

CONTINUING THE LEGACY






Figure 1. The new Cat D10 dozer utilises several enhancements to reduce maintenance and repair costs by up to 8% compared to the D10T2.

Caterpillar Inc., USA, presents the latest contribution to the dozer sector and considers its prospects of upholding the proud tradition of the historic Cat® D10 Dozer line.

The first Cat® D10 Dozer rolled off the production line in September of 1977 with a radically different design compared to other dozers of that era. Large mining customers required a more powerful dozer than the D9 (the largest Cat dozer at the time), one that could rip harder rock and move more material. The D10 answered the call with a resilient undercarriage and an industry-first elevated sprocket, plus high weight and horsepower.

The D10's elevated sprocket design provided several benefits for customers. As it still does today, the sprocket enabled a fully suspended high-drive undercarriage that reduces the shock load feedback to the operator, improving comfort. The suspension provided more track on the ground, since it conformed to the underfoot, offering more traction. With its introduction, the dozer's ripping and pushing capabilities made a significant impact in the mining industry, as studies showed the cost per yard to

move material with the D10 was comparable to that of larger draglines.

Unlike low-drive tractors, the new undercarriage design also kept the sprocket out of the dirt, reducing wear and tear on driveline components. The more modular tractor reduced service time, as technicians had improved access to the transmission, final drives, axles, and other driveline components. By comparison, low-drive tractors required multiple components to be removed prior to a technician gaining access to a power module or other component.

Several D10 model series changes throughout the last 46 years featured design upgrades, increases in horsepower and engine updates to meet changing emissions standards. The new D10's most recent predecessor, the D10T2, started production in 2014 and offered a machine for two different emissions categories – one designed to meet US EPA Tier 4 standards, and another for US EPA Tier 2 equivalent standards.

The D10T2 featured updates to the cab plus upgrades to the electrical architecture, which allowed for more technology integration into



Figure 2. Caterpillar compared the performance of the new D10 (left) against the D10T2 (right) at an opencast mine, over a three-day test period.



Figure 3. One test included two sets of six slots with a level test area, flat loading and carry segments, and the fill producing a 5% uphill grade.

machine design. Newly introduced load-sensing hydraulics delivered more power to the ground for increased responsiveness and fuel efficiency. Driven by customer demand, the D10T2 was the first dozer in the industry to offer high-horsepower reverse, which was carried into the new D10 design as well.

The powerful D10T2 had 447 kW (600 hp) in forward direction, but power output jumped to 538 kW (722 hp) when traveling in reverse. The feature helped customers to reduce overall cycle times in downhill dozing applications; as uphill forces worked against the machine, the dozer automatically increased horsepower in reverse to maintain speed on grade. This allowed the operator to get the blade back in the dirt faster and move material quicker to increase productivity.

Today's D10

Previewed at MineExpo and now in full production, the new D10 Dozer continues the legacy of its predecessors in productivity and hard rock ripping capabilities. The large dozer boasts a weight just under 70 300 kg (155 000 lb) with 3881 mm (152.8 in.) of track on the ground. Plus, its high horsepower reverse feature offers 20% more power in reverse. It also offers aftertreatment solutions to meet the needs of the global market with US EPA Tier 4 Final/EU Stage V, as well as Tier 2 equivalent designs.

Its stator clutch torque converter and load-sensing hydraulics help increase efficiencies by 6% compared to the D10T2. Additionally, a combination of improved technology, longer component life, extended oil changes, and increased serviceability helps to reduce maintenance and repair costs by up to 8% compared with its predecessor, and deliver industry-leading low cost of ownership.

Major components, including the frame and powertrain, can be rebuilt using new, remanufactured, or used parts and components for a cost-effective second machine life. Undercarriage-driven improvements to the D10 help to drive enhancements to the entire machine. With a focus on delivering the right value for mining operations, three undercarriage offerings are available for the D10: general duty (GD); heavy duty (HD); and heavy-duty extended life (HDXL). Providing 20 – 40% longer life than the HD undercarriage, the HDXL with DuraLink™ design offers an 8000 hr bushing seal life.

The reengineered engine compartment with single-plane cooling system improves heat dissipation and delivers improved serviceability and clean-out space. A 50% higher capacity oil pan improves average oil quality and extends change intervals by up to 250 hours more than the D10T2.

Inside the cab, a new multicolour touchscreen display monitors machine performance and enables the operator to tailor machine parameters to the application. Technology plays an increased role in the design and performance of the new D10, and it is future-ready to integrate tomorrow's technology advancements. Standard dual-tilt and automated blade assist (ABA) reduces operator workload by automating blade movement to preset load, carry, and spread positions. Remote flash and remote troubleshoot are also part of the standard technology package for remote software updates and diagnostic testing, respectively.

Optional technologies like AutoCarry™, Cat Grade Control 3D, and automatic ripper control allow mines to customise the dozer to site conditions and increase productivity and efficiency. The D10 ships from the factory capable of integrating Cat MineStar™ technologies to optimise grading efficiency and for remote operating capabilities. MineStar Terrain with automatic blade control delivers real-time blade load and cut/fill monitoring to minimise overcut, overfill, and rehandling costs. Command for dozing offers line-of-sight operation with an over-the-shoulder remote control console and non-line-of-sight operation using the remote operator station.

Proving the claims

Caterpillar recently compared performance of the D10 against the D10T2 at an opencast mine in the western US. Over a three-day test period, operators ran both models in manual mode with no advanced blade control features. To ensure a fair comparison, observers confirmed the health of each machine prior to the production study.

For this production study, both dozers were configured equally and were in similar condition. Each unit was outfitted with new tracks, blade cutting edges, and end bits prior to starting. The study focused on slot dozing to preserve survey result integrity. Minimising result variability caused by material distances across pit width, the dozers alternated between pits. After the first half of each test the operators switched machines, and both operators employed front-to-back dozing and manual gear selection operating techniques. Material consisted of previously moved overburden, compressed over time by high haul traffic, and observers estimated bank density at 2280 kg/m³ (3843 lb/yd³).

Test Day 1: the tested area included two sets of six slots approximately 67 m (200 ft) wide and 58 m (190 ft) long. Slot width measured 6.1 m (20 ft) with 4.6 m (15 ft) of space between each slot, in order to allow each dozer to push three total slots per set while mixing very little fill material. The test area



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was level, loading and carry segments were flat, and the fill produced about a 5% uphill grade.

Observers noted this test area had been well compacted by the thousands of truck cycles driven over the surface. Each dozer spent additional time prying out rocks and/or reloading blades for portions of the runs. Subsequent days saw material loaded easier or with trucks recently



Figure 4. Dozer speed tests proved the D10 was 5% faster in reverse, and its optimised forward gear offered 5% more cycles per hour than the D10T2.

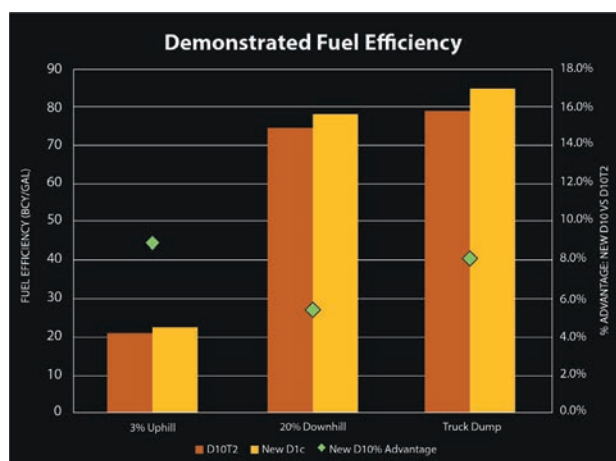


Figure 5. The D10 offers 5 – 9% more fuel efficiency than the D10T2 across a range of applications.



Figure 6. The D10 proved to be 3 – 7% more productive than the D10T2 in all tests, and its stator clutch torque divider improved efficiency.

moving the material, and there were less unproductive operations on days two and three.

Day 2 testing moved location to the edge of the truck dump site with an average 20% downhill and slot length of approximately 22 m (74 ft). Material was similar to the previous day but not as compacted, making it easier to load.

Day 2 also focused on the new D10's faster reverse speeds. Travelling up the 20% grade in second gear reverse, the D10 was more than 5% faster than the D10T2, at 7.97 km/h (4.95 mph). Its optimised forward gear performance also delivered 5% more cycles per hour, with 4% more cubic yards per cycle, than the D10T2.

On Day 3, trucks hauled material from a single source and the machines dozed the truckloads into a solid berm to create a depth and height allowing for full blade loads to be pushed in each pass. The berm was divided equally between the D10 and D10T2 based on a centre point. The operators picked up full bladeloads on each pass and rebuilt the safety berm on the edge of the dump during each push. The new D10 was nearly 7% more efficient, primarily due to drivetrain improvements and other efficiencies.

Study conclusions

Test procedures implemented for the production study enabled a fair comparison of dozer performance by minimising the effects of operator skill level and technique and other outside factors. The three-day study of the new D10 dozer reinforced claims of productivity and fuel efficiency improvements in all operating conditions, including:

- The new D10 is 3 – 7% more productive than the D10T2 in all tests.
- D10 offers 5 – 9% more fuel efficiency across a range of applications, including production dozing and truck dump support work.
- High-horsepower reverse with the new D10's optimised drivetrain improved productivity by offering nearly 5% reduced total cycle times in downhill dozing.
- Both operators preferred the D10's hydraulic response over the D10T2 in production dozing and berm building.
- Seamless transitions between locked/unlocked stator modes of the stator clutch torque divider improved efficiency without operator input.

All things considered, the new D10 has shown itself fit-for-purpose – backing up performance claims with proven results – and a worthy successor to the Cat D10 Dozer line. It will look to continue to establish itself as it continues to be rolled out across the industry. 