

CM Labs Dozer Training Pack Instructor Guide

1.2

June 11, 2019

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Welcome

The Vortex Dozer Simulator lets students and experienced operators practice safe techniques for dozer operation. Guided exercises give students experience spreading material, production dozing, creating an access road, and moving the dozer on and off of different trailers. Students can become familiar with controls and practice for certification exams with no risk to equipment or personnel.



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Intended Audience

This Guide is intended for instructors of heavy equipment training programs who will supervise students as they use the simulator to learn and enhance operating skills.

Instructors should have some experience operating construction equipment and basic knowledge of the Microsoft Windows operating system.

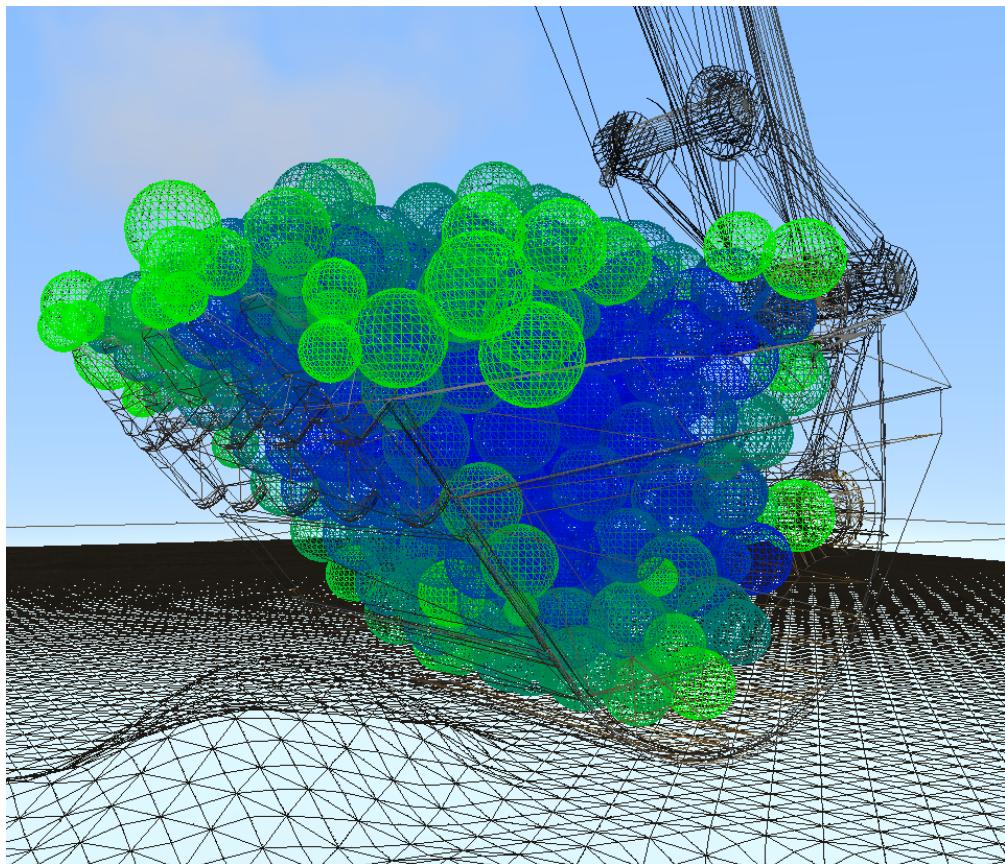
About this Guide

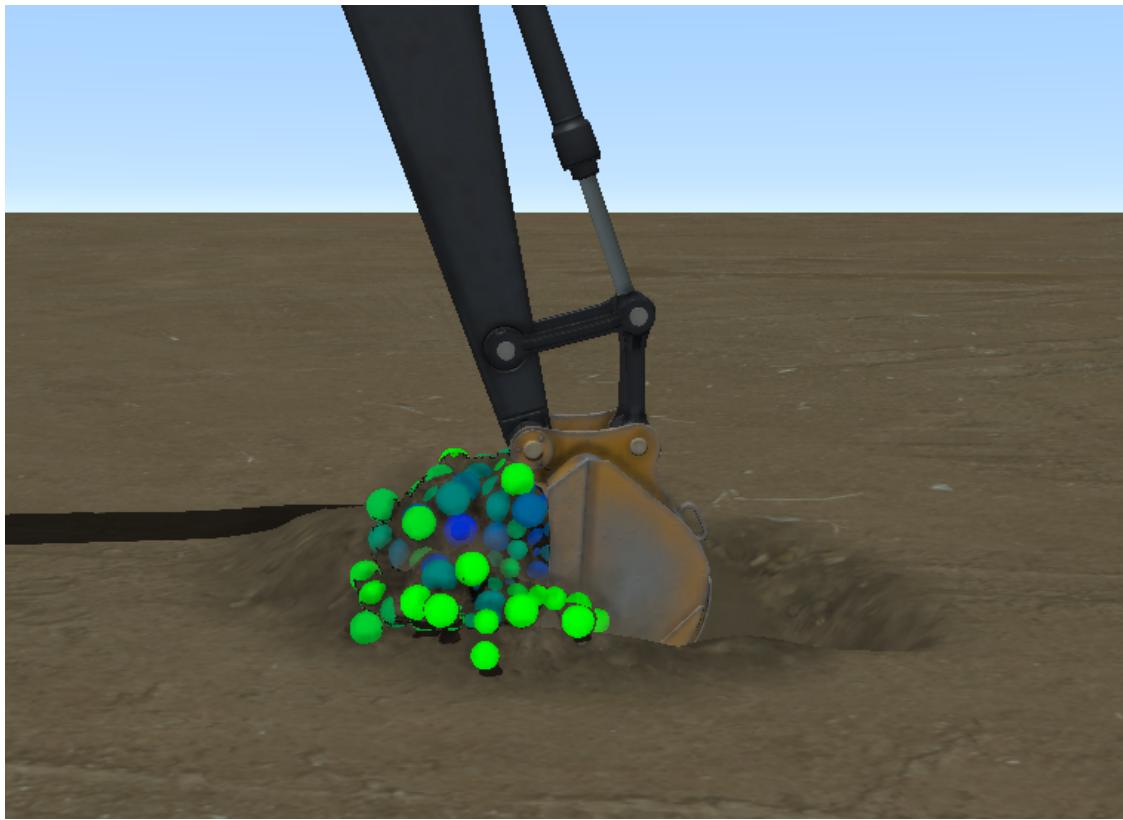
To help instructors accomplish training objectives, this Guide offers information about the following:

Section	Description
Hardware , on page 15	Describes hardware, controls, and displays you can use with this solution.
Getting Started , on page 21	Describes how to launch the Vortex software application, navigate the user interface, and start a training exercise.
Managing Accounts and System Access , on page 31	Describes how to add user accounts for students and instructors, and how to add students to classes.
Operating the Dozer , on page 43	Describes how to operate the dozer using control levers, foot pedal, and simulated controls on the touch screen.
Conducting Training Sessions , on page 63	Activities typically involved in conducting a training session, such as assigning exercises to students, modifying weather conditions, scoring values, using hand signals, and reporting.
Dozer Training Exercises , on page 83	Detailed descriptions of training exercises and learning outcomes, and information for lift planning.

Vortex Studio

Each simulator training module is developed using the Vortex Studio platform. Vortex Studio is a modular software platform that allows for the creation of extremely realistic equipment simulation, including training, visualization, planning, and prototyping. Vortex Studio simulates articulated assemblies, contacts and constraints, realistic tracked and wheeled vehicle dynamics, precise grasping of virtual artifacts, simulating digging and dumping soil, and high-fidelity cable behavior.





For more information about Vortex Studio, see [Vortex Studio User Documentation](#).

Dozer Simulation

The Vortex Dozer Simulator is designed to realistically reproduce the experience of operating a dozer with a 6-way power blade. The simulation software relies on exact specifications and collaboration with manufacturers to make sure that the dozer moves, sounds, and operates like a real dozer. The simulated excavator features a heavy duty blade, rear-camera display, realistic HMI, and 3D track animation.

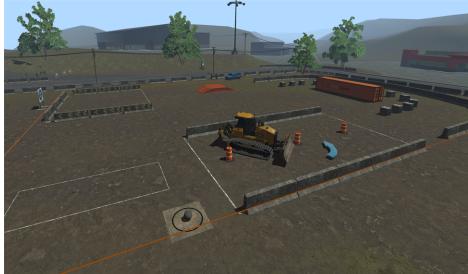


Dozer Specifications

Component	Specification
Machine Weight	22 t (24 USt)
Engine	152 kW (204 HP)
Blade Capacity	4.3 m ²

Work Environment

Dozer training exercises take place in practice areas designed to resemble environments in typical heavy equipment training schools. Operators and instructors can see shadows and light change with the time of day.

Exercise	Image	Description
Basic Controls		Practice course.
Loading and Unloading		Practice yard with a detached lowboy trailer.
Production Dozing		Practice yard with area dedicated to excavation and grading activities.
Material Spreading		Practice area with obstacles such as a curb and manhole where the operator can practice moving and leveling material.

Exercise	Image	Description
Access Road		Practice area where the operator can grade material to specifications consistent with an access road.
Sandbox		Practice yard with different areas for grading a drainage inlet, creating a transversal ditch. There are also courses for practicing steering and turns, and another course for pushing a concrete ball with the blade.

Learning Program

Training exercises are designed to gradually build student skills and confidence in critical areas of competency:

- Working safely around hazards, using caution in blind spots
- Using controls to steer the dozer and move the blade with accuracy
- Setting the correct blade angle
- Using the blade to move and grade material
- Excavating and grading a drainage inlet
- Excavating a transversal ditch
- Moving the dozer on and off of a trailer

Safety Features

Learning to recognize and react safely to unsafe conditions is a critical part of operator training. The following features are designed to help operators learn safe operating procedures:

Tips and Instructions

Before each exercise begins, the tips tell the operator how to complete tasks safely. Safety tips use animations to show operators best practices give specific instructions on how to operate the dozer safely.

Activity	Safety Guidance
Looking for hazards in the work site	Before you start to do work, look for hazards in the work site. Always operate equipment as far as possible from fire hydrants, power lines, and other persons.
Using caution in blind spots	Know where your blind spots are and use extra caution when you operate the dozer in areas outside your field of vision.
Moving over the tipping point	When the dozer moves over the ramp, the tipping point is under the equipment center of gravity, aligned with the pedals. To minimize the force of tracks landing on the ground, reduce speed and turn slightly.
Extending the service life of undercarriage components	Using three-point turns extends the service life of undercarriage components. Turn in small, gradual increments to reduce wear on undercarriage components and track pads.

Safety Violations

The system records important safety violations during each exercise. When Critical safety violations occur, the system automatically ends the exercise and assigns the operator a failing score.

Safety Violation	Description
Vehicle Flip Over	If the dozer tips over for any reason, the system stops the simulation immediately and the operator earns a failing score.
Human Contact	If any part of the dozer touches a person in the work site, the system stops the simulation immediately and operator earns a failing score.
Contact with Power Line	If any part of the dozer touches a power line or electric cable, the system stops the simulation immediately and the operator earns a failing score.
Safe Parking Position	The system records how many times the operator turns off the engine without making sure equipment is level and positioning the blade on correctly. The value appears in any reports the instructor generates for the session.

Evaluation and Assessment

To help instructors monitor student progress and ability, the system records measurements for several key performance metrics.

At the end of each training session, instructors can generate reports which detail how the operator performed in these areas:

- The number of tasks the operator completed, and the completion time for each task.
- How productive the operator was (quantity of mass the operator moved, cycle time, blade capacity, fuel consumption).
- The quality of the work (the grade of trenches the operator digs, track slippage, whether material is left over a manhole or curb).
- How safely the operator performed tasks (collisions, safety violations).

For more information about ways instructors can monitor student progress, see **Monitoring Performance**, on page 74.





Hardware

All Vortex simulators feature realistic work sites and equipment simulation. Each simulator includes physical operator controls, a main display for showing the view from the operator cab, and a simulated Human Machine Interface displayed on a secondary display.

For a more immersive training experience, some simulators feature an operator seat with a motion platform and a separate touch-sensitive screen showing simulated controls.

Vortex Advantage Hardware Platforms

Vortex Advantage simulator systems feature enclosed computers which run Vortex software. Each simulator includes an operator seat with a motion platform and an LCD touch-sensitive screen which shows simulated controls and engine information.

Display Configuration

Simulator System

1-display



3-display



5-display



Vortex Edge Plus

The Vortex Edge Plus configuration uses a support that fits onto a table or desk. Attached to the support are the vertical monitor, the physical controls, and a laptop which runs simulator software and shows simulated controls.



The Vortex Edge Plus simulator can be easily transported and installed on classroom desktops or trade and job fair booths in minutes. All components, from the configurable pedals to the operator controls and workstation-class laptop, can be ergonomically positioned for optimal trainee comfort.



Vortex Edge

The Vortex Edge laptop simulator is a compact training tool that allows construction equipment operator trainers to deploy virtual equipment in classrooms, in order to demonstrate machine components, safe operator practices, and equipment behavior.



It can be transported in a single carrying case. The laptop is designed to plug into classroom displays or projectors, or operated as is, out of the box. The Vortex Edge runs on the same engineering-grade simulation that powers the larger Vortex simulators used by training schools.





Getting Started

Getting started on the simulator involves the following activities:

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Launching the Simulator Application

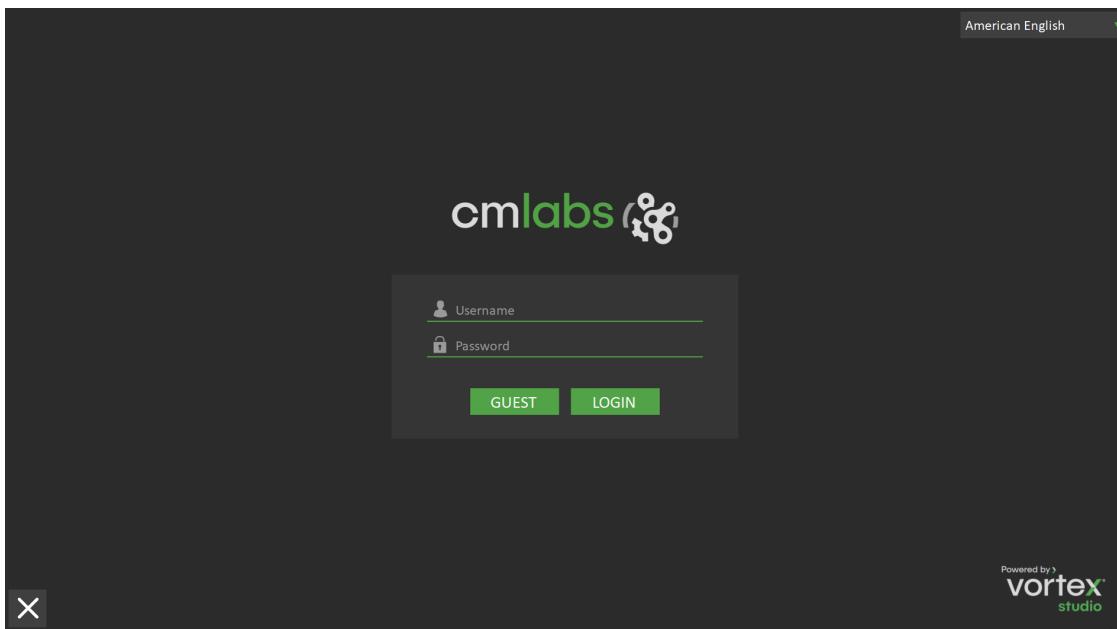
Launching the simulator application involves choosing the correct desktop icon and selecting a training module.

Depending on the training modules installed on the simulator, the desktop icons for launching the simulator software may be different:

Desktop Icon	Supported Training Modules
	Click to launch simulation software.

Logging On for the First Time

Before you log into the system for the first time, ensure you know the valid user name and password for your user account. Ask the person who set up your training solution for information about your account if you do not know your user name and password.



Important: Because the default password for the system administrator account is not private, we strongly recommend that you change your password the first time you log into the system.

Using the System Guest Account

Anyone can use the simulator without system reporting features for performance metrics. For example, an operator may want to test the simulator without negatively contributing to performance reports the system generates for his user account. To conduct anonymous training sessions, you can log into the system using the guest account.

Users logged into the system as guest can conduct training exercises and view performance metrics for training exercises, but have no access to the instructor

menu, student account information, or class information. When you log out of the system from the guest account, the system records no information on training exercises completed during the session.

Default System Credentials

The Vortex application is pre-configured with a default Administrator account. As part of preparing the system for other users, the Administrator can log on using the default account to create accounts for any instructors or users who will use the system.

Default User name	Default Password
admin	admin

Important: For security purposes, we strongly recommend that you change the password for the default Administrator account when you log in to the system for the first time.

For information about changing your password, see **Resetting Passwords**, on page 38.

Starting a Training Exercise

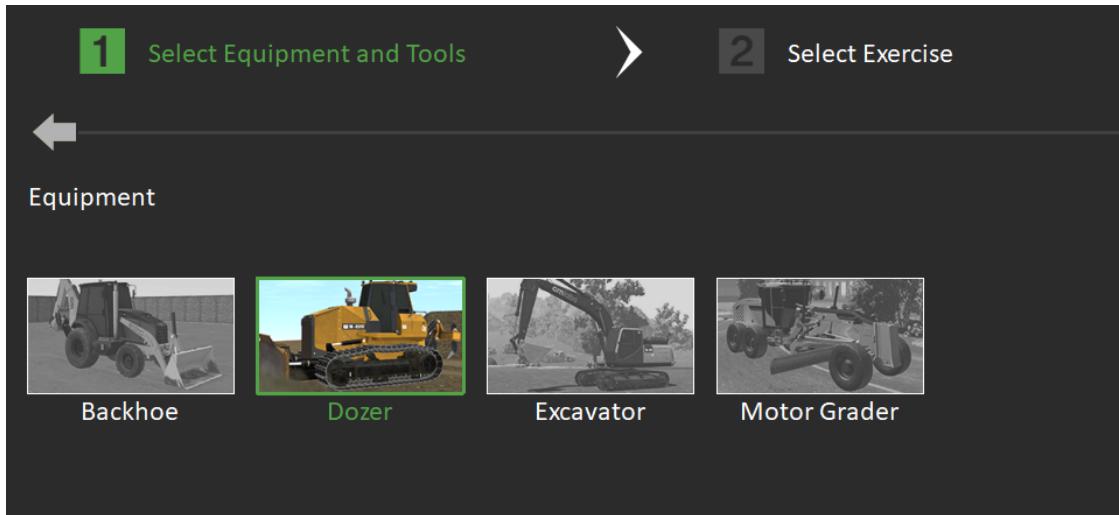
The user interface is designed to help instructors conduct training exercises and monitor performance metrics in real time. Starting a training exercise typically involves the following activities:

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Selecting an Equipment Simulation

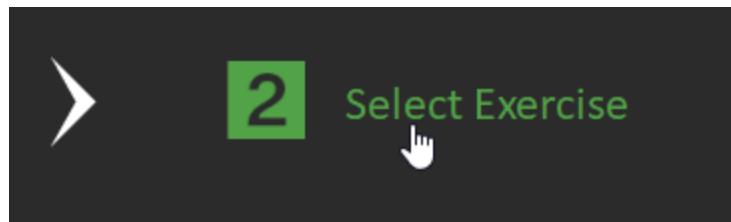
When the Vortex application launches, system shows the available equipment training modules:

Your particular training modules may differ.



Do the following:

1. Click **Dozer**.
2. Click **Select Exercise**.



Selecting a Training Exercise

Once you select an equipment training module and click the next button, available exercises for the equipment training module appear:

Depending on the equipment training module, training exercises differ.



To select a training exercise, click the exercise you want to run and then click the **Load** button.

Once the exercise loads and is ready, press the **Horn** button on the joystick or controller to begin.

Customizing the Report Logo

By default, when you generate system reports following a training exercise, CM Labs Vortex logo is displayed in the upper left corner by default.

To use your own corporate logo, you can specify the image file the system uses for reports.

Saving a new logo image file

The image the system uses as the logo on reports is named *companyLogo* and is stored in the following directory:

```
<drive>\<cmlabs_installation_folder>\Reports
```

Example: C:\CM_Labs\Reports

The system supports only **PNG** or **SVG** image formats. Any image you use will be scaled to fit the report automatically.

To specify a new logo image file, do the following:

1. Locate the logo file you want to use for reports. The file must have a .png or .svg extension.
2. Rename the file *companyLogo.png* or *companyLogo.svg* (depending on the format of the image).

NOTE: Do not replace *comanlyLogo* with the name of your company. The literal name of the file must be *companyLogo.png* or *companyLogo.svg*.

3. Save the new logo in the CM_Labs\Reports folder.

Any reports you generate now should display the new logo image. If you do not specify a file, the system uses the CM Labs logo file saved in installation files.

If you install a new version of simulator software you will need to specify the file again.





Managing Accounts and System Access

Before beginning training activities, a system Administrator must set up the system with accounts for students and instructors, and groupings for classes.

Name	Class	Company	Active	Classes	Company	Status
Ned Dozer	Excavator - Beginner	Safer Operator Training	Active	Dozer		
Jerry Seinfeld	Instructors	Yankee Construction	Active			
Susan Ross		J Peterman Enterprises	Active			
Jacapo Peterman	Motor Grader	Cosmic Heavy Equipment	Active			
Ruth Cohen	Dozer		Active			
Administrator			Active			
Elaine Benes	Instructors, Motor Grader, Excav...	Safer Operator Training	Active			
Norbert Newman	Excavator - Beginner	Better Building Construction	Active			
Frank Costanza	Motor Grader	Better Building Construction	Active			
George Costanza	Excavator - Beginner	Yankee Construction	Active			
George Steinbrenner	Motor Grader	Yankee Construction	Active			
Cosmo Kramer	Motor Grader	Cosmic Heavy Equipment	Active			

Administrators can also customize scoring settings the system uses to evaluate students at the end of the exercise, and add a custom logo to appear in any PDF reports.

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Account Management

System administrators create accounts for any students or instructors who will use the system. For each account, the system can show records of any training exercises and whether or not the student passed or failed.

At the end of each exercise, the system can generate performance reports showing the student and instructor names.

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User Roles

The training simulator is designed to support multiple types of users. The role associated with each account reflects the responsibilities you have on the simulator.

User Role	Permissions
Administrator	Responsible for setting up the system for regular use by instructors and students. The administrator should add at least one instructor account, and can customize scoring and report settings.
Instructor	Responsible for managing students and classes. The instructor can add accounts for students and group them in classes. While operators use the simulator to complete training exercises, the instructor monitors their performance and gives feedback during training exercises. Instructors can also generate performance reports.
Student	Uses the simulator to complete training exercises and become a better operator. As the student works through each exercise, the system scores performance and records metrics for the student and instructor to review together.
Guest	Can explore exercise environments and use controls anonymously. The system does not record scores or metrics for Guest sessions.

Creating a New Account

The system identifies instructors and students in the system with unique user names. Each user must have a valid user name and password to log into the system. You can enter other identifying attributes for each user to make search more convenient.

When you create a new account, the system prompts you for the following information:

Attribute	Description	Example
User Name	A combination of letters, numbers, or both which uniquely identify the user in the system. Instructors and students must type their user names every time they log into the system.	jsmith
Full Name	The user's given name and surname. This name will be displayed throughout the user interface and on any performance reports for the user.	Jane Smith
Password	The password the user can use to access the system.	\$Chang3Me!
Type	<p>The type of user account. Choose from the following:</p> <ul style="list-style-type: none">■ Student■ Instructor■ Administrator <p>Note: Only administrators can create administrator accounts. Instructors can create other Instructor and Student accounts. cannot create new accounts in the system.</p>	Student
Company	The name of the company or organization the user account is associated with. It can be useful to sort user accounts by company.	MyCompany

Attribute	Description	Example
User ID	Any other identifying information for the user. For example, a birthday or employee ID. User ID is helpful if you know you will want to search for user accounts with a unique identifier other than User Name .	19840408

Add a New Account

Add an account for each student and instructor who will use the simulator. For each account, the system records every training session and records performance metrics which you can review in the form of reports.

NOTE: Only system Administrators and Instructors can create new accounts in the system. Choose a password that you can remember for new accounts.

Students and instructors must know their user name and password before they log on to the system.

To add a new student account, do the following:

1. On the side menu, click Instructor and then click **Students**.
The system displays a list detailing all existing user accounts.
2. On the Action menu, click **Create User**.

A window for adding a new account opens.

Name	Class	Company	Status
Gerald Seinfeld	Instructors, Dozer	Safer Operator Training	Active
Susan Ross	Dozer	Yankee Construction	Active
Jacapo Peterman			Active
Ruth Cohen			Active
Administrator			Active
Elaine Benes			Active
Norbert Newman			Active
Frank Costanza			Active
George Costanza			Active
George Steinbrenner			Active
Cosmo Kramer			Active

3. In the new account window, do the following:
 - a. In the **User Name** text box, type a unique identifier for the user. Users need to use the User Name each time they log into the system.
 - b. In the Full Name text box, type the user's full name.
 - c. In the Type drop-down list, click to select the type of account you want to create (**Student** or **Instructor**).
 - d. Do one of the following:
 - To activate the account immediately, select the **Active** check box.
 - To leave the account inactive after you create it, clear the **Active** check box.
 - e. In the **Password** box text box, type a password for the new user account.
 - f. In the **Confirm Password** text box, confirm the password.
 - g. In the **Company** text box, type the name of the company the user works for.
 - h. In the **User ID** text box, type other identifying information about the user.
 - i. Click **Create**.

The new account appears in the list of all users.

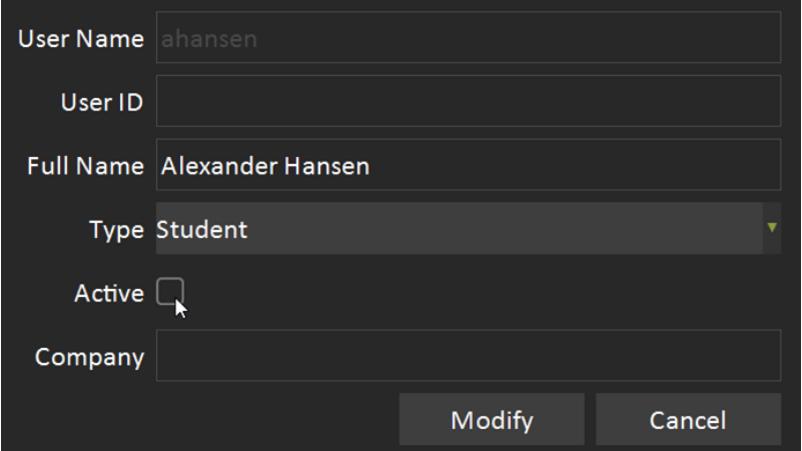
Deactivating User Accounts

By default, user accounts you create in the system are active. When a user is no longer active, you can deactivate their account to prevent them from accessing the system.

Note: To deactivate a user account, you must be logged into the system as an Administrator.

To deactivate a user account, from the instructor station, do the following:

1. On the side menu, click the **Instructor** tab and then click **Students**.
2. In the list of students, click on the user account you want to deactivate.
3. Click the **Action** menu and then click **Modify User**.
4. To disable the account, in the **Active** field, click to clear the check box.



The screenshot shows a dark-themed 'Modify User' dialog box. It contains the following fields:

- User Name: ahansen
- User ID: (empty)
- Full Name: Alexander Hansen
- Type: Student
- Active: A checkbox that is currently checked (indicated by a small square with a dot).
- Company: (empty)

At the bottom right of the dialog are two buttons: 'Modify' and 'Cancel'. A cursor arrow is pointing towards the 'Active' checkbox.

5. Click **Modify**.

In the list of students, the system now shows the status of the user account as **Disabled**.

Resetting Passwords

Your role determines your privileges in the user interface. Only users with Administrator or Instructor roles can reset passwords for other user accounts. All users can reset their own passwords at any time.

User Role	Privileges
Administrator	Can create Administrator, Instructor, and Student accounts and reset passwords for all other users.
Instructor	Can create Instructor and Student accounts, and reset passwords for Instructor and Student accounts.
Student	Cannot create accounts, and can only change their own passwords.

To Reset the Password for a Different Account

Before you can reset the password for a different user, you must be logged in with a valid Administrator or Instructor account.

Note: Only Administrators can reset the password for other Administrator accounts.

From the instructor station, do the following:

1. On the side menu, click **Instructor** and then click **Students**.
2. In the list of accounts, click to select the user account you want to modify.
3. Click the **Action** menu and then click **Reset Password**.

A dialog box for resetting the password appears.

4. In the **New Password** text box, type a new password for the user account.
5. In the **Confirm New Password** text box, confirm the new password.
6. Click **OK**.

The password for the account is changed.

Change Your Password

Before changing your password, you must be logged in with a valid user account.

Note: If you do not know your password, you must contact a system Administrator or Instructor to reset it for you.

From the user interface, do the following:

1. In the upper left of the screen, click on your user name.
2. Click **Change Password**.
A dialog box appears.
3. In the **Old Password** text box, type the current password for your account.
4. In the **New Password** text box, type a new password for the user account.
5. In the **Confirm New Password** text box, confirm the new password.
6. Click **OK**.

Your password is changed.

Class Management

The system is designed as a training tool which you can use to manage multiple classes of students. The Vortex student database lets the instructor group students into classes. Once students are grouped into classes, the instructor can generate separate reports for each class.

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Creating a New Class

Setting up a new class involves creating a new class entity in the system and then adding student accounts to it.

To set up a new class, from the instructor station, do the following:

1. On the side menu, click **Instructor** and then click **Manage Class**.
2. On the **Action** menu, click **Create Class**.
3. In the **Enter new class name** text box, type a name for the class. This name identifies the class throughout the user interface. For example, type **Summer 2018**.
4. Click **Create**.

The new class name appears above the **Class** list.

5. To add a student to the class, select the student's name in the **Users** list, then click the arrow button to add it to the **Class** list for the new class.

In the **Users** list, in the row for the student, the **Classes** column now shows the new class name.

Deleting Classes

If you create a class by mistake, or would like to retire a class label, you can delete it from the **Manage Classes** page.

The screenshot shows a user interface for managing classes. On the left, there's a sidebar with icons for Michael Scott (Administrator), Exercise Running (Crawler Crane), Instructor, Students, and Manage Class. The main area has two tabs: 'Users' and 'Class'. Under 'Users', there's a table with columns: Name, Company, and Classes. The 'Classes' column contains a dropdown menu with options like '2018-Fall', '2018-Summer', etc. Under 'Class', there's another table with columns: Name, Company, and Actions. The 'Actions' column includes a 'Delete Class' button. A large green box highlights the 'Delete Class' button. To the right of the tables are two arrows: a right-pointing arrow above a left-pointing arrow, indicating a transition between the two sections.

To delete a class, from the instructor station, do the following:

1. On the side menu, click **Instructor** and then click **Manage Class**.
2. Under the **Class** section, in the **Class** filter box, click to select the class you want to delete.
3. On the **Action** menu, click **Delete Class**.
4. In the confirmation window, click **Yes**.
5. The class is deleted and the students who were previously grouped into the class you deleted still appear in the list of **Users**, but they are no longer associated with the class you deleted.

This screenshot shows the 'Manage Classes' page with the 'Class' tab selected. The 'Class' filter box at the top right contains the options '2018-Spring' and '2018-Summer'. The main area has two tables: 'Users' and 'Class'. The 'Users' table lists various students with their names, companies, and classes. The 'Class' table lists the same students, but their 'Classes' column is empty, indicating they have been removed from any class. A large green box highlights the 'Delete Class' button in the 'Actions' column of the 'Class' table. To the right of the tables are two arrows: a right-pointing arrow above a left-pointing arrow, indicating a transition between the two sections.



Operating the Dozer

The operator uses physical and simulated controls to operate the dozer during training exercises. Depending on your simulator solution, the controls you use to operate the dozer can differ.

The system Human Machine Interface (HMI) and is simulated on a touch-sensitive screen near the operator seat. Instructors can see simulated controls from the instructor desktop on the **Operator Controls** page. There are also controls for changing the operator's point-of-view in the work site, exiting the dozer cab, and turning on the Grade Quality Sensor display.

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Controls (Vortex Advantage Simulator)

Vortex Advantage simulators typically include control levers and foot pedals to operate equipment during exercises.



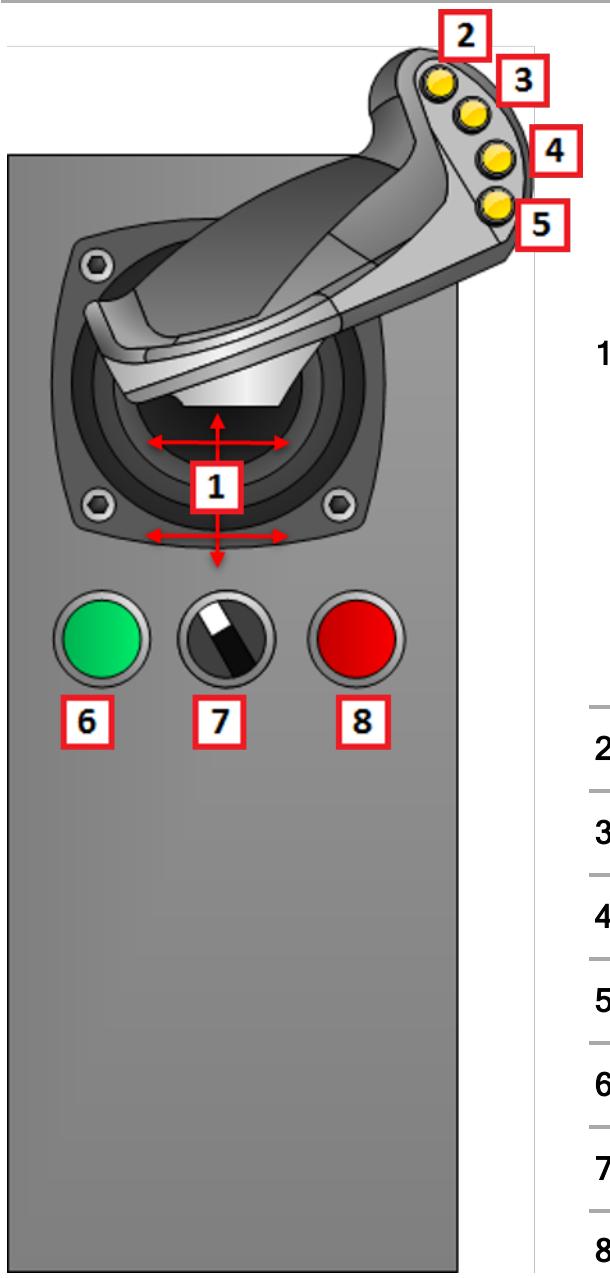
Control Levers	45
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Control Levers

The operator uses control levers to operate the blade, drive, and steer.

Left Control Lever and Buttons

The left control lever controls steering, travel direction, and transmission.



Control lever:

- To **move forward**, push the lever completely forward.
- To **reverse**, pull the lever completely back.
- To **turn**, in forward or reverse, move the lever in the direction you want to turn. If you move the control more than 80% in either direction, the dozer begins to **counter-rotate tracks** (for a tighter turn).

1

2

No function

3

Horn

4

Gear up

5

Gear down

6

Start/Stop engine

7

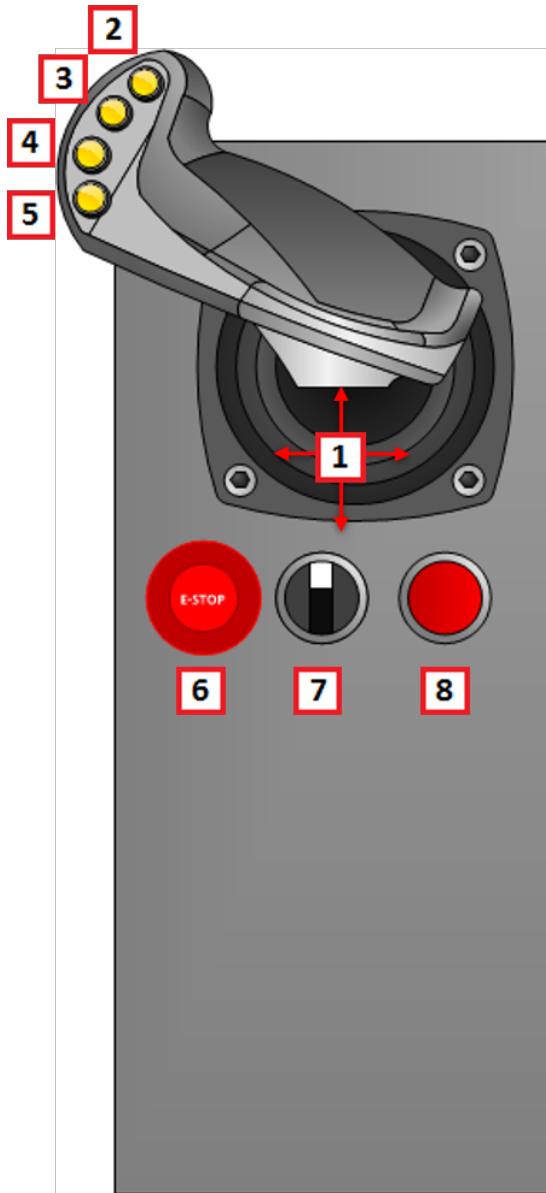
No function

8

No function

Right Control Lever and Buttons

The right control lever controls the blade.



- To **lower the blade**, push control forward.
- To **raise the blade**, pull control back.
- To **tilt the blade left**, move control left.
- To **tilt the blade right**, move control right.
- To **float the blade**, push the lever forward to 100% and release to neutral.

1

2 No function

3 Blade shake

4 Blade rotate right

5 Blade rotate left

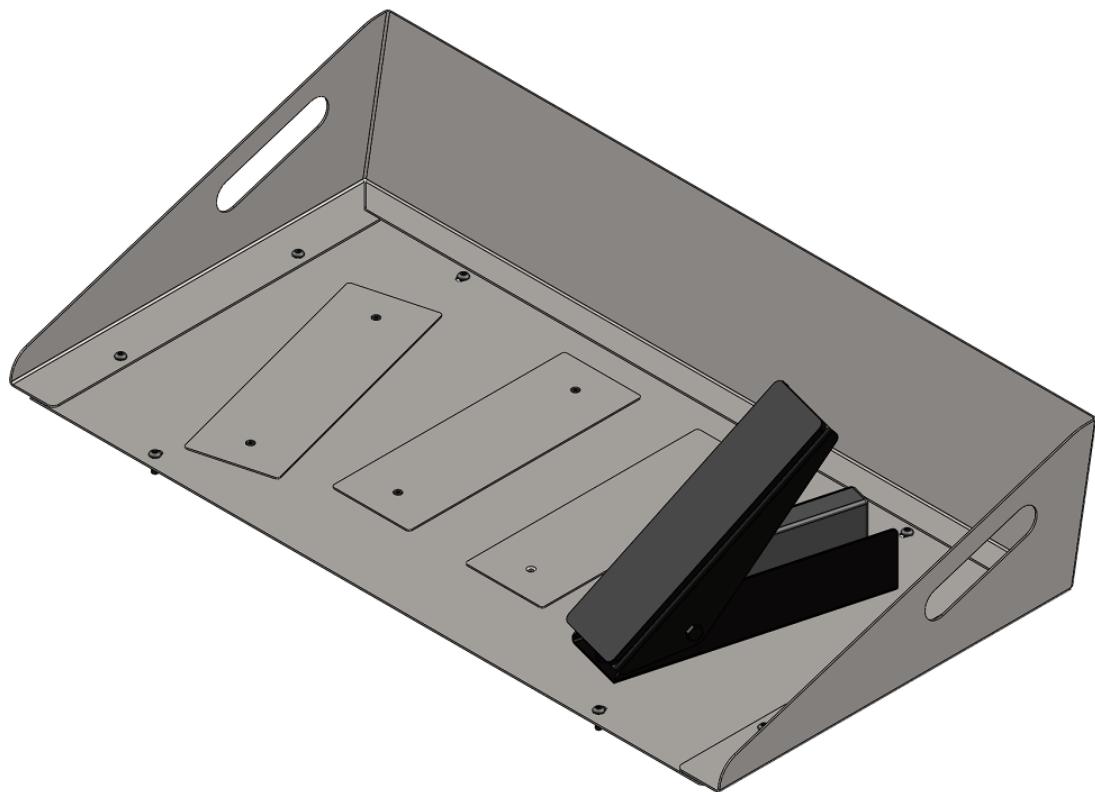
6 Emergency stop

7 No function

8 No function

Foot Pedals

The operator uses a foot pedal to brake or decelerate.



Controls (Vortex Edge Plus Simulator)

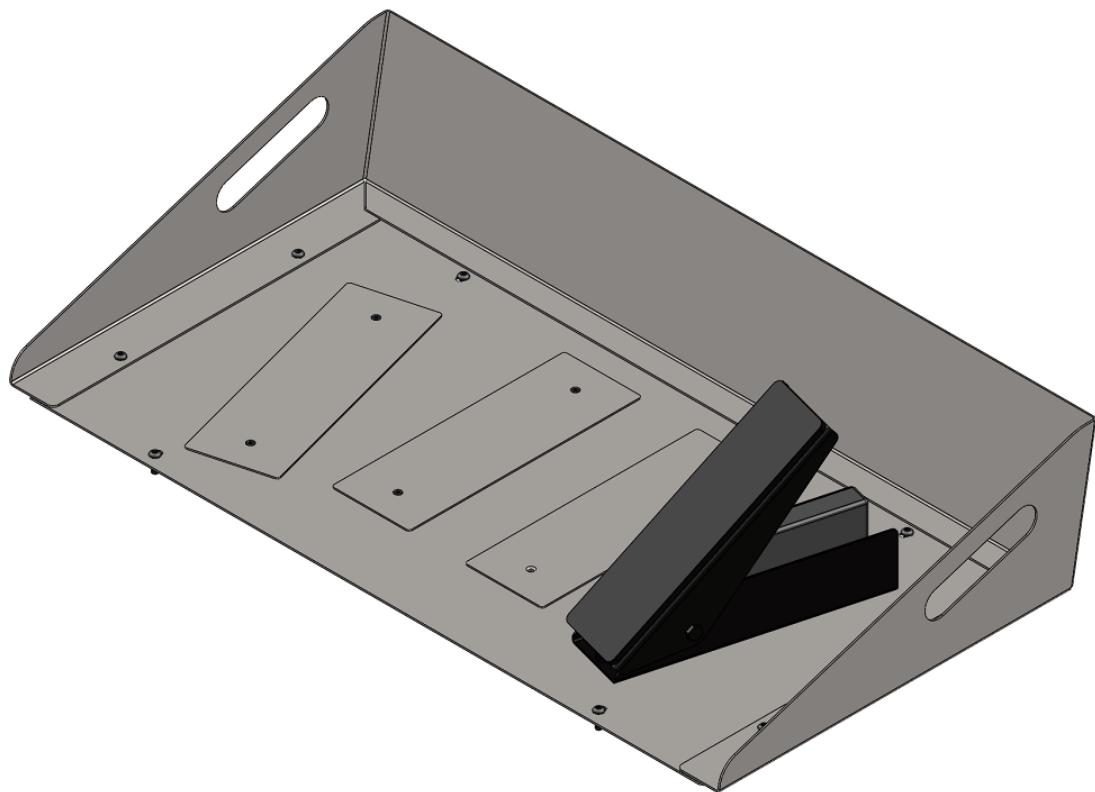
Vortex Edge Plus simulators typically include joysticks and foot pedals to operate equipment during exercises.



Foot Pedals	49
Joysticks	50

Foot Pedals

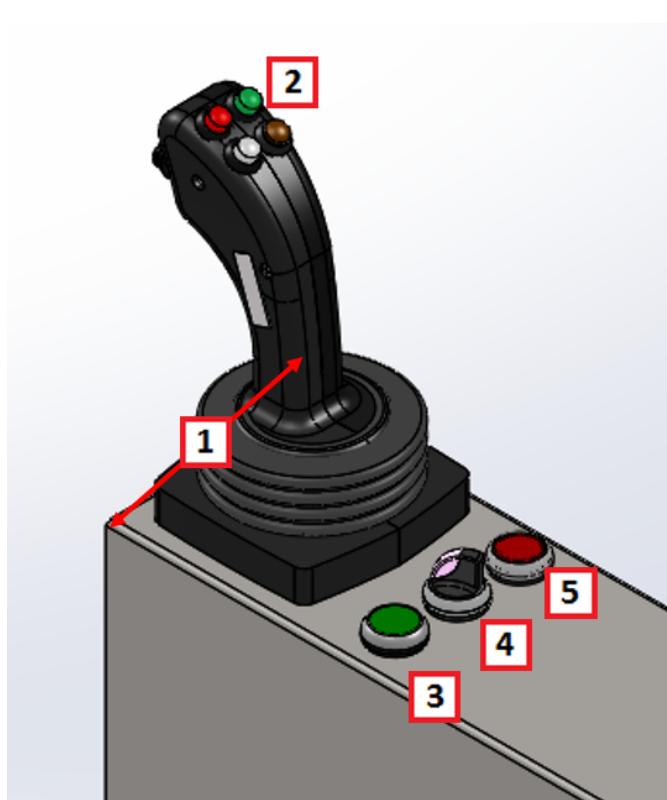
The operator uses a foot pedal to brake or decelerate.



Joysticks

Joysticks supplied with the Vortex Edge Plus simulator function as follows:

Left Joystick



Joystick:

To **turn**, in forward or reverse, move the lever in the direction you want to turn. If you move the control more than 80% in either direction, the dozer begins to **counter-rotate tracks** (for a tighter turn).

Joystick Buttons:

- Upper left (red): **increase gear**
- Lower left (white): **decrease gear**
- Upper right (green): **forward**
- Lower right (orange): **reverse**
- Front left (black): **horn**

3 Start/Stop Engine

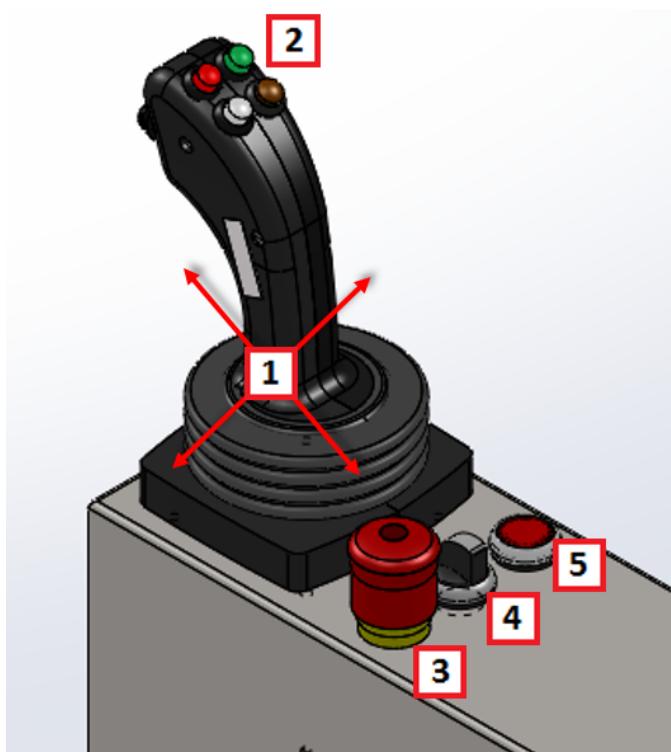
4 No function

5 No function

Right Joystick

Joystick:

- To lower the blade, push control forward
- To raise the blade, pull control back
- To tilt the blade left, move control left
- To tilt the blade right, move control right
- To float the blade, push the lever forward to 100% and release to neutral



1

2

Joystick Buttons:

- Lower left (white): blade rotate left
- Lower right (orange): blade rotate right
- Upper right (green): blade shake

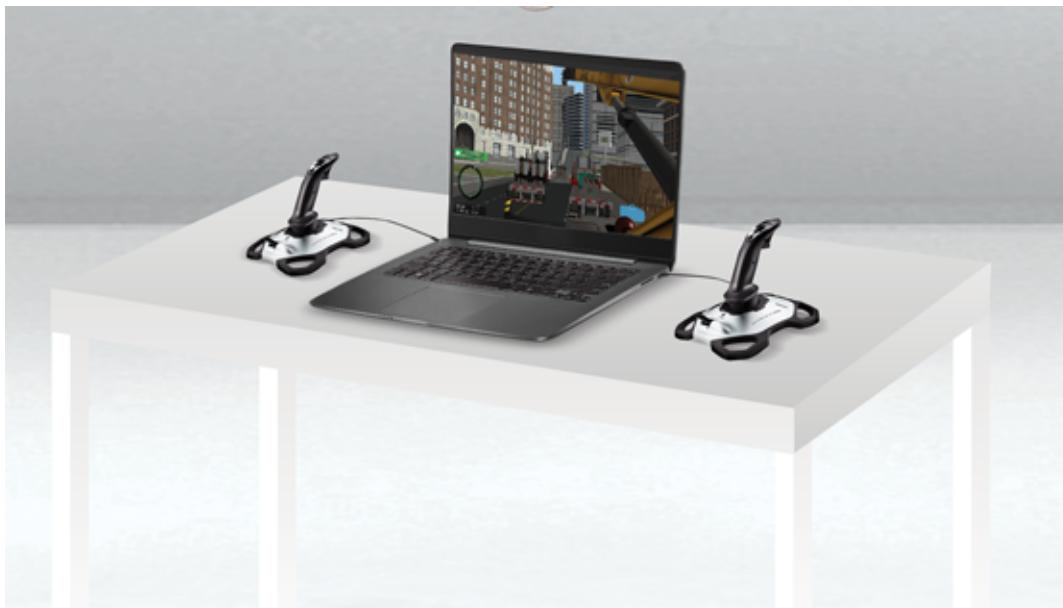
3 Emergency Stop

4 No function

5 No function

Controls (Vortex Edge Laptop Simulator)

For simulations running on the Vortex Edge Laptop simulator, the operator uses USB joysticks and a gamepad controller to operate equipment during the exercise.

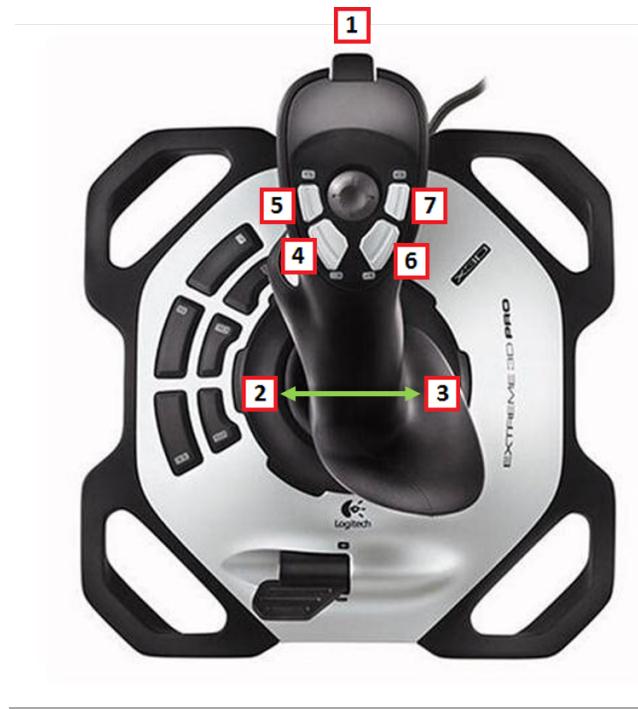


USB Joysticks	53
Gamepad Controller	55

USB Joysticks

Joysticks function as follows:

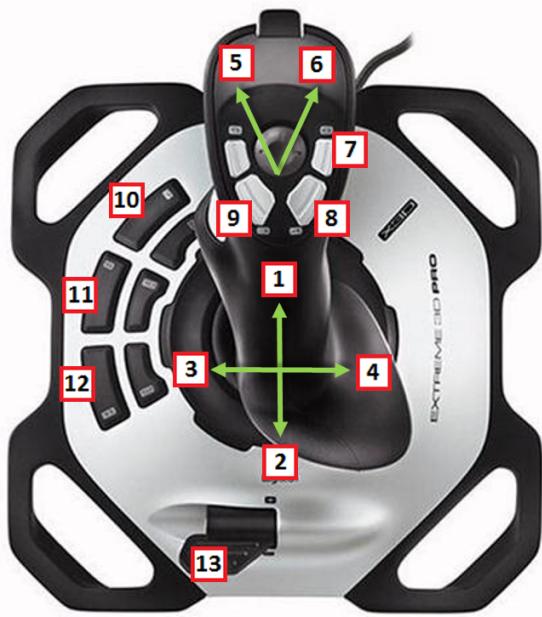
Left Joystick Functions



Controls

- | | |
|---|---------------|
| 1 | Horn |
| 2 | Turn Left |
| 3 | Turn Right |
| 4 | Decrease Gear |
| 5 | Increase Gear |
| 6 | Reverse |
| 7 | Forward |

Right Joystick Functions



Controls

- | | |
|----|---------------------|
| 1 | Blade Down |
| 2 | Blade Up |
| 3 | Tilt Left |
| 4 | Tilt Right |
| 5 | Blade Angle Left |
| 6 | Blade Angle Right |
| 7 | Increase RPM |
| 8 | Decrease RPM |
| 9 | Blade Shake |
| 10 | Exit Cabin |
| 11 | Park Brake |
| 12 | Start/Stop |
| 13 | Decelerator / Brake |

Gamepad Controller

You can use a gamepad controller in the following ways during the simulation:

Operating the Dozer



Instructor Beholder Mode



Instructor Avatar Mode

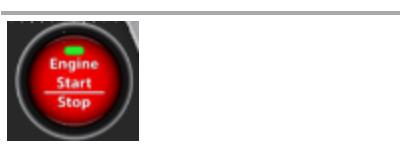


Simulated Dozer Controls and HMI

The **Operator Controls** page shows switches for various operating modes, and an HMI which displays engine information.



Control	Description
	LCD status display Shows status information about the engine and working mode.

Control	Description
	<p>Operator POV controls</p> <p>Controls for changing the operator's view from the cab. Buttons let the operator program views.</p>
	<p>Engine Start and Stop</p> <p>Press to start and stop the engine.</p>
	<p>Parking Brake</p> <p>Use switch to engage and disengage the parking brake.</p>
	<p>Hydraulic Lock</p> <p>Use switch to lock or unlock hydraulic functions.</p>
	<p>Decelerator Mode</p> <p>Use switch to make Decelerator mode come on or off.</p> <p>When Decelerator mode is ON, the system maintains engine speed when the operator presses the brake pedal. Transmission decreases but the level of RPM remains constant.</p> <p>When Decelerator mode is OFF, pressing the brake pedal decreases the transmission speed and the engine speed.</p>

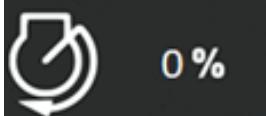
Control	Description
 A black rectangular switch with a small orange icon of a leaf and the word "ECO" below it.	<p>Eco Mode</p> <p>Use switch to make ECO Mode come on and off.</p>
 A black rectangular switch with a small orange icon of a person walking and the letters "A/I" below it.	<p>Auto-Idle</p> <p>Use switch to make Auto-Idle Mode come ON and OFF.</p> <p>In Auto-Idle Mode, the engine automatically returns to Idle when the machine is not moving and hydraulics are not engaged.</p>
 A black rectangular switch with a small orange icon of a light bulb and horizontal lines below it.	<p>Working Lights</p> <p>Use switch to make working lights come on and off.</p>
 A black rectangular switch with a small orange icon of a gear and horizontal lines below it.	<p>Reverse Ratio</p> <p>Use switch to set the reverse speed ratio. The switch has three settings:</p> <ul style="list-style-type: none"> ■ Reverse speed ratio of 100% ■ Reverse speed ratio of 115% ■ Reverse speed ratio of 130%
 A black rectangular switch with a small orange icon of a battery and plus/minus signs above it.	<p>RPM</p> <p>Use switch to increase or decrease engine RPM.</p>
 A circular button with a black icon of a person walking down a path.	<p>Exit Cab</p> <p>Press to exit the cab of the dozer and explore the work site from the perspective of a worker walking through the site.</p>

Control	Description	
	Grade Quality Sensor	Press to show Grade Quality indicators on the terrain.

HMI Display



Symbol	Description	
	Parking brake indicator	Light comes on when parking brake is engaged.
	Auto idle indicator	Light comes on when Auto Idle is ON.
	Working lights indicator	Light comes on when working lights are ON.

Symbol	Description
	Decelerator mode indicator Light comes on when Decelerator mode is ON.
	Indicates transmission mode (FNR)
	Fuel tank level indicator Shows the current fuel level.
	Engine torque indicator Shows current engine torque, as a percentage.
	RPM indicator Shows current engine RPM.
	Working Mode Shows current working mode (Power, Eco, or Lifting)





Conducting Training Sessions

The Vortex Instructor interface is designed to help the instructor train operators on the simulator. Conducting a training exercise typically includes the following activities:

- Launching a training exercise from the user interface and assigning it to students.
- Customizing scoring settings.
- Modifying weather conditions in the simulated environment.
- Viewing the simulation as the operator works through challenges in the exercise.
- Triggering unexpected events from the **Faults** page.
- Evaluating operator performance as reported by metrics on the **Dashboard** page and generating reports.

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Scoring	65
Changing Weather Conditions in the Environment	71
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Evaluating and Ending the Exercise	80

Assigning an Exercise to a Student

Once an operator is seated at the simulator and ready to begin training, you can assign an exercise from the instructor station. Anyone can operate the system anonymously using the Guest account, but when you assign an exercise to an operator by name (their user account), the system records performance metrics and you can generate a detailed report with an assessment and any comments.

To assign an exercise for a specific operator to complete, from the instructor station, do the following:

1. While logged in as the Instructor, on the side menu, click **Select Exercise**.
2. Under **Equipment**, select the training module you want to launch.
3. Click **Select Exercise**.
4. Click to select the training exercise you want to assign the student.
5. Click **Select Students**.
6. In the **Users** list, double click to select the user you want to assign the training exercise to.

Note: By default, the name of the Instructor appears in the **Participants** list for each training exercise they conduct while logged in.

7. Click **Load**.

After a few moments, the exercise loads on the operator display system.

Scoring

Evaluation and assessment are an important part of operator training. The system is designed to record measurements of key performance metrics and use them to evaluate operator performance at the end of each exercise. Depending on your curriculum and training objectives, the metrics and thresholds you use to assess performance may differ from the default settings.

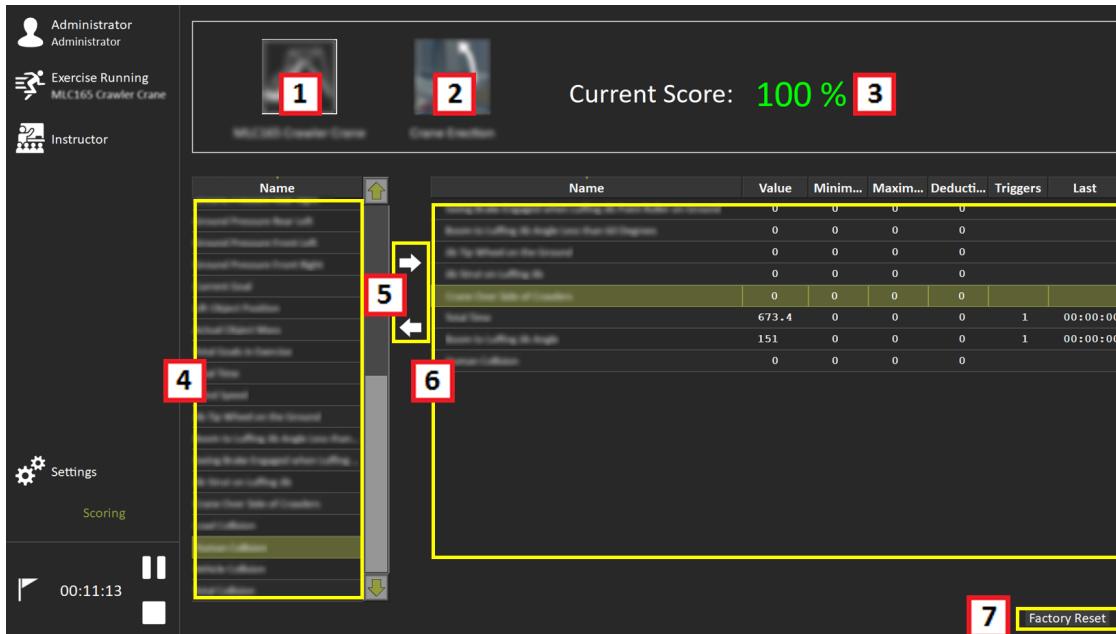
For each training exercise, the system lets you customize the metrics the system uses to score operators. From the Scoring page for any exercise, system administrators can weight each metric and specify thresholds which the operator must not exceed.

The score is displayed to the operator at the end of each training exercise. Any reports the instructor generates for the exercise also display the score. Once you customize scoring settings, the system saves your configuration for future exercises. You can revert to system settings at any time.

The Scoring Page

The **Scoring** page shows the specific metrics and thresholds the system uses to evaluate operator performance for each exercise.

The first time you view the **Scoring** page, the system shows the default settings for each metric. Once you customize scoring thresholds for a given metric, you can revert to default settings by clicking the **Factory Reset** button in the lower right of the screen.



Feature Description	Description
1 Equipment Name	Shows the name of the equipment simulation
2 Training Exercise	Shows the name of the training exercise you started.
3 Current Score	The current score, as calculated using the scoring thresholds configured in the table below.
4 Metrics	List shows the metrics the system records measurements for during the exercise.
5 Selector Arrows	Use selector arrows to add metrics you want to add scoring thresholds for to the list of configured thresholds.

Feature Description	Description
6 List of Scoring Thresholds	<p>A table shows each scoring threshold that the system currently uses to calculate the score for the exercise. Each threshold has the following attributes:</p> <ul style="list-style-type: none"> ■ A metric ■ The current measurement in the system for the metric ■ A minimum threshold for the metric ■ A maximum threshold for the metric ■ A penalty (point deduction) the system applies when the system observes values which are outside the minimum and maximum thresholds ■ The number of times the system observed values outside the thresholds. ■ The time when the system applied the last penalty.
7 Factory Reset Button	Press to return all scoring settings to system defaults.

Scoring Rules

By default, the system records measurements for many metrics, such as Collisions, Idle Time, and Fuel Consumption. You can configure scoring rules to make the system deduct points from the operator's score whenever measurements for a metric reach a specific value.

For example, you can create a rule that makes the system deduct 10 points when the operator exceeds a time limit you define.

Adding a new rule involves the following activities:

1. You use the selector arrows to add a metric to the list of configured rules.
For example, you add a rule for the **Collisions** metric.
2. You specify when you want the system to deduct points. For example, when the system observes a collision.
3. You specify how many points the system should deduct for the rule. (For example, 10 points).

For each scoring rule, the system displays the following information:

Column Head	Description
Value	The current system measurement for the metric.
Minimum	The lower limit of the threshold the system uses to assess operator performance for the metric.
Maximum	The upper limit of the threshold the system uses to assess operator performance for the metric.
Deduction	The number of percentage points the system deducts if the value for the metric exceeds the maximum limit of the threshold or is below the minimum.
Triggers	The number of times the value for the metric was outside the defined threshold.
Time	The time stamp of the last event.

Customize Scoring Rules

NOTE: Only users logged into the system with an Administrator account can modify scoring settings.

1. Log into the system using the **Administrator** account.
2. Launch the exercise you want to customize scoring settings for.
3. Press the **Horn** or **Hook** button to start the exercise.

Note: You cannot edit scoring rules until the exercise is running.

4. On the side menu, click **Settings** and then click **Scoring**.
The system displays the default scoring rules for the exercise, and the current score for the exercise.
5. In the **Name** list, click the metric you want to create a new rule for and then click the selector arrow button to move it to the list of metrics the system uses to score the exercise.
6. For each column, click to select and then enter custom values for the following:

Minimum	Type a minimum value for the threshold.
Maximum	Type a maximum value for the threshold.
Deduction	Type the number of percentage points the system will deduct if values for the metric exceed or are below the maximum and minimum values for the threshold.

The system updates the current score to reflect the updated scoring rules immediately.

7. (Optional) Select and modify other metrics as needed.

Restore Default Scoring Settings

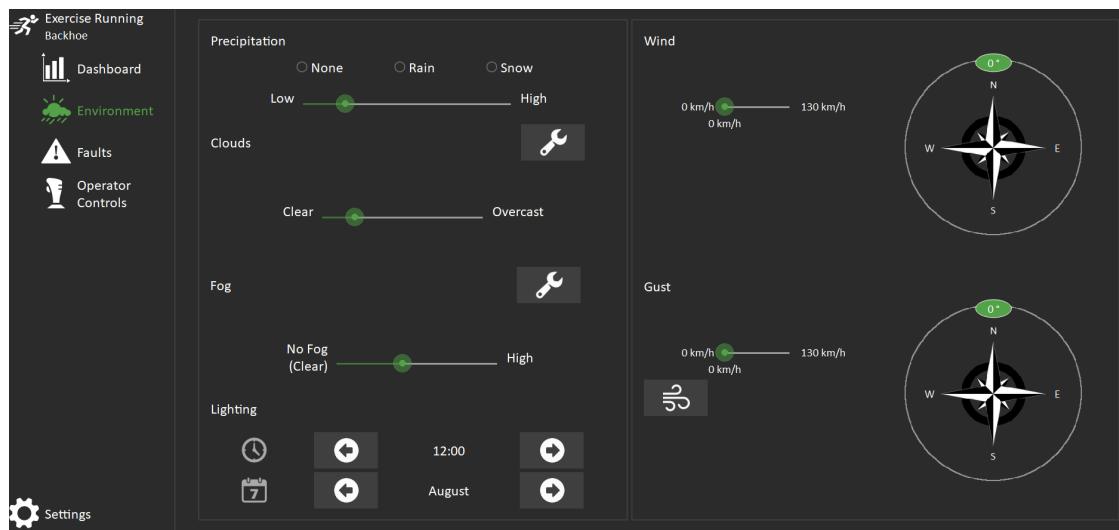
System Administrators can restore scoring settings to system defaults at any time. To reset scoring settings, do the following:

NOTE: Only users logged into the system with an Administrator account can reset Scoring settings.

1. Log into the system using the **Administrator** account.
2. Launch and start the exercise you want to reset Scoring settings for.
3. In the lower right of the screen, press the **Factory Reset** button.
Scoring values for each metric return to system defaults. The score at the top of the screen is updated at the same time.

Changing Weather Conditions in the Environment

From the **Environment** page, you can modify weather settings in the simulated environment during any training exercise.



To modify weather conditions, do the following:

1. On the side menu, **Environment**.
2. Use controls to change weather conditions in the environment. You can observe changes you make to the weather from any Instructor views of the environment.

To Increase Cloud Cover

In the **Clouds** section, do one of the following:

- To increase cloud cover in the sky, move the slider toward **Overcast**.
- To decrease cloud cover in the sky, move the slider toward **Clear**.

To Increase Fog Density

In the **Fog** section, do one of the following:

- Press the button corresponding to the fog density you want to introduce in the simulated environment.
- To adjust the fog density using a slider, press the tool button.

To Modify Wind Speed and Heading

In the **Wind** section, do any of the following:

- To increase wind speed, move the slider toward **130 km/s** (the maximum wind speed that the system supports)
- To change the wind heading, move the slider around the compass rose to the correct angle.
- To introduce a gust of wind, in the **Gust** section, use the slider and compass rose to choose a speed and heading, and then press the Gust button. The wind gust temporarily overrides wind settings.

To Make it Rain

1. In the **Precipitation** section, click **Rain**.
2. Do one of the following:
 - For heavier rain, move the slider toward **High**.
 - For lighter rain, move the slider toward **Low**.
 - To adjust rain settings using graphical buttons, press the tool button.

To Make it Snow

1. In the **Precipitation** section, click **Snow**.
2. Do one of the following:
 - For heavier snow, move the slider toward **High**.
 - For lighter snow, move the slider toward **Low**.
 - To adjust snow settings using graphical buttons, press the tool button.

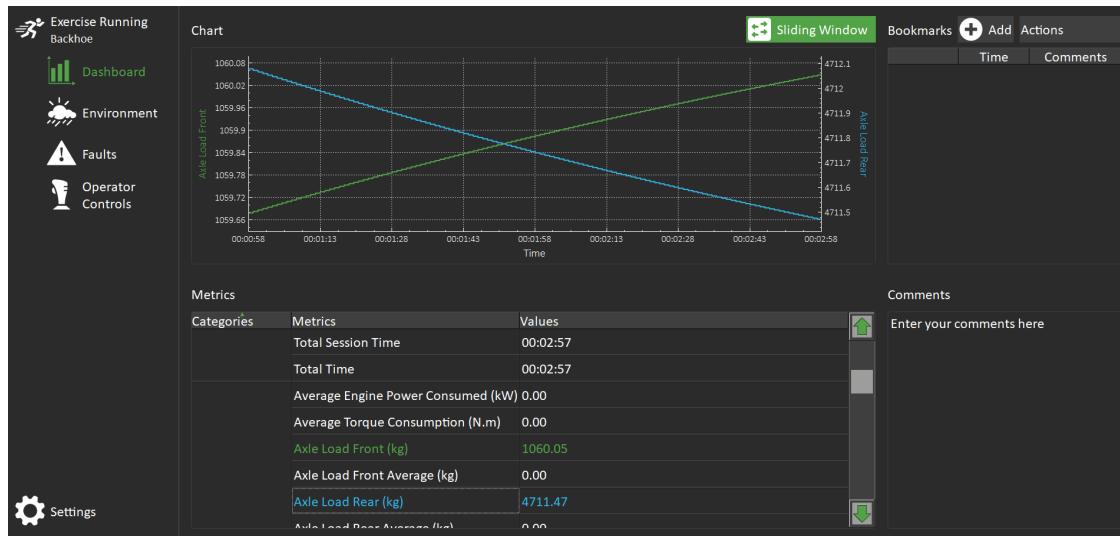
To Adjust Lighting

In the **Lighting** section, do one of the following:

- To adjust light in the simulated environment for the time of day, in the row for time use the arrow buttons to set the time.
- To adjust light in the simulated environment for the time of year, in the row for month, use the arrow buttons to set the month.

Monitoring Performance

Once a training exercise is running, the instructor console automatically displays the **Dashboard** page. From the **Dashboard** page, the instructor can monitor and assess operator performance in real-time using the charts and metrics. The instructor can also bookmark specific moments during the training exercise to give specific written feedback.



The **Dashboard** page shows multiple panes for monitoring performance and offering timely, relevant feedback.

Dashboard Pane	Description
Metrics	View various statistics for assessing performance during the training exercise. Click any metric to plot it over time in the Chart pane.
Chart	Plot any metrics you select in the Metrics pane over time. You can select up to two metrics for the system to plot on the Y-axis (The X-axis represents time). Press a metric in the list to select or deselect it.

Dashboard Pane	Description
Bookmarks	<p><i>Only available when logged into the system.</i></p> <p>Bookmark any specific time in the exercise and comment for later review. By default, the system inserts bookmarks anytime the instructor triggers a fault.</p>
Comments	<p><i>Only available when logged into the system.</i></p> <p>Type general comments for the operator to review here.</p>

Dozer Performance Metrics

During each training exercise, the system records measurements for performance metrics which the instructor can use to assess operator progress. Depending on the exercise, the system may offer different metrics.

Metric	Description
Time	The total time elapsed during the exercise.
Goals	The number of goals which the operator completed.
Blade Height	The current height of the blade, as measured from the bottom lip and the footprint of the tracks. Shows the relative roll angle of the blade as seen from the cab of the dozer.
Collisions	The number of times the dozer came into contact with any object in the work site, excluding material during digging operations.
Blade Efficiency	Shows how efficiently the operator used the blade to move material. The system calculates the metric as: $(\text{Quantity of material moved}) * (\text{Vehicle Velocity}) / (\text{Fuel Consumption Rate})$. Measured in $(\text{kg} * \text{km}) / \text{L}$
Track Spin	The number of times the operator let tracks spin while the dozer pushed material, and for how long.
Grade Quality Sensor	The average grade, deviation, and average angle of the current grade, in reference to the target grade. Expressed as a percentage.
Average Speed	The average speed of the vehicle when it moved during the exercise.
Idle Time	The total amount of time when the dozer was not driving or moving, and the number of times. The system begins to measure Idle Time when the dozer is idle for more than five seconds.
Cycle Time	The total number of cycles which the operator used to complete the exercise. The duration of the current cycle. The current cycle distance. (The system counts each pass as one cycle)
Fuel Consumption	The current rate of fuel consumption (expressed in liters per hour)

Metric	Description
Decelerator Pedal Position	The current position of the operator pedal, expressed as a percentage. The average position of the pedal during the exercise.
Engine Torque	The current amount of torque consumed, in Newton meters.
Engine Power	The amount of power currently consumed (kW), the average power consumed over the exercise (kW).
Barrels Touched	The percentage of power consumed (out of the maximum possible value) and the average percentage of power consumed during the exercise.
Barrels Knocked Over	The number of barrels the dozer contacted during the exercise.
Cones Touched	The number of cones the dozer knocked over during the exercise.
Cones Knocked Over	The number of cones the dozer contacted persons in the work site. The system automatically ends the exercise if the dozer contacts persons in the work site.
Material Over Obstacle	The number of cones the dozer knocked over during the exercise.
Vehicle Flip Over	True, if the dozer flipped over due to instability during the exercise. The system automatically ends the exercise if the dozer flips over.
Human Contact	True, if the dozer contacted persons in the work site. The system automatically ends the exercise if the dozer contacts persons in the work site.
Electric Pole or Cable Contact	True, if the dozer contacts a power line or pole. The system automatically ends the exercise if the dozer contacts a power line.

Graphing Performance Metrics

Plotting performance metrics which the system records for each a training session on a graph can offer insights into whether a student is improving certain skills through practice. You can plot up to two performance metrics over the time elapsed since the training exercise began, or the past 120 seconds, on a graph in the **Chart** pane of the **Dashboard** page.

To view a graph of a performance metric over time during a training exercise, on the **Dashboard** page of the instructor console, do the following:

1. In the **Metrics** section, click the metric you want to plot. For example, click **Engine Power Consumed**.

The **Chart** pane displays a graph of the **Engine Power Consumed** metric over the time elapsed since the training exercise began appears.

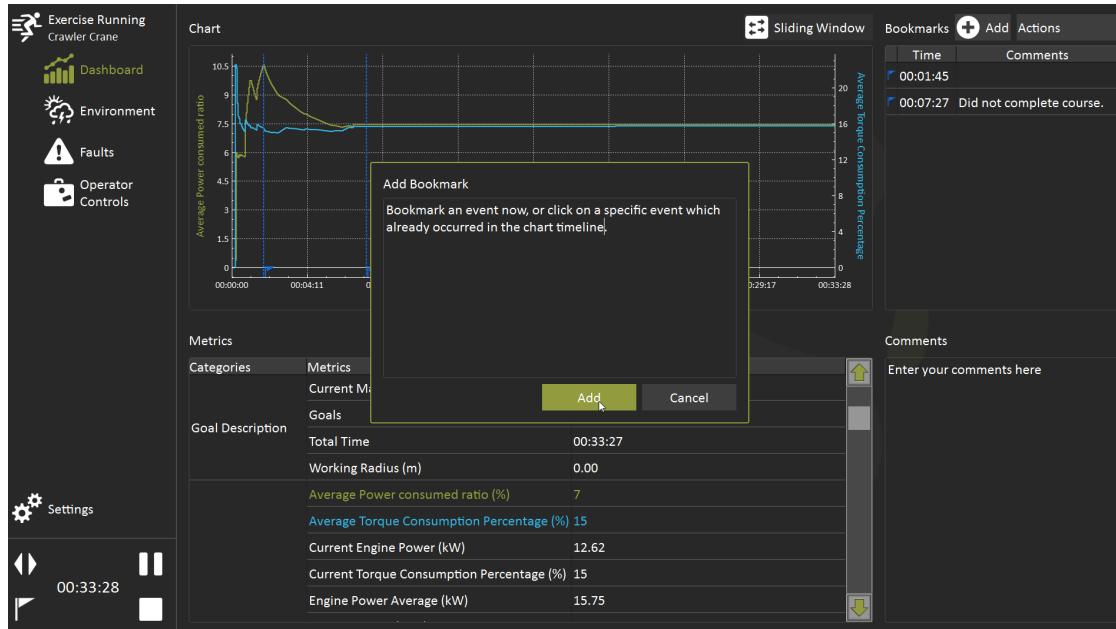
2. To plot another metric over time in the same graph, click the metric you want to view. For example, click **Idle Time**.

The **Chart** pane displays a graph of the **Idle Time** metric over the time elapsed since the training exercise began appears.

3. To plot the metrics over the past 120 seconds, click the **Sliding Window** button.

Bookmarking Events for Review

As you observe the operator completing exercises, there may be events for which you want to provide targeted, timely feedback. You can *bookmark*, or flag timestamps in the training exercise to review with the operator and provide commentary.



For example, if you notice the operator ignore a pedestrian in the work area but don't want to stop the exercise to discuss the event, you can bookmark the event on the **Bookmarks** pane, add a comment, and review the incident with the operator at the end session.

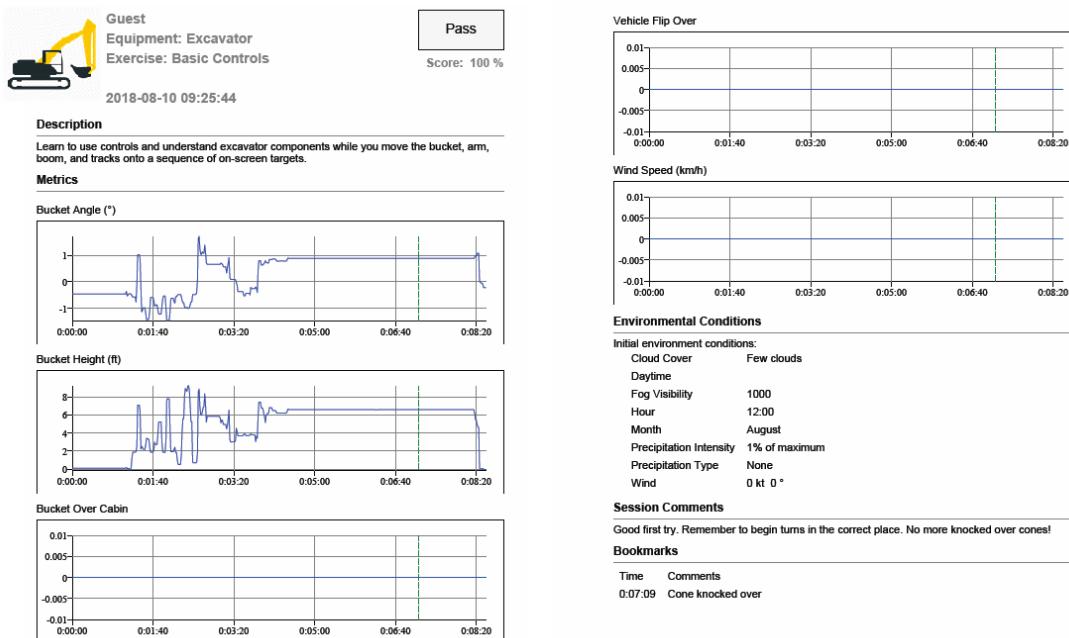
The system lets you bookmark an event which is occurring now, or an event that occurred previously in the session.

All bookmarks and comments appear in the reports you generate for this training session.

Evaluating and Ending the Exercise

Once the student completes all the tasks in an exercise, you can end the session and evaluate operator performance. You can also generate a performance report for the session.

Sample Report



Any time you end a training exercise, the system prompts you to evaluate the student. You can choose from the following options:

Option	Description
Pass	Any reports that the system generates for this exercise will show that the operator passed this exercise.
Fail	Any reports the system generates about this exercise will show that the operator did not pass this exercise.

Option	Description
Don't record	The system will not store any performance metrics for this training exercise, and no record of it will appear under the list of exercises the operator completed. This is useful if something outside the operator's control prevents him from completing the exercise.

To End an Exercise and Evaluate the Session

Once the operator completes the tasks in the exercise, the instructor can end the exercise from the instructor station as follows:

1. In the lower left of the application, click the **Stop** button .
2. In the window that appears, do one of the following:
 - To indicate that the operator successfully completed the exercise, click **Pass**.
 - To indicate that the operator did not successfully complete the exercise, click **Fail**.
 - To discard the session and leave the record of it in the system, click **Don't Record**.
3. In the **Comments** text box, type any feedback you would like the operator to review. The feedback will appear in any reports that you generate for the session.
4. (Optional) To generate a performance report for this session, on the **Action** menu, click **Generate exercise report**.
The system generates a PDF report detailing performance statistics for the exercise.
5. (Optional) To return to the exercise after generating the report, click the **Back** button.
6. To end the exercise, click **Stop**. The exercise closes.



Dozer Training Exercises

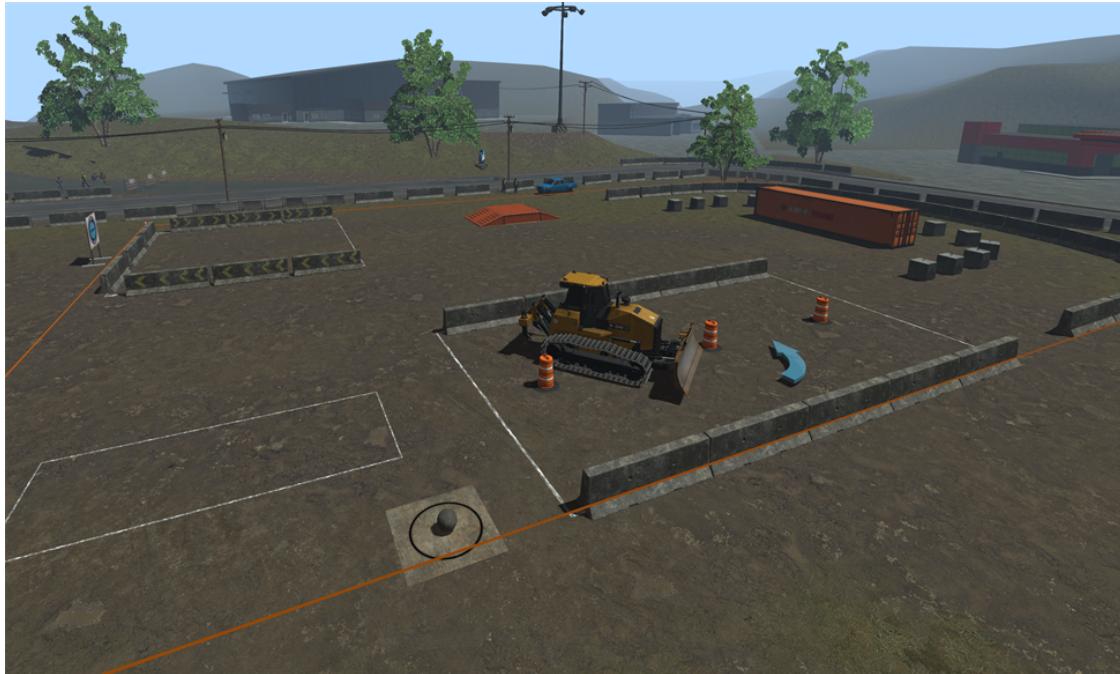
Dozer training exercises are designed to help students learn main dozer components and functions, as well as basic control techniques to perform everyday operations.

This training solution includes the following exercises:

Basic Controls	84
Loading and Unloading Trailer	88
Production Dozing	93
Material Spreading	97
Access Road	100
Sandbox	104

Basic Controls

Operators learn to use controls in different combinations to move the blade and drive through a slalom course on tracks. Each goal is more difficult than the last. At the end of the exercise, the operator must lower the blade to secure the dozer in a parked position.



Learning Outcomes

This exercise is designed to teach operators these skills:

Goal	Methodology
<ul style="list-style-type: none">■ Distinguish controls and dozer functions.■ Position the blade accurately.	<p>Operators must use controls to rotate, lower, raise, and tilt the blade to position it on a sequence of targets.</p> <p>An on-screen status display is updated each time the operator completes a goal.</p>
Accurately steer and travel on tracks	Operators must use controls to drive through a course which is lined by cones.
Perform a three-point turn	Traveling to each target requires the operator to move the dozer forward and backward, and counter-rotate tracks for turns.
Safely drive over the tipping point of the dozer and use the correct method to land tracks on the ground.	Operators must perform a three-point turn to complete the exercise.
Show knowledge of the spatial relationship between the dozer, targets, and objects in the work site.	On-screen tips tell the operator to turn in small, gradual increments to reduce wear on undercarriage components and track pads.
	Operators must safely manage the tipping point of the dozer when they drive over a ramp.
	On-screen tips tell the operator to be aware of the machine center of gravity and to turn slightly and reduce speed to absorb the force of the tracks landing on the ground.
	The system realistically simulates equipment and the work site under different lighting and weather conditions.
	On-screen tips tell the operator to look at shadows to estimate the distance between the blade and the ground, and to use caution in blind spots.

Goal	Methodology
Make sure the dozer is always a safe distance from objects, personnel, and utilities.	<p>The system warns operators to look for objects and persons in the work site before they start tasks.</p> <p>On-screen tips tell operators to use caution in blind spots and when the machine moves over the tipping point.</p> <p>Operators use mirrors and back-up cameras when they reverse the dozer or perform turns.</p> <p>The exercise automatically ends if the system detects a collision between the dozer and a worker or power line.</p>
Demonstrate understanding of equipment components and limitations.	To complete the exercise, operators must use controls accurately to move the blade to the correct positions and use methods to turn which reduce wear on track pads.

Exercise Workflow

When the exercise starts, the dozer is parked a few meters away from a course which is marked by barrels.

To complete the exercise, the operator does these things.

1. To start the exercise, press and hold the Horn button.
2. Follow on-screen instruction to complete these activities:

Task	Description
Blade targets	Use blade controls to position the blade on targets.
Driving position	Position the blade on a target to prepare for travel.

Task	Description
Move forward	<ul style="list-style-type: none"> a. Use controls to move forward through the slalom course. b. Steer the dozer through the slalom course, following on-screen arrows. c. Follow on-screen indicators through an arc path. d. Stop the dozer on the target at the end of the course.
Drive over ramp	Follow on-screen indicators to drive over the orange ramp to the next target.
Perform a three-point turn	Follow on-screen instructions to do a three-point turn.
Drive back through the course	Use controls to drive through the path in the opposite direction.
Drive over ramp	Follow on-screen indicators to drive over the orange ramp again.
Drive back through path	Follow indicators to drive through arc path again.
Parked position	Position the bucket on the ground to secure the excavator.

When the operator completes all tasks, the exercise ends and the system shows a success message.

Loading and Unloading Trailer

Operators learn to move the dozer on and off of a detached lowboy trailer and put it in a safe position for transport. On-screen targets and tips help operators learn the correct procedure for aligning tracks with the trailer, moving up the ramp, and positioning the blade.



Learning Outcomes

This exercise is designed to teach operators these skills:

Goal	Methodology
Accurately align tracks with the trailer.	On-screen tips show the operator how to align with the trailer before moving onto the ramp.
Put the blade in the correct position for safe travel.	On-screen targets show the operator how to position the blade on the trailer.
Operate the dozer safely when it moves over the tipping point.	On-screen tips tell the operator to use caution when the dozer goes over the tipping point while it moves up and over the ramp of the trailer.
Make sure the mass of the dozer is in the middle of the trailer.	On-screen tips remind the operator to make sure the mass of the dozer is in the middle of the trailer. If the dozer becomes unstable, it can fall off the trailer and the exercise will automatically end.

Exercise Workflow

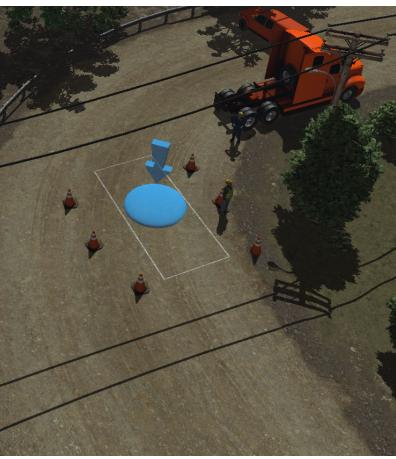
When the exercise starts, the dozer is parked in front of a lowboy trailer.

1. To start the task, press the Horn button.
2. Follow on-screen instructions to complete these activities:

Task	Description
	Start Start the engine. Make sure the work site is clear of hazards and personnel.

Task	Description
	<p>Drive toward trailer</p> <ul style="list-style-type: none"> a. Move forward. b. Align the tracks with the ramp of the trailer.
	<p>Move onto trailer</p> <ul style="list-style-type: none"> a. Slowly move onto the ramp. b. Use caution when you move over the tipping point and land tracks on the trailer. c. Rotate the blade to the on-screen target.
	

Task	Description
	<p>Center blade</p> <ul style="list-style-type: none">a. Center the blade to the on-screen target.b. Secure the dozer in a safe position for transport.
	<p>Reverse off trailer</p> <p>Slowly reverse off of the trailer toward the track target.</p>
	<p>Move to target</p> <p>Position the dozer on the track target.</p>

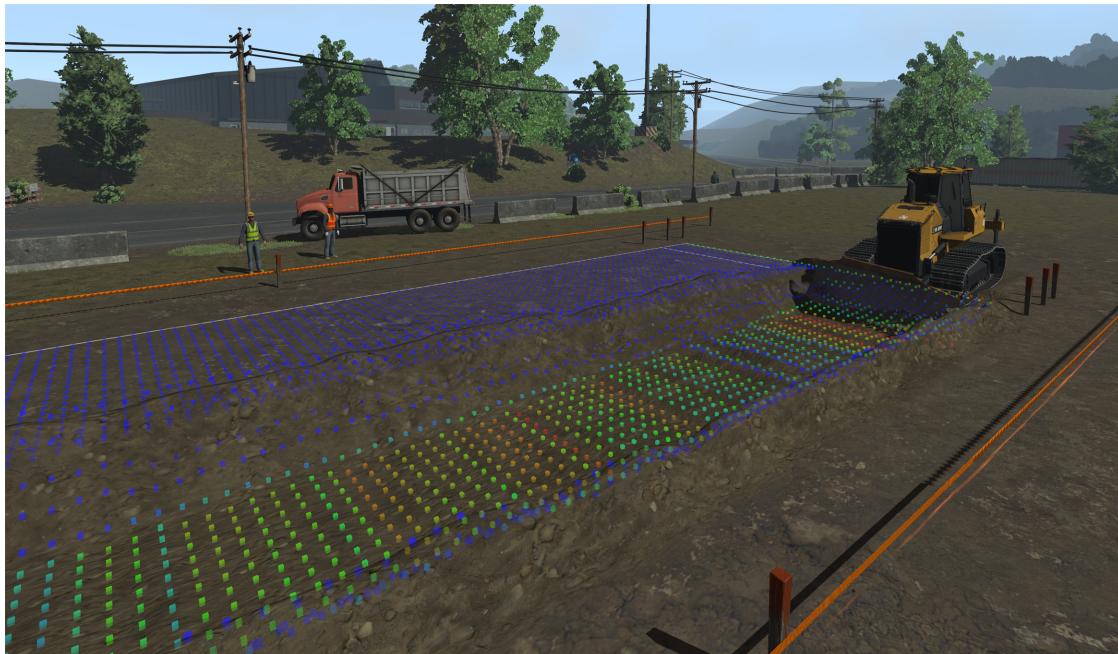
Task	Description
	Drive to parking position
	Drive forward to the parking position.

When the operator completes all tasks, the exercise ends and the system shows a success message.

Production Dozing

Production (slot) dozing is method of moving large quantities of material where each trip is made in the same path. Spillage from the sides of the blade builds up along each side to make windrows. The windrows keep material in front of the blade so that it can push a bigger load.

This exercise is designed to teach operators the procedure for production dozing. Operators follow on-screen instructions to excavate a yard to a specific grade using either a basic technique or an advanced front-to-back technique.



Learning Outcomes

This exercise is designed to teach operators these skills:

Goal	Methodology
Plan before you start work to minimize idle time and unnecessary movement	<p>The system records measurements for several metrics to help evaluate operator efficiency:</p> <ul style="list-style-type: none">■ The <i>Idle Time</i> metric records how much time the operator spends inactive during the exercise.■ The <i>Fuel Consumption</i> metric shows the rate of fuel consumption over the duration of the exercise.■ The <i>Blade Efficiency</i> metric shows how efficiently the operator uses the blade to move material during the exercise.
Learn the correct procedure for slot dozing	On-screen tips show the operator how to doze the first slot and then continue dozing the rest of the area.
Put the blade in the correct position for dozing.	On-screen targets show the operator how to position the blade before beginning work.
Use the correct travel speed during operations.	The Average Speed metric shows the average speed of the dozer during the training exercise.
Use blade and driving controls at the same time to keep the blade level during each pass.	The <i>Grade Quality Sensor</i> shows how the position of the blade affects the quality and depth of each pass.
Load the blade quickly and keep the load on the blade consistent during each pass.	The <i>Blade Efficiency</i> metric shows how efficiently the operator uses the blade to move material during the exercise.
Remove material in shallow layers (8-10 cm).	
Keep the grade of the area level (within +/- 0.75 of specification).	The <i>Grade Quality Sensor</i> shows where material is outside the acceptable threshold for the target grade.
Create an entry and exit ramp with the correct slope (3:1).	The <i>Grade Quality Sensor</i> shows where the ramps do not have the correct slope.

Goal	Methodology
Use techniques which prevent wear to equipment.	The system instructs the operator to avoid twisting or spinning undercarriage components.
Balance the load on the blade with available traction to keep tracks from spinning.	Metrics record the current load on the blade, and show values for the load on the blade throughout the exercise. The <i>Track Spin</i> metric shows the number of times tracks slipped during the exercise, and for how long.
Reduce cycle time through practice	The <i>Cycle Time</i> metric shows the total number of cycles the operator needed to complete the exercise, and the average duration the cycles. With practice, operators can reduce the time of each cycle.

Workflows

This exercise supports operators learning to production doze using two techniques:

1. Basic Slot-Dozing

The operator learns to position the blade to create ramps and make successive trips until windrows form and excess material is pushed to a stockpile. Once the slot is excavated to the correct depth, the operator reverses to begin the second slot with a berm. When the second slot is excavated to the correct depth, the operator removes the berm and ensures the area is level.

2. Advanced Front-to-Back Dozing

The operator builds on basic skills to doze each slot from front-to-back. Front-to-back dozing is more efficient and reduces the need to reverse along the length of the slot by one third.

Exercise Steps

1. To start the task, press the **Horn** button.
2. Turn on the dozer engine and release the parking brake.
3. From the HMI, turn on the Grade Quality Sensor.

4. Move the blade to the target position.
5. Move the dozer forward and lower the blade to begin pushing material.
6. Use the Grade Quality Sensor to estimate how much material to remove.
7. Once the area is excavated to specification, you can continue to improve technique or park and stop the dozer in the correct location.

When the operator completes all tasks, the exercise ends and the system shows a success message.

Material Spreading

This exercise is designed to help operators practice spreading material near obstacles to a specific grade. A dump truck brings material and dumps it near the operator. The operator must use the horn to signal the truck to stop in the correct location.



Learning Outcomes

This exercise is designed to teach operators these skills:

Goal	Methodology
Grade, spread and level ground and material	On-screen tips instruct the operator to use the blade correctly to spread material. The Grade Quality Sensor gives the operator immediate feedback on the quality of the work.
Use the correct methods to move material	On-screen tips instruct the operator to: <ul style="list-style-type: none">■ Angle the blade to the side they will spread material to reduce the height of windrows.■ Use the bolts on the blade as a reference point to keep the material height the same over the entire area.■ Always keep the blade partially loaded to smooth the ride and correct irregularities on the surface.
Signal the dump truck to stop in the correct location.	On-screen tips show the operator how to: <ul style="list-style-type: none">■ Use the horn to signal the dump truck to come.■ Stop the dump truck in the correct location The system measures how many times the operator uses the horn to signal the dump truck.
Level material near obstacles, such as the curb.	On-screen tips instruct the operator to create a windrow the correct from each obstacle and angle the blade so that surplus material moves under the blade (and does not leave a ridge).

Exercise Steps

1. To start the task, press the **Horn** button.
2. Turn on the dozer engine and release the parking brake.
3. From the HMI, turn on the Grade Quality Sensor.
4. Use the horn to signal the dump truck to bring material.
5. When the dump truck is in the correct position, use the horn to signal it to stop.

The dump truck releases material and then drives away.

6. Spread material until the surface is level.

Use the Grade Quality Sensor to and refer to the Grade Quality Score to estimate the quality of the grade.

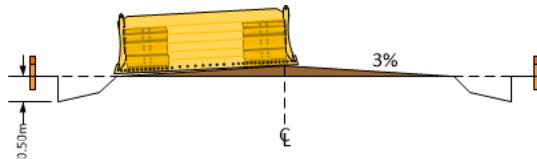
Be attentive to the curb and other obstacles during operation.

7. If you need more material, press the horn to signal the dump truck to bring more material.
8. Repeat steps until the Grade Quality Sensor shows material is spread to the correct specification.
9. Once the area is excavated to specification, you can continue to improve technique or park and stop the dozer in the correct location.

Access Road

An access road is a temporary road designed for transporting material and equipment to a work site.

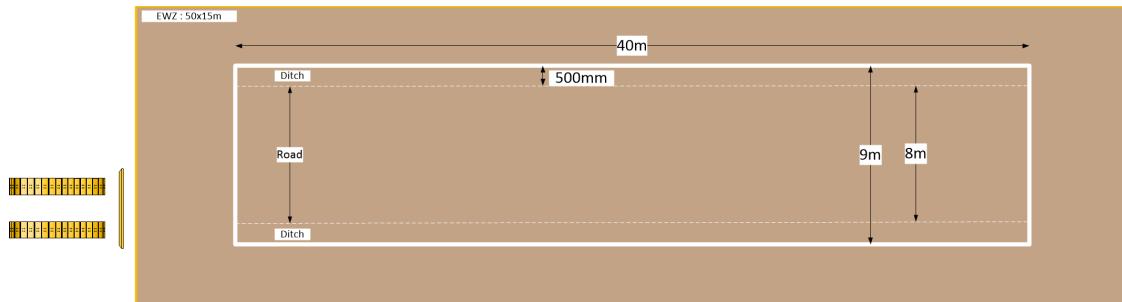
This exercise is designed to teach operators to create a road with a center-line crown with the correct cross-slope for an unpaved road and with two parallel ditches along it.



The length of the road must be 40 m with 3% cross-slope. The depth of the ditches must be 500 mm.



Access Road Area

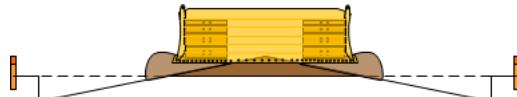


Creating an Access Road

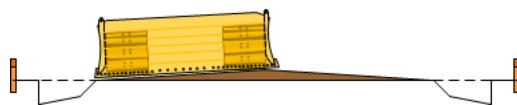
1. Make the first pass at the end section of the road, at the edge of the ditch. The goal is to create a hole prevent material from spilling during each pass.
2. Try to back up onto the track marks you make. The operator makes multiple passes in the same corridor and spread the material evenly along the road to produce an approximate shape.
3. Remove layers of material with each pass until you attain 500 mm of depth from the opposite direction.
4. On the opposite side of the road, do the same thing until all the material is spread in the middle of the road.



5. Use the blade to push material outward to each side of the road until you create a crown with the correct dimensions. Prevent the tracks from spinning by adjusting the height of the blade when necessary.



6. To make the crown, work with the blade on one side at a time. The dist should be one-track wide.



Learning Outcomes

This exercise is designed to teach operators these skills:

Goal	Methodology
Plan before you start work to minimize idle time and unnecessary movement.	<p>The system records measurements for several metrics to help evaluate operator efficiency:</p> <ul style="list-style-type: none">■ The <i>Idle Time</i> metric records how much time the operator spends inactive during the exercise.■ The <i>Fuel Consumption</i> metric shows the rate of fuel consumption over the duration of the exercise.■ The <i>Blade Efficiency</i> metric shows how efficiently the operator uses the blade to move material during the exercise.
Keep the grade of the area level and at the correct height.	<p>The <i>Grade Quality Sensor</i> shows where material is outside the acceptable threshold for the target grade.</p>
Use blade and driving controls to keep the blade level while you excavate at an angle.	<p>The <i>Grade Quality Sensor</i> shows how the position of the blade affects the quality and depth of each pass.</p> <p>The <i>Blade Efficiency</i> metric shows how efficiently the operator uses the blade to move material during the exercise.</p>
Use techniques which prevent wear to equipment.	<p>The system instructs the operator to avoid twisting or spinning undercarriage components.</p>
Balance the load on the blade with available traction to keep tracks from spinning.	<p>Metrics record the current load on the blade, and show values for the load on the blade throughout the exercise.</p> <p>The <i>Track Spin</i> metric shows the number of times tracks slipped during the exercise, and for how long.</p>

Exercise Workflow

1. To start the exercise, press the Horn button.
2. Turn on the dozer engine and release the parking brake.
3. From the HMI turn on the Grade Quality Sensor.
4. Move forward to the target position.

The system shows a success indicator when the dozer is in the correct position.
5. Move the dozer forward to the next target.

The system shows a success indicator when the dozer is in the correct position
6. Follow on-screen targets to make the material level.
7. Use the Grade Quality Sensor to estimate how much material to remove.
8. Once the area is excavated to specification, you can continue to improve technique or park and stop the dozer in the correct location.
9. When the operator completes all tasks, the exercise ends and the system shows a success message.

Sandbox

In this exercise, there is no special order in which operators must complete tasks. Operators can practice specific skills alone, or instructors can refer to training needs to select tasks for the operator to complete.

The practice yard has different practice areas where operators can do these things:

- Grade an area to make a drainage inlet
- Use the dozer to make a transversal ditch
- Steer the dozer through a slalom course
- Move the dozer on and off of different trailers
- Use the blade to push a concrete ball through an obstacle course



Learning Outcomes

This exercise is designed to help operators learn these skills:

Goal	Methodology
Excavate and grade terrain for a drainage inlet	The operator excavates and grades the terrain to direct water to drain toward the manhole. Material must be highest at every corner and edge (20 cm higher than the ground). Material must be lowest (30 cm lower than the ground) at the center of the other edge. On screen tips tell the operator how to excavate and grade the area correctly.
Make a transversal ditch	The operator excavates and moves material to make transversal ditch. Material must be at its highest point on the right and left edges of the ditch (same elevation as the ground) Material must be at its lowest elevation in the center of the ditch (50 cm lower than the ground)
Improve steering	The operator uses controls to drive the dozer through a slalom course marked with barrels or a course marked with poles.
Improve skill controlling the blade	The operator can use the dozer to push a concrete ball through a slalom course.

Exercise Workflow

When the exercise starts, the excavator is in the center of a training yard with different areas for each challenge.

To complete the exercise, the operator does these things.

1. To start the exercise, press and hold the Horn button.
2. Following on-screen instructions, complete these activities in any order:

Task	Description
Excavate and grade a drainage inlet	<p>On-screen tips show the operator how to divide the area into sections and work from one section to another.</p> <ol style="list-style-type: none">a. Use the blade to trace the inside of the perimeter of the area you will excavate and grade. Make sure the lines are straight because you will use them as a guide while you work.b. Start to excavate material at the point with the lowest elevation.c. To maintain the correct elevation, each time you make a pass, move slowly to the right and align with the diagonal of the previous pass. Use this method to complete the first two sections of the area.d. Move the machine on the highest part of the slope in section 1 and grade material to the correct elevation. Move extra material to the third section.e. Repeat in section 2.f. To sketch section 3, grade in a diagonal to the highest point of the slope.g. Repeat for the other side.h. To complete the task, level each section. Avoid crossing sections.

Task	Description
Make a transversal ditch	<ul style="list-style-type: none"> a. Position the dozer perpendicular to the ditch to make the first pass. b. To make work easier, move down the slope. Gravity makes each pass easier. Moving material up a slope is more difficult. c. If necessary, you can make more than one pass to excavate the ditch to the correct specification. You must make sure tracks do not slip when you make the final pass. d. Repeat until the full length of the ditch is excavated to the correct specification. To maintain a constant grade, overlap 1/3 of the blade when you make each new pass.
Barrel Course	Drive the dozer through an obstacle course marked with barrels. The course includes uneven terrain and obstacles.
Pole Course	Steer the dozer through a course marked with poles. The avoid hitting poles, the operator must perform tight turns.
Concrete Ball Course	Use the blade to move a concrete ball through a slalom course marked with barrels.
Trailer	Practice moving the dozer on an off of the detached lowboy trailer.

To end the exercise, the operator press the horn two time and drives to the parking area.