

The Cripple Creek and Victor Gold Mining Company operation runs around the clock on every day of the year. About 300 full-time employees and 50 contractors work 12-hour shifts to produce 163,000 tonnes (180,000 short tons) of ore per day. Four crews in each department are required to provide coverage throughout the year.

The ability of these employees to meet their production targets is largely dependent on the availability of the mining machines they operate. The site relies heavily on consistent production from its haulage fleet and work can come to a standstill if a machine breaks down. The mine operates a fleet of Caterpillar 793D trucks, and as it began looking to expand its fleet, agreed to be a field follow site for the new Cat 793F.

U.S. GOLD MINE EVALUATES A NEW HAULAGE FLEET

AVAILABILITY IS KEY



A HISTORIC GOLD MINE

The Cripple Creek and Victor Gold Mining Company mine (CC&V) is owned by AngloGold Ashanti (Colorado) Corp. The current mining operation, started in 1994, is called the Cresson Project. The site south of Denver, Colorado, USA, had been mined using underground methods since the late 1890s and into the 1950s. The area is famous for the great gold find of the district, the “Cresson Vug,” a cavity in the rock, lined with crystals somewhat like a geode, where gold was

essentially picked from the walls of a room-sized void encountered about 366 meters (1,200 feet) below the surface in 1914.

Engineering for the modern Cresson mine began in 1993. Obtaining the various permits necessary to mine was completed in 1994 and AngloGold became sole owner of the site in 1999. The first Cresson gold was poured in 1995, and an expansion construction began in 2000. In late 2003, CC&V reached its planned expansion capacity of 18.1 million tonnes (20 million tons). The mine poured its two millionth ounce in 2004.





As of mid-2009, the mine reported a proven ore reserve of 112.5 million tonnes (124 million short tons), containing 1.6 million tonnes (1.8 million short tons) of recoverable gold. The annual gold production rate from the Cresson Project varies somewhat with about 250,000 troy ounces produced in 2008. Currently, the mine life is estimated to last until 2016.

This low-grade, open-pit operation produces doré that is 70 percent gold and 20 percent silver. CC&V processes 22 million tonnes (24 million short tons) of ore per year. The ore is treated using a valley-type, heap-leach process with activated carbon used to recover the gold. The resulting doré buttons are shipped to a refinery for final processing.

EVALUATING HAUL TRUCKS

Buying a mining truck is serious business. Not only is there the substantial outlay of money to consider, but there are also the myriad ways that truck will impact operations on the site. From matching with shovels, to fitting on the haul road, to handling high altitudes—many variables combine to determine the right truck for the site. And it's imperative to strive for the lowest cost-per-ton possible to succeed in the competitive gold mining business.

When it was time to add some new trucks to the CC&V fleet, the site began an evaluation process that lasted nearly six months. “We did extensive studies on a number of manufacturers’ trucks,” says Vivien Hui, a senior engineer in mine operations for AngloGold Ashanti (Colorado) Corp.

“We looked at everything you can think of—from evaluating the engine block material to gauge its ability to handle our site’s rough terrain, to evaluating the ease of maintenance on the drive system.”

The site evaluated dozens of variables, including how the truck options matched the site’s current shovels and how the truck fit with the site’s infrastructure, which requires travel from the shop, to load-out, to bin, to crusher. The site considered the overall capital cost for each truck, the costs for

planned maintenance and major components, and the cost for labor required to maintain them.

The mine looked at all variables first by cost-per-hour, then used a modeling program called Q’PIT to measure each option on a cost-per-ton basis. “We fed the details into the model and it told us the cost-per-ton over the life of our specific mine.”

CONSIDERING SIZE OPTIONS

One might think that in order to get the most production from a site, the haulage fleet should be the largest size trucks possible. That wasn’t true in the case of CC&V.

“We evaluated the ultra class trucks over 360 tons,” says Hui. “And we found that for our mine, the larger trucks would actually result in a higher cost-per-ton than a 240-ton class truck.”

There are a number of reasons why:

Haul profile. The site has both uphill and downhill loaded haul roads and judged the trucks by the cost per ton based on both of these profiles.

Infrastructure. Going with a large truck would have made it necessary to expand the road width in order to meet the CC&V standard requiring roads that are just over three times the width of the truck.

Dilution. Considering the dilution in its average ore grade, it was determined that the additional waste material would reduce the advantages gained from using a larger truck.

Tires. As trucks get larger, exponentially the tires get more expensive. CC&V considered its relationship with tire manufacturers and the allocation of available tires.

Shovels. The shovels currently on site were not the right size to be the most productive with larger trucks.

TESTING A NEW MODEL

When Caterpillar approached CC&V to consider being a field follow site for its new F-Series trucks, the timing couldn’t have been better. The site was able to evaluate this new and improved truck in the midst of its search for new trucks to add to its haulage fleet.

The site was happy with its existing fleet of 250-ton 793D trucks and agreed to test two of the 793F trucks. The fifth generation of the 793 has a powerful new engine, choice of power train options, choice of body systems and a completely redesigned operator station. Serviceability has been updated with more ground level service points and 1,000-hour hydraulic filter service internals. Other changes promote safe operator and technician access—wider walkways, flat upper deck, rear access ladder and three-way lock-out tag-out box mounted on the bumper.

“We short-listed down to three trucks that we were considering, and then we narrowed it even further to the Cat 793 trucks,” says Hui. “We had a combined 15,000 hours to study the new F-Series, and after the field follow we purchased not only those two, but an additional five D-Series trucks as well.”

Hui reports that the F-Series met the site’s cost-per-ton criteria and the capital cost comparison was favorable. While all of the F-Series enhancements are important, there are several that are of particular importance to CC&V.

PERFORMANCE

The 793F’s new engine is a great match for the environment in the Cripple Creek mining district, reports Bruce Neldner, parts and service manager at Cat dealer Wagner Equipment, which is responsible for the Cat equipment at the Cresson Project.

“This mine is on the side of a mountain, and there is a huge elevation change from top to bottom,” he explains.

“They’re working at 3,048 to 3,350 meters (10,000 to 11,000 feet) altitude. The less air there is, the less fuel you can use, which means less power. But with this engine, you don’t have to cut the fuel in the higher elevations.”

Hui agrees that it’s very important that the engine doesn’t derate at the mine’s altitude. “We get the same horsepower at two miles high as we do at one mile high,” she says.

below/ Vivien Hui, senior engineer in mine operations, helped evaluate the new trucks based on XXX,XXX and XXX.



The 16-cylinder, 2,650-horsepower Cat C175-16 diesel engine displaces 5.3 liters (323 in³) per cylinder—for a total displacement of 85 liters (5,187 in³). The 793F delivers 234 horsepower more than its predecessor, the 793D.

The engine redesign was done in part to meet Tier 2 emissions requirements; however, CC&V has found a number of additional benefits. “We found that, yes, they redesigned the engine to be better for the environment,” says Hui. “But we’ve also learned that the new block material is stronger, which is great for our hard rock environment. And performance went up in the process.”

The 793F delivers more power to the ground, explains David Rea, a product marketing specialist in Caterpillar’s Global Mining division.

“It’s faster on grade, and because mining trucks spend the majority of their time on grade, it can travel faster, move more tons, and deliver a lower cost per ton,” he says.

takes off good on the grades. The throttle locks and retarder set are really nice—I use them every round. It works like a cruise going downhill.”

Caterpillar uses oil-cooled multiple disc brakes on all four wheels. They provide immediate, fade resistant braking and retarding and with proper attention to oil temperatures, the brake discs and plates experience virtually no wear. Four-wheel balanced braking improves handling and machine control.

Another advantage is that unlike some of its competitors’ trucks, the Cat engine and truck are made by the same manufacturer. “They’re designed to work well together and we only have one manufacturer to deal with if there is an issue,” Hui says.

SAFETY AND COMFORT

The new cab in Cat’s F-Series trucks features a number of improvements to make it a more comfortable working environment, including controls and gauges that are positioned to maximize productivity and minimize fatigue.



Hui reports the truck is a good match for the site’s haul profile. “It goes fast uphill and fast downhill. It has great retarding going down and good torque and speed going up. This reduces our cycle time.”

Operator Vic Hines, who has been an operator at CC&V for eight years, is impressed with the truck’s performance. “The new engine and torque converter are super,” he says. “It takes the hills great and

Hines says he appreciates the smooth, comfortable ride and the improved visibility due to more window area. “The cab is roomy and all the controls are reachable,” he says. “The comfort is great.”

The safety enhancements of the new truck, such as improved access and aggress, are also appreciated by the operators. “Cat definitely thought about safety when they designed the F-Series,” says Hui.

“It’s a number one goal for us and Cat is helping us achieve it.”

SERVICEABILITY

A number of the changes in the 793F were done to make it easier to service—a welcome improvement for the dealer and site technicians who work on the trucks. The operators also appreciate that walk-around inspections are easier.

“The oil checks and hubs are nice and the air bleed system is easy to access,” says Hines. “The sights on the tanks are also improved.”

Wagner performs most of the maintenance on the Cat equipment at the Cresson Project, although CC&V does much of their own planned maintenance on site. “Overall we’ve found the new truck easier to service,” says Neldner. “A lot of the improvements are concentrated on the service points. Having as many at ground level as possible makes them easier to access. It’s also safer because the less you crawl around on the machine, obviously the safer you are.”



DURABILITY

CC&V also was impressed by the new frame on the 793F. Cat frames use a high strength, low alloy (mild) steel with castings in highly stressed areas. A key advantage of mild steel frames is that they can be easily welded in the field. They’re designed to last in rugged mining environments.

Field follow program tests new trucks in real applications

Companies that purchase a new Cat F-Series truck may be buying a new model—but they’re getting a truck that has been tested for thousands of hours. And it hasn’t just been tested in a controlled environment. It has been put to work in a real-life environment on an actual customer mine site.

Caterpillar’s Tinaja Hills Demonstration and Learning Center is a one-of-a-kind proving ground for Cat trucks. But there’s nothing quite like the real-world environment, where different altitudes and climates, haul profiles and operator skill levels all have a different impact on a truck.

“We want to put trucks in all applications and run them in a variety of environments—the cold of Canada, the coal fields of Wyoming, the high altitudes of South America,” says Jeff Lester, Caterpillar service engineer. “From deep pits to shallow grades, high speeds to high temperatures. We want the really complete story of the performance before we go to production.”

The answer is Caterpillar’s field follow program, during which Cat dealers and customers test developing trucks in real applications.

“Caterpillar benefits by getting a truck that is validated in a real-world application with a real customer,” says Lester. “We are able to tell the marketplace, ‘Yes, this is a new product. But it has been validated on a customer site. Customer testimonials give the product credibility.’”



The program is a benefit to customers as well, as they get an early look at new technology and an opportunity to train operators and maintenance people on the new trucks. And those that participate in a field follow program are able to use the truck for actual production for a low fee, then get a good deal on the truck if they choose to purchase it.

“Customers also get the advantage of giving their input about new models directly back to Caterpillar,” Lester says. “The operator is in the cab 12 hours a day and he knows if he is fatigued or if he has good visibility. We give his input back to the factory and that can influence change. Field follow customers are impacting the future

of our trucks. When customers make comments, we look at every single one.”

Cripple Creek & Victor Gold (CC&V) in Colorado, USA, has partnered on several field follow programs with Caterpillar and recently tested the new 793F. While it can be a challenge to operate a truck that is still being proven, the benefits outweigh the negatives, says Vivien Hui, a senior engineer in mine operations for AngloGold Ashanti (Colorado) Corp., owner of CC&V.

“We do field follow as part of our good neighbor policy,” she says. “We agree to show other mines what has been learned, and to show Caterpillar how the trucks are performing. It’s good for us and it’s good for the industry.”

“The percentage of castings went up, so the frame has more durability,” says Hui. Frame life is important because it dictates the long-term economic life of the machine. “We know we can keep rebuilding this truck and its components as long as the frame lasts,” she says. “This new frame gives us confidence that we can run the truck to or even past the life of our mine.”

TECHNOLOGY

Technology also weighed heavily on CC&V’s decision to purchase the F-Series field follow trucks—in particular, the upgraded VIMS technology. VIMS collects and transmits machine data and turns it into valuable information used to track productivity, machine performance, service scheduling, trends, diagnostics and equipment condition monitoring.

“There were third party technologies that do the same thing, but we like that it’s integrated into the truck,” says Hui.

The third generation of the system—VIMS3G—offers enhanced convenience and functionality, along with updated communications capabilities. A real-time browser allows users to view machine data on up to 10 machine parameters in an easy-to-access Web browser. “Plenty of technologies can capture the data, but this is realtime, which makes it much more useful,” says Hui. CC&V partners with Wagner to analyze the data, review trends and develop predictive maintenance plans.

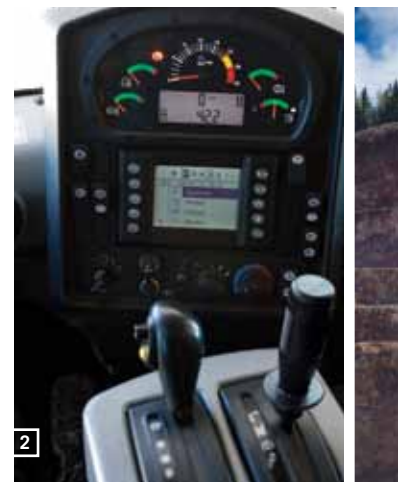
GUARANTEEING AVAILABILITY

While many variables are weighed when considering the purchase of a new truck, what the decision really comes down to is availability. “That’s our No. 1 goal,” says Hui. “If a truck goes down, we want to know that we will have a make-up truck on site to allow us to meet our targets. Cat and our dealer offered us an availability guarantee. That was a big part of our decision.”

That guarantee is just one of the many benefits CC&V finds in its relationship with Wagner. “Our mine superintendent would agree that the support of the dealer is one of the most important things in our decision to purchase Cat trucks,” says Hui. “This consistent support—from both Cat and the dealer—helps us stay on budget. We could maybe buy products with more bells and whistles, but if we can’t count on them, then they’re not giving us that consistency we need to meet our targets.”

Wagner’s Neldner says the dealership has worked hard to earn the mine’s trust. “They have to know that their trucks are going to be supported,” he says. “We have a lot of Cat equipment there and our support is proven to them. We have a good, healthy relationship.”

Hui says the support the mine receives from Wagner is second to none. “We’ve built a relationship where we are working together to make things happen,” she says. “There’s no finger-pointing when something goes wrong. It’s Caterpillar, Wagner and us, working together.”





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Cat dealers see benefits in participating as well. During the field follow process, they are responsible for the trucks just as they would be if they sold them to the site. They do inspections and updates, gather the truck feedback on performance, keep parts working and develop preventive maintenance processes.

“We like it because it involves us with the process,” says Bruce Neldner, parts and service manager at Wagner Equipment, a Cat dealer in Colorado, New Mexico and Texas, USA. “We can be a part of the changes to make it not just a good truck, but a great truck.”

HOW FIELD DEVELOPMENT WORKS

Caterpillar has field follow engineers on every new product team. They are responsible for a certain location and have daily contact with the dealer about the performance of the machine. He travels a minimum of one week a month to visit the site, ride along with the operator and gather feedback from everyone who interacts with the truck.

Internal reports are issued every day and are included on an online diary called the Pre-Production Reliability Database (PPRD). “Any time the dealer technicians touch the truck, perform an inspection, do maintenance, deal with an operator performance issue, gather operator comments—everything goes into this database. Engineering groups responsible for every component or part have access to PPRD and can see exactly what is being done.”

What is learned in the field directly affects the development of the truck and its components. “For example, we’ve had three or four generations of the cab redesigned based on what the operators are telling us,” says Lester. “The seat goes back further than it used to and there is greater head room. If operators tell us they need a little more power when pulling out from under the shovel, or when they are traveling fully loaded up a grade, we take that information back to the factory and work with our software or engine group to resolve the problem.”

Dealer feedback is also important. “Their service work ultimately affects the customer because it has an impact on reliability and availability,” says Lester. “Say there are hoses rubbing, or the routing of a tube could be better. All these little things add up to affect the time necessary for service and maintenance. More reliability means greater production for the customer.”

A VALIDATED TRUCK

Caterpillar will not put a truck into production without adequate testing, but the real-life operation of the field follow program goes a long way to convince customers that these trucks are ready to go to work.

“The Proving Grounds are great, but real life helps sell the truck,” says Hui. “We wouldn’t want to be first to buy a truck. But if these trucks have 48,000 hours at three or four real mines, that would put me more at ease. The reputation of these trucks will be proven over time. I hope we have helped with a big chunk of that—working together to get this to be a reliable truck.”

After thousands of hours of field development, two of Caterpillar’s new F-Series large mining trucks are now in production. Nearly 20 retrofit 797F and 793F retrofit trucks were tested in four U.S. states, Canada and Chile, in a variety of applications, haul profiles, altitudes and climates. Production studies have proven their improved performance in head-to-head comparisons with older

Cat models as well as against competitive trucks. In fact, the 793F has been found to be up to 20 percent faster and 15 percent more productive in performance studies. A third F-Series truck, the new size class 795F AC, will begin limited production starting in 2011.