

THOROUGHTEC™
simulation



CYBERMINE™ 
simulator system

GRADER SIMULATORS

“The versatility of the grader is limited only by the skill and experience of the operator. CYBERMINE simulator systems maximise both.”

The grader is an incredibly versatile piece of machinery, capable of filling a wide variety of earthmoving roles. But to get the most out of this vehicle, well trained, experienced grader operators are essential.

Using advanced training techniques, CYBERMINE grader simulators train operators to achieve this level of skill and experience, exposing them to all likely procedural and emergency scenarios so they are prepared for the real-life equivalent.

ThoroughTec's high-fidelity grader simulators are true to the original vehicle in every way, from the ergonomics of the cab with authentic replication of

operator interfaces to highly accurate behavioural characteristics of the equipment being simulated. The CYBERMINE grader operates in a high-fidelity 3D mine world where the operator can perform all necessary propulsion and grading operations, interacting with artificially intelligent human assistants and TLBs.

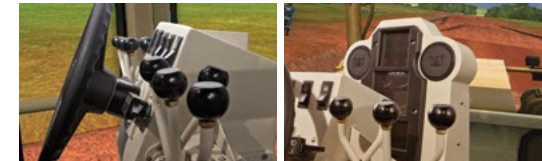
Dedicated areas are provided within the operational 3D mine world to provide for the training of various cutting, levelling and ripping/scarifying situations.

It's in this world that operators develop their skills and experience, so that they can get the most out of the equipment.



> Physically accurate vehicle cab

The trainee operator executes all propulsion and grading tasks from a highly accurate replica of the cab interior. The seat is surrounded by fully functional controls including steering wheel, switches, gauges, levers, pedals and joysticks. The vehicle's functionality is also customisable to available factory options.



A SIMULATED VEHICLE THAT LOOKS AND FEELS REAL

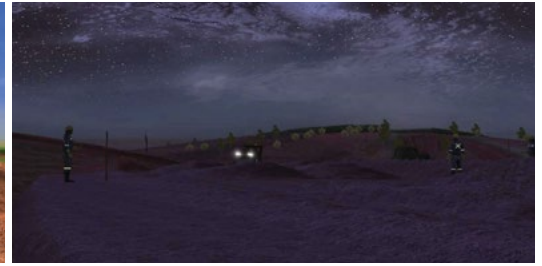
Operating a CYBERMINE grader is like operating the real vehicle, but without the associated high costs and inherent risks.

Authenticity and accuracy

The simulated grader cab makes use of original components and specifications to create an ergonomically correct and accurate replica of the original. All simulated vehicle behaviour dynamics are based on detailed mathematical models that use vehicle manufacturer specifications to provide accurate behavioural realism. As a result, full blade control, ripping/scarifying and levelling exercises are an accurate reflection of reality.

Highly customisable

While each CYBERMINE grader simulator is a highly accurate replication of the OEM vehicle in appearance and function, it can be customised to match factory optional features or operating procedures used at a particular mine site. Any OEM vehicle from any OEM manufacturer can be simulated.



> **Advanced soil modelling**

Advanced soil interaction models developed specifically for grading simulation require the operator to exercise correct propulsion, blade and scarifying techniques for the various terrain types and requirements in order to achieve effective results.

> **Advanced modelling of vehicle systems**

Effective grader simulation takes into account the complex interactions between blade and soil, as well as the articulation of the vehicle necessary for accurate propulsion and crabbing. ThoroughTec accomplishes this by detailed physics-based modelling of both the vehicle and the terrain.

> **Multiple configurable cut and function scenarios**

The virtual world includes a number of ripping and levelling scenarios, each set in an appropriate area for the objective. These include:

- Levelling of stockpiles and road, including rock removal
- Interaction with Artificially Intelligent human assistants for levelling tasks
- Interaction with Artificially Intelligent backhoe
- Concrete mixing and dressing

> **Variable world settings**

Trainees are introduced to a number of scenarios that they may encounter under real operating conditions, including variations of:

- Light levels
- Visibility
- Weather
- Emergency situations
- Critical vehicle failures

PHYSICALLY ACCURATE VIRTUAL MINE WORLD

Trainee grader operators are immersed in a high-fidelity 3D mine world complete with roads and stockpile areas that need precise finishing by the grader. Weather, visibility and emergency and procedural scenarios can be defined and adjusted by the instructor. Artificially intelligent human assistants simulate the use of ropes, measuring sticks and hand signals to assist the trainee operator with accurate levelling, while artificially intelligent backhoes perform support roles.

A custom mine site can also be created: A world that looks identical to your mine and operates in accordance with your unique operating scenarios and procedures.



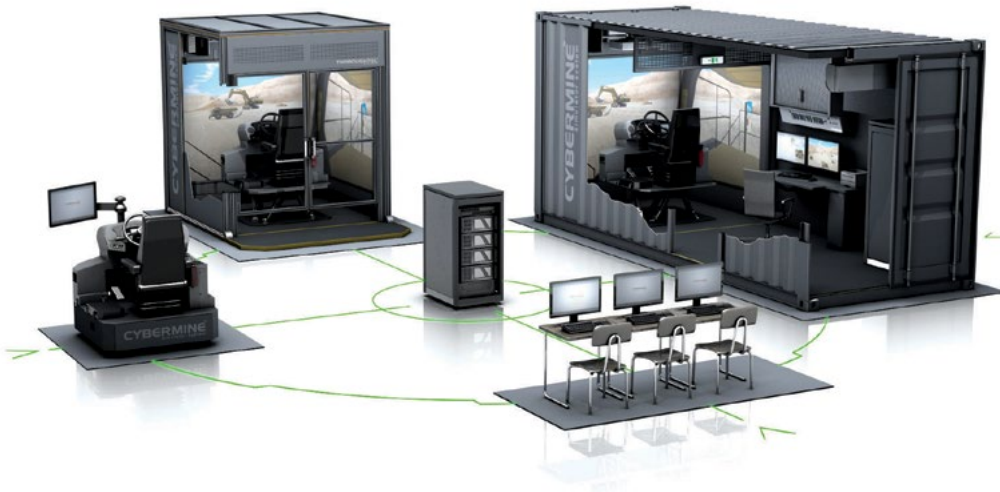
TRAINING AND EVALUATION TOOLS TO MAXIMISE SIMULATOR EFFECTIVENESS

Exercises can be configured to address various training requirements, including operations with different terrain characteristics, sub-system failures and advanced emergency situations such as engine fires and burst tyres.

The entire exercise is continually monitored and recorded, including instrumentation states and controls interaction, while the instructor is also able to view real-time graphs of the engine revs, blade height, vehicle speed and slippage of individual wheels. Scoring is against a set of predefined checks for the cab type, including correct equipment handling techniques and

response to emergency situations and failures, and each is categorised into affecting one of health and safety, machine use or productivity enhancement.

These multifaceted performance reports, together with the instructor's after-action review capability, provide a complete training and evaluation system for grader operators.



The Complete CYBERMINE Training Solution

A range of ISO 9001 certified and MIL-STD design engineering compliant training tools linked to a central student database for a seamless progression from new recruit to productive operator

> Computer Based Training (CBT)

- Developed in collaboration with recognised training specialists
- Fully interactive multimedia content including photographic still shots, 2D and 3D computer animations and video with audio overlay
- Integrates fully with CYBERMINE FMS and OFT systems
- Wide variety of course topics: Machine introduction, roles and responsibilities, standard operating procedures, occupational health and safety, production techniques and machine operation in emergency situations

> Operator Familiarisation Trainer (OFT)

- Familiarises operators with new equipment
- Identification and basic operation of the instruments and controls of a specific machine type
- Utilises interchangeable CYBERMINE vehicle cabs
- Fully adjustable touch-sensitive HD screen
- Exploration, Training and Evaluation modes of operation
- Video and audio feedback to the trainee

> Full Mission Simulator (FMS)

- High fidelity simulation for comprehensive operator training
- High resolution projected displays with 270° or 360° field of view
- Utilises interchangeable CYBERMINE vehicle cabs
- Active force feedback steering (as required)
- 6DOF or 3DOF motion platforms
- Spacious instructor station with dual HD screens
- Single base unit provides both surface and underground vehicle simulation
- Containerised or fixed facility units

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