diesel can keep biodiesel blends working in very cold climates. The organization has collected several testimonials from biodiesel users — the City of Brooklyn Park, Minn., Yellowstone National Park, City of Denver, Colo., City of Ann Arbor, Mich. — that work through freezing winters with B20 blends.

The NBB is cataloging states' authority to regulate fuels; their status in adopting ASTM D6751 as the fuel specification for biodiesel; and assessments of their capacity to analyze fuel samples. Information gathered from this project will be presented on NBB's State Fuel Quality Index web page.

Ethanol production shares some energy-efficiency concerns often expressed concerning the cost to make biodiesel. Fermenting fuel-quality ethanol from grains such as corn or corn sorghum is energy intensive, but comparing 2001 production data to 2006 data, a study by Argonne National Laboratory suggests that American ethanol producers have reduced water use nearly 27 percent, electricity use nearly 16 percent, and reduced total energy use nearly 22 percent. The domestic ethanol industry simultaneously increased production nearly 300 percent.

Making ethanol from cellulose, rather than grain, expands the types and amount of available raw materials to produce ethanol, including many materials now regarded as wastes such as corn stalks, rice straw and wood chips. So called "energy crops" of fast-growing trees and grasses can also provide cellulose feed stock. A recent Stanford University study asserts that switchgrass produced 540

percent more renewable energy than the amount of nonrenewable energy consumed in making it.

Sugar cane is an even better ethanol raw material. Brazilian sugar growers produce feed stock for 45 percent of that country's ethanol production on only 1 percent of its arable land. Brazil is nearly energy independent, thanks largely to the size of its ethanol industry.

Opponents to grain-derived biofuels argue that cropland diverted to growing fuel feed stocks must be replaced given a growing, increasingly meat-fed world population. They warn that using more grain for biofuels contributes to market dynamics that have been inflating food prices out of reach of the poorest portion of world population.

Markets are much too complex to either vilify or exonerate biofuels for encouraging the slashing of rainforests or rise in food prices. In reality, elevated fuel costs are the primary source of food-price inflation and, ironically, increasing biofuels use is likely to reduce fuel costs. Rapidly growing middle classes in Asia and India are buying more dairy and meat products, too, which greatly intensifies demand for agricultural land (it takes about eight times as much corn to produce the same number of calories from meat as from bread).

Use of marginal land in the United States, where subdivision and mall development costs nearly three acres of farmland every minute, is controlled fairly carefully. So it should be no surprise that the rate of rainforest deforestation, in countries without strong controls on land use, shadows grain prices. Losing rainforest releases CO₂ and diminishes the earth's ability to absorb more of the greenhouse gas.

The jury is still out on how grain-derived fuels will affect greenhouse gases, but sugar and waste-stream feed stock such as wood waste appear to be better for the environment and global food economics than fossil-derived fuel. Refinement of cellulosic and biomass conversion suggests that biofuels makers are moving toward even more convincing solutions.


Commercialization of a process called Fischer-Tropsch converts natural gas or bio-

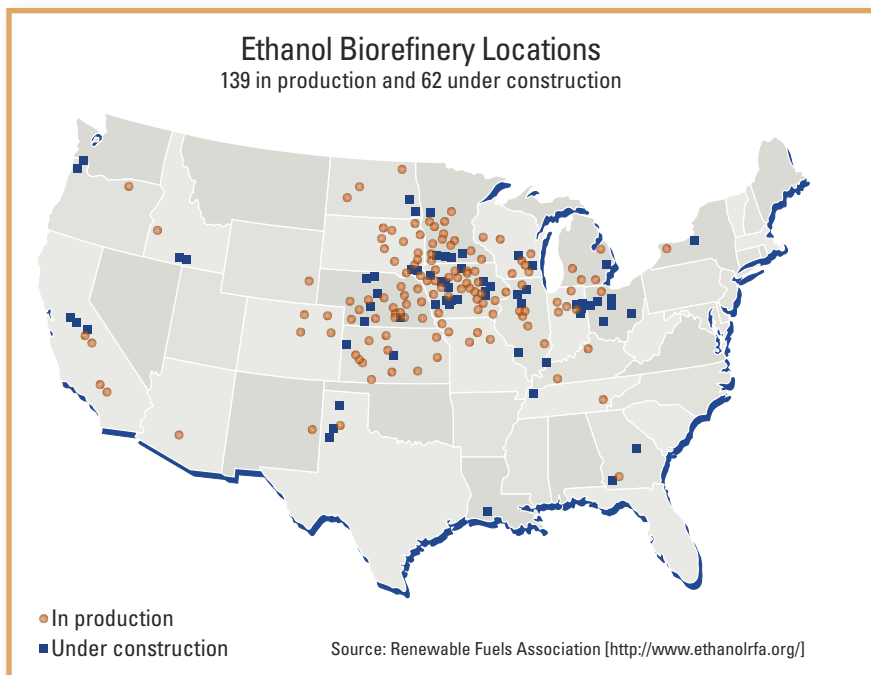
mass to an ultra-clean, diesel fuel. Not only does this gas-to-liquid (GTL) synthetic diesel fuel reduce particulate matter and NOx emissions from current diesel engines, but when using biomass as the feed stock the process gasifies the whole plant. The result is that converting biomass to liquid fuel by way of Fischer-Tropsch uses less land area per unit of energy compared with grain biodiesel or ethanol.

It seems the stepping stone for developing GTL-fuel processing will be remote natural gas reserves — too expensive to bring to market in gaseous form. One PetroSA plant in South Africa and Shell's Indonesian plant currently produce GTL fuels suitable for heavy-duty diesels. Discussions are under way to develop GTL production in Alaska. Existing technology, pipeline capacity and North Slope gas reserves are adequate to deliver more than 1,000,000 barrels per day.

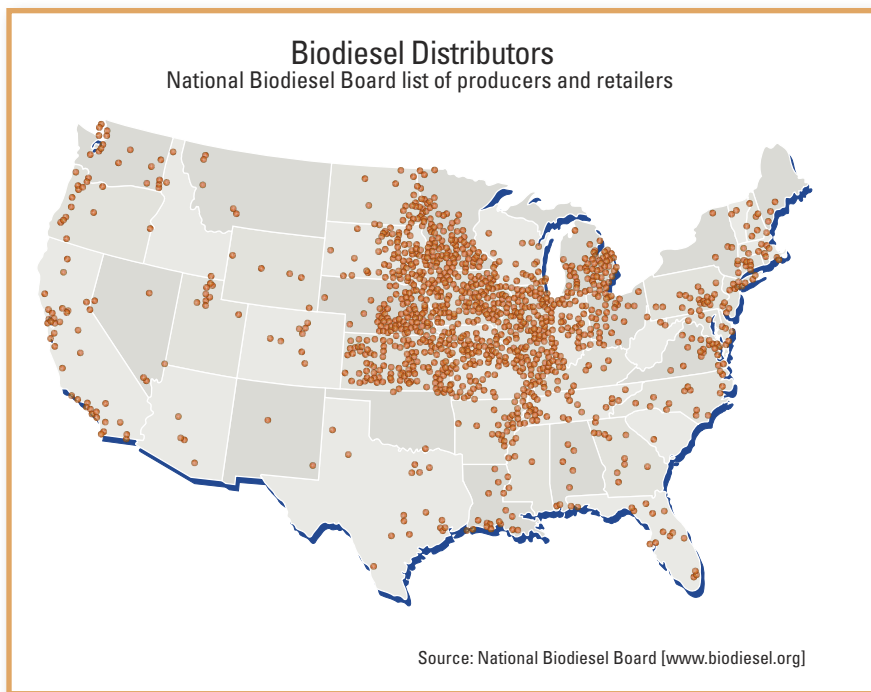
Synthetic diesel powers a range of diesel engines overseas. Southern-California testing with International Class 6 delivery trucks retrofit with Johnson Matthey diesel particulate filters proved that Shell GTL reduced emission of hydrocarbons, carbon monoxide and particulate matter by 99 percent, and reduced NOx by 14 percent. No maintenance or component-life problems were reported in 24,000 miles of use. Fuel economy didn't change significantly.

Cetane number of GTL fuels is usually greater than 74, much higher than conventional diesel. This may be a hint of what has pushed a diesel-powered Audi to two straight road-race wins at Le Mans, and claiming first and second places in this spring's Long Beach Grand Prix. Audi's R10 is the first grand-prix winner with a diesel engine, and it is fueled by a version of Shell's GTL synthetic diesel.

With governments pushing increased production of biofuels and the promise of safe, high-performance fuels such as biodiesel and synthetic diesel, the economics to simply convert today's construction equipment to a cleaner fleet have never been better. 



The Energy Security Act authorizes \$700 million of federal support each year until at least 2014 to develop the U.S. biofuels industry.



The National Biodiesel Board is accrediting producers and marketers of biodiesel with a program based on ASTM's D6751 standard for biodiesel and systems quality.

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HURON MANUFACTURING Units Available with Tires or Tracks

With a fine grade trimmer available in various widths and diameters for simultaneous pouring and trimming, the Easi-Pour 880 Compact is considered the most versatile and popular slipform paver in the Huron product line. The "Compact" can handle a radius as tight as 2 feet, pour barriers up to 42 inches high, pave widths up to 8 feet, and still be able to pour up to a mile a day.

Number of models: 4

Product-line features: Powered predominately by John Deere 4045T diesel engines, Huron's Easi-Pour 880 Compact slipform pavers use up-front conveyors to deliver concrete to the hopper. The hopper auger feeds concrete into the mouth of the slipform, which cuts concrete pressure that can cause irregular curb and gutter.

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CURB APPEAL INTERNATIONAL Next-Generation Technology Takes Form

Atop the three-model Pro Curb compact paver series, Curb Appeal offers the PC600, capable of pouring a 2-foot radius with a 24-inch-wide curb and gutter. The PC600 requires only one person to operate and, by design, each model can pour within 2 feet of an object



and back out over what was just poured. With the 4,500-pound PC600 and 3,000-pound PC400 models, auto rear steering allows for precise, tight turns and reversing down the string line. A floating finisher allows the pouring of material within 6 inches of a previously poured curb

section that is 90 degrees to the current pour. The PC200 slipforms vertical curb to a height of 18 inches and width of 12 inches.

Number of models: 3

New model: PC200

Product-line features: All Pro Curb models can be steered in either automatic or manual modes.

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CURB FOX

Company Adopts Brand Name

Formerly Messinger, the manufacturer of Curb Fox paving machines has formally adopted the brand name as a corporate entity. Curb Fox Equipment continues to offer three compact models — the CF2000, CF3000 and CF5000, competing in the 2,000- to 5,000-pound operating-weight range.

On the smallest unit, the curb-and-gutter paving width has been extended to 24 inches. On the CF5000, paving-width capacity has been increased to 6 feet for sidewalk work. A belt conveyor option added to the CF5000 within the past 18 months both allows for a continuous feed of concrete during normal operation and holds enough concrete to allow paving around tight radii where and when a truck cannot follow.

Number of models: 3

Product-line features: Curb Fox models share common traits. Compact, they transport easily at legal width and, during operation, offer tight turning. Easy-to-operate controls minimize training time, although the largest CF5000 model uses a sensing system similar to larger pavers for precise control of alignment and elevation.

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MILLER SPREADER It's Back to the Basics

The focus at Miller Spreader is on the traditional compact landscaping and tack-down "Curbilder" product line it has served for 40 years. It extended its product offering with the MC1050 Curbilder, capable of offset curb and gutter to a width of 24 inches, but is now stepping back from the 5,000-pound slipform paver market at which that model was aimed.



The Curbilder MC900 tops the remaining product offering at 1,045 pounds, employing offset curb extrusion that allows the placing of curb at the extreme edge of the pavement, to the right or left of the compact Curbilder.

Number of models: 6

Product-line features: Miller Spreader's interchangeable extrusion auger assemblies give each Curbilder model the capability to extrude a wide variety of shapes and sizes.

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MANKIND 1
EARTH 0



The SK650. The most powerful and productive mini skid steer in its class. With an impressive, 31-hp diesel engine and 20 net horsepower to the attachment, it outperforms any other comparable machine—even riding units. Plus it drives more than 70 quick-change attachments. For details on the SK650, or any of the three Ditch Witch® mini skid steers, call 800-654-6481 or visit ditchwitch.com/SK.

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Mini Skid Steers

TORO

Featuring a 27-horsepower Kohler engine, Toro's gas-powered Dingo TX 427 compact utility loader delivers added torque for increased pulling and digging force. When working in harsh environments, the loader's heavy-duty two-stage air cleaner prevents the machine from becoming overwhelmed by dirt and dust. The TX 427 pumps 16.9 gallons per minute of flow to each track, 11.4 gallons per minute to the auxiliary hydraulics, and 6 gallons per minute to the loader arm.

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DITCH WITCH

Equipped with a 31-horsepower Kubota turbo diesel engine, the SK650 directs 20 net horsepower to the attachment for increased performance. To facilitate the operator's work, both the fuel and hydraulic tanks are mounted on the outside of the machine's frame, the company says, allowing for a larger 8-gallon fuel tank for extended operation as well as increased hydraulic fluid capacity for improved performance.

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BOBCAT

The MT52 and MT55, Bobcat's latest additions to its B-Series mini track loaders, boast features that increase operator safety and comfort, and improve machine durability. The auxiliary-hydraulic continuous-flow shutoff lever, located on the directional control handle,



cuts power to hydraulic attachments when the operator releases the lever. Adjustable tilt steering on the directional control handle can be adjusted based on the height of the operator. Also, MT52 and MT55 rubber tracks are composed of a more durable compound for longer life.

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VERMEER

Vermeer's S400TX mini skid steer, powered by a 23-horsepower Kohler Command gas engine, boasts a new control system based in two joysticks integrated within a hand-grip bar that controls transport, and boom and bucket motion. The S400TX has a hydraulic flow rate of 11.5 gallons per minute, operating capacity of 500 pounds, and maximum lift height of 69 inches. As for safety, the mini skid steer locks out machine functions when the operator steps off of the platform.

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Three Keys to Making Telematics Work

AEMP's efforts to streamline data flow are on target, and here are some steps that must be taken to ensure that managers reap the right benefits

Few meetings give the feeling of promise and excitement that I experienced at the recent Association of Equipment Management Professionals (AEMP) conference in Scottsdale, where I received an update on the collaborative effort underway to define key telematics data and make it available to end-users in a well-understood, standardized format. The work is essential for the future of our business. AEMP has taken the lead, and it is time for us to pull together and make sure that the initiative succeeds.

In March 1999, I wrote a letter to Mac Klingler, then manager of advanced research and development at John Deere. We were trying to wrap our minds around the huge potential offered by our emerging ability to instrument machines and wirelessly transmit the resulting data. We divided the system into four components with the following principal functions:

Collect and Buffer: to collect the outputs from the sensors, including the GPS antennae, store them, and prepare them for later transmission.

Transmit and Receive: to use the best available and most cost-effective technology to transmit the data to a central location either on demand or at preset intervals.

Process and Archive: to collect the received data, process them, produce the reports, and manage the vast flow of data.

Disseminate and Use: to disseminate the reports and graphs, and provide end-users with information tailored to their needs.

Much has changed in 10 years, and much has been achieved by manufacturers, software developers and suppliers. Most of the questions relating to the first three components have been solved. The question that remains, though, is can we disseminate all the information and build a business case based on improved day-to-day fleet management?

One of the folk with whom I have the priv-

ilege of working put it into context when he said, "The manufacturers and their engineers try to know everything about one machine. That would be nice, but I am a fleet manager with several hundred machines of different makes and models in my fleet. I need to know one or two things about every machine, not everything about one machine." That is the challenge now being addressed by AEMP and the collaborative group it has assembled.

The diagram on page 48 gives a good overview of the current state of play. Every company owns a mixed fleet and every machine can be fitted with telematics. Sensors can collect data and measure a wide variety of parameters. That part of the system is in place and working. Price points are coming down. Reliability is going up. In exchange for this, fleet managers must accept that every OEM and supplier will develop, implement and market their own technology. It is simply neither possible nor cost-effective to standardize the first two components of the system.

The same is true for the process-and-archive component. Every OEM and every third-party supplier will develop and market its own unique method, will use the data to improve its products, and will see its method as a brand-specific competitive advantage. The end-user benefits from the improvements, creativity and competition this generates and must again accept that standardization across a mixed fleet is neither possible nor, in most cases, desirable.

Standardization becomes a real issue when it comes to disseminating and using the information. This is where a balance must be struck between knowing everything about one machine and knowing something about all machines. Look at the three steps defined in the diagram for dissemination and use.

Step 1. These are the OEM and machine-specific machine health and performance reports now available from most systems. They

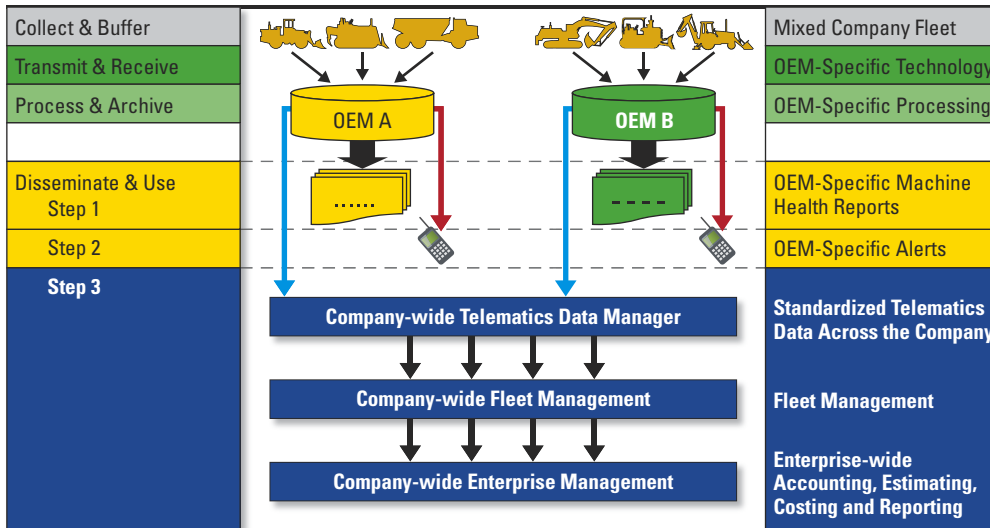


Mike Vorster

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

We can collect the data, transmit it, and archive it. But can we disseminate it and build a business case based on improved day-to-day fleet management?

Telematics Data Flow



Standardization becomes an issue when it comes to disseminating and using the information. This is where a balance must be struck between knowing everything about one machine and knowing something about all machines.

tell you everything about one machine and make high-bandwidth use of all the archived data. They are valuable for specific forensic studies of machine health, performance, utilization and production, but they are a source of massive information overload when it comes to managing a large mixed fleet. The volume of information is overwhelming; the format is different for each hardware supplier; and accessing the information requires switching from website to website. Step 1 information is for machine-health geeks. It will and should continue to be developed by OEMs and third-party suppliers as part of their competitive product development process. It will continue to be of value to fleet managers on an as-needed basis, but these reports and this part of the process will never find use on a day-to-day basis across the breadth of a large mixed fleet.

Step 2. These are the OEM- and machine-specific alerts currently in place. They are initiated at each supplier's site and follow the "red route" to individual managers' phone or e-mail systems. They provide minimum urgent information of value but have the potential to become overwhelming if not well managed. They are, in many instances, part of day-to-day fleet management, but no comprehensive telematics system can build a solid business case based on this as the only company-wide information produced.

that receives and integrates it into the enterprise-management systems. The challenge is not trivial, but it is doable. Three things must occur.

1) End-users must define the key telematics data they require to be available in a well-understood, standardized format. They must define the one or two things they need to know every day about every machine.

2) OEMs and third-party suppliers must develop the routines needed to push the data to each of their customers at agreed intervals. The technology is not new. It should be possible to "podcast" essential equipment-management data from OEM A to Company B every day.

3) Innovative and creative software developers need to develop telematics data managers that call for the defined, well-understood and standardized data available at each OEM specific processing site; combine it into a single company database; and provide it to the enterprise accounting, estimating costing and reporting systems.

Step 3 integrates telematics into the day-to-day corporate management system. Without it, the most promising fleet-management technology of recent years has no real business case and is destined to remain out in the cold. The AEMP initiative must succeed: There is too much at stake and there is too much money to be made.

Step 3. This is the step that the AEMP initiative seeks to achieve. It requires that protocols are developed whereby a limited number of standardized and well-defined data fields are exported on a regular basis along the "blue route" from the OEM-specific processing site to a company-wide telematics data manager

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Firm Uses GPS to 'See' Under Water

Subcontractor develops underwater grade control to rebuild eroded canal without interrupting cooling-water flow

Blue Goose Construction of Fort Pierce, Fla., conquered what might be the prototype application for GPS grade control on an excavator, relining a mile-long canal on the Florida coast. The banks were eroded by recent hurricanes, and as the source of cooling water for a nuclear power plant, the 25-foot-deep canal had to remain full of seawater throughout the project.

Working with general contractor Underwater Engineering Services of Port St. Lucie, Blue Goose developed an underwater application of a Topcon grade-control system indexed by Global Positioning System (GPS) satellites.

"A decision was made to rebuild the canal and line the walls with protective mats made of concrete blocks linked with cables," said Blue Goose General Manager Larry Tarr. "Specifications were very tight. We were allowed only a 6-inch tolerance in the finished surface, which meant the real tolerance we had to work to was much smaller."

Each embankment is 135 feet long with a 3:1 slope, two-thirds of which is under water. The bottom is 40 feet wide.

"We had to repair the erosion damage, then place, level, and compact a base of crushed stone and coarse sand before installing the mats," Tarr said. "We couldn't just dump the fill because the sand and stone would separate; it had to be placed and compacted one bucket load at a time."

Blue Goose commissioned Nortrax of Florida to build four special long-reach excavators starting with a John Deere 850D, a 450D, and two 240D excavators. Jewell Manufacturing built the booms. The JD 850D has a reach of 95 feet, the 450D can reach 70 feet, and the 240Ds each reach 60 feet. Heavy-lift kits and special counterweights allow them to lift rated load at full extension, but doing the work with precision remained a challenge.

"The machine operator can't see what's happening at the end of a 90-foot boom that's under 25 feet of water, but we still have to meet the specs," says John Allen, senior project manager. "The answer, of course, is to equip the machine with a high-precision GPS location system that tracks the bucket location and displays it for the operator along with the actual grade and specified grade. Sounds simple, but we quickly discovered that the system we needed didn't exist."

The vendor of laser and GPS systems Blue Goose had worked with before couldn't offer a solution.

"So we started talking to other GPS suppliers including Lengemann Corp., a Topcon distributor here in Florida,"

Tarr said. "Jay Waller, the local representative, said nothing in the standard product line fit our requirement, but Lengemann and Topcon would be glad to work with us."

Each excavator is equipped with a Topcon Dual GGD Spread Spectrum receiver that precisely locates it to within a few millimeters in three dimensions. Waterproof position sensors attached to the boom, stick and bucket track and report their motions. The software and display technology puts all the data together.

"Everything is combined in the onboard computer to create a readout that shows the exact location of the bucket to within a few tenths of a foot in real time," says Allen. "The unit has proven to be very rugged and reliable on the job and delivers all the accuracy promised."

A survey database stored in the computer shows the actual contours of the embankment and a model of the finished grade. They show up on the display as a pair of contour lines along with a side view of the bucket.

"All the operator has to do is watch the display and put the bucket where it's supposed to be," says Allen. "Sounds easy, but teaching the operators how to use the system was one of the biggest challenges we faced on the project."

The work was completed on schedule, without a hitch.

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Waterproof position sensors on the boom, stick and bucket track their motions and integrate with GPS positioning so excavators can grade the canal floor 25 feet under the surface.

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T-Line Trucks Offered by Thrice-Revived Builder

Successor to Osterlund's Diamond Reo focuses on construction markets

A newly available series of heavy vocational trucks uses a tried-and-true design and modern componentry with a name deeply rooted in American automotive history. "T-Line" trucks, a recent iteration of Diamond T and Reo trucks dating to the early 20th century, includes three models offered by Diamond Vehicle Solutions LLC of Harrisburg, Pa., which for five years has been supplying parts for still-running trucks here and overseas.

"The T-Line is a blend of vintage Diamond T heritage and modern engineering," the firm said in an announcement in late October. Seven complete trucks were built in early 2008 for export to South America, and the company is ready to build more for domestic and overseas customers, says Joe Whitman, director of operations. Meanwhile, it supplies service parts for existing Diamond Reos, Diamond Ts, and Reos as old as 1949.

Most of the older trucks in the United States are dumpers, mixers and block haulers, and T-Line targets that same market, he says. The company plans a "package" mixer truck with a rear-discharge drum from Indiana Phoenix, and might do a dump version, too. It now offers one long-nose and two medium-nose conventional-cab models designed in 1996, and trucks can be custom designed to suit each customer.

Diamond Vehicle Solutions builds its own main frames and other parts, and outfits basic cabs it obtains from Navistar International. It offers Caterpillar and Cummins diesels, Eaton and Allison transmissions, and Dana and Meritor axles. It will begin using International engines, starting with the MaxxForce 7 V-8, as Caterpillar phases out its truck engines this year.

Diamond Vehicle is a small company with limited finances, but it has been able to engineer EPA-legal diesels into its chassis because "we're engineering people here," says Whitman, adding that he and others are veterans of a predecessor company that began building Diamond Reo Giant trucks in the late 1970s. "Plus, we've had good relations with some of the supplier folks who have helped quite a bit in this."

The company is an offshoot of the enterprise begun by a Diamond Reo dealer, Loyal Osterlund. He obtained the legal rights to

the name, spare parts and manufacturing dies following bankruptcy in 1975 of Diamond Reo Trucks, which had been formed in 1967 from Reo Motor Car of Lansing, Mich., and Diamond T of Chicago. Osterlund added the Giant moniker.

After Osterlund retired, the company was run briefly by a son, then shut down in 1997. Under new owners, it built trucks using the Diamond T name until '99, and new investors again revived it in '03. Last year work moved into the Harrisburg plant built by Loyal Osterlund in the early '80s.

"There's been no truck production lately, but we did some chassis kits to refurbish old Giants — customers take cabs, hoods, and power trains from old trucks and place them on the new chassis. We have done gliders and could do more," using 1999 to '03 diesels in new cab-chassis assemblies. "There are still some real loyal (no pun intended) customers who stay with them," he said of the old trucks.

Loyal Osterlund once had 50 dealers worldwide, but many had left by the time the operation shut down in '97. Diamond Vehicle now has 17 U.S. dealers — mostly in the Northeast and Mid Atlantic, but also Texas and California, and four in Latin America. Whitman indicated that new business will be pursued as economic conditions allow.

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T-Line 5364V, one of three models from Diamond Vehicle Solutions in Harrisburg, Pa., is aimed at vocational users. It's standard with a Cat C7 diesel, Eaton manual transmission, and Dana axles. The cab is International's old S design, but a new cab is planned.

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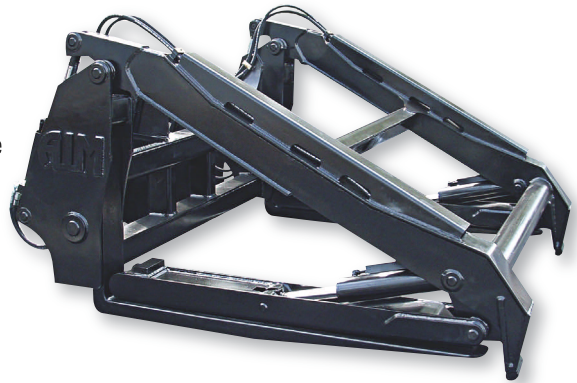
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▶ AIM Attachments

With new special pipe grapples available, loaders of assorted sizes can securely hold pipes of varying diameters, thanks to the use of stabilizing clamps. The fully forged steel-tine grapples feature oversized dual-arm top clamps connected with steel tubing, a high-strength structural-steel back frame, and top clamps and stabilizer clamps articulated by quality hydraulic cylinders. Hose guards protect hydraulic lines.

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◀ TrynEx

With a 1.4-cubic-yard polyethylene hopper that fits full-sized pickup truck beds, the SnowEx SP-7550 V-Maxx bulk spreader is suited for municipalities and contractors. The 7550 is managed by an in-cab independent spinner/auger controller that allows the driver to adjust spinner speed and material flow. Spread width is infinitely variable up to 40 feet.

The 7550, as with other V-Maxx models, has the ability to spread various combinations of materials, from 100-percent bulk salt to a 50/50 salt/sand mixture. An inverted-V baffle design and a longitudinal auger configuration reduce potential binding and bridging of materials.

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Dust Control Technologies

DustBoss DB-45 controls airborne particles and surface dust, the company says. The mid-range DB-45 can cover 12,000 square feet from a single location, with a throw of nearly 50 yards. With its 15-horsepower fan, DB-45 generates 18,000 cfm of air flow to maximize coverage and particle capture. Elevation adjusts from 0 to 50 degrees with 40 degrees of oscillation. It requires 10 psi of constant water pressure.

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◀ Innovative Equipment Solutions

With a high-volume, high-pressure water design, the automated Neptune drive-through wheel-wash system does its work without the undesired knocking of oil and grease from the truck chassis. Designed for aggregate and mining industries, the Neptune system can be configured with one, two or three tire revolutions of cleaning to eliminate site track-out. The system features concrete- or galvanized-steel-side-wall construction. All models have a fully automated, closed-loop water recycling and solids separation process.

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▶ Roadtec

Roadtec engineers designed new paver seats to slide out to the side in a straight line, instead of swinging out on an arc. The straight sideways movement of the seat results in a position that provides the operator with visibility down the side of the machine and to the rear augers. Being able to see the augers allows the operator to monitor such variables as paving speed, flow gate settings and feed sensor position to deliver mix evenly across the augers and thus across the entire leading edge of the screed plate.

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Market Watch Lite



M.C. Faulkner and Sons

A new compaction wheel attachment from M.C. Faulkner and Sons is designed with broad-based feet to increase soil density and compaction density. A custom front lip design on the excavator attachment allows the moving of dirt around the trench effectively. During compaction, the front lip can be tipped up, out of the way.

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Griffin

Variable-use Compressor Prime Silent Pac water pump has a large cleanout that allows users to remove debris from the impeller without removing suction hose or suction piping. The nonclog impeller design handles 3-inch spherical solids. The unit's pump is sound-attenuated enclosed.



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Ringfeder

Multi Mont couplings are available in a variety of torque ranges for increased compatibility with different types of power transmissions. The Multi Mont Sella comes in torque ranges of 350 to

177,000 lb-in, the Multi Mont Deka comes in 345,000 to 885,070 lb-in, and the Multi Mont Gigant comes in 1,416,100 to 8,850,700 lb-in. Capable of

withstanding high overloads while absorbing shocks and vibrations, the couplings are torsionally flexible, and their jaw design allows for positive locking.

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Cummins Power Generation

Two new containerized and mobile Rental Power units contain two generator sets in a single sound-attenuated enclosure.

C1600D6RG 1600 kW has two 800-kW generator sets, and C2000D6RG 2 MW has two 1,000-kW generator sets. Two gen sets provide redundancy for critical loads, the company says, and also provide higher starting capacity and fuel economy. Cooling system is designed to handle temperatures up to 122 F, and Cummins says the generator can operate at maximum load in temperatures higher than 90 F.

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Parker Hannifin

An optional torque limiter is available for 75 cc/rev models of the company's P1/PD series of medium pressure variable-displacement, axial-piston pumps. The torque limiter is designed to adjust flow in the circuit to keep the prime mover from stalling under heavy loads. The pumps are said to have a new design featuring a compact, round housing that is smaller and quieter than conventional pumps with comparable capabilities. It is offered in five different configurations.

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Atlas Copco

Weighing 4,520 pounds, the DP 2000 hydraulic demolition pulverizer attachment is designed for carriers in the 18- to 27-metric-ton weight class. It boasts 292 tons maximum cutting force and 94 tons of crushing force at the jaw tip. Operating at a maximum pressure of 5,075 psi and accepting hydraulic flow of 66 gpm, the attachment uses a straight-jaw design that allows the jaws to open 30.7 inches wide. An advanced speed valve allows shorter opening and closing cycle times for increased production. For easier operation, the DP 2000 hydraulically rotates 360 degrees.

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▶ Radiodetection

As a built-in feature to its newest pipe and cable locators, Radio-detection has enabled the light-weight RD8000 and RD7000 product range to engage the Centros measurement engine. Designed to improve the accuracy and repeatability of measurements, and deliver high responsiveness in the field, the Centros platform combines "new and innovative algorithms" with established software on a high-performance processor core. The RD8000 is the high-end-feature model designed for multiple applications and industries; the RD7000 family is for operators who require an application or industry-specific locator with a cost-effective feature set.

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▶ Cummins Filtration

Fleetguard ES Compleat Glycerin is a heavy-duty engine coolant that substitutes glycerin for ethylene glycol (EG) or propylene glycol (PG). Glycerin is derived from renewable sources, the primary byproduct of manufacturing biodiesel. Testing and field trials confirmed that ES Compleat Glycerin prediluted coolant provides the anti-freeze, anti-boil, heat transfer and corrosion protection required of today's fully formulated, heavy-duty antifreeze/coolant. The formula also meets or exceeds performance specs of all heavy-duty engine makers.

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▶ Lincoln Electric

Featuring stick, TIG, MIG and flux-cored capabilities, the Power MIG 350MP offers an output range from 5 to 350 amps. Its Waveform Control Technology delivers customized welding parameters, with additional welding waveforms for download directly to the machine. Also included are an easy-to-use spool gun, a push-pull ready connection, and a second gas solenoid. With the 115-volt AC auxiliary receptacle, the 350MP accepts work lights, grinders and other shop tools.

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A man's profile is shown in a three-quarter view, looking upwards and to the left. On top of his head, a small yellow excavator and a grey skid steer loader are balanced. The background is white.

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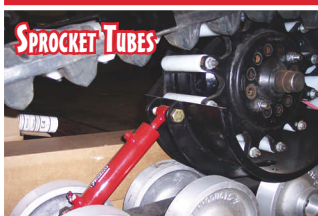


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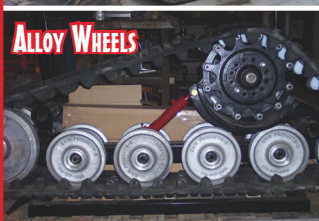
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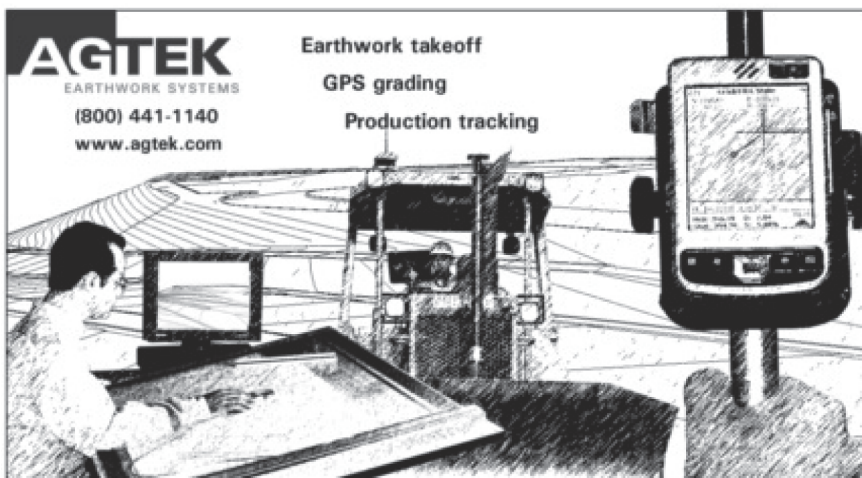
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Intermat 2009	54	20	*Trimble Geomatics & Engineering	50	25
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Watch Vermeer's Four-module Tractor

Construction Equipment executive editor Larry Stewart reports on the RTX1250, Vermeer's 110-horsepower trencher/plow tractor.

Equipped with the rubber quad-track system, the RTX1250 has the same steering capability as the wheeled undercarriage. The quad-track system also provides the tractor with enough flotation and traction to work through probably the worst conditions for a plow — pulling the blade through dense, wet clay from a soft, slippery surface.

Stewart's online report includes video of the RTX1250 in action as well as detailed images of the tracks. Also featured are animations of how the quad-track system works.

GPS Guides Grace Pacific



Lorne Fleming, Grace Pacific's equipment division director, talks about how his Hawaii-based paving firm took advantage of GPS to boost operations efficiency.

Listen as Fleming tells a story of how GPS and telematics once helped get Grace Pacific out of trouble, and how the technology has made it easier to crack down on operators who have used equipment improperly.



Webcast: Crane Safety



In the latest edition of a *Construction Equipment* Webcast, J. Chris Ryan, vice president of Boh Bros.; and Ronald Kohner, president of Landmark Engineering Services, discuss key elements of safe crane usage from a company culture, supervision, operator, and machine perspective as they relate to standards, equipment managers, and OEM perspective.

Listen to Kohner and Ryan as they offer their advice on how to develop a culture of safe crane usage and how to meet the requirements for developing a proper lift plan.



Cat Launches New Compact Track Loaders



Caterpillar updated its line of rubber-track loaders with the introduction of the C-Series compact track loaders. Central to the 279C, 289C and 299C are the steel embedded track and steel undercarriage components, which extend machine life even in rough operating environments.

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