Lesson Plans for 22206-13

ROUGH-TERRAIN FORKLIFTS

The Trainee Guide for *Heavy Equipment Operations Level Two* is available as a NCCERconnect e-book. Contact your NCCER customer service representative at 1-888-622-3720 for more information.

**Module One (22206-13)** provides training on the primary components of a rough-terrain forklift, prestart inspections, preventive maintenance, and the proper operating procedures. Common procedures used by forklift and telehandler operators on site are also presented.

**Objectives**

<table>
<thead>
<tr>
<th>Learning Objective 1</th>
<th>Performance Tasks</th>
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</table>
| • Identify and describe the components of a rough-terrain forklift.  
  a Identify and describe chassis components.  
  b Identify and describe the controls.  
  c Identify and describe the instrumentation.  
  d Identify and describe the attachments. | **Performance Task 1** (Learning Objective 2)  
• Complete a proper prestart inspection and maintenance on a rough-terrain forklift. |
| **Learning Objective 2** | **Performance Task 2** (Learning Objective 3)  
• Describe prestart inspection procedures.  
• Describe preventive maintenance requirements. | **Performance Task 3** (Learning Objective 3)  
• Perform proper startup, warm-up, and shutdown procedures on a rough-terrain forklift. |
| **Learning Objective 3** | **Performance Task 4** (Learning Objective 3)  
• Describe startup and operating procedures for a rough-terrain forklift.  
  a State rough-terrain forklift-related safety guidelines.  
  b Describe startup, warm-up, and shutdown procedures.  
  c Describe basic maneuvers and operations.  
  d Describe related work activities. | **Performance Task 5** (Learning Objective 3)  
• Interpret a forklift load chart.  
• Perform basic lifting operations with a rough-terrain forklift. |
| **Performance Task 6** (Learning Objective 3)  
• Demonstrate proper parking of a rough-terrain forklift. |

**Teaching Time: 22.5 hours**

(Nine 2.5-Hour Sessions)

Session time may be adjusted to accommodate your class size, schedule, and teaching style.

**Prerequisites**


**Before You Begin**

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the written examinations and performance profile sheets for *Heavy Equipment Operations Level Two* from [www.nccerirc.com](http://www.nccerirc.com). The passing score for submission into NCCER’s Registry is 70% or above for the written examination; performance testing is graded pass or fail.
Safety Considerations
This module requires trainees to demonstrate how to safely inspect, start, and operate a rough-terrain forklift. Safe working habits in the vicinity of heavy equipment must be emphasized for all trainees. As operators, ensure that trainees observe all required safety precautions before starting and operating the equipment. Performance tasks must be completed under your supervision. Each trainee must use the required PPE and follow safe heavy-equipment operating procedures.

Classroom Equipment and Materials
Whiteboard/chalkboard
Markers/chalk
Pencils and paper

Heavy Equipment Operations Level
Two PowerPoint® Presentation
DVD player or a computer with a DVD drive
LCD projector and screen
Computer with Internet access
Copies of the Module Examination and Performance Profile Sheets

Equipment and Materials for Laboratories and Performance Testing
Personal protective equipment:
- Standard eye protection
- Gloves
- Proper footwear as designated by the instructor or training facility provider
- Hearing protection as designated by the instructor or training facility provider
- Hard hats

Functional rough-terrain forklift and/or telehandler (a telehandler is preferred)
A suitable facility to drive the equipment and practice basic work activities
Loads to lift and move
A method of two-way communication with hands-free characteristics

Operator’s manual for the equipment in use
The following fluids and materials for the forklift in use:
- Fuel
- Engine oil
- Hydraulic fluid
- Water
- Lubricating grease and grease guns

Any common hand tools (such as a screwdriver or adjustable wrench) that may be required for the general maintenance and inspection of the equipment to be used for demonstration and practice
Orange traffic cones
Rags

Additional Resources
This module presents thorough resources for task training. The following resource material is suggested for further study.

The Occupational Safety and Health Administration (OSHA) publishes safety requirements for forklifts and related equipment in OSHA Standard 1910.178, found at www.osha.gov. In addition, OSHA offers e-learning tools directly associated with powered industrial trucks. This tool can be found at http://www.osha.gov/dcsp/products/etools/pit/index.html.

There are a number of online resources available for trainees who would like more information on rough-terrain forklifts and other heavy equipment. A search for additional information may be assigned as homework to interested trainees.

An effective way for trainees to see rough-terrain forklifts in action is to shoot your own video at a job site where the forklifts are being used. You can use this video to point out both correct and incorrect operations. Such video can also be used to test the trainees on their knowledge of correct and incorrect operation. For rough-terrain forklifts, this video could include:

- Prestart walk-around inspection
- Startup and shutdown process
- Various work activities in progress

Instructors should view all videos identified in the lesson plan before using them, to ensure their suitability. The videos will provide teachable moments in both proper and improper operation. Be prepared to stop the videos at appropriate times to point out and discuss both proper and improper techniques.

Instructors should also consider taking photos of controls and instrumentation inside a rough-terrain forklift cab and adding them to the PowerPoint® presentation. Images from the specific machine the trainees will operate are especially helpful. The use of such images for a review of the controls and instrumentation with trainees is recommended as an exercise in a number of lesson plan sessions.
Session Outline for 22206-13

ROUGH-TERRAIN FORKLIFTS

The Lesson Plan for this module is divided into nine 2.5-hour sessions. This time includes 10 minutes for administrative tasks and a 10-minute break per session.

Due to the often-limited access to heavy equipment, it is suggested that the text of this module be presented in its entirety in the classroom environment before demonstrations and hands-on practice begins. Once the text has been presented, the practical instruction, demonstrations, and trainee practice using a functional forklift can be done continuously without interruption. As a result, Sessions One through Four are designed exclusively for the classroom environment, while Sessions Five through Eight are dedicated to demonstrations, practice, and the execution of performance tasks.

**SESSIONS ONE AND TWO**

Session One introduces trainees to rough-terrain forklifts, their primary components, and their common operating controls. This session is designed for the classroom environment only. The use of available video is encouraged.

Session Two covers rough-terrain forklift instrumentation, followed by a discussion of the attachments that can be used. The session concludes with coverage of the various prestart inspection tasks that rough-terrain forklifts require.

It is suggested that instructors begin to focus on the equipment model to be used for demonstration and practice early in the program.

Show Sessions One and Two PowerPoint® slides.

Distribute the operator’s manual for the specific equipment to be used in demonstration and practice. Refer to the manual during the session to complement the text and provide a practical example.

After studying different rough-terrain forklift cab and control configurations, have trainees practice pointing out various controls without the aid of labels.

After studying different rough-terrain forklift instrument layouts, have trainees practice identifying various icons associated with indicator and warning lights without the aid of labels. Use images of various attachments and have trainees practice identifying them following the related lecture.

**SESSION THREE**

Session Three covers the preventive maintenance requirements related to rough-terrain forklifts. A discussion of safety guidelines related to rough-terrain forklifts, along with startup and shutdown procedures follows. The session concludes with a review of basic rough-terrain forklift maneuvers.

Show Session Three PowerPoint® slides.

Distribute copies of the operator’s manual for the equipment to be used in demonstration and practice. Refer to the manual during the session to complement the text and provide a practical example.

**SESSION FOUR**

Session Four includes one laboratory for Performance Task 4. This session introduces the use of load charts related to rough-terrain forklifts. The session concludes with a review of various work activities and the use of rough-terrain forklift attachments.

Show Session Four PowerPoint® slides.

Review forklift load charts and how an operator makes use of them during work activities. Demonstrate the use of the load chart and conduct a laboratory with trainees to ensure they know how to use them. Discuss the details of operating a rough-terrain forklift to accomplish various work activities.
SESSIONS FIVE THROUGH EIGHT

Sessions Five through Eight are devoted exclusively to demonstrations, laboratories, and performance tasks. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. The performance tasks to be practiced and/or completed during this session include:

• Complete a proper prestart inspection and maintenance on a rough-terrain forklift.
• Perform proper startup, warm-up, and shutdown procedures.
• Execute basic maneuvers with a rough-terrain forklift.
• Perform basic lifting operations with a rough-terrain forklift.
• Demonstrate proper parking of a rough-terrain forklift.

Under your supervision, have trainees practice the requirements of Performance Tasks 1, 2, 3, 5, and 6 as a laboratory. Trainee proficiency noted during laboratory exercises can be used to satisfy the performance testing requirements.

Download and/or prepare examination materials for the next session.

SESSION NINE

Session Nine is a review and testing session. Have trainees complete the Module Review Questions. (Alternatively, these may be assigned as homework at the end of Session Eight). Answer any questions that the trainees may have.

Have trainees complete the written examination. Any outstanding performance testing must be completed by the end of this session.

Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
### Materials Checklist for Rough-Terrain Forklifts, 22206-13

<table>
<thead>
<tr>
<th>Personal protective equipment:</th>
<th>Equipment and Materials</th>
<th>Tools</th>
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<tbody>
<tr>
<td>Standard eye protection</td>
<td>Functional rough-terrain forklift and/or telehandler (a telehandler is preferred)</td>
<td>Any common hand tools (such as a screwdriver or adjustable wrench) that may be required for the general maintenance and inspection of the equipment to be used for demonstration and practice</td>
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<td>Gloves</td>
<td>A suitable facility to drive the equipment and practice basic work activities</td>
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<tr>
<td>Hearing protection as designated by the instructor or training facility provider</td>
<td>Orange traffic cones</td>
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<td>Hard hats</td>
<td>A method of two-way communication with hands-free characteristics</td>
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<td>Rags</td>
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<td>Operator’s manual for the equipment in use</td>
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<td>The following fluids and materials for the forklift in use: Fuel Engine oil Hydraulic fluid Water Lubricating grease and grease guns</td>
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</tbody>
</table>

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
The Trainee Guide for Heavy Equipment Operations Level Two is available as a NCCERconnect ebook. Contact your NCCER customer service representative at 1-888-622-3720 for more information.

Module Two (22202-13) contains descriptions of on-road dump trucks used in construction and other types of work, as well as instructions for inspecting, maintaining, and safe operation of on-road dump trucks.

### Objectives

<table>
<thead>
<tr>
<th>Learning Objective 1</th>
<th>Learning Objective 2</th>
<th>Learning Objective 3</th>
<th>Learning Objective 4</th>
<th>Learning Objective 5</th>
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</thead>
</table>
| • Identify the types of on-road dump trucks.  
  a Identify and describe standard dump trucks.  
  b Identify and describe special dump trucks and trailers. | • Identify and describe the instruments and specialized control systems found on an on-road dump truck.  
  a Identify and describe instruments.  
  b Identify and describe control systems. | • Describe the operator inspection and maintenance requirements for an on-road dump truck.  
  a Describe inspection, startup, and shutdown procedures.  
  b Identify preventive maintenance procedures that must be performed. | • Describe safe on-road driving practices for on-road dump trucks.  
  a State the normal driving practices associated with dump truck operation.  
  b Describe how to handle a dump truck in an emergency. | • Describe the procedures for operating a dump truck on the job.  
  a State the safety practices associated with dump truck operation on a job site.  
  b Describe proper loading, dumping, and snow-plowing procedures. |

### Performance Tasks

| Performance Task 1 | Performance Task 2 | Performance Task 3 | |
|-------------------|-------------------|-------------------||
| (Learning Objective 3) | (Learning Objective 3) | (Learning Objectives 4 and 5) | |
| • Complete proper prestart inspection and maintenance for a dump truck. | • Perform the proper startup, warm-up, and shutdown procedures. | • Carry out basic operations with a dump truck:  
  a Dump a load in a designated spot, and tailgate-spread the load.  
  b Back up with a trailer attached.  
  c Perform tailgate adjustment, as applicable. | |

### Teaching Time: 20 hours

(Eight 2.5-Hour Sessions)

Session time may be adjusted to accommodate your class size, schedule, and teaching style.

### Prerequisites

Completion of Heavy Equipment Safety, Module 22102-13

### Before You Begin

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the written examinations and performance profile sheets from [www.nccerirc.com](http://www.nccerirc.com). The passing score for submission into NCCER’s Registry is 70% or above for the written examination; performance testing is graded pass or fail.
Safety Considerations
This module requires trainees to demonstrate how to safely inspect, start, and operate an on-road dump truck. Safe working habits in the vicinity of heavy equipment must be emphasized. Trainees must observe all required safety precautions before starting and operating a dump truck. Performance tasks must be completed under your supervision. Each trainee must use the required PPE and follow safe operating procedures.

Equipment and Materials
Whiteboard/chalkboard
Markers/chalk
Pencils and paper
Heavy Equipment Operations Level Two PowerPoint® Presentation Slides
DVD player or a computer with a DVD drive
LCD projector and screen
Computer
Copies of the Module Examination and Performance Profile Sheets

Personal protective equipment:
- Standard eye protection
- Gloves
- Proper footwear, as designated by the instructor or training facility provider
- Hearing protection, as designated by the instructor or training facility provider
- Hard hats

Functional on-road dump truck
A suitable facility to drive the truck and practice basic work activities
Loader or excavator to load the truck
Soil or other material to use as a load
Trailer
Traffic cones
One or more copies of the operator’s manual for the dump truck in use
Copies of the prestart inspection checklist and preventive maintenance schedules from the operator’s manual
The following fluids and materials for the dump truck in use:
- Fuel
- Engine oil
- Hydraulic fluid
- Water
- Lubricating grease and grease guns
- Power-steering fluid
- Automatic transmission fluid (if applicable)
- Any common hand tools (such as a screwdriver or adjustable wrench) that may be required for the general maintenance and inspection of the dump truck to be used for demonstration and practice
- Rags

Equipment and Materials for Laboratories and Performance Testing

Additional Resources
This module presents thorough resources for task training. The following resource material is suggested for further study.

The Occupational Safety and Health Administration (OSHA) publishes safety requirements for dump trucks and related material handling equipment, which may be found at www.osha.gov.

OSHA Standard 1926.601 covers the operation of dump trucks on a job site.
OSHA Standard 1926.602 covers material-handling equipment in general.

There are a number of online resources available for trainees who would like more information on dump trucks and other heavy equipment. A search for additional information may be assigned as homework to interested trainees.

An effective way for trainees to see dump trucks in action is to shoot your own video at a job site where on-road dump trucks are being used. You can use this video to point out correct and incorrect methods of inspection, maneuvering, and dumping. Such video can also be used to test the trainees on their knowledge of correct and incorrect operation. For on-road dump trucks, this video should include:

- Prestart walk-around inspection
- Shutdown procedure
- A dump truck maneuvering on a job site
- Loading and dumping procedures

Personal protective equipment:
- Standard eye protection
- Gloves
- Proper footwear, as designated by the instructor or training facility provider
- Hearing protection, as designated by the instructor or training facility provider
- Hard hats

Functional on-road dump truck
A suitable facility to drive the truck and practice basic work activities
Loader or excavator to load the truck
Soil or other material to use as a load
Trailer
Traffic cones
One or more copies of the operator’s manual for the dump truck in use

Copies of the prestart inspection checklist and preventive maintenance schedules from the operator’s manual
The following fluids and materials for the dump truck in use:
- Fuel
- Engine oil
- Hydraulic fluid
- Water
- Lubricating grease and grease guns
- Power-steering fluid
- Automatic transmission fluid (if applicable)
- Any common hand tools (such as a screwdriver or adjustable wrench) that may be required for the general maintenance and inspection of the dump truck to be used for demonstration and practice
- Rags

Additional Resources
This module presents thorough resources for task training. The following resource material is suggested for further study.

The Occupational Safety and Health Administration (OSHA) publishes safety requirements for dump trucks and related material handling equipment, which may be found at www.osha.gov.

OSHA Standard 1926.601 covers the operation of dump trucks on a job site.
OSHA Standard 1926.602 covers material-handling equipment in general.

There are a number of online resources available for trainees who would like more information on dump trucks and other heavy equipment. A search for additional information may be assigned as homework to interested trainees.

An effective way for trainees to see dump trucks in action is to shoot your own video at a job site where on-road dump trucks are being used. You can use this video to point out correct and incorrect methods of inspection, maneuvering, and dumping. Such video can also be used to test the trainees on their knowledge of correct and incorrect operation. For on-road dump trucks, this video should include:

- Prestart walk-around inspection
- Shutdown procedure
- A dump truck maneuvering on a job site
- Loading and dumping procedures
Due to the often-limited access to equipment such as dump trucks, it is suggested that the text of this module be presented in its entirety in the classroom environment before demonstrations and hands-on practice begin. Once the text has been presented, the practical instruction, demonstrations, and trainee practice using a functional dump truck can be done continuously without interruption. For that reason, Sessions One through Three are designed exclusively for the classroom environment, while Sessions Four through Seven are dedicated to demonstrations, practice, and the execution of performance tasks.

### Session One

Session One introduces trainees to on-road dump trucks, their primary components, and their control systems. This session is designed for the classroom environment only. The use of available video is encouraged.

It is suggested that instructors begin to focus on the dump truck model to be used for demonstration and practice. One or more copies of the manual for this truck should be made available for reference by trainees during the session.

Show Session One PowerPoint® slides.

Clarify the difference between on-road and off-road dump trucks. If possible, use video available through Internet sites to aid in this discussion. Be sure to pre-screen videos for suitability.

Ensure that trainees understand and can identify the different types of on-road dump trucks and trailers and the different axle configurations used on dump trucks.

Make sure the trainees understand and can locate the controls for the truck’s on-board systems such as differential lockout, air brakes, and the dump bed hoist. Have trainees practice pointing out selected controls.

In your presentation, focus on the unique safety hazards associated with operating a dump truck on a public highway, especially on steep grades.

### Session Two

Session Two will familiarize the trainees with the prestart inspection and preventive maintenance tasks that on-road dump trucks require. This session is designed for the classroom environment only; however, practical exercises could be done if an appropriate dump truck is readily available. The use of available video is encouraged.

Show Session Two PowerPoint® slides.

Distribute copies of the prestart inspection and preventive maintenance checklists for the dump truck to be used in demonstration and practice.

Point out the hydraulic system components and remind the trainees that these systems are under pressure and could cause injury.

Discuss each inspection item on the checklists and make sure the trainees understand the importance of these items.

If you have video showing a walk-around inspection, show it to the trainees.

### Session Three

Session Three covers safe operation of a dump truck on a highway, including how to handle emergency situations. It also covers loading and dumping operations on a job site. Although information on the use of snow plows is covered, it may not be applicable for all locations. This session is designed for the classroom environment only; however, practical exercises can be done if an appropriate dump truck is readily available. The use of available video is encouraged.

Show Session Three PowerPoint® slides.

Safety, whether traveling on a highway or on a job site, should be emphasized.

Make sure the trainees understand how the size and weight of a loaded dump truck can affect its ability to stop quickly and maintain speed control on a downgrade.
**SESSION FOUR**

Sessions Four is devoted exclusively to demonstrations, laboratories, and Performance Tasks. Trainees must perform the designated task to the satisfaction of the instructor to receive recognition from NCCER.

- Have trainees complete a proper prestart inspection and preventive maintenance on a dump truck. This laboratory corresponds with Performance Task 1.

If the dump truck to be used in this session has a manual transmission, make sure trainees are able to operate it. This may require separate lessons for those trainees who are not familiar with manual transmissions.

**SESSIONS FIVE THROUGH SEVEN**

Sessions Five through Seven are devoted exclusively to demonstrations, laboratories, and Performance Tasks. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER.

- Have trainees perform proper startup, warm-up, and shutdown procedures on a dump truck. This laboratory corresponds to Performance Task 2.

- Have trainees carry out basic operations with a dump truck:
  - Dump a load in a designated spot, and tailgate-spread the load.
  - Back up with a trailer attached.
  - Perform tailgate adjustment, as applicable.

This laboratory corresponds to Performance Task 3.

Download and/or prepare examination materials for the next session.

**SESSION EIGHT**

Session Eight is a review and testing session. Have trainees complete the Module Review Questions. (Alternatively, these may be assigned as homework at the end of Session Seven.) Answer any questions that the trainees may have.

Have trainees complete the written examination. Any outstanding performance testing must be completed by the end of this session.

Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
### Materials Checklist for On-Road Dump Trucks, 22202-13

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<td>Proper footwear, as designated by the instructor or training facility provider</td>
<td>Loader or excavator to load the truck</td>
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<td>Hearing protection, as designated by the instructor or training facility provider</td>
<td>Soil or other material to use as a load</td>
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<td>Hard hats</td>
<td>Trailer</td>
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<td>Copies of the Module Examination and Performance Profile Sheets</td>
<td>Traffic cones</td>
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</tr>
<tr>
<td><strong>Heavy Equipment Operations Level Two PowerPoint® Presentation Slides, DVD player</strong></td>
<td>One or more copies of the operator’s manual for the dump truck in use</td>
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</tr>
<tr>
<td>Whiteboard/chalkboard</td>
<td>Copies of the prestart inspection checklist and preventive maintenance schedules from the operator’s manual</td>
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<td>Markers/chalk</td>
<td>The following fluids and materials for the dump truck in use:</td>
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To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
The Trainee Guide for *Heavy Equipment Operations Level Two* is available as a NCCERconnect e-books. Contact your NCCER customer service representative at 1-888-622-3720 for more information.

Module Three (22207-12) provides training on the formulas and calculations used to determine the amounts of soil and other material to be removed from or added to a job-site excavation, focusing on volume and weight calculations.

### Objectives

**Learning Objective 1**
- Explain how to use formulas.
  - a. Explain the sequence of operations in solving a problem using a formula.
  - b. Explain how squares and square roots are derived.
  - c. Define angles and identify the types of angles.

**Learning Objective 2**
- Explain how math is used to solve right triangle problems.
  - a. Explain how to determine the length of a slope.
  - b. Explain how a building is laid out using right triangle math.

**Learning Objective 3**
- Define area and explain why determining the area of a space is required.
  - a. Determine the area of squares and rectangles.
  - b. Determine the area of a triangle.
  - c. Determine the area of a trapezoid.
  - d. Determine the area of a circle.

**Learning Objective 4**
- Define volume and explain the purpose of calculating volume.
  - a. Calculate the volume of a cube.
  - b. Calculate the volume of a prism.
  - c. Calculate the volume of a cylinder.
  - d. Describe the estimating process used to determine the volume and weight of simple and complex excavations.

### Performance Task

**Performance Task 1 (Learning Objective 4)**
- Using information provided by the instructor, calculate the volume and weight of a given excavation project.

### Teaching Time: 17.5 hours
(Seven 2.5-Hour Sessions)
Session time may be adjusted to accommodate your class size, schedule, and teaching style.

### Before You Begin
As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the written examinations and performance profile sheets from [www.nccerirc.com](http://www.nccerirc.com). The passing score for submission into NCCER’s Registry is 70% or above for the written examination; performance testing is graded pass or fail.
**Equipment and Materials**
- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- **Heavy Equipment Operations Level**
- Two PowerPoint® Presentation Slides
- DVD player
- LCD projector and screen
- Computer
- Copies of the Module Examination and Performance Profile Sheets

**Equipment and Materials for Laboratories and Performance Testing**
- Excavation drawings
- Markers
- Survey stakes

**Additional Resources**
This module presents thorough resources for task training. The following resource material is suggested for further study.


*Soil Properties That Affect Groundwater:* [www.co.portage.wi.us/groundwater/undrstnd/soil.htm](http://www.co.portage.wi.us/groundwater/undrstnd/soil.htm).
The Lesson Plan for this module is divided into seven 2.5-hour sessions. This time includes 10 minutes for administrative tasks, and a 10-minute break per session.

### Session One
Session One describes how to interpret and solve math formulas, introduces the trainees to squares and square roots, and defines the various types of angles.
Show Session One PowerPoint® slides.

### Session Two
In Session Two, trainees will learn how to solve right triangle problems using the Pythagorean theorem. They will also learn how to apply the 3-4-5 rule to lay out or check a right triangle.
Show Session Two PowerPoint® slides.
Use site drawings to show examples of situations in which right triangle calculations would be used.

### Session Three
Session Three covers calculating the areas of squares, rectangles, and triangles.
Show Session Three PowerPoint® slides.
In presenting this material, it is important to relate it to conditions the trainees will encounter on job site excavations. For example, foundations are generally squares or rectangles; the bed of a dump truck is a rectangle; slopes are triangular, and so forth.

### Session Four
Session Four covers calculating the areas of circles and trapezoids.
Show Session Four PowerPoint® slides.
Demonstrate how to calculate the area for trapezoids and circles and have the trainees practice these calculations.

### Session Five
Session Five focuses on calculating the volume of shapes, including squares, rectangles, prisms, and cylinders.
Show Session Five PowerPoint® slides.
Have the trainees measure objects in the classroom and then calculate the volumes of these objects. Emphasize that the knowledge gained in this lesson will be needed on the job in order to calculate cut and fill volumes, as well as haul volumes for trucks and scrapers and bucket volume for loaders and excavators.

### Session Six
Session Six covers the use of area and volume calculations to determine the volume of an excavation and the weight of the material to be removed from it, including foundations and slopes.
Show Session Six PowerPoint® slides.
If a loader bucket is available, have the trainees measure it and calculate its volume as an example of a practical exercise.
This session includes a Performance Test in which trainees will be required to calculate the volume and weight of material associated with an excavation project to be specified by the instructor.

### Session Seven
Session Seven is a review and testing session. Have trainees complete the Module Review Questions. (Alternatively, these may be assigned as homework at the end of Session Six.) Answer any questions that the trainees may have.
Have trainees complete the written examination. Any outstanding performance testing must be completed by the end of this session.
Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
### Materials Checklist for Excavation Math, 22207-13

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To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
Lesson Plans for 22209-13

INTERPRETING CIVIL DRAWINGS

The Trainee Guide for *Heavy Equipment Operations Level Two* is available as a NCCERconnect e-book. Contact your NCCER customer service representative at 1-888-622-3720 for more information.

**Module Four (22209-13)** introduces trainees to the types of drawings used in highway and building site construction projects. Drawing interpretation and a review of common specifications are also presented.

**Objectives**

**Learning Objective 1**
- Describe the types of drawings usually included in a set of plans and list the information found on each type.
  - a. Explain the use of title sheets, title blocks, and revision blocks.
  - b. Describe the types of drawings used in highway construction.
  - c. Describe the types of drawings used in building site construction.
  - d. Describe how as-built drawings are prepared.

**Learning Objective 2**
- Read and interpret drawings.
  - a. Identify different types of lines and symbols used on drawings.
  - b. Define common abbreviations used on drawings.
  - c. Interpret building site and highway drawings to determine excavation requirements.

**Learning Objective 3**
- Explain specifications and the purpose of specifications.
  - a. Identify the types of information contained in specifications.
  - b. Explain the common format used in specifications.

**Performance Tasks**

**Performance Task 1** (Learning Objective 1)
- Determine the scale of different drawings.

**Performance Task 2** (Learning Objectives 1, 2, and 3)
- Interpret a set of drawings to determine the proper type and sequence of excavation and grading operations needed to prepare the site.

**Teaching Time: 20 hours**

(Eight 2.5-Hour Sessions)

Session time may be adjusted to accommodate your class size, schedule, and teaching style.

**Before You Begin**

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the written examinations and performance profile sheets from [www.nccerirc.com](http://www.nccerirc.com). The passing score for submission into NCCER's Registry is 70% or above for the written examination; performance testing is graded pass or fail.
**Safety Considerations**

This module requires trainees to demonstrate their ability to read and interpret common civil drawings. As a result, the majority of the instruction will take place in the classroom environment. However, field trips to active job sites will expose trainees to the same hazards as workers in that environment. Safe working habits in the vicinity of heavy equipment must be emphasized for all trainees. Also ensure that all trainees know to avoid hazardous job-site areas, such as trenches or other excavations, and wear the proper PPE for the environment.

**Equipment and Materials**

- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- **Heavy Equipment Operations Level**
- **Two PowerPoint® Presentation Slides**
- DVD player
- LCD projector and screen
- Computer
- Copies of the Module Examination and Performance Profile Sheets

**Equipment and Materials for Laboratories and Performance Testing**

- Personal protective equipment (for site visits):
  - Standard eye protection
  - Gloves
  - Proper footwear as designated by the instructor or training facility provider
  - Hearing protection as designated by the instructor or training facility provider
  - Hard hats
- Civil drawing sets from multiple local highway construction sites and building construction sites
- Calculators (optional)
- Engineering scales
- Rulers
- 100 feet or longer tape measure

**Additional Resources**

This module presents thorough resources for task training. The following resource material is suggested for further study.

*Surveying with Construction Applications*, Barry F. Kavanaugh; Pearson, Upper Saddle River, NJ.


There are a number of online resources available for trainees who would like more information on civil drawings. A search for additional information may be assigned as homework to interested trainees.

Instructors should consider taking photos and videos of drawings being used on a job site and adding them to the PowerPoint® presentation. The use of such images for a review with trainees is recommended as an exercise in a number of lesson plan sessions.
Interpreting Civil Drawings

The Lesson Plan for this module is divided into eight 2.5-hour sessions. This time includes 10 minutes for administrative tasks and a 10-minute break per session.

**SESSION ONE**
Session One introduces trainees to the typical sections of a drawing and the information contained in them. The structure of plan and profile sheets is also covered, as well as typical cross-sections.

Show Session One PowerPoint® slides.

Have trainees practice the use of scales by making and recording measurements. This laboratory corresponds to Performance Task 1.

Review drawings specifically used in highway construction.

**SESSION TWO**
Session Two provides coverage of the various drawings used to prepare building construction sites, such as site and foundation plans. Soil reports are also introduced.

Show Session Two PowerPoint® slides.

Show one or more videos associated with digging safety and underground utility location.

Examine as-built drawings with trainees and discuss how they differ from an original design.

**SESSION THREE**
Session Three covers the interpretation of various civil drawings that were introduced in previous sessions. This session is designed for the classroom environment only.

Show Session Three PowerPoint® slides.

Ensure trainees understand that both symbols and abbreviations can differ among organizations and design professionals.

Show trainees how to interpret plans and use contour lines to help determine a course of action.

Compare and contrast highway drawings with those for building sites.

**SESSION FOUR**
Session Four covers drawing and project specifications are covered during this session.

Show Session Four PowerPoint® slides.

Introduce specifications associated with civil site projects and how they are organized.

Distribute drawings sets associated with the upcoming site visits. Have trainees analyze the drawings to practice interpretation skills and prepare a list of earthmoving steps required to create the excavations and the proper grades. Establish a plan for the site visits and ensure all trainees understand where they are to go and what they should do.

**SESSIONS FIVE AND SIX**
Sessions Five and Six are devoted to construction site visits. Trainees should be given an opportunity to visit one or more active sites and review the associated civil drawings. This creates an important connection between the two-dimensional drawings and the three-dimensional site and project.

Contact companies that are actively working on sites in the local area. Preferably, both a highway site and a building construction site should be selected. Instructors should request access to the site for training purposes, and one or more copies of the site drawings. This should be done well in advance of the class. The site drawings should be reviewed in the classroom before the trip is made so that trainees will be aware of specific site characteristics and conditions to look for.

**SESSION SEVEN**
Under your supervision, have trainees practice the requirements of Performance Task 2 as a laboratory. Trainee proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.

Download and/or prepare examination materials for the next session.
Session Eight is a review and testing session. Have trainees complete the Module Review Questions. (Alternatively, these may be assigned as homework at the end of Session Seven). Answer any questions that the trainees may have.

Have trainees complete the written examination. Any outstanding performance testing must be completed by the end of this session.

Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
### Materials Checklist for Interpreting Civil Drawings, 22209-13

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To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
Module Five (22210-13) describes the work involved in preparing a site for excavation and construction. The module first identifies important site safety practices. Other key topics include controlling water on a site, establishing grades, and laying pipe.

Lesson Plans for 22210-13

SITE WORK

The Trainee Guide for Heavy Equipment Operations Level Two is available as a NCCERconnect ebook. Contact your NCCER customer service representative at 1-888-622-3720 for more information.

Objectives

Learning Objective 1
- Describe the safety practices associated with site grading work.
  a. Explain the purpose of a site safety program.
  b. Describe why safety inspections and investigations are important.
  c. Explain how hazardous materials are controlled on a job site.
  d. Describe safety practices associated with trenching and excavations.
  e. Describe how to prepare heavy equipment for transporting.

Learning Objective 2
- Describe the methods used to control water on job sites.
  a. Explain the importance of maintaining proper drainage on a job site.
  b. Describe the methods used to control groundwater and surface water.
  c. Describe the safety practices and construction methods used when working around bodies of water.

Learning Objective 3
- Explain how grades are established on a job site.
  a. Describe how to set grades from a benchmark.
  b. Describe how grades are set for highway construction.
  c. Describe how grades are set for building construction.
  d. Explain how grading operations are performed.
  e. Describe the use of stakeless and stringless grading systems.

Learning Objective 4
- Describe grading and installation practices for pipe-laying operations.
  a. Explain how grades are established for pipe-laying operations.
  b. Describe the equipment and methods used to lay pipe.

Performance Tasks

Performance Task 1 (Learning Objective 3)
- Interpret layout and marking methods to determine grading requirements and operation.

Performance Task 2 (Learning Objective 3)
- Set up a level and determine the elevations at three different points, as directed by the instructor.

Teaching Time: 20 hours
(Eight 2.5-Hour Sessions)
Session time may be adjusted to accommodate your class size, schedule, and teaching style.

Prerequisites

Before You Begin
As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the written examinations and performance profile sheets from www.nccerirc.com. The passing score for submission into NCCER’s Registry is 70% or above for the written examination; performance testing is graded pass or fail.
**Safety Considerations**

It is suggested that the trainees visit a job site at some point during this lesson. If that occurs, make sure that all trainees wear the required PPE. Also, conduct a safety briefing to remind the trainees of the hazards that exist on an active job site.

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**Equipment and Materials**

- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- Heavy Equipment Operations Level Two PowerPoint® Presentation Slides
- DVD player
- LCD projector and screen
- Computer with Internet access
- Copies of the Module Examination and Performance Profile Sheets

**Equipment and Materials for Laboratories and Performance Testing**

- Personal protective equipment:
  - Standard eye protection
  - Gloves
  - Proper footwear as designated by the instructor or training facility provider
  - Hearing protection as designated by the instructor or training facility provider
  - Hard hats
  - Materials to install a silt fence (optional)

- Example of an MSDS
- Laser level or builder’s level
- A suitable facility to set grade stakes and check elevations
- Grade stakes
- Markers
- Slings
- Rigging hooks
- Shackles
- Site and grading planes for highway and building construction projects

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**Additional Resources**

This module presents thorough resources for task training. The following resource material is suggested for further study.

- The Occupational Safety and Health Administration (OSHA) publishes safety requirements for dump trucks and related material handling equipment, which may be found at www.osha.gov.

  *OSHA Standard 1926.601* covers the operation of dump trucks on a job site.

  *OSHA Standard 1926.602* covers material-handling equipment in general.

- There is a series of videos on site preparation and excavation at ownerbuilderonline.com. Review videos to ensure that they are suitable for your class.
Session One covers site safety programs; safety investigations and inspections; and hazardous material safety. This session is designed for the classroom environment only. The use of available video is encouraged.

Show Session One PowerPoint® slides.

Describe how a company safety program is set up. Try to obtain a copy of a company safety manual so that trainees can examine it. Make sure trainees understand the purpose of a HAZCOM program and the use of an MSDS.

Session Two familiarizes the trainees with safety practices specific to excavation sites, especially as related to trench safety. This session also covers preparation of equipment for transporting.

Show Session Two PowerPoint® slides.

Use information available online from NIOSH to emphasize the importance of trench safety. Make sure trainees understand the OSHA requirements, as well as the methods used to protect workers in trenches.

Discuss the methods used to safely prepare a machine for transport.

Session Three covers methods for controlling and removing groundwater from excavation sites, preventing soil erosion and sedimentation, the safety practices used when working around water, and the methods used to isolate work sites from surrounding water.

Show Session Three PowerPoint® slides.

Describe groundwater sources and explain the methods used to drain sites. Explain how water is removed from sites. Discuss the importance of using flotation devices and other required safety measures when working around water. Explain how coffer dams and caissons are used.

Session Four covers the placement and use of benchmarks as well as the excavation and grading of roadways.

Show Session Four PowerPoint® slides.

Describe the sequence of operations for highway grading. Explain how benchmarks are established and explain how they are used in establishing grade. Describe how highway profile and cross-section drawings are used in establishing grade and how grade information is represented on grade stakes.

Session Five covers methods for establishing grade for building foundations as well as grading methods and grading systems.

Show Session Five PowerPoint® slides.

Explain how grade is established for building foundations using site plans. Describe the methods used to establish proper grade and to prevent erosion and sedimentation. Describe the use of laser- and GPS-based grading.
systems.

**SESSION SIX**

Session Six is devoted to demonstrations, laboratories, and Performance Tasks.

Under your supervision, have each trainee practice performing the requirements of Performance Tasks 1 and 2. Trainee proficiency noted during laboratory exercises can be used to satisfy the NCCER Performance Testing requirements.

**SESSION SEVEN**

Session Seven covers methods used to establish grade in a trench as well as rigging and laying of pipe in a trench.

Show Session Seven PowerPoint® slides.

Explain how grade is established for a trench using both a laser level and a string line. Describe how to properly rig a pipe and how pipe is installed using an excavator or a dozer with a side boom.

**SESSION EIGHT**

Session Eight is a review and testing session. Have trainees complete the Module Review Questions. (Alternatively, these may be assigned as homework at the end of Session Seven.) Answer any questions that the trainees may have.

Have trainees complete the written examination. Any outstanding performance testing must be completed by the end of this session.

Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
### Materials Checklist for Site Work, 22210-13

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To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
Soils

Module Six (22308-12) introduces trainees to the various types of soils, their properties, and how these properties affect the heavy equipment operator.

Objectives

Learning Objective 1
- Describe the different types and characteristics of soils.
  a. Identify the types of soils.
  b. Describe the properties of soils.
  c. Explain how soil density is determined.
  d. Explain how moisture affects soil.

Learning Objective 2
- Describe the factors that affect soil excavation.
  a. Explain what the swell factor is and how to calculate the swell factor of soils.
  b. Explain what the shrink factor is and how to calculate the shrink factor of soils.
  c. Describe how swell and shrink factors affect cycle times and equipment selection.

Learning Objective 3
- Describe working in various soil conditions.
  a. Describe the weight bearing and flotation properties of different soils.
  b. Explain how soil characteristics affect machine performance.
  c. Describe how soil conditions can affect trenching safety.

Performance Tasks

Performance Task 1 (Learning Objective 1)
- Identify five basic types of soils and summarize their characteristics.

Performance Task 2 (Learning Objective 1)
- Read results from a field density test and explain what additional compaction effort is needed.

Performance Task 3 (Learning Objective 2)
- Compute shrinkage and relative compaction for two different types of soil.

Teaching Time: 10 hours
(Four 2.5-Hour Sessions)

Session time may be adjusted to accommodate your class size, schedule, and teaching style.

Before You Begin

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the written examinations and performance profile sheets from www.nccerirc.com. The passing score for submission into NCCER’s Registry is 70% or above for the written examination; performance testing is graded pass or fail.
**Safety Considerations**

This module requires trainees to demonstrate an ability to identify various soils and their characteristics. As a result, field trips to one or more active job sites may be in order. This could expose trainees to the same hazards as workers in that environment. Safe working habits in the vicinity of heavy equipment must be emphasized for all trainees. Also ensure that all trainees know to avoid hazardous job-site areas, such as trenches or other excavations, and wear the proper PPE for the environment.

**Equipment and Materials**

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**Equipment and Materials for Laboratories and Performance Testing**

- Generous samples of various soil types (see Table 3 of the Trainee Guide) for identification and testing, collected in cans or bags
- Water bottle
- Typical soil density test results

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**Equipment and Materials**

- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- Calculators (optional)
- **Heavy Equipment Operations Level**
- Two PowerPoint® Presentation Slides
- DVD player or a computer with a DVD drive
- LCD projector and screen
- Computer with Internet access
- Copies of the Module Examination and Performance Profile Sheets

**Additional Resources**

This module presents thorough resources for task training. The following resource material is suggested for further study.


There are a number of online resources available for trainees who would like more information on soils and their characteristics. A search for additional information may be assigned as homework to interested trainees.

Instructors should view all videos identified in the lesson plan before using them to ensure their suitability. Be prepared to stop the videos at appropriate times to point out and discuss the information or techniques presented.
Session One
Session One introduces trainees to the basic types of soils and the properties that set them apart. The engineering properties associated with various soils are also presented. Show Session One PowerPoint® slides. Show videos related to identifying soil through feel. Conduct a laboratory in soil identification.

Session Two
Session Two covers the property of soil density and the ways soil density tests are accomplished. The effect of moisture on soils is presented to complete the session. Show Session Two PowerPoint® slides. Show videos related to soil density testing. Conduct a laboratory in reading and understanding soil density reports and curves.

Session Three
Session Three covers the use of swell and shrink factors, and how various soil conditions affect the operation and handling of heavy equipment. The hazards of trenching in different soils are also presented. Show Session Three PowerPoint® slides. Demonstrate to trainees how swell and shrink factors directly affect calculations related to heavy equipment operations. Conduct a laboratory to allow trainees to practice calculating shrink factors and compaction requirements. Show videos related to soils and trenching safety.

Session Four
Session Four is a review and testing session. Have trainees complete and/or review the Module Review Questions. These may have been assigned as homework at the end of the previous session. Answer any questions that the trainees may have. Have trainees complete the written examination. Any outstanding performance testing must be completed by the end of this session. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
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To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
The Trainee Guide for *Heavy Equipment Operations Level Two* is available as a NCCERconnect e-book. Contact your NCCER customer service representative at 1-888-622-3720 for more information.

**Module Seven (22212-12)** provides training on the primary components of a skid steer, prestart inspections, preventive maintenance, and the proper operating procedures. Common procedures used by skid steer operators on site are also presented.

### Objectives

#### Learning Objective 1
- Identify and describe the components of a skid steer.
  - a. Identify and describe chassis components.
  - b. Identify and describe skid steer controls.
  - c. Identify and describe skid steer instrumentation.
  - d. Identify and describe skid steer attachments.

#### Learning Objective 2
- Describe the prestart inspection and preventive maintenance requirements for a skid steer.
  - a. Describe prestart inspection procedures.
  - b. Describe preventive maintenance requirements.

#### Learning Objective 3
- Describe the startup, shutdown, and operating procedures for a skid steer.
  - b. Describe startup, warm-up, and shutdown procedures.
  - c. Describe basic maneuvers and operations.
  - d. Describe related work activities.

### Performance Tasks

#### Performance Task 1 (Learning Objective 2)
- Complete a proper prestart inspection, maintenance, and housekeeping on a skid steer.

#### Performance Task 2 (Learning Objective 3)
- Demonstrate proper entrance and exiting of the operator cab.

#### Performance Task 3 (Learning Objective 3)
- Perform proper startup, warm-up, and shutdown procedures.

#### Performance Task 4 (Learning Objective 3)
- Execute basic maneuvers with a skid steer, including:
  - a. Grading
  - b. Removing stumps and boulders
  - c. Steering
  - d. Changing attachments
  - e. Loading a dump truck
  - f. Maneuvering on slopes
  - g. Utilizing a fork attachment for moving materials

#### Performance Task 5 (Learning Objective 3)
- Properly load and secure a skid steer for transport.

### Teaching Time: 22.5 hours
(Nine 2.5-Hour Sessions)

Session time may be adjusted to accommodate your class size, schedule, and teaching style.

### Prerequisites
Completion of Heavy Equipment Safety Module 22102-12.

### Before You Begin
As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the written examinations and performance profile sheets from [www.nccerirc.com](http://www.nccerirc.com). The passing score for submission into NCCER's Registry is 70% or above for the written examination; performance testing is graded pass or fail.
Safety Considerations

This module requires trainees to demonstrate how to safely inspect, start, and operate a skid steer and related attachments. Safe working habits in the vicinity of heavy equipment must be emphasized for all trainees. As operators, ensure that trainees observe all required safety precautions before starting and operating the equipment. Performance tasks must be completed under your supervision. Each trainee must use the required PPE and follow safe heavy equipment operating procedures.

Equipment and Materials

- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- Heavy Equipment Operations Level Two PowerPoint® Presentation Slides
- DVD player
- LCD projector and screen
- Computer with Internet access
- Copies of the Module Examination and Performance Profile Sheets

- Personal protective equipment:
  - Standard eye protection
  - Gloves
  - Proper footwear as designated by the instructor or training facility provider
  - Hearing protection as designated by the instructor or training facility provider
  - Hard hats
- Functional skid steer machine with compatible attachments, including (as a minimum) a bucket, pallet forks, and a grapple bucket
- A suitable facility to drive the skid steer and practice basic work activities
- A suitable truck to load soil and other loads, such as stumps/rocks and palletized materials
- A method of two-way communication with hands-free characteristics
- Operator’s manual for the skid steer in use
- The following fluids and materials for the skid steer in use:
  - Fuel
  - Engine oil
  - Hydraulic fluid
  - Water
  - Lubricating grease and grease guns
- Any common hand tools (such as a screwdriver or adjustable wrench) that may be required for the general maintenance and inspection of a skid steer
- Rags

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

The Occupational Safety and Health Administration (OSHA) publishes safety requirements for heavy equipment in Standard 1926.602, found at www.osha.gov.

There are a number of online resources available for trainees who would like more information on skid steers and other heavy equipment. A search for additional information may be assigned as homework to interested trainees.

An effective way for trainees to see skid steers in action is to shoot your own video at a job site where they are being used. You can use this video to point out correct and incorrect methods of operation. Such video can also be used to test the trainees on their knowledge of correct and incorrect operation. For skid steers, this video could include:

- Prestart walk-around inspection
- Startup and shutdown process
- Various work activities
- Challenging maneuvers in tight spaces

Instructors should view all videos identified in the lesson plan before using them to ensure their suitability. The videos will provide teachable moments in both proper and improper operation. Be prepared to stop the videos at appropriate times to point out and discuss both proper and improper techniques.

Instructors should also consider taking still pictures of controls and instrumentation inside a skid steer cab and adding them to the PowerPoint® presentation. Images from the specific machine the trainees will operate are especially helpful. The use of such images for a review of the controls and instrumentation with trainees is recommended as an exercise in a number of lesson plan sessions.
Session Outline for 22212-13

SKID STEERS

The Lesson Plan for this module is divided into nine 2.5-hour sessions. This time includes 10 minutes for administrative tasks, and a 10-minute break per session.

Due to the often-limited access to heavy equipment, it is suggested that the text of this module be presented in the classroom environment in its entirety before demonstrations and hands-on practice begins. Once the text has been presented, the practical instruction, demonstrations, and trainee practice using a functional skid steer can be done continuously without interruption. As a result, Sessions One through Four are designed exclusively for the classroom environment, while Sessions Five through Eight are dedicated to demonstrations, practice, and the execution of performance tasks.

**SESSION ONE**

Session One introduces trainees to the primary components of skid steers, as well as their common operating controls.

Show Session One PowerPoint® slides.

Distribute one or more copies of the operator’s manual for the skid steer to be used in demonstration and practice. Refer to the manual during the session to complement the text.

After studying a variety of different skid steer cabs and controls, have trainees practice pointing out various controls without the aid of labels.

**SESSION TWO**

Session Two begins with coverage of skid steer instrumentation, followed by a review of the many versatile attachments. The session also includes coverage of skid steer prestart inspections and preparations for use.

Show Session Two PowerPoint® slides.

Discuss the flow of a prestart inspection and the items that should be checked and/or serviced. Explain why certain items need attention.

**SESSION THREE**

Session Three covers preventive maintenance requirements for skid steers. The session includes a review of the safety issues and guidelines associated with skid steer operation. Startup, warm-up, and shutdown procedures are also covered.

Show Session Three PowerPoint® slides.

Review skid steer maintenance requirements beyond the prestart inspection. Familiarize trainees with typical maintenance task intervals.

Utilize OSHA and manufacturer web sites and their resources to expand on coverage of safety, as well as available industry CD and DVDs.

**SESSION FOUR**

Session Four covers skid steer maneuvers and basic operating procedures. A review of the common work activities and how they are accomplished is also included.

Show Session Four PowerPoint® slides.

Distribute one or more copies of the operator’s manual for the skid steer to be used in demonstration and practice. Refer to the manual during the session to complement the text.

Talk about basic skid steer operation and movement. Review common work activities assigned to skid steer operators and discuss the techniques.

Prepare the trainees for the next four sessions when they will have an opportunity to operate a skid steer and demonstrate what they have learned.
Sessions Five through Eight are devoted exclusively to demonstrations, laboratories, and Performance Tasks. Note that no PowerPoint® presentations are associated with these sessions. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER.

Under your supervision, have trainees individually practice the requirements of Performance Tasks 1 through 5 as a laboratory. Trainee proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.

Download and/or prepare examination materials for the next session.

Session Nine is a review and testing session. Note that no PowerPoint® presentation is associated with this session. Have trainees complete the Module Review Questions. (Alternatively, these may be assigned as homework at the end of the previous session.) Answer any questions that the trainees may have.

Have trainees complete the written examination. Any outstanding performance testing must be completed by the end of this session.

Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
# Materials Checklist for Skid Steers, 22212-13

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
<th>Equipment</th>
<th>Tools</th>
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<tbody>
<tr>
<td><strong>Personal protective equipment:</strong></td>
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<tr>
<td>Standard eye protection</td>
<td>Functional skid steer machine with compatible attachments, including (as a minimum) a bucket, pallet forks, and a grapple bucket</td>
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<tr>
<td>Gloves</td>
<td>A suitable facility to drive the skid steer and practice basic work activities</td>
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<tr>
<td>Proper footwear as designated by the instructor or training facility provider</td>
<td>A suitable truck to load</td>
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<td>Hearing protection as designated by the instructor or training facility provider</td>
<td>Soil and other loads, such as stumps/rocks and palletized materials</td>
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<td>Hard hats</td>
<td>A method of two-way communication with hands-free characteristics</td>
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<td></td>
<td>Operator’s manual for the skid steer in use</td>
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<td></td>
<td>The following fluids and materials for the skid steer in use:</td>
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<td>Fuel</td>
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<td>Engine oil</td>
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<td>Hydraulic fluid</td>
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<td>Lubricating grease and grease guns</td>
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<td></td>
<td>Copies of the Module Examination and Performance Profile Sheets</td>
<td>Rags</td>
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<tr>
<td></td>
<td>Heavy Equipment Operations Level Two PowerPoint® Presentation Slides, DVD player</td>
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<td>TV/VCR/DVD player (optional)</td>
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To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
The Trainee Guide for *Heavy Equipment Operations Level Two* is available as a NCCERconnect e-book. Contact your NCCER customer service representative at 1-888-622-3720 for more information.

**Module Eight (22205-12)** provides training on the primary components of a loader, prestart inspections, preventive maintenance, and the proper operating procedures. Common procedures used by loader operators on site are also presented.

### Objectives

**Learning Objective 1**
- Identify and describe the components of a loader.
  - a. Identify and describe chassis components.
  - b. Identify and describe loader controls.
  - c. Identify and describe loader instrumentation.
  - d. Identify and describe loader attachments.

**Learning Objective 2**
- Describe the prestart inspection and preventive maintenance requirements for a loader.
  - a. Describe prestart inspection procedures.
  - b. Describe preventive maintenance requirements.

**Learning Objective 3**
- Describe the startup and operating procedures for a loader.
  - a. State loader-related safety guidelines.
  - b. Describe startup, warm-up, and shutdown procedures.
  - c. Describe basic maneuvers and operations.
  - d. Describe related work activities.

### Performance Tasks

**Performance Task 1 (Learning Objective 2)**
- Complete a proper prestart inspection and maintenance on a loader.

**Performance Task 2 (Learning Objective 3)**
- Perform proper startup, warm-up, and shutdown procedures.

**Performance Task 3 (Learning Objective 3)**
- Execute basic maneuvers with a loader, including proper movements and curling the bucket.

**Performance Task 4 (Learning Objective 3)**
- Carry out basic earthmoving operations with a loader, load a truck (to capacity, if possible), and build a storage pile.

### Teaching Time: 17.5 hours

(Seven 2.5-Hour Sessions)

Session time may be adjusted to accommodate your class size, schedule, and teaching style.

### Prerequisites

Completion of Heavy Equipment Safety Module 22102-12

### Before You Begin

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the written examinations and performance profile sheets from [www.nccerirc.com](http://www.nccerirc.com). The passing score for submission into NCCER’s Registry is 70% or above for the written examination; performance testing is graded pass or fail.
**Safety Considerations**

This module requires trainees to demonstrate how to safely inspect, start, and operate a loader. Safe working habits in the vicinity of heavy equipment must be emphasized for all trainees. As operators, ensure that trainees observe all required safety precautions before starting and operating the loader. Performance tasks must be completed under your supervision. Each trainee must use the required PPE and follow safe heavy equipment operating procedures.

**Equipment and Materials**

- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- **Heavy Equipment Operations Level Two**
  - PowerPoint® Presentation Slides
  - DVD player or a computer with a DVD drive
  - LCD projector and screen
  - Computer with Internet access
  - Copies of the Module Examination and Performance Profile Sheets

**Equipment and Materials for Laboratories and Performance Testing**

- Personal protective equipment:
  - Standard eye protection
  - Gloves
  - Proper footwear as designated by the instructor or training facility provider
  - Hearing protection as designated by the instructor or training facility provider
  - Hard hats
  - Functional loader
  - A suitable facility to drive the loader and practice basic work activities
  - A suitable dump truck to load
  - A method of two-way communication with hands-free characteristics
  - Operator’s manual for the loader in use

- The following fluids and materials for the loader in use:
  - Fuel
  - Engine oil
  - Hydraulic fluid
  - Water
  - Lubricating grease and grease guns
  - Any common hand tools (such as a screwdriver or adjustable wrench) that may be required for the general maintenance and inspection of a loader
  - Rags

**Additional Resources**

This module presents thorough resources for task training. The following resource material is suggested for further study.

The Occupational Safety and Health Administration (OSHA) publishes safety requirements for loaders and related material handling equipment in *OSHA Standard 1926.602*, found at www.osha.gov.

There are a number of online resources available for trainees who would like more information on loaders and other heavy equipment. A search for additional information may be assigned as homework to interested trainees.

An effective way for trainees to see loaders in action is to shoot your own video at a job site where they are being used. You can use this video to point out correct and incorrect methods of operation. Such video can also be used to test the trainees on their knowledge of correct and incorrect operation. For loaders, this video could include:

- Prestart walk-around inspection
- Startup and shutdown process
- Various loader tasks in progress

Instructors should view all videos identified in the lesson plan before using them to ensure their suitability. The videos will provide teachable moments in both proper and improper operation. Be prepared to stop the videos at appropriate times to point out and discuss both proper and improper techniques.

Instructors should also consider taking photos of controls and instrumentation inside a loader cab and adding them to the PowerPoint® presentation. Images from the specific loader the trainees will operate are especially helpful. The use of such images for a review of the controls and instrumentation with trainees is recommended as an exercise in a number of lesson plan sessions.
Session Outline for 22205-13

LOADERS

The Lesson Plan for this module is divided into seven 2.5-hour sessions. This time includes 10 minutes for administrative tasks, and a 10-minute break per session.

Due to the often-limited access to heavy equipment, it is suggested that the text of this module be presented in its entirety in the classroom environment before demonstrations and hands-on practice begins. Once the text has been presented, the practical instruction, demonstrations, and trainee practice using a functional loader can be done continuously without interruption. As a result, Sessions One through Three are designed exclusively for the classroom environment, while Sessions Four through Six are dedicated to demonstrations, practice, and the execution of performance tasks.

SESSION ONE

Session One introduces trainees to the primary components of loaders, as well as their common operating controls, instrumentation, and attachments.

Show Session One PowerPoint® slides.
Distribute copies of the operator’s manual for the loader to be used in demonstration and practice. Refer to the manual during the session to complement the text and provide a practical example.

SESSION TWO

Session Two covers prestart and preventive maintenance tasks that loaders require. The session also includes coverage of loader safety as well as startup, warm-up, and shutdown procedures. This session is designed for the classroom environment only; however, practical exercises could be done if an appropriate loader is readily available.

Show Session Two PowerPoint® slides.
Discuss the importance of safe work habits and help trainees to understand what kinds of accidents involving heavy equipment can occur. Utilize the OSHA and Caterpillar web sites and their resources to expand on coverage of the subject.

Review the proper procedures associated with the startup, warm-up, and shutdown of loaders.

SESSION THREE

Session Three covers the operating procedures and work activities related to loaders. The session includes coverage of the operating procedures and different approaches related to loader operations and the required maneuvers to accomplish job site assignments. This session is designed for the classroom environment only; however, practical exercises can be done if an appropriate loader is readily available.

Show Session Three PowerPoint® slides.
Talk about basic loader and bucket movements. Review common work activities assigned to loader operators and discuss the techniques.

While covering common work activities and the versatile nature of loaders, emphasize the importance of working as a team with other heavy equipment operators. Stress the importance of working efficiently and minimizing cycle times. Remind trainees that no project can be truly successful without a dedication to safety.


**SESSIONS FOUR THROUGH SIX**

Sessions Four through Six are devoted exclusively to demonstrations, laboratories, and Performance Tasks. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER.

Demonstrate a complete pre-start inspection on the machine in use. Then demonstrate the common maintenance tasks presented during the lecture. Finally, demonstrate startup and warm-up procedures. Load and dump the bucket in a truck and/or stockpile.

Under your supervision, have trainees practice the requirements of Performance Tasks 1, 2, 3, and 4 as a laboratory. Trainee proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.

Download and/or prepare examination materials for the next session.

**SESSION SEVEN**

Session Seven is a review and testing session. Have trainees complete the Module Review Questions. (Alternatively, these may be assigned as homework at the end of Session Six.) Answer any questions that the trainees may have.

Have trainees complete the written examination. Any outstanding performance testing must be completed by the end of this session.

Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
### Equipment and Materials Checklist for Loaders, 22205-13

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<td>Hard hats</td>
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<td>The following fluids and materials for the loader in use:</td>
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To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
The Trainee Guide for *Heavy Equipment Operations Level Two* is available as a NCCERconnect e-book. Contact your NCCER customer service representative at 1-888-622-3720 for more information.

**Module Nine (22204-12)** provides training on the primary components, prestart inspections, preventive maintenance, and the proper operating procedures of a scraper. Common procedures used by scraper operators on site are also presented.

### Objectives

**Learning Objective 1**
- Identify and describe the components of a scraper.
  - a. Identify and describe chassis components.
  - b. Identify and describe scraper controls.
  - c. Identify and describe scraper instrumentation.

**Learning Objective 2**
- Describe the prestart inspection and preventive maintenance requirements for a scraper.
  - a. Describe prestart inspection procedures.
  - b. Describe preventive maintenance requirements.

**Learning Objective 3**
- Describe the startup, shutdown, and operating procedures for a scraper.
  - b. Describe startup, warm-up, and shutdown procedures.
  - c. Describe basic maneuvers and operations.
  - d. Describe related work activities.

### Performance Tasks

**Performance Task 1** (Learning Objective 2)
- Complete a proper prestart inspection and preventive maintenance on a scraper.

**Performance Task 2** (Learning Objective 3)
- Perform proper startup, warm-up, and shutdown procedures on a scraper.

**Performance Task 3** (Learning Objective 3)
- Execute basic maneuvers with a scraper, including forward/backward movement, turning, loading, and unloading.

### Teaching Time: 17.5 hours
(Seven 2.5-Hour Sessions)

Session time may be adjusted to accommodate your class size, schedule, and teaching style.

### Prerequisites

Completion of Heavy Equipment Safety Module 22102-12

### Before You Begin

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the written examinations and performance profile sheets from www.nccerinc.com. The passing score for submission into NCCER’s Registry is 70% or above for the written examination; performance testing is graded pass or fail.
**Safety Considerations**

This module requires trainees to demonstrate how to safely inspect, start, and operate a scraper. Safe working habits in the vicinity of heavy equipment must be emphasized for all trainees. As operators, ensure that trainees observe all required safety precautions before starting and operating the scraper. Performance tasks must be completed under your supervision. Each trainee must use the required PPE and follow safe heavy equipment operating procedures.

**Equipment and Materials**

- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- **Heavy Equipment Operations Level Two** Presentation Slides
- DVD player or a computer with a DVD drive
- LCD projector and screen
- Computer with Internet access
- Copies of the Module Examination and Performance Profile Sheets

**Personal protective equipment:**
- Standard eye protection
- Gloves
- Proper footwear as designated by the instructor or training facility provider
- Hearing protection as designated by the instructor or training facility provider
- Hard hats

- Functional self-propelled scraper
- A suitable facility to drive the scraper and practice basic work activities
- A method of two-way communication with hands-free characteristics
- Operator's manual for the scraper in use

**Equipment and Materials for Laboratories and Performance Testing**

- The following fluids and materials for the scraper in use:
  - Fuel
  - Engine oil
  - Hydraulic fluid
  - Water
  - Lubricating grease and grease guns
  - Any common hand tools (such as a screwdriver or adjustable wrench) that may be required for the general maintenance and inspection of the scraper to be used for demonstration and practice
  - Rags

**Additional Resources**

This module presents thorough resources for task training. The following resource material is suggested for further study.

The Occupational Safety and Health Administration (OSHA) publishes safety requirements for scrapers and related material handling equipment in *OSHA Standard 1926.602*, found at www.osha.gov.

There are a number of online resources available for trainees who would like more information on scrapers and other heavy equipment. A search for additional information may be assigned as homework to interested trainees.

An effective way for trainees to see scrapers in action is to shoot your own video at a job site where scrapers are being used. You can use this video to point out correct and incorrect operations. Such video can also be used to test the trainees on their knowledge of correct and incorrect operation. For scrapers, this video could include:

- Prestart walk-around inspection
- Startup and shutdown process
- The loading and dumping process

Instructors should view all videos identified in the lesson plan before using them to ensure their suitability. The videos will provide teachable moments in both proper and improper operation. Be prepared to stop the videos at appropriate times to point out and discuss both proper and improper techniques.

Instructors should also consider taking photos of controls and instrumentation inside a scraper cab and adding them to the PowerPoint® presentation. Images from the specific scraper the trainees will operate are especially helpful. The use of such images for a review of the controls and instrumentation with trainees is recommended as an exercise in a number of lesson plan sessions.
The Lesson Plan for this module is divided into seven 2.5-hour sessions. This time includes 10 minutes for administrative tasks, and a 10-minute break per session.

Due to the often-limited access to heavy equipment, it is suggested that the text of this module be presented in its entirety in the classroom environment before demonstrations and hands-on practice begin. Once the text has been presented, the practical instruction, demonstrations, and trainee practice using a functional scraper can be done continuously without interruption. As a result, Sessions One through Three are designed exclusively for the classroom environment, while Sessions Four through Six are dedicated to demonstrations, practice, and the execution of performance tasks.

**Session One**
Session One introduces trainees to scrapers, their primary components, and their common operating controls.
Show Session One PowerPoint® slides.
Distribute copies of the operator’s manual for the scraper to be used in demonstration and practice. Refer to the manual during the session to complement the text and provide a practical example.
Ensure that trainees see that the primary components of scrapers are basically the same with only minor differences in form.
After studying a variety of different scraper cab and control configurations, have trainees practice pointing out various controls without the aid of labels.

**Session Two**
Session Two begins with coverage of scraper instrumentation, followed by a discussion of the various prestart and preventive maintenance tasks that scrapers require. The session finishes with an emphasis on personnel and heavy equipment safety.
Show Session Two PowerPoint® slides.
After studying different scraper instrument layouts, have trainees practice identifying various icons associated with indicator and warning lights without the aid of labels.
Discuss the importance of safe work habits and help trainees to understand what kinds of accidents involving heavy equipment can occur. Utilize the OSHA and Caterpillar websites to expand on coverage of the subject.

**Session Three**
Session Three covers the operating procedures related to scrapers. It begins with the basic procedures related to the startup, warm-up, and shutdown of scrapers. The session concludes with coverage of the operating procedures and different approaches related to scraper operations and the required maneuvers to accomplish job-site assignments.
Show Session Three PowerPoint® slides.
Distribute copies of the operator’s manual for the scraper to be used in demonstration and practice. Refer to the manual during the session to complement the text and provide a practical example.
SESSIONS FOUR THROUGH SIX

Sessions Four through Six are devoted exclusively to demonstrations, laboratories, and Performance Tasks. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER.

Demonstrate how a prestart inspection is accomplished on the machine in use. Then demonstrate the common preventive maintenance tasks presented during the lecture. Finally, demonstrate startup and warm-up procedures.

Under your supervision, have trainees practice the requirements of Performance Tasks 1, 2, and 3 as a laboratory. Trainee proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.

Download and/or prepare examination materials for the next session.

SESSION SEVEN

Session Seven is a review and testing session. Have trainees complete the Module Review Questions. Alternatively, these may be assigned as homework at the end of Session Six. Answer any questions that the trainees may have.

Have trainees complete the written examination. Any outstanding Performance Testing must be completed by the end of this session.

Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
## Materials Checklist for Scrapers, 22204-13

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
<th>Equipment</th>
<th>Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal protective equipment:</strong></td>
<td>Functional self-propelled scraper</td>
<td>Any common hand tools (such as a screwdriver or adjustable wrench) that may be required for the general maintenance and inspection of the scraper to be used for demonstration and practice</td>
</tr>
<tr>
<td>Standard eye protection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gloves</td>
<td>A suitable facility to drive the scraper and practice basic work activities</td>
<td>Rags</td>
</tr>
<tr>
<td>Proper footwear as designated by the instructor or training facility provider</td>
<td>A method of two-way communication with hands-free characteristics</td>
<td></td>
</tr>
<tr>
<td>Hearing protection as designated by the instructor or training facility provider</td>
<td>Operator’s manual for the scraper in use</td>
<td></td>
</tr>
<tr>
<td>Hard hats</td>
<td>The following fluids and materials for the scraper in use:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fuel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Engine oil</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hydraulic fluid</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lubricating grease and grease guns</td>
<td></td>
</tr>
<tr>
<td>Copies of the Module Examination and Performance Profile Sheets</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Heavy Equipment Operations Level Two PowerPoint® Presentation Slides, DVD player</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Markers/chalk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pencils and paper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LCD projector and screen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TV/VCR/DVD player <em>(optional)</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.