GRADE

TECHNOLOGIES FOR EXCAVATORS

CAT® GRADE TECHNOLOGY
BOOSTS YOUR PRODUCTIVITY

Digging a foundation. Trenching for a water line. Working on a slope. These jobs demand the precision and speed you get from Cat® Grade technologies. Combining advanced guidance with optional automated machine control, Grade helps operators hit grading targets right on the money in fewer passes.

ACCURATE DIGGING. FASTER. EASIER. SAFER. EVERY TIME.

Four ways Cat Grade delivers results for excavator applications:

- **REDUCED COSTS:** SAVES TIME, LABOR AND FUEL COSTS.
- **IMPROVED ACCURACY:** PRECISE GUIDANCE REDUCES WASTED EFFORT.
- **BETTER OPERATOR EFFICIENCY:** EXPERIENCED OPERATORS WORK MORE ACCURATELY THAN EVER. NEW OPERATORS GET UP TO SPEED MORE QUICKLY.
- **ENHANCED SAFETY:** FEWER SITE PERSONNEL ARE NEEDED ON THE GROUND.

DEEP INTEGRATION

MEANS SMOOTH OPERATION

Cat Grade technologies are deeply integrated into new Cat equipment for smooth, precise operation. Some Grade technologies are available as aftermarket upgrades to add advanced capabilities.

THE RIGHT TECHNOLOGY FOR ANY JOB

Cat Grade for excavators includes 2D and 3D technologies to suit a range of application needs and operating budgets. The Assist feature allows you to partially automate some operations for even more efficiency and productivity.

Contact your Cat dealer to discuss the best systems and options for your fleet, operators and applications.

GRADE TECHNOLOGY

CHOOSE WHAT MATCHES YOUR WORK

GRADE WITH 2D

BOOST OPERATOR EFFICIENCY

Cat Grade with 2D helps excavator operators work up to 35%* more efficiently in a wide variety of applications. Delivering real-time guidance for accurate vertical and horizontal control, Grade with 2D helps to ensure that cuts and fills are made to exact specifications – without under or over cutting.

+ **Eliminates ground stakes** in most applications.
+ **Displays target grade** with visual guidance plus height and depth.
+ **Easily adjust to target depth and slope** using joystick commands, a touchscreen interface or a jog dial.
+ **Integrated components are protected** from damage, ensuring long life.
+ **Move and maintain consistent grade** with optional laser catcher capability.
+ **Enable single-lever digging** by combining this system with Cat Grade with Assist
+ **Works with various bucket types:** digging, cleaning, grading, and tilting.

*Compared with traditional grading methods. Individual results may vary.

RECOMMENDED FOR: GENERAL APPLICATIONS

Use the Grade with 2D system to increase efficiency and productivity when digging and grading basements, footings, foundations, utility trenches, slopes and drainage ditches.

DIGGING

GRADING

TRENCHING

SLOPING

RECOMMENDED FOR: COMPLEX AND VERY LARGE JOBS

Grade with 3D is ideal for complex cuts and fills requiring pinpoint precision, as well as large infrastructure, civil, heavy highway, and commercial site projects.

COMMERCIAL PROJECTS

PRECISION PROJECTS

GRADE WITH 3D

WORK COMPLEX DESIGNS ACROSS MULTIPLE MACHINES

Grade with 3D adds real-time satellite positioning guidance. This system uses one or two GNSS receivers and a correctional data source to achieve Real Time Kinematic (RTK) positioning guidance in three-dimensional space.

Grade with 3D helps operators maximize productivity and job site efficiency when working to the complex designs often found on large infrastructure and commercial site projects.

+ **Maintain accuracy across large job sites and multiple machines** with in-field design plan functionality and control.
+ **Tracks the machine and bucket's absolute location** on the job site.
+ **Automatically compensates for excavator pitch and roll** caused by sloping ground conditions.
+ **Set up 2D avoidance zones** withing the design file to inform operators where not to work within the site plan.
+ **Uses the same added touchscreen monitor** as Grade with 2D.
+ **All Cat Grade systems are compatible** with radios and base stations from Trimble, Topcon and Leica.

EXPANDED CAPABILITIES

GRADE 3D OPTIONS

CAT GRADE 3D READY

The Cat Grade 3D Ready option includes all the hardware required for the Grade with 3D system, installed and tested from the factory.

This option provides an easier upgrade path for customers who want to add Grade with 3D after their initial purchase.

To activate, contact your Cat Dealer to purchase the required 3D software licenses. Licenses can be installed remotely or manually loaded onto the machine.

SINGLE & DUAL GNSS ANTENNAS

Caterpillar's single antenna global navigation satellite system (GNSS) makes it easy by giving you visual and auditory guidance to grade.

Upgrade to dual antenna GNSS for maximum grading efficiency. The system lets you create and edit designs on the touchscreen monitor while you're on the job, or you can have the plan design sent to the excavator to make your work easier.

Plus, you get added benefits such as avoidance zones, cut and fill mapping, lane guidance, augmented reality, and advanced positioning capability.

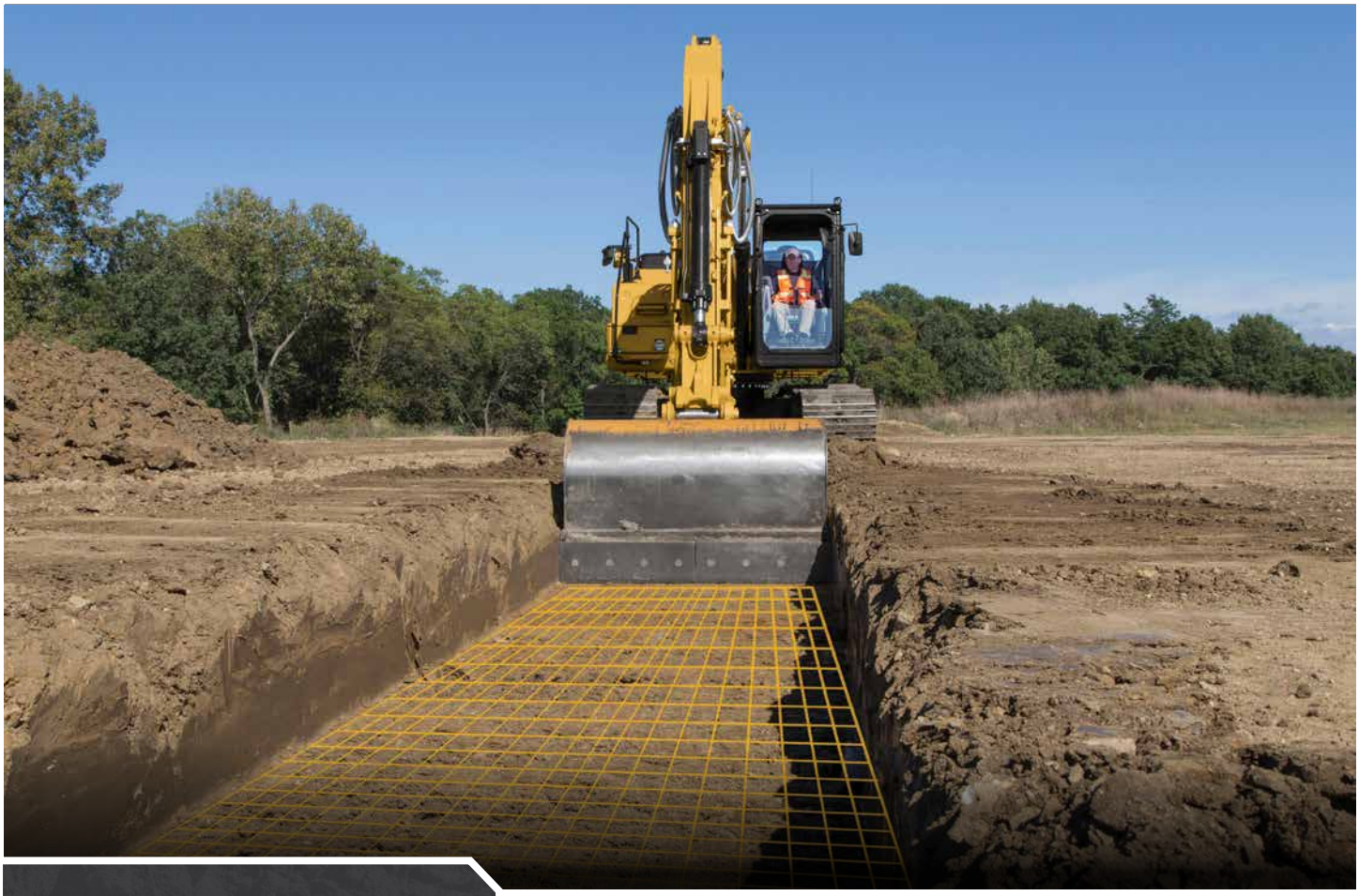
CAT GRADE CONNECTIVITY

Cat Grade Connectivity* is designed to make using Grade with 3D easier. Depending on local cellular and internet service availability, Grade Connectivity can eliminate the need for additional cellular radio modems and local base stations. It is ideal for use in urban areas and anywhere that offers good virtual reference system (VRS) coverage via reliable cellular service and internet access.

Cat Grade Connectivity enables you to:

+ Install, configure, and update individual machine Cat Grade licenses.
+ Send Grade 3D design files remotely without the need for external USB drives.
+ View active and inactive devices on individual machines and add or update firmware.
+ Remotely assist operators using Grade's online monitoring features.

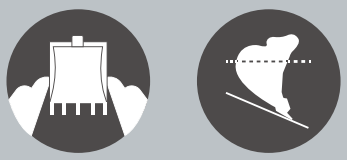
**Grade Connectivity subscription required. Availability may vary by region, consult your Cat Dealer for more details.*



RECOMMENDED FOR: MOST APPLICATIONS

Grade with Assist enables operators of all skill levels to work more confidently, efficiently and productively in most digging, sloping, leveling, fine grading, trenching and loading jobs.

DIGGING GRADING LOADING



TRENCHING SLOPING

GRADE WITH ASSIST

Grade with Assist adds semi-autonomous digging to help boost operator efficiency. This system works with Grade with 2D and 3D, allowing you to optimize your Grade system to your applications.

SINGLE-LEVER DIGGING SIMPLIFIES OPERATION

Single-lever digging automates boom and bucket movements for more accurate cuts, using both standard and tilting attachments. Using a single lever reduces manual inputs, errors, and fatigue – improving grading consistency for operators at all experience levels. The guidance system, machine display, and easy joystick control make operation easy, with speed control and less operator effort.

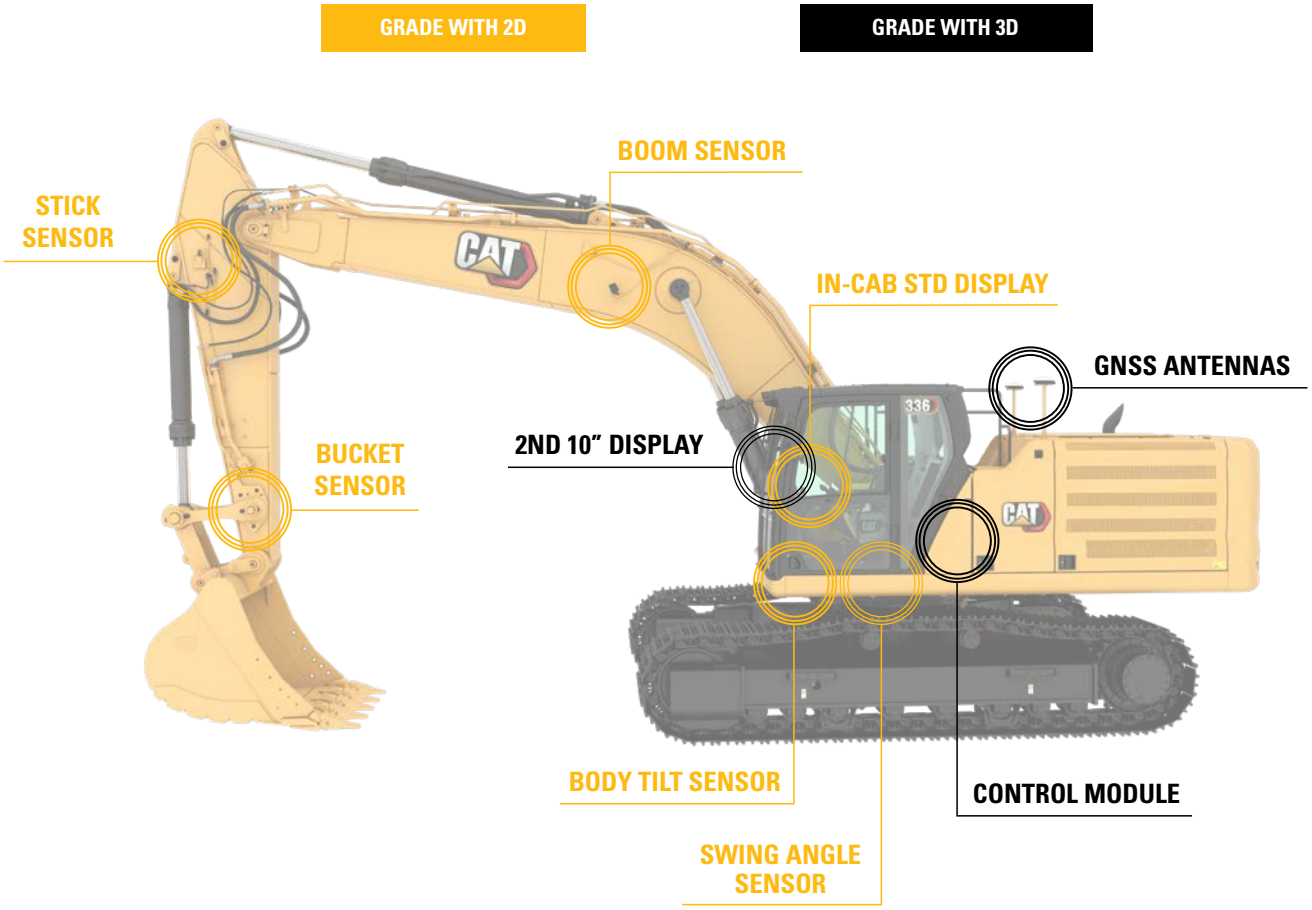
TYPES OF AUTOMATED ASSISTANCE AVAILABLE

+ **Grade Assist** – Takes over boom and bucket functions to maintain desired depth and slope. The operator sets the target grade and controls stick speed with one hand.
+ **Bucket Assist** – Maintains bucket angle and keeps the cut accurate in sloping, leveling, fine grading and trenching applications.
+ **Boom Assist** – Automatically raises the boom to keep the excavator from lifting off the ground when digging, lifting or rotating under load.
+ **Swing Assist** – Automatically stops excavator swing at defined points when truck loading and trenching, reducing fuel usage and improving cycle times.
+ **Tilt Assist** – Takes over bucket angle movements to automatically maintain the desired slope.

GRADE TECHNOLOGY

MODULAR COMPONENTS, EASY UPGRADES

Cat Grade is a modular system that can be optimized and upgraded to meet the needs of a wide range of applications and site requirements. Features and availability may vary. Consult your Cat dealer for model-specific information.



Note: 2D Components are utilized with 3D elements.

GRADE WITH 2D

Grade with 2D is the base-level system. Components are factory* integrated with machine systems. This system comes standard on many new Cat excavators.

GRADE WITH 3D

Grade with 3D components include GNSS receivers and antennas. A site radio or internet connection is required. As with the 2D system, Grade with 3D can be added at the factory* or as an aftermarket upgrade.

**Cat Grade availability may vary by region and model. Consult your Cat dealer for details.*

ADDITIONAL COMPONENTS

LASER CATCHER (OPTIONAL)

A laser catcher (or laser receiver) senses when the device is centered directly in a red-wavelength rotating laser plane. When working in 2D mode, this enables the Grade system to transfer and maintain the elevation target while moving or re-orienting the machine.

ROTATING LASER TRANSMITTER (REQUIRED FOR LASER REFERENCE)

A high-quality rotating laser transmitter is recommended for the best accuracy and ease of referencing from the laser plane. See your Cat dealer for recommendations.

SNR RADIOS (OPTIONAL)

The on-machine Grade corrections SNR radio options communicate with fixed GNSS base stations or Trimble Universal Total Stations (UTS).

GPS/GNSS CORRECTIONS (REQUIRED FOR ACCURATE MAPPING)

A GPS/GNSS correction source is required to improve location precision when using Real-Time Kinematic (RTK) mapping systems. Satellite base stations are commonly used for corrections and may be tripod-mounted for portability or mast-mounted on a semi-permanent location.

Additionally, the Cat Grade provides Internet Base Station Service (IBSS) correction over the Internet via Wi-Fi or a cellular network, as well as Universal Total Stations (UTS) when overhead obstructions interfere with GNSS signals.

As an alternative to base stations, Cat Grade Connectivity* uses machine telematics to connect to Virtual Reference Station (VRS) networks.

All Cat Grade systems are compatible with radios and base stations from Trimble, Topcon, and Leica.

**Subscription required.*

GRADE TECHNOLOGY

HOW IT WORKS

GRADE WITH 2D

Cat Grade with 2D provides elevation, slope, cross slope, and mainfall guidance to the operator.

This system continually calculates the elevation difference between a reference benchmark (such as a known ground point, string line, laser reference, etc.) and a focus point on the bucket's cutting edge.

Cat Grade with 2D informs the operator of the distance above, below, or on-grade between the bucket cutting edge and the benchmark point.

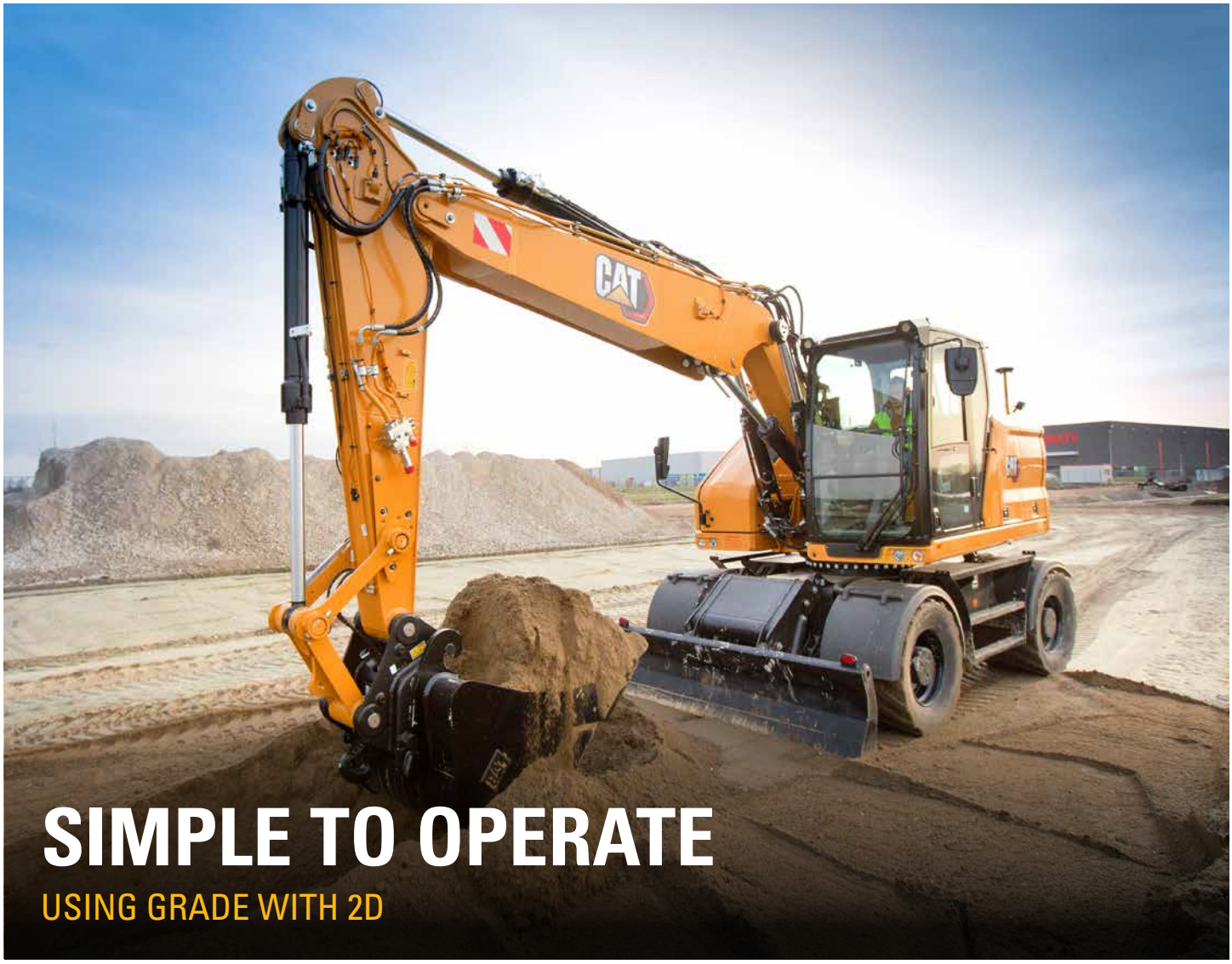
The status screen provides the following views:

- BUCKET PROFILE
- BUCKET CROSS SECTION
- BUCKET SLOPE ANGLE AND DIRECTION
- DEPTH TO GRADE DATA WITH DIRECTION INDICATOR
- ROTATION ANGLE AND DIRECTION (WHEN USING A ROTATION SENSOR)
- BENCHMARK STATUS ICON
- LINKAGE ELEVATION STATUS ICON

GRADE WITH 3D

Cat Grade with 3D for excavators adds deeper design capabilities, plus GNSS technology for RTK positioning guidance for more complex planes, slopes, contours and curves.

+ PROVIDES THE OPERATOR WITH BUCKET POSITIONING IN RELATION TO PRELOADED 3D DESIGN FILES OR BACKGROUND MAPS.
+ HELPS TO COORDINATE MULTIPLE MACHINE OPERATIONS WHILE MAINTAINING ACCURATE DIGGING PARAMETERS ACROSS LARGE JOB SITES.



SIMPLE TO OPERATE

USING GRADE WITH 2D

SET BENCH

STEP 1:

Set a benchmark by touching a known reference point with the bucket tip or bottom of the bucket edge.

DEPTH

STEP 2:

When the target elevation has been set, the Grade system will show the vertical distance between the work tool tip and the target elevation.

GRADE CONTROL

STEP 3:

Complete work in the first machine position and orientation, using the guidance values, monitor views and audible signals for assistance.

TOUCH POINT

STEP 4:

To move into a new position, first position the work tool tip on any fixed reference point that may be reached from both the current and new positions (a stake, rock, curb, etc.). Press “Touch Point” on the display menu to save the reference point.

GRADE CONTROL

STEP 5:

Move the machine to the new position, touch the reference point again and press Apply. The system will reset the target elevation automatically, enabling the operator to quickly resume work.

Basic operation is roughly equivalent for laser-guided 2D and 3D operation. The 3D system does not require re-benching when moving to a new position. Consult each system’s Operation Manual for detailed instructions.

CAT GRADE EASILY WINS IN SIDE-BY-SIDE PRODUCTION STUDY

STUDY SET UP:
Two Cat hydraulic excavators on identical job sites – one with Cat Grade with 2D, one without.

ASSIGNMENT:
Dig a partial basement square, trench at a 10% slope to a second location and dig a second basement square.

GOAL:
Compare time to grade and grading accuracy.

OPERATION:
The machine using conventional methods repeatedly stopped to wait for the grade checker. Grade checker was idle most of the time. The machine with Cat Grade continued to work at full pace, re-benching as needed – no grade checker required.

RESULTS:

Grade-equipped machine finished in 1 hour 17 minutes.
Non-equipped machine finished in 1 hour 40 minutes.

27 MINUTES SAVED

35% INCREASE IN PRODUCTIVITY

LOWER COSTS
for fuel and manpower

IMPROVED SITE SAFETY
with no personnel needed on the ground

Note: Individual results may vary.

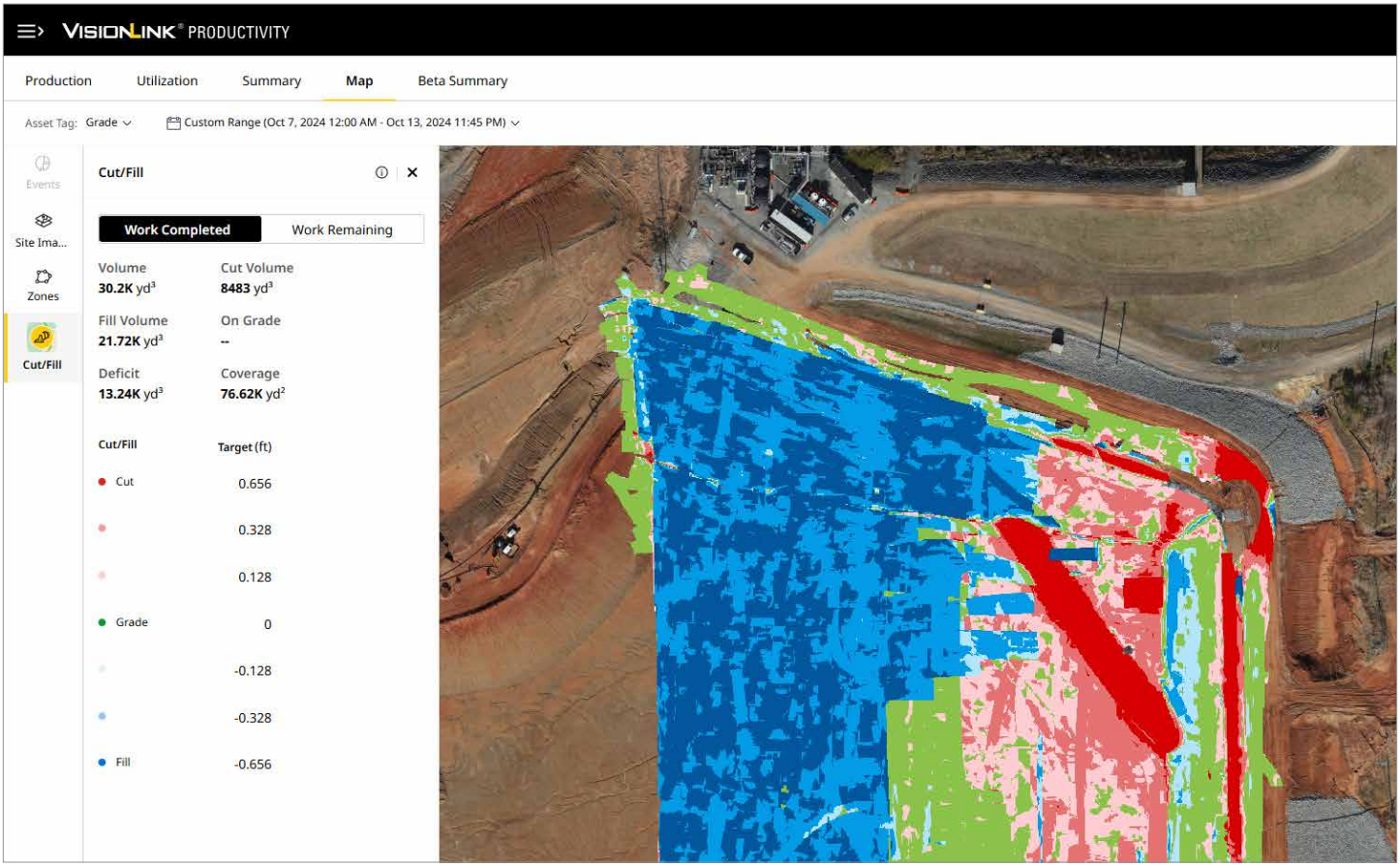
VISIONLINK® PRODUCTIVITY

BETTER DATA, BETTER DECISIONS

While every jobsite engages in production, productivity remains a challenge for many. Low productivity means low revenue and has a direct impact on profitability. VisionLink® Productivity helps you measure, monitor, and manage your assets to maximize productivity - on or off the jobsite.

VisionLink Productivity is a scalable, cloud-based application that collects and summarizes machine telematics and jobsite data from all your equipment - regardless of the manufacturer.*

The platform provides users with actionable information, including idle time, fuel burn, location, material moved, and more. The data is transmitted from the onboard cellular Cat Product Link™ device to the web platform. Users can access information using a smartphone, tablet, or desktop device.



YOU HAVE QUESTIONS

VISIONLINK PRODUCTIVITY HAS THE ANSWERS

Whether you are a site manager, foreman, or owner, you will have questions about your operations. VisionLink Productivity can provide answers to how work is progressing wherever you are on or off the jobsite.

- Hourly Production
- Volume Per Day
- Total Volume
- Cycle Time
- Cut/Fill Volume Completed & Remaining
- Elevation
- On Grade Percentage
- Grade Volume Remaining
- Pass Count
- Total Distance
- Runtime Hours
- Idle Hours
- Fuel Burned

*NOTE: A VisionLink® Productivity subscription for each asset is required. Machines must be equipped with Cat Grade to provide more advanced productivity data. Availability may vary by region and model. Consult your Cat dealer for details. *Data field availability can vary by equipment manufacturer.*

CAT GRADE SYSTEMS AT A GLANCE

FEATURE	GRADE WITH 2D	GRADE WITH 3D
Real-time depth and slope guidance relative to target grade with in-cab indicators	●	●
Available factory-installed*	●	●
Fully integrated components protected from damage	●	●
Over cut prevention with Grade with Assist	●	●
Laser compatibility	●	●
Grade with Assist compatibility	●	●
Compatibility with integrated Cat® onboard technologies: – Cat Command remote control for construction – Cat 2D E-fence excavator safety system – Cat Payload onboard weighing system	●	●
Compatibility with off-board back-office systems: – VisionLink® equipment and operations management – Cat API software modules for machine systems integration	●	●
Ability to create/edit 3D site designs for planes, slopes, contours and complex curves in cab on second monitor		●
Compatibility with radios and base stations from Trimble, Topcon and Leica	●	●
On-machine SNR radio availability (GNSS or UTS options)		●
GPS/GNSS, Galileo, and BeiDou compatibility		●
Single or dual GNSS antenna availability		●
Cat Tiltrotator System (TRS) compatibility	●	●
Internet Base Station Service (IBSS) corrections		●
Universal Total Stations (UTS) corrections		●
Virtual Reference Station (VRS) corrections (requires Cat Grade Connectivity)		●
VisionLink® Productivity compatibility	●	●

● - Available

**Availability may vary by region and model. Consult your Cat dealer for details.*

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For more complete information on Cat products, dealer services and industry solutions, visit us on the web at www.cat.com.

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