TERRAIN LEVELER®

SURFACE EXCAVATION MACHINE (SEM)

Vermeer

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IS DRILLING AND BLASTING **THE FUTURE OR PAST?**

Drilling and blasting has been the predominant method of surface mining for many years. The use of explosives in mining dates back as far as the 17th century. Today, however, even advocates agree that drilling and blasting presents many side effects and challenges — in terms of safety, precision and productivity — that put its future in question.

3 million tons of bauxite ore in first year

Time periods up to 33% shorter

The side effects of blasting*

- **Flyrock:** A piece of rock thrown beyond the permit boundary that may result in injury, death or property damage
- **Ground vibrations:** A seismic wave that moves through the ground following a blast
- **Airblast:** A concussion (or pressure) wave that moves through the air following a blast
- **Fumes:** The gaseous byproducts of detonated explosives
- **Dust:** Small particles of earthen material that may be temporarily suspended in the air

The challenges of drilling and blasting

- **Government restrictions:** Government oversight and regulations largely dictate what, where, when and how operators can blast. Typically, a blasting plan containing drilling and blasting patterns and controls must be submitted, approved and followed in order to avoid penalties and fines.
- **Permitting restrictions:** Permits dictate the proposed shot, number of blasts and time of each blast. Unforeseen issues such as inclement weather can disrupt approved blast schedules.
- **Urban encroachment:** The side effects of blasting restrict drilling and blasting near populated areas.
- **High water tables:** The seismic wave that moves through the ground following a blast also moves through underground water and can cause damage to nearby buildings, roads and land.
- **Underground infrastructure:** Seismic waves can also cause serious damage to underground utilities.
- **Product sizing:** Drilling and blasting limits the ability of operators to control the consistency in the size and shape of the end material. Additional screening and crushing can have a major impact on operational costs.
- **Unexpected costs:** An uneven mine floor upon blasting may require additional work that could result in additional expenses.

Guinea mine reaps benefits of precision surface mining.

The Boké Mine in Guinea, Africa, produces high-quality bauxite, a key ingredient in aluminum. Efficiency is a major priority for the mine, and that's what initially drew the company to the Vermeer T1255III Terrain Leveler® SEM. The machines have delivered, each one yielding around 3 million t (2.7 million mT) of bauxite ore in the first year of operation, setting a new standard for productivity and efficiency. While traditional drilling and blasting will remain common in some operations, surface mining — and Vermeer Terrain Leveler SEMs — represent the future for the Boké Mine.

Surface excavation takes hold in Chile.

In Chile's mines, concerns about mining safety and the overall quality have created new demand for surface mining. Vermeer people and machines have helped operators overcome those challenges and much more. In addition to eliminating the handling of explosive chemicals, Vermeer T1655III Terrain Leveler SEMs have enabled miners to capture more concentrated high-quality output, sometimes in areas previously inaccessible via conventional drilling and blasting methods. The machines have a bright future in Chile's mines given double-digit mineral recovery increases in time periods up to 33% shorter than those with conventional methods.

*Source: Office of Surface Mining Reclamation and Enforcement

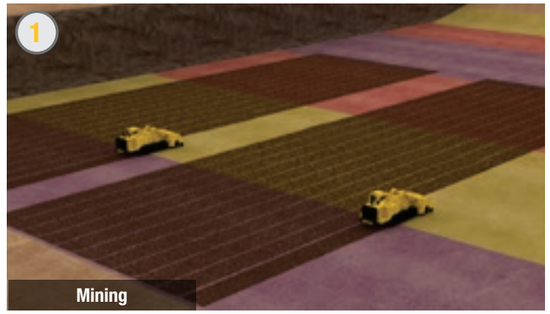
A BETTER SOLUTION TO SURFACE MINING

There's a better way to perform surface mining, extract aggregates or prep a site for civil construction. Using a machine like the Vermeer Terrain Leveler SEM to perform continuous mining allows you to methodically mine or prep a site layer by layer, optimizing productivity and precision and eliminating many of the safety challenges and restrictions associated with drilling and blasting.

Terrain Leveler SEMs versus drill and blast

- **Reduced liability:** Helps minimize the chance of injuries, deaths or property damage caused by flyrock and resolves urban encroachment issues
- **Fewer underground concerns:** Limits seismic waves so operators can mine closer to underground pipelines, areas with high water tables or underground utilities
- **Continuous mining:** Allows operators to follow the seam for less contamination and selective loading methods
- **Increased access:** Provides the ability to access areas with blast restrictions tied to highway, wildlife, environmental or permitting limitations
- **Quality product:** Minimizes product dilution and produces smaller, more consistent particle sizes, eliminating the primary crusher
- **Optimal precision:** Performs precise cuts while following intricate GPS-engineered mine plans* and produces a flat mine floor
- **Fleet versatility:** Allows for the use of smaller loaders and over-the-road haul trucks
- **Tilting capabilities:** Allows for cutting on slopes and producing a controlled floor
- **Smooth surface:** Can produce a flat mine and designed floors

How continuous mining works



The Vermeer Terrain Leveler SEM cuts the surface row by row and layer by layer while producing particle sizes that do not typically require additional screening or crushing.

Loading equipment places the material in over-the-road trucks to haul it to offsite locations.

Open the camera on your smartphone and hover over the QR code to see the Terrain Leveler SEM in action.

*Optional

Mine various types of materials

Other applications

The Vermeer Terrain Leveler SEM can be used for a variety of applications, including:

- Haul road construction, road maintenance and drainage
- Civil engineering site prep, roughing out streets, oil and gas well pads, and housing pads

Cutting precision

The Vermeer Terrain Leveler SEM uses GPS-engineered cutting maps, giving operators the ability to perform precise cuts that other methods would require multiple machines and steps to achieve.

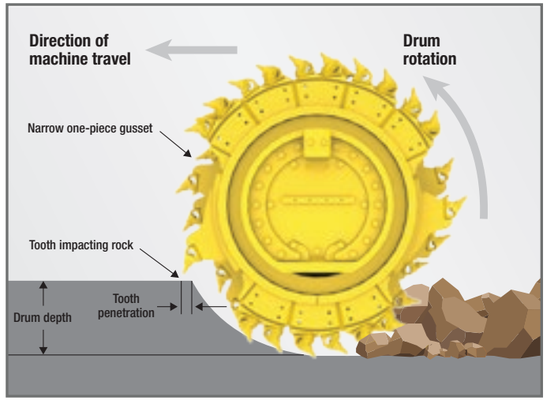
- Square corners: Machines can cut up to 90° corners (inside and outside).
- Vertical high wall: Operators can extract more ore from the site.
  - Single-side direct drive attachment can cut 80° high wall.
  - Chain drive attachment can cut 90° high wall.
- Flat mine floor: A single machine can produce a flat mine floor or create 5° - 10° ramps.

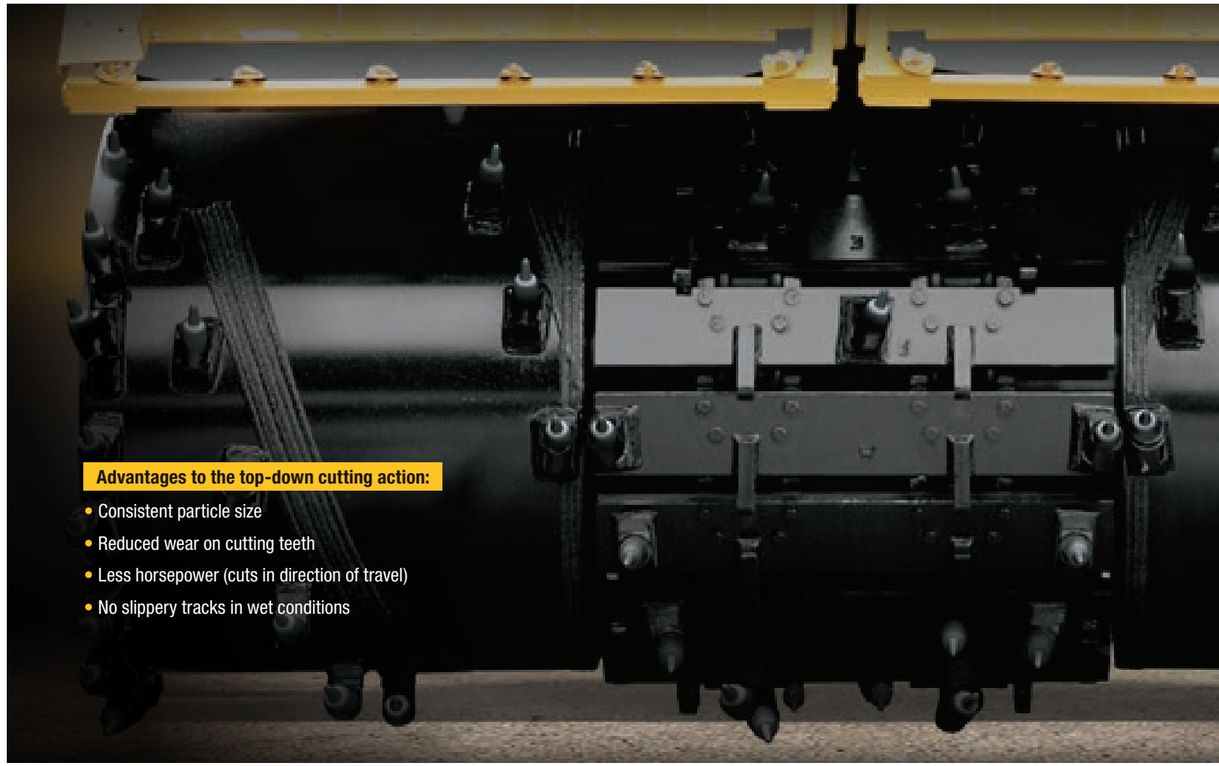
TOP-DOWN CUTTING

Top-down cutting is a major breakthrough in rock cutting. This technique allows the teeth to gain penetration without the tracks having to drive the tooth into the rock. Cutting from the top down on the rock helps with less material grade blending, and less wear on the drum, tooling and machine undercarriage, resulting in increased drum power availability.

Operators have the ability to size material by varying the depth of cut, mining speed and drum rotation speed. Since all the material passes under the drum, and the tooth penetration reduces with depth, deeper cuts achieve smaller material. Conversely, larger particles may be achieved by reducing the digging depth and increasing the speed (increased tooth penetration).

Top-down cutting minimizes contact of the cut material with the drum, which reduces wear on the picks and pick holders.





Advantages to the top-down cutting action:

- Consistent particle size
- Reduced wear on cutting teeth
- Less horsepower (cuts in direction of travel)
- No slippery tracks in wet conditions

THE SEM **ADVANTAGE**

The Terrain Leveler SEM offers many advantages that make it unlike any machine on the market today.

One machine for many jobs

One Terrain Leveler SEM can mine material, perform site preparation and excavation, or remove roads. This reduces the need for primary crushers, large loaders, large mining haul trucks, rippers and vertical drills.

GPS technology and autonomous control

GPS technology can be used to create a mine-by-line plan, allowing the machine to automatically cut to the plan with minimal operator involvement.

Low center of gravity and maneuverability

Dual tracks and a low center of gravity allow for optimal maneuverability (including zero-turn radius) and stability over changing and diverse surface conditions.

Operator safety and comfort

A rollover protective module and a falling object protective structure for working near a high pit wall provide operator safety. In addition, a pressurized cab with a filtered air system provides an increased level of operator comfort.

Sound and dust reduction

The use of drilling and blasting is generally restricted or prohibited in mines located near urban areas, utilities or other obstacles. This is due to the ground shock (seismic waves) but also the tremendous sound generated by the blast. The Terrain Leveler SEM has the advantage of creating lower amplitude and higher frequency noise compared to blasting — meaning it can get closer to the aforementioned areas without creating a noise disturbance. This helps protect the crew and also allows for mining operations to continue throughout the day, whereas drilling and blasting may be limited to a single blast every 24 hours. It also helps with dust control. Plus, the machine sets the industry standard for reliability, with crucial components backed by warranty.

Fueling productivity

Fuel tank capacity is vital to productivity, and the maximized capacity of the fuel tanks on the Terrain Leveler SEM — ranging from 200 gal to 800 gal (757.1 L to 3,028.3 L) — reduces the frequency in machine refueling.

T955III Terrain Leveler® surface excavation machine	200 gal (757.1 L)
T1055III Terrain Leveler® surface excavation machine	200 gal (757.1 L)
T1155III Terrain Leveler® surface excavation machine	270 gal (1,022.1 L)
T1255III Terrain Leveler® surface excavation machine	370 gal (1,400.6 L)
T1655III Terrain Leveler® surface excavation machine	800 gal (3,028.3 L)

Full remote control in tough terrain

The optional full-function remote control from Vermeer is available on all TEC® Plus electronic control system tractors — including the Terrain Leveler SEM. This allows remote operation of the machine and attachment for select jobsite conditions in surface mining, site prep, and road or pipeline construction. This provides added:

Operator comfort

Vibrations throughout the machine occur when cutting rock. Although the cushioned cabin and operator seat are installed, there is still a potential for high vibrations, especially in conglomerates or hard rock conditions. Taking the operator away from the cabin frees them from long-term exposure to physical vibrations.

Visibility

Having full visibility of the worksite is crucial to productivity. Optional cameras and remote operation provide the means to have visibility on the entire area around the machine.

Convenience

The remote control can be used in tough operating conditions, such as working near a high wall or loading or unloading onto a trailer. The system allows the operator to be located within a vehicle, such as a pickup, and seated on a mat-style seat switch to operate the machine functions.

T1255III TERRAIN LEVELER SEM

The T1255III Terrain Leveler SEM can be equipped with either a chain-drive or direct-drive drum to achieve performance goals in various mining applications.

Chain-drive drum | Direct-drive drum

Chain-drive drum

- **Applications:** Use for surface mining extraction, removing ground surface or creating a smooth, level area for site preparation, road construction or soil remediation.
- **Vermeer advantage:** Drum has a maximum cutting depth of 27 in (68.6 cm), and the chains are driven by low-speed, high-torque hydrostatic motors — delivering up to 56 rpm to help produce optimal material size.

Chain-drive drum | Direct-drive drum

Direct-drive drum

- **Applications:** Drum offers a single-sided attachment that packs the power you need to take on tough civil and surface mining projects.
- **Vermeer advantage:** The unique single-sided attachment allows the operator to cut an 80° high wall and produces minimal noise, dust and vibration — helping mines to increase production by excavating reserves they might not be able to access due to drill and blast restrictions, air quality regulations or urban encroachment.

T1655III TERRAIN LEVELER SEM

The T1655III Terrain Leveler SEM combines operator comfort and the power of dual CAT engines that deliver 1,200 hp (895 kW) to the machine for optimal productivity.

- **Applications:** Equipped with a direct drive and dual CAT engines delivering up to 1,200 hp (895 kW) to the machine, it excels in the biggest civil and surface mining environments.
- **Vermeer advantage:** The air-ride suspension system on the cab helps provide a smooth, quiet ride, while a filtered air system, dual self-contained cooling-and-heating systems and sound-attenuating foam provide optimum comfort inside the cab. Outside the cab, the patented tilt attachment tilts 5° in either direction, allowing for cutting to grade and providing a smooth pit floor.

THE VERMEER FAMILY OF TERRAIN LEVELERS

MODEL	DRUM OPTION	ENGINE						USC VALUES	OPERATIONAL ANGLES			CUTTING		
		BRAND	MODEL	EPA	RATING	POWER	CONSUMPTION T3 - T4	APPLICATIONS	APPROACH	DRUM TILT	HIGHWALL (L/R)	WIDTH	DEPTH	ROTARY SPEED
T955III Terrain Leveler® SEM	Chain drive	Caterpillar	C13 ACERT	T3 - T4	B	415.7 hp (310 kW)	21.3 gph - 20.9 gph (80.6 L/hr - 79.1 L/hr)	Dirt, rock: 20,000 psi (138 MPa)	16°	NA	90°/90°	11.2 ft (3.4 m)	32 in (81.3 cm)	59 rpm
T1055III Terrain Leveler® SEM	Chain drive	Caterpillar	C13 ACERT	T3 - T4	B	415.7 hp (310 kW)	21.3 gph - 20.9 gph (80.6 L/hr - 79.1 L/hr)	Dirt, rock: 20,000 psi (138 MPa)	16°	NA	90°/90°	11.2 ft (3.4 m)	32 in (81.3 cm)	59 rpm
T1155III Terrain Leveler® SEM	Chain drive	Caterpillar	C15 ACERT	T3 - T4	B	540.4 hp (403 kW)	28.9 gph - 28.1 gph (109.4 L/hr - 106.4 L/hr)	Dirt, rock: 22,000 psi (152 MPa)	16°	+/- 5°	90°/90°	11.2 ft (3.4 m)	25 in (63.5 cm)	37 rpm
T1255III Terrain Leveler® SEM	Chain drive	Caterpillar	C18 ACERT	T3 - T4	B	599.4 hp (447 kW)	31.8 gph - 30.5 gph (120.4 L/hr - 115.5 L/hr)	Rock: 25,000 psi (172 MPa)	15°	+/- 5°	90°/90°	12 ft (3.7 m)	27 in (68.6 cm)	56 rpm
T1255III Terrain Leveler® SEM	Direct drive	Caterpillar	C18 ACERT	T3 - T4	B	599.4 hp (447 kW)	31.8 gph - 30.5 gph (120.4 L/hr - 115.5 L/hr)	Rock: 25,000 psi (172 MPa)	15°	+/- 5°	80° non-motor side	12 ft (3.7 m)	20 in (50.8 cm)	24.7 rpm
T1655III Terrain Leveler® SEM	NA	Caterpillar	2 x C18 ACERT	T3	B	1,200.2 hp (895 kW)	60.5 gph (229 L/hr)	Rock: 25,000 psi (172 MPa)	15°	+/- 5°	45°/45°	14.8 ft (4.5 m)	28 in 71 cm)	26 rpm

VERMEER **ROCK LAB**

The Vermeer Rock Lab takes rock collecting to a whole new level. Using state-of-the-art equipment, our experts test rock samples (limestone, salt, bauxite, iron ore, etc.) from all over the world in a variety of ways. Each sample is cored and undergoes unconfined compressive strength, indirect tension, abrasivity and energy index testing.

The results of these tests help to characterize:

Consult with your local Vermeer dealer to work on collecting representative rock samples from your jobsite. This will help determine the appropriate tooling to use for your ground conditions, based on a calculator that accounts for rock testing results and estimates production ranges and cost of operation. With this information, you can make more informed business decisions. As a Vermeer customer, the Vermeer Rock Lab services are available at no cost.

TERRAIN TECHNOLOGY DONE RIGHT

SmartTEC performance software

SmartTEC performance software helps operators adjust machine controls to maximize, monitor and record machine performance for future analysis by the machine owner or fleet manager. Advantages include:

- **Manual control of cut depth and cross slope:** Independent adjustment of the depth and tilt of the cutting drum
- **Auto-tilt grade control:** Manual control of the cut depth and automatic leveling of the cutting drum cross slope
- **Clean dash display:** Status of the most critical elements of machine performance
- **Optimized performance:** Visual cues for recommended control adjustment
- **Machine history:** Record of historical machine usage hours
- **Observed fluid life:** Monitor of fluid life intervals for proactive maintenance
- **Vermeer telematics tool:** Around-the-clock mobile machine monitoring and reporting in real time

Global Navigation Satellite System (GNSS) guidance*

- **Mine-by-line capability:** Cuts 3D to mine plan
- **Convenience:** Slopes the mine and creates ramps, pit sumps, roads, waterways, etc. while mining
- **Accuracy:** Chases specific seams
- **Efficiency:** Helps reduce risk of human error and enables minimal cutting head overlap
- **Productivity:** Minimizes steering corrections

*Optional

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