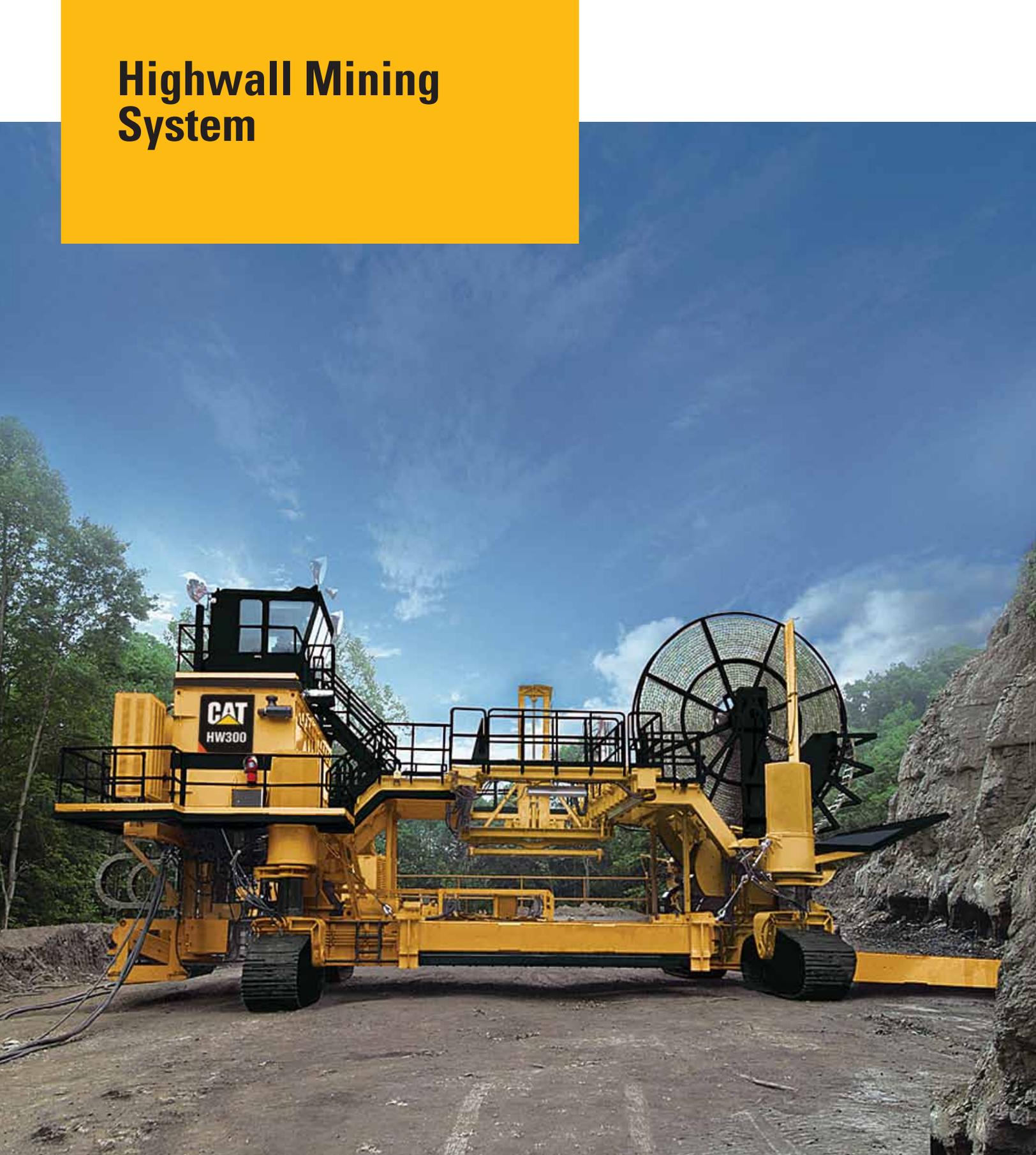


# Highwall Mining System





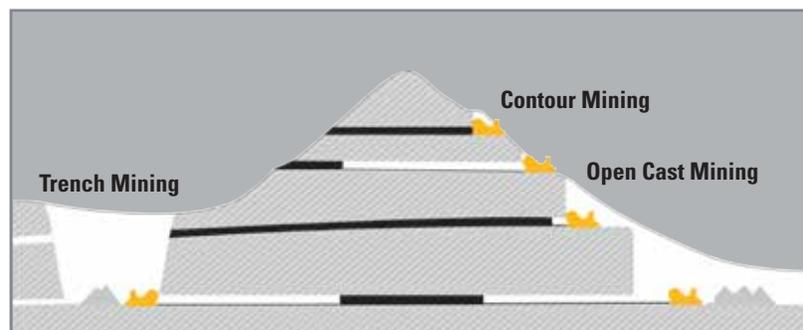
## Highwall Miner: Bridging the Gap

Linking underground and surface mining operations, the Cat® highwall mining system is a testament to versatile mining equipment. It offers a safe and innovative method for extracting coal from outcropping seams in a multitude of applications.

### What is Highwall Mining?

Highwall mining is a proven primary method for mining coal from outcropping horizontal seams. In this method of mining, an unmanned continuous miner is driven underground and operated in front of the highwall. The highwall mining machine stands on the pit floor or on a bench, directly in front of the exposed seam and makes long parallel rectangular drives into the coal seam. A remote-operated cutter module is pushed into the seam by a string of push beams (unmanned coal-conveying elements) that transport the mined coal back to the entry of the drive onto a stockpile. The whole mining cycle is completed by a three- or four-man crew, with no personnel going underground at any time.

The self-contained Cat highwall mining system offers an innovative method for extracting coal from outcropping seams in a multitude of applications.



Whether you're operating a trench, open cast or contour mine, the Cat highwall mining system can extract coal affordably and safely.

- **Open cast:** Highwall mining is used to mine coal from underneath the final highwall, when the strip limit is reached due to economic reasons or surface conditions
- **Contour mining:** In a mountainous area, the Cat highwall mining system can follow a coal seam along the side of the hill
- **Trench mining:** The unit mines coal from both sides of a purpose-prepared trench; this mining method is used when an open pit is not an option

Our highly skilled team is eager to assist you to determine the feasibility of your highwall mining project. The Caterpillar team uses an evaluation of your geological data and site plan to determine how best to use a Cat highwall mining system. We can even assist you to develop a mine plan if you don't already have one.

### Cat® Highwall Mining System

The industry-leading Cat highwall mining system is a new, low-cost addition to traditional mining methods. The system can produce 40 000-110 000 tonnes (44,000 to 121,000 tons) of coal per month, depending on seam height. Capable of full operation with a three- to four-man crew, the Cat highwall mining system averages 27 to 36 tonnes (30 to 40 tons) per man-hour. Innovative technologies, such as an effective cutter module and powerhead assembly, contribute to the system's outstanding productivity.

The Cat highwall mining system is designed for easy maintenance with a reliable, straightforward design and a comprehensive diagnostic system with troubleshooting capabilities to enhance uptime. Able to be disassembled in modules, the system can be transported over long distances. Everything about this highly efficient highwall mining system is engineered to provide excellent return on investment.

### Machine Service & Support

Every Cat highwall mining system is backed by 24/7 support from our highly skilled and experienced staff. Our large warehouse is fully stocked with spare parts to ensure the highest levels of machine uptime. Service and parts back-up can be tailored to your needs.

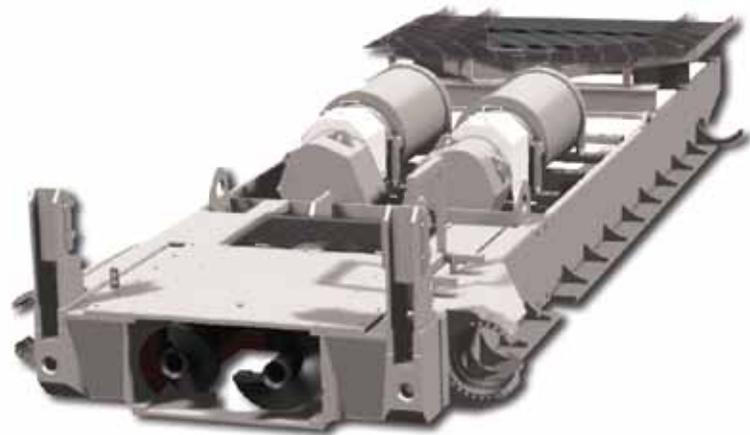


### Proven Cutter Module

Caterpillar offers two electric cutter modules: a low-seam cutter for seams 0.76 – 1.62 m (2.5 – 5.3 ft) in height and a high-seam cutter module to mine 1.3 – 3.05 m (4.3 – 10 ft) seams. The cutter modules are interchangeable and quickly attached to the powerhead assembly. The cutting cycle is fully automated, yet allows the operator to manually adjust the machine function using an ampere reading as the coal seam varies. This proven technology allows the cutter module to accurately follow the coal seam and produce a clean product.

### Heavy-Duty Powerhead Assembly

The powerhead drives the cutter module and push beam string forward using two hydraulically-powered sump cylinders with a 6.85 m (22.47 ft) stroke. At 276 bars of hydraulic pressure, a pushing force of 136/276 tonnes (150/304 tons) pulling force propels the cutter module to depths of more than 300 m (1,000 ft).



*Heavy-duty powerhead assembly*

## Advanced Technology

An optional Gamma Ray Detection system can be used to guide the cutter module through the coal seam, leaving predetermined amounts of coal in the roof and floor, if required. This system also allows the mining of coal in soft roof and/or soft floor situations.

For even more accurate directional mining operation, Caterpillar offers an optional solid-state, fiber-optic, gyro-based navigation and steering system. This provides operators with very precise cutter module location data in real time for enhanced cutter module steering and pillar width control.

## Excellent Mobility

The Cat highwall mining system is an agile, self-propelled machine that operates on contour benches as narrow as 18 m (59 ft). It trams easily from entry to entry and discharges coal in tight spaces.

An optional right-angle conveyor system discharges coal on the right or left side on narrow benches. It can also discharge onto a stacking conveyor system, where coal is moved to the center of the bench for stockpiling large volumes.

Four heavy-duty, hydraulically-powered tracks articulate independently in two operating modes – mine mode and tram mode – and can rotate the machine 360°, which improves maneuverability in congested areas. Mine mode is used for moving parallel to the highwall, while tram mode is used when moving from pit to pit.

## Operator Comfort

The Cat highwall mining system is equipped with a comfortable, air-conditioned cab that offers a full view of the mining operation and the highwall. The full-suspension operator seat and the two user-friendly touch-screens create an ergonomic workplace, placing controls and system information at the operator's fingertips.



*Tram mode*



*Mine mode*



*User-friendly touch screens*

## Dependable Push Beams

Cat push beams are 6 m long (20 ft), rectangular, reinforced steel box structures joined together to form a string, which connects the highwall mining system to the cutter assembly. The push beam string is the backbone of the machine; pushing and pulling the cutter module in and out of the highwall with retract forces up to 363 tonnes (400 tons) at 345 bars. The push beams also transport mined coal and support the hose chain that supplies control and power to the cutter.

Moving coal inside the push beam (via a pair of screw conveyors) protects the coal from contamination and the moving mechanical parts from rock debris, resulting in higher availability. Other Cat push beam advantages include:

- A strong method of attachment that is secured and disengaged quickly
- A horizontal hinge design that allows the string and cutter to navigate through coal seam rolls and undulations
- Structural rigidity that ensures mining in parallel drives
- A simple design free of electrical and hydraulic connections
- Push beams that can be stacked six high for storage in narrow worksites, even under tough pushing and pulling conditions

## Robust Reel & Chain

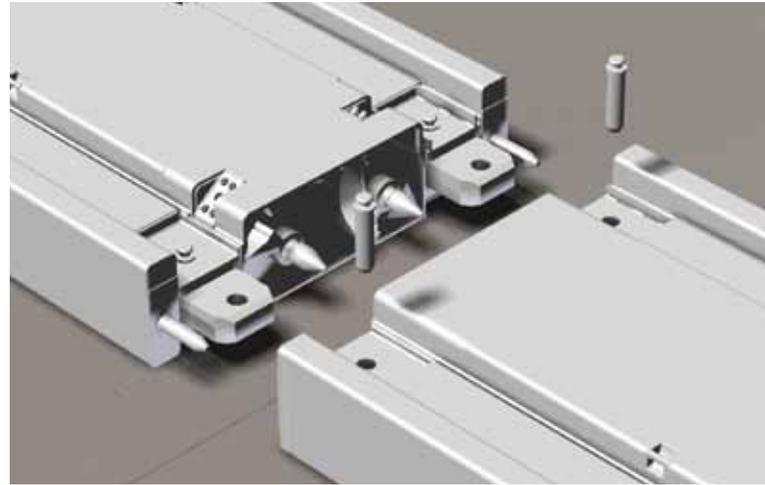
A steel-armored hose chain stores and protects all electric power cables, hydraulic and water lines, and the control cable to the cutter module. The hose chain is automatically unrolled and retracted on a reel during mining.

## Control System with Diagnostics

The Cat highwall mining system's operation is controlled by a Programmable Logic Controller, which provides reliable performance for greater uptime. A comprehensive diagnostics system, including troubleshooting assistance, streamlines maintenance procedures.

## Anchoring System

Two drills mounted on the front of the machine are used to drill into the pit floor up to 2.5 m (8.2 ft). High-strength pins are then inserted through the base frame into the pit floor to help stabilize the machine and to maintain its accurate position, even under tough pushing and pulling conditions.



*Push beams*



*Reel and chain*

## Easy Equipment Relocation

For quick relocation over long distances, the Cat highwall mining system can be taken apart in modules. Rapid disassembly and reassembly is facilitated by convenient hydraulic and electrical connectors, and all modules are sized for transport using regular public roads. Depending on local conditions, the system can also be transported between sites and without disassembly by heavy haul trucks.



Remote operation

## Specialized Training

Our operational and technical training covers every aspect of the Cat highwall mining system. We offer a two-week training program from our Beckley, West Virginia, USA, facility to new customers and to existing customers as a refresher. We can also offer a tailored program at your location.

## OPTIONS:

**Push Beam String Holding System:** When mining on a dipping seam, this option prevents the push beam string and cutter module from sliding back down into the mined entry when disconnected from the power head.

**Gamma Ray Sensors:** A direct-ship product is produced with rock and debris left underground when gamma sensors are used in either a top and/or floor application.

**Tropical Package:** For hot-climate applications, this package extends the operating temperature of the equipment up to 55° C (131° F).

**Arctic Package:** For extreme-cold climates, this package extends the operating temperature to -40° C (-40° F). Infrared or electrical heaters are equipped for the cab, BPM, generating set and working platforms. Hydraulic oil is circulated, cylinders are insulated and heat-tracing cables are added.

**Right-Angle Discharge:** This feature discharges coal to the right or left of the machine.

**Stacker Belt:** This is a heavy-duty conveyor that moves coal from the right angle conveyor to produce a surge pile for loading coal into trucks.

**Push Beam Grapple:** This tool is mounted to the front of a wheel loader to provide safe and efficient transportation of push beams to and from the highwall mining system.

**Generator Set:** A self-contained, trailer-mounted generator system provides electrical power to the highwall mining system in remote locations where connection to a utility grid is not practical. It includes a 16-cylinder diesel engine with a 4 160 V, 1 500 kW alternator, a fuel supply tank and all required electrical switch gear, packaged in a silenced container.

<b>Cat Highwall Mining System</b>	
<b>Mine Mode Dimensions</b>	Width: 10 m (33.6 ft) Height: 8.4 m (28 ft) Length: 16.6 m (55.3 ft)
<b>Tram Mode Dimensions</b>	Width: 9.0 m (30 ft) Height: 8.4 m (28 ft) Length: 16.6 m (55.3 ft)
<b>Weight: Highwall Mining System</b>	225 000 kg (496,040 lb)
<b>Weight: Push Beam</b>	5 624 kg (12,400 lb)
<b>Weight: Low-Seam Cutter Module</b>	21 800 kg (48,061 lb)
<b>Weight: High-Seam Cutter Module</b>	43 084 kg (93,000 lb)
<b>Pit Floor Gradient</b>	8 degrees nominal in any direction, 10 degrees maximum in any direction for traveling. Contact Caterpillar for steeper applications.
<b>Maximum Seam Gradient</b>	8 degrees down dip relative to horizontal (Level side-to-side, pit floor prepared at 3 degrees). Contact Caterpillar for steeper applications.
<b>Coal Seam Height Range</b>	760 mm (30 in) to 3.05 m (10 ft)
<b>Maximum Penetration Capability</b>	305 m (1,000 ft)



**Research and Development**

The Cat highwall mining system is developed completely in-house by our own engineering department. New product developments are implemented on a continuous basis after being thoroughly tested in the field. The customers from our worldwide customer base play an important role in the development of new product enhancements.

- Patents and patents pending:
- PCT/NL2004/000518, 372, 793, 794
- PCT/NL2005/000024, 115, 123
- PCT/NL2009/050583
- USA 5938289
- US 11/572,464
- US 11/569,520
- RU 2006145870
- CN/0480043435.9

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For more complete information on Cat products, dealer services, and industry solutions, visit us on the web at [mining.cat.com](http://mining.cat.com) and [www.cat.com](http://www.cat.com)

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