Module One (36101-17) introduces the trainees to careers, equipment, and processes used in the construction of highways and bridges.

Objectives

Learning Objective 1
- Describe the trade.
  a. Describe the types of work performed in the trade.
  b. Describe the opportunities available in the trade.

Learning Objective 2
- Describe the basic processes used in heavy construction.
  a. Describe the general steps used to plan and prepare for a heavy construction project.
  b. Identify the processes in highway construction.
  c. Identify the processes in bridge construction.
  d. Identify steps taken when a heavy construction project is complete.

Learning Objective 3
- Describe NCCER standardized training.
  a. Explain how apprenticeship programs are structured.
  b. Describe the basic principles of apprenticeship training.
  c. Explain the licensing requirements for apprenticeship training.

Performance Tasks
This is a knowledge-based module; there are no performance tasks.

Teaching Time: 7.5 hours
(Three 2.5-Hour Sessions)
Session time may be adjusted to accommodate your class size, schedule, and teaching style.

Prerequisites
Core Curriculum

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

Using your access code, download the PowerPoint® presentations and Performance Profile Sheets from www.nccerinc.com. The passing score for submission into NCCER’s Registry is 70% or above for the module examination; performance testing is graded pass or fail.
Safety Considerations
Safety must be emphasized at all times. Trainees should be carefully observed to ensure that they wear the proper PPE, follow safe practices, and give due respect to unseen hazards. Any deficiencies must be corrected to ensure future trainee safety. All practice sessions and Performance Tasks must be completed under your direct supervision.

Classroom Equipment and Materials
Whiteboard
Markers
Pencils and paper
Heavy Highway Construction Level One PowerPoint® Presentation
LCD projector and screen
Computer with internet access
Module Review answer key
Module Examinations

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

The following websites offer resources for products and training:
  Build Your Future (initiative of NCCER), www.byf.org
  Occupational Information Network (O*NET), sponsored by the US Department of Labor / Employment and Training Administration. “My Next Move.” www.mynextmove.org
  Scranton Gillette Communications. “Roads and Bridges.” www.roadsbridges.com

Instructors are also encouraged to locate additional audiovisual aids available on the internet, make personal videos, and take still pictures related to the subject matter and add them to the presentations throughout the program.
The Lesson Plan for this module is divided into three 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 various skills required in the trade and the opportunities for advancement available in the trade. It also provides an introduction to the processes involved in building bridges and highways. This session covers Sections 1.0.0 through 1.2.0.

1. Open the Session One presentation.
2. Use the Kickoff Activity to get trainees engaged and give them an idea of what they will learn from this module.
3. Describe the roles of the various craft professionals used in the construction of highways and bridges.
4. Discuss the various growth opportunities available to craft professionals.
5. Explain the importance of professionalism and hold a class discussion on this topic.

SESSION TWO

Session Two covers the NCCER training methods and curricula. It describes apprenticeship programs and explains the Youth Apprenticeship program. Licensing of craft professionals is also covered. This session covers Sections 2.0.0 through 3.3.0.

1. Open the Session Two presentation.
2. Use the Kickoff Activity to get trainees engaged.
3. Describe the general steps and procedures associated with heavy construction projects.
4. Describe how registered apprenticeship programs are structured and how the training is acquired.
5. Explain the importance of apprenticeship standards.
6. Describe the role of licensing and continuing education.

SESSION THREE

Session Three is a review and testing session. Have trainees complete the Module Review. Alternatively, these may be assigned as homework at the end of Session Three. Go over the Module Review in class prior to the exam and answer any questions that the trainees may have.

1. Administer the Module Examination.
2. Submit the results to your Training Program Sponsor through the Registry system.
Lesson Plans for Module 36111-17

HEAVY EQUIPMENT IN HIGHWAY CONSTRUCTION

Module Two (36111-17) describes the types of heavy equipment, utility equipment, and cranes used in the construction of bridges and highways. Trainees will be expected to recognize the equipment and describe its use.

Objectives

Learning Objective 1
• Identify the heavy equipment used in highway and bridge construction and describe their uses.
  a. Identify heavy equipment used in excavation and grading.
  b. Identify the types of trucks used in highway and bridge construction.
  c. Identify paving equipment used in highway construction.

Learning Objective 2
• Identify utility equipment used on the job site and describe their uses.
  a. Identify and describe compaction equipment.
  b. Identify and describe electrical generators.
  c. Identify and describe air compressors.

Learning Objective 3
• Identify the mobile cranes used in highway and bridge construction and describe their uses.
  a. Identify and describe crawler cranes.
  b. Identify and describe truck-mounted cranes.

Performance Tasks
This is a knowledge-based module; there are no performance tasks.

Teaching Time: 10 hours
(Four 2.5-Hour Sessions)
Session time may be adjusted to accommodate your class size, schedule, and teaching style.

Prerequisites
Core Curriculum

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

Using your access code, download the PowerPoint® presentations and Performance Profile Sheets from www.nccerirc.com. The passing score for submission into NCCER’s Registry is 70% or above for the module examination; performance testing is graded pass or fail.
Safety Considerations
Safety must be emphasized at all times. Trainees should be carefully observed to ensure that they wear the proper PPE, follow safe practices, and give due respect to unseen hazards. Any deficiencies must be corrected to ensure future trainee safety. All practice sessions and Performance Tasks must be completed under your direct supervision.

Equipment, Materials, and Resources
Whiteboard
Markers
Pencils and paper
LCD projector and screen
PowerPoint® Presentations for Module 36111-17
Computer with Internet access
Module Review answer key
Module Examinations
A selection of heavy equipment brochures

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


Instructors are also encouraged to locate additional audiovisual aids available on the Internet, make personal videos, and take still pictures related to the subject matter and add them to the presentations throughout the program.
Session Outline for Module 36111-17

HEAVY EQUIPMENT IN HIGHWAY CONSTRUCTION

The Lesson Plan for this module is divided into four 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 excavation and grading equipment used on highway and bridge construction sites, including tractors, loaders, excavators, dozers, and motor graders. This session covers Sections 1.0.0 through 1.1.9.

1. Open the Session One presentation.
2. Use the Kickoff Activity to get trainees engaged and give them an idea of what they will learn from this module.
3. Describe the equipment items used in excavating such as tractors, loaders, backhoes, and excavators.
4. Describe the equipment items used in grading, such as scrapers, dozers, and motor graders.
5. Test the trainees on their ability to identify heavy equipment and describe its purpose.

**SESSION TWO**

Session Two introduces trainees to the dump trucks and paving equipment used on highway and bridge construction sites. This session covers Sections 1.2.0 through 1.3.3.

1. Open the Session Two presentation.
2. Use the Kickoff Activity to get trainees engaged and give them an idea of what they will learn from this module.
3. Describe the various types of on-road and off-road dump trucks used in hauling material both on and off the site.
4. Describe the various types of equipment used in placing and finishing concrete and asphalt highway paving material.
5. Test the trainees on their ability to identify equipment and describe its purpose.

**SESSION THREE**

Session Three covers the utility equipment used on job sites, including electrical generators, air compressors, and compaction equipment, as well as the various types of cranes used for lifting loads and driving piles. This session covers Sections 2.0.0 through 3.2.0.

1. Open the Session Three presentation.
2. Use the Kickoff Activity to get trainees engaged.
3. Describe the types of generators used on job sites and how they are used to provide electricity and lighting.
4. Explain the types of air compressors and how they are used.
5. Describe the different types of compaction equipment.
6. Describe the different types of cranes and how they are used.
Session Four is a review and testing session. Have trainees complete the Module Review. Alternatively, these may be assigned as homework at the end of Session Three. Go over the Module Review in class prior to the exam and answer any questions that the trainees may have.

1. Administer the Module Examination.

2. Submit the results to your Training Program Sponsor through the Registry system.
Lesson Plans for Module 36110-17

HIGHWAY AND BRIDGE SAFETY

Module Three (36110-17) Reviews the safety hazards and precautions associated with construction of highways and bridges. It also emphasizes the importance of following safety procedures in order to prevent accidents and injuries associated with working in hazardous places/conditions.

Objectives

Learning Objective 1
- Identify the common hazards found in highway and bridge construction and explain how to minimize the risks associated with those hazards.
  a. Identify the hazards commonly associated with equipment used in highway and bridge construction.
  b. Identify common job site hazards.
  c. Describe methods used to identify hazards on a job site.
  d. Describe hazards commonly associated with confined spaces.
  e. Describe the purpose of a job safety analysis.

Learning Objective 2
- Identify the hazards associated with working in hot and cold weather and the precautions for minimizing these hazards.
  a. Describe heat-related hazards.
  b. Describe cold-related hazards.

Learning Objective 3
- Identify the four main causes of accidents on the job site.
  a. Explain the importance of fall protection.
  b. Explain pinch points and caught-between hazards.
  c. Explain struck-by hazards.
  d. Explain the hazards associated with electricity.

Learning Objective 4
- Explain traffic zones and the importance of flagging.
  a. Explain traffic zones.
  b. Explain flagging.

Learning Objective 5
- Describe the safety hazards associated with trenches.
  a. Identify trench-related hazards and the safety requirements associated with trenches.
  b. Explain how to work safely in and around trenches.

Performance Task

Performance Task 1 (Learning Objective 1)
- Develop a Job Safety Analysis.

Teaching Time: 5 hours
(Two 2.5-Hour Sessions)

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

Prerequisites
Core Curriculum

Before You Begin

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

Using your access code, download the PowerPoint® presentations and Performance Profile Sheets from www.nccerinc.com. The passing score for submission into NCCER’s Registry is 70% or above for the module examination; performance testing is graded pass or fail.
**Safety Considerations**

Safety must be emphasized at all times. Trainees should be carefully observed to ensure that they wear the proper PPE, follow safe practices, and give due respect to unseen hazards. Any deficiencies must be corrected to ensure future trainee safety. All practice sessions and Performance Tasks must be completed under your direct supervision.

**Classroom Equipment and Materials**

- Whiteboard
- Markers
- Pencils and paper
- PowerPoint® presentations for Module 36110-17
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module examinations
- Examples of PPE commonly worn on job sites
  - Personal flotation device
  - Life ring
  - Rebar caps
  - A toy crane or other methods of simulating a crane hoisting a load
  - Bottles or other containers with NFPA or HMIS labels
  - Confined space permit
  - Completed and blank JSA forms
  - Slow/stop paddle
  - Flags used by flaggers

**Additional Resources**

This module presents thorough resources for task training. The following reference material is recommended for further study.


Instructors are also encouraged to locate additional audiovisual aids available on the Internet, make personal videos, and take still pictures related to the subject matter and add them to the presentations throughout the program.
The Lesson Plan for this module is divided into two 2.5-hour sessions. This time includes 10 minutes for administrative tasks and a 10-minute break per session.

**SESSION ONE**

Session One focuses on basic safety concerns such as hazard identification, common job site hazards, and confined space hazards. It also covers weather-related hazards and the “fatal four” hazards: slip and fall, caught-between, struck-by, and electrocution. This session covers Sections 1.0.0 through 3.4.0.

1. Open the Session One presentation.
2. Use the Kickoff Activity to get trainees engaged and give them an idea of what they will learn from this module.
3. Describe hazards related to working around moving equipment.
4. Discuss water safety and rebar-related hazards.
5. Describe methods used to identify and avoid hazards.
6. Discuss confined space hazards and related procedures.

**SESSION TWO**

Session Two describes traffic control and flagging procedures, as well as safety hazards and practices associated with working in and around trenches and excavations. This session covers Sections 4.0.0 through 5.2.1.

1. Open the Session Two presentation.
2. Use the Kickoff Activity to get trainees engaged.
3. Describe how to set up a traffic control zone.
4. Describe flagging procedures and devices.
5. Discuss hazards associated with working around trenches and the methods for avoiding these hazards.
6. Administer the Module Examination and any outstanding performance testing.
7. Submit the results to your Training Program Sponsor through the Registry system.
Module Four (75104-13) introduces the signs, signals, and barricades found on various job sites. It also covers highway work-zone safety requirements.

### Objectives

#### Learning Objective 1
- Identify signs, signals, and barricades used on a job site.
  - Identify the meaning of various signs.
  - Identify the meaning of audible signals.
  - Identify the meaning of barricades.

#### Learning Objective 2
- Identify highway work-zone safety requirements.
  - Describe the use of temporary traffic control.
  - Identify the responsibilities of a flagger.
  - List the requirements for moving equipment safely.

### Performance Tasks

#### Performance Task 1 (Learning Objective 2)
- Demonstrate how to properly use traffic control devices.

### Teaching Time: 5 hours
(Two 2.5-Hour Classroom 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 PowerPoint® presentations and performance profile sheets from www.nccerirc.com. The passing score for submission into NCCER's Registry is 70% or above for the module examination; performance testing is graded pass or fail.
**Classroom Equipment and Materials**

- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- PowerPoint® Presentations for Module 75104-13
- DVD player
- LCD projector and screen
- Computer
- Copies of the Module Examination and Performance Profile Sheets

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

- Hard hat
- Hearing protection
- Reflective vest(s)
- Traffic control devices, including barriers/cones, flags, and a STOP/SLOW paddle

**Safety Considerations**

This module may require that participants visit job sites. Participants should be carefully observed to ensure that they wear the proper PPE and follow site-specific safety practices.

**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 at [www.osha.gov](http://www.osha.gov) for participants who would like more information on work-zone safety. A search for additional information may be assigned as homework to interested participants.

Instructors should view any videos that may be identified in the lesson plan before using them to ensure their suitability. The videos can provide teachable moments in both proper and improper work processes and behaviors. Be prepared to stop the videos at appropriate times to point out and discuss both proper and improper conduct and techniques.

Instructors are also encouraged to locate additional audiovisual aids available on the internet, make personal videos, and take photos related to work-zone safety and add them to the PowerPoint® presentation throughout the program.
The Lesson Plan for this module is divided into two 2.5-hour classroom sessions. This time includes 10 minutes for administrative tasks and a 10-minute break per session.

**Session Outline for 75104-13**

**WORK-ZONE SAFETY**

**SESSION ONE**

Session One covers the safety hazards and precautions required in work zones.

1. Show the Session One PowerPoint® presentation.
2. Use the Kickoff Activity to get participants engaged and focused on signs, signals, and barricades.
3. Identify the meaning of various signs, signals, and barricades that may be found on a job site.

**SESSION TWO**

Session Two covers the safety hazards and precautions required when working on public highways and job sites. This session also includes the module review and testing. Have participants complete the Module Review Questions. Go over the Module Review Questions in class prior to the exam and answer any questions that the participants may have.

1. Show the Session Two PowerPoint® presentation.
2. Discuss the requirements for temporary traffic control (TTC).
3. Explain the responsibilities of a flagger.
4. Review the safeguards for moving heavy equipment on public highways and job sites.
5. Demonstrate the use of traffic control devices and have the participants demonstrate how to properly use traffic control devices to satisfy Performance Task 1.
6. Have participants complete the written examination.
7. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
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.
  - Identify the types of soils.
  - Describe the properties of soils.
  - Explain how soil density is determined.
  - Explain how moisture affects soil.

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

**Learning Objective 3**
- Describe working in various soil conditions.
  - Describe the weight bearing and flotation properties of different soils.
  - Explain how soil characteristics affect machine performance.
  - 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 PowerPoint® presentations 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 module 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
Whiteboard/chalkboard
Markers/chalk
Pencils and paper
Calculators (optional)
PowerPoint® Presentations for Module 22308-13
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
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

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 any videos that may be identified in the lesson plan before using them to ensure their suitability. The videos can provide teachable moments in both proper and improper work processes and behaviors. Be prepared to stop the videos at appropriate times to point out and discuss both proper and improper conduct and techniques.

Instructors are encouraged to locate additional audiovisual aids available on the Internet, make personal videos, and take photos related to the subject matter and add them to the PowerPoint® presentations throughout the program.
Session Outline for 22308-13

SOILS

The Lesson Plan for this module is divided into four 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 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.
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.

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
Completion of Heavy Equipment Safety, Module 22102-13 and Interpreting Civil Drawings, Module 22209-13.

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 PowerPoint® presentations and Performance Profile Sheets from www.nccerinc.com. The passing score for submission into NCCER’s Registry is 70% or above for the module 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.

### Equipment and Materials

<table>
<thead>
<tr>
<th>Whiteboard/chalkboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Markers/chalk</td>
</tr>
<tr>
<td>Pencils and paper</td>
</tr>
<tr>
<td>PowerPoint® Presentations for Module 22210-13</td>
</tr>
<tr>
<td>DVD player</td>
</tr>
<tr>
<td>LCD projector and screen</td>
</tr>
<tr>
<td>Computer with Internet access</td>
</tr>
<tr>
<td>Copies of the Module Examination and Performance Profile Sheets</td>
</tr>
</tbody>
</table>

### 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)

### Equipment and Materials for Laboratories and Performance Testing

<table>
<thead>
<tr>
<th>Example of an MSDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laser level or builder’s level</td>
</tr>
<tr>
<td>A suitable facility to set grade stakes and check elevations</td>
</tr>
<tr>
<td>Grade stakes</td>
</tr>
<tr>
<td>Markers</td>
</tr>
<tr>
<td>Slings</td>
</tr>
<tr>
<td>Rigging hooks</td>
</tr>
<tr>
<td>Shackles</td>
</tr>
<tr>
<td>Site and grading planes for highway and building construction projects</td>
</tr>
</tbody>
</table>

### 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](http://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](http://ownerbuilderonline.com). Review videos to ensure that they are suitable for your class.

Instructors should view any videos that may be identified in the lesson plan before using them to ensure their suitability. The videos can provide teachable moments in both proper and improper work processes and behaviors. Be prepared to stop the videos at appropriate times to point out and discuss both proper and improper conduct and techniques.

Instructors are encouraged to locate additional audiovisual aids available on the Internet, make personal videos, and take photos related to the subject matter and add them to the PowerPoint® presentations throughout the program.
Session Outline for 22210-13
SITE WORK

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.

At some time during the conduct of this lesson, the trainees should have the opportunity to visit a job site where excavation work is being done. Ideally, this site visit will coincide with the performance testing, so that the trainees can complete the performance tasks in a normal work environment.

SESSION ONE

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 THREE

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 TWO

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 FOUR

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

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.
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 PowerPoint® presentations and performance profile sheets from www.nccerirc.com. The passing score for submission into NCCER’s Registry is 70% or above for the module examination; performance testing is graded pass or fail.
Equipment and Materials
Whiteboard/chalkboard
Markers/chalk
Pencils and paper
PowerPoint® Presentations for Module 22207-13
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
Survey stakes
Markers

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


Instructors should view any videos that may be identified in the lesson plan before using them to ensure their suitability. The videos can provide teachable moments in both proper and improper work processes and behaviors. Be prepared to stop the videos at appropriate times to point out and discuss both proper and improper conduct and techniques.

Instructors are encouraged to locate additional audiovisual aids available on the Internet, make personal videos, and take photos related to the subject matter and add them to the PowerPoint® presentations throughout the program.
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.
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 PowerPoint® presentations and performance profile sheets from www.nccerirc.com. The passing score for submission into NCCER's Registry is 70% or above for the module 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
PowerPoint® Presentations for Module 22209-13
DVD player
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.

Instructors should view any videos that may be identified in the lesson plan before using them to ensure their suitability. The videos can provide teachable moments in both proper and improper work processes and behaviors. Be prepared to stop the videos at appropriate times to point out and discuss both proper and improper conduct and techniques.

Instructors are encouraged to locate additional audiovisual aids available on the Internet, make personal videos, and take photos related to the subject matter and add them to the PowerPoint® presentations throughout the program.
Session Outline for 22209-13
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

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.
Module Three (38102-18) presents basic rigging, which refers to the preparation of a load for movement, as well as the preparation of hardware and other components used to connect the load to the crane. Rigging must be completed safely and effectively, resulting in a reliable connection to the load. An understanding of rigging fundamentals is essential to safely operate cranes and move/position heavy equipment, components, and structures.

**Objectives**

**Learning Objective 1**
- Identify and describe various types of rigging hardware.
  a. Identify and describe various hooks, shackles, eyebolts, and clamps.
  b. Identify and describe various lugs, turnbuckles, plates, and spreader beams.

**Learning Objective 2**
- Identify and describe various types of slings and sling hitches.
  a. Identify and describe wire-rope slings and their proper care.
  b. Identify and describe synthetic slings and their proper care.
  c. Identify and describe chain slings and their proper care.
  d. Explain the significance of sling angles and describe common hitches.
  e. Describe how to properly rig and handle piping materials and rebar.
  f. Identify and describe how to use taglines and knots for load control.
  g. Identify common rigging-related safety precautions.

**Learning Objective 3**
- Identify and describe how to use various types of hoisting and jacking equipment.
  a. Identify and describe how to use manual and powered hoisting equipment.
  b. Identify and describe how to use jacks.

**Performance Tasks**

**Performance Task 1 (Learning Objectives 1 and 2)**
- Inspect various types of rigging components and report on the condition and suitability for a task.

**Performance Task 2 (Learning Objective 2)**
- Configure a sling to produce a single-wrap basket hitch.

**Performance Task 3 (Learning Objective 2)**
- Configure a sling to produce a double-wrap basket hitch.

**Performance Task 4 (Learning Objective 2)**
- Configure a sling to produce a single-wrap choker hitch.

**Performance Task 5 (Learning Objective 2)**
- Configure a sling to produce a double-wrap choker hitch.

**Performance Task 6 (Learning Objective 2)**
- Select the correct tagline for a specified application.

**Performance Task 7 (Learning Objective 2)**
- Tie specific instructor-selected knots.

**Performance Task 8 (Learning Objective 3)**
- Select, inspect, and demonstrate the safe use of the following rigging equipment:
  - Block and tackle
  - Chain hoist
  - Ratchet-lever hoist
  - One or more types of jack
Recommended Teaching Time: 20 Hours

This Lesson Plan (LP) is divided into sections that correspond to the sections in the Trainee Guide module. As you plan your class times, review the objectives, content, and lesson plan outline for the section you plan to teach. Allow sufficient class time for demonstrations, laboratories, field trips, and testing. Each class period should also include time for administrative tasks and periodic breaks.

Be sure to gather the required equipment, materials, visual aids, and answer keys. Using your access code, download the PowerPoint® presentations and Performance Profile Sheets for this module from NCCER’s Instructor Resource Center at www.nccerirc.com.

It is advisable to assign the reading of a module section prior to the classroom instruction. The Section Review and Module Review questions may be assigned as homework. At their discretion, instructors may assign additional homework to meet the teaching objectives.

Performance Testing may be administered at any suitable time in the course of the module training. Tasks are graded pass/fail. Trainee performance and proficiency during practice sessions that meets or exceeds the standards for a task can be accepted as Performance Task completion. Complete the Performance Profile Sheet for each trainee.

The final class is generally reserved for a brief review of the module and administering the module examination. For information about accessing the Module Examinations, visit www.nccer.org/testing. The passing score for submission into NCCER’s Registry is 70% or above for the module exam. Submit the testing results for each trainee to your Training Program Sponsor through the Registry system.

Prerequisites
Core Curriculum

Safety Considerations
This module requires trainees to work with and around rigging equipment including various slings, hoists, and jacks. Work in the vicinity of mobile cranes is also possible. Safety must be emphasized at all times. Gloves should be worn at all times when working with slings. Trainees should be carefully observed to ensure that they wear the proper PPE, follow safe practices, and give due respect to unseen hazards related to rigging and the mobile crane environment. Any deficiencies must be corrected to ensure the future safety of all trainees. All practice sessions and Performance Tasks must be completed under your direct supervision.

Equipment, Materials, and Resources

- Whiteboard
- Dry-erase markers
- Pencils and paper
- PowerPoint® presentations for Module 38102-18
- LCD projector and screen
- Computer (Internet access optional)
- Module Review answer key
- Module Examinations
- Performance Profile sheets
- Appropriate PPE as directed by the instructor or training facility provider, including but not limited to:
  - Safety glasses
  - Proper footwear
  - Hearing protection
  - Hard hat
- A varied selection of wire-rope slings (some damaged)
- A varied selection of synthetic web slings (some damaged)
- A varied selection of chain slings (some damaged)
- A varied selection of lifting hooks (some damaged)
- A varied selection of shackles (some damaged)
- Lengths of rope sufficient for tying knots
- Block and tackle (simple or compound)
- Chain hoist
- Ratchet-lever hoist
- Various types of jacks, including a ratchet jack, bottle jack, and a hydraulic jack with an external pump
- Portable gantry or suitable permanent structure from which hoists can be suspended
Additional Resources

This module presents thorough resources for task training. The following reference material is recommended for further study.


NCCER Module 00106-15, Introduction to Basic Rigging.


The following websites offer resources for products and training:

Occupational Safety and Health Administration (OSHA), www.osha.gov


North American Crane Bureau, Inc. website offers resources for products and training, www.cranesafe.com

There are many online resources available for trainees who would like more information about rigging fundamentals. A search for additional information may be assigned as homework to interested trainees.

Instructors should view any videos that may be identified in the lesson plan to ensure their usability before using them. The videos can provide teachable moments in both proper and improper work processes and behaviors. Be prepared to stop the videos at appropriate times to point out and discuss both proper and improper conduct and techniques.

Numerous videos related to the topic are available on the Internet. These can be located by searching crane rigging or similar terms and using the Video tab on the results page of your preferred search engine. Note that The Crosby Group, a leading manufacturer of rigging equipment and hardware, has many videos available on their website at www.thecrosbygroup.com. Their videos and other resources can be found under the Resources/Tools tab.

Instructors are encouraged to locate additional audiovisual aids available on the Internet, make personal videos, and take still pictures related to the subject matter and add them to the presentations throughout the program.
Lesson Plans for Module 21106-18

CRANE SAFETY AND EMERGENCY PROCEDURES

Module Ten (21106-18) emphasizes safety as the highest priority. Crane operators and other members of a lift team must embrace their responsibility as the manager of a powerful machine that can both accomplish great things and destroy property and lives. Thousands of successful crane operations occur each day without incident; all of the lifts in the future can end the same way. The goal of this module is to present a wide variety of safety information related to crane operation and prepare lift team members for their role in a safe workplace.

Objectives

Learning Objective 1
- Identify relevant OSHA and ASME standards and general crane safety considerations.
  a. Identify safety standards relevant to mobile cranes and their operation.
  b. Identify general safety considerations for mobile crane operation.

Learning Objective 2
- Identify mobile-crane operation considerations related to specific applications and explain how to respond to various incidents.
  a. Describe the purpose of pre-lift meetings and identify the topics of discussion.
  b. Identify safety considerations related to power lines.
  c. Identify safety considerations related to weather conditions.
  d. Describe safety considerations related to specific crane functions and how to respond to various incidents.

Performance Tasks
This is a knowledge-based module; there are no Performance Tasks.

Recommended Teaching Time: 15 Hours
This Lesson Plan (LP) is divided into sections that correspond to the sections in the Trainee Guide module. As you plan your class times, review the objectives, content, and lesson plan outline for the section you plan to teach. Allow sufficient class time for demonstrations, laboratories, field trips, and testing. Each class period should also include time for administrative tasks and periodic breaks.

Be sure to gather the required equipment, materials, visual aids, and answer keys. Using your access code, download the PowerPoint® presentations and Performance Profile Sheets for this module from NCCER’s Instructor Resource Center at www.nccerirc.com.

It is advisable to assign the reading of a module section prior to the classroom instruction. The Section Review and Module Review questions may be assigned as homework. At their discretion, instructors may assign additional homework to meet the teaching objectives.

Performance Testing may be administered at any suitable time in the course of the module training. Tasks are graded pass/fail. Trainee performance and proficiency during practice sessions that meets or exceeds the standards for a task can be accepted as Performance Task completion. Complete the Performance Profile Sheet for each trainee.

The final class is generally reserved for a brief review of the module and administering the module examination. For information about accessing the Module Examinations, visit www.nccer.org/testing. The passing score for submission into NCCER’s Registry is 70% or above for the module exam. Submit the testing results for each trainee to your Training Program Sponsor through the Registry system.

Prerequisites
Core Curriculum
Safety Considerations
This module is designed for instruction in the classroom or a similar environment. No skill-based tasks are required to be completed. Therefore, safety considerations are limited to those common to the classroom. Ensure that all trainees follow any safety guidelines set forth by the host organization.

Equipment, Materials, and Resources
Whiteboard
Dry-erase markers
Pencils and paper
PowerPoint® presentations for Module 21106-18
LCD projector and screen
Computer (Internet access optional)
Module Review answer key

Module Examinations
Appropriate PPE as directed by the instructor or training facility provider, such as but not limited to:
Safety glasses
Proper footwear
Hearing protection
Hard hat

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 about crane safety. A search for additional information may be assigned as homework to interested trainees.

Instructors should view any videos that may be identified in the lesson plan to ensure their usability before using them. The videos can provide teachable moments in both proper and improper work processes and behaviors. Be prepared to stop the videos at appropriate times to point out and discuss both proper and improper conduct and techniques.

Numerous videos related to the topic are available on the Internet. These can be located by searching crane safety or similar terms and using the Video tab on the results page of your preferred search engine.

Instructors are encouraged to locate additional audiovisual aids available on the Internet, make personal videos, and take still pictures related to the subject matter and add them to the presentations throughout the program.
Module Eleven (21102-18) focuses on the types of mobile cranes and their common components. A fundamental understanding of crane types and how they move from place to place is important to riggers and signal persons as well as to crane operators. Cranes also have different types of lifting booms, each of which has its own strengths and weaknesses. This module presents specific features of various cranes and booms, and introduces the basic principles of lifting and leverage.

### Performance Tasks

**Performance Task 1 (Learning Objective 2)**
- Verify the boom length of a telescopic- and/or lattice-boom crane using manufacturer’s data or a measuring tape.

**Performance Task 2 (Learning Objective 2)**
- Measure the operating radius of a telescopic- and/or lattice-boom crane using a measuring tape.

**Performance Task 3 (Learning Objective 2)**
- Calculate the amount of blocking needed for the outrigger of a specific crane.

**Performance Task 4 (Learning Objective 2)**
- Verify that a crane is level.

### Objectives

#### Learning Objective 1
- Identify and describe various types of cranes and crane components.
  a. Identify and describe mobile cranes based on their means of travel.
  b. Identify and describe various types of crane boom types.
  c. Identify and describe common crane attachments and accessories.
  d. Describe common crane instrumentation and safety devices.
  e. Identify and describe various crane reeving patterns.

#### Learning Objective 2
- Identify factors related to lifting capacity and explain their significance.
  a. Explain the significance of ground conditions and a level surface.
  b. Describe the bearing surface and explain how to determine the required blocking.
  c. Define and describe the significance of the center of gravity and the quadrants of operation.
  d. Describe the significance of boom length, angle, operating radius, and elevation.
  e. Explain how to use a load chart and understand the basic concepts of critical lifts.
Recommended Teaching Time: 15 Hours

This Lesson Plan (LP) is divided into sections that correspond to the sections in the Trainee Guide module. As you plan your class times, review the objectives, content, and lesson plan outline for the section you plan to teach. Allow sufficient class time for demonstrations, laboratories, field trips, and testing. Each class period should also include time for administrative tasks and periodic breaks.

Be sure to gather the required equipment, materials, visual aids, and answer keys. Using your access code, download the PowerPoint® presentations and Performance Profile Sheets for this module from NCCER’s Instructor Resource Center at www.nccerirc.com.

It is advisable to assign the reading of a module section prior to the classroom instruction. The Section Review and Module Review questions may be assigned as homework. At their discretion, instructors may assign additional homework to meet the teaching objectives.

Performance Testing may be administered at any suitable time in the course of the module training. Tasks are graded pass/fail. Trainee performance and proficiency during practice sessions that meets or exceeds the standards for a task can be accepted as Performance Task completion. Complete the Performance Profile Sheet for each trainee.

The final class is generally reserved for a brief review of the module and administering the module examination. For information about accessing the Module Examinations, visit www.ncce.org/testing. The passing score for submission into NCCER’s Registry is 70% or above for the module exam. Submit the testing results for each trainee to your Training Program Sponsor through the Registry system.

Prerequisites

Core Curriculum

Safety Considerations

This module requires that trainees work with and around mobile cranes. Safety must be emphasized at all times. Trainees should be carefully observed to ensure that they wear the proper PPE, follow safe practices, and give due respect to unseen hazards related to the mobile crane environment. Any deficiencies must be corrected to ensure the future safety of all trainees. All practice sessions and Performance Tasks must be completed under your direct supervision.

Equipment, Materials, and Resources

Whiteboard
Dry-erase markers
Pencils and paper
Calculators (optional)
PowerPoint® presentations for Module 21102-18
LCD projector and screen
Computer (Internet access optional)
Module Review answer key
Module Examinations
Performance Profile sheets

Appropriate PPE as directed by the instructor or training facility provider, such as but not limited to:
- Safety glasses
- Proper footwear
- Hearing protection
- Hard hat

Manufacturer’s documentation for one or more cranes

Functional telescopic- or lattice-boom mobile crane, with manufacturer’s documentation

Measuring tape (longer than the boom of the crane in use)

Level
Additional Resources
This module presents thorough resources for task training. The following reference material is recommended for further study.

- North American Crane Bureau, Inc. website offers resources for products and training, www.cranesafe.com

There are a number of online resources available for trainees who would like more information on the application and components of mobile cranes. A search for additional information may be assigned as homework to interested trainees.

Instructors should view any videos that may be identified in the lesson plan to ensure their usability before using them. The videos can provide teachable moments in both proper and improper work processes and behaviors. Be prepared to stop the videos at appropriate times to point out and discuss both proper and improper conduct and techniques.

Numerous videos related to the topic are available on the Internet. These can be located by searching mobile crane types or similar terms and using the Video tab on the results page of your preferred search engine.

Instructors are encouraged to locate additional audiovisual aids available on the Internet, make personal videos, and take still pictures related to the subject matter and add them to the presentations throughout the program.
Lesson Plans for Module 53101-18

CRANE COMMUNICATIONS

Module Twelve (53101-18) provides a formal introduction to methods, modes, and specifics of communications required in crane operations. The principles that crane signal persons must use to guide safe and efficient crane operations are addressed.

Objectives

Learning Objective 1
- Describe the communication process and identify barriers to effective communication.
  a. Describe the basic communication process.
  b. Identify common barriers to effective communication.

Learning Objective 2
- Identify and interpret the OSHA regulations related to crane communications and explain how to communicate with crane operators verbally and nonverbally.
  a. Identify and interpret construction-related OSHA regulations associated with crane communications and signaling.
  b. Describe the equipment used for verbal communications and how to communicate with and direct a crane operator verbally.
  c. Explain how to communicate with and direct a crane operator nonverbally.

Performance Tasks

Performance Task 1 (Learning Objective 2)
- Demonstrate proper crane-communication techniques using a handheld radio or another acceptable verbal-signaling device.

Performance Task 2 (Learning Objective 2)
- Demonstrate each standard hand signal depicted in 29 CFR 1926.1400, Subpart CC, Appendix A.

Performance Task 3 (Learning Objective 2)
- Direct an operator to move and place a load using the appropriate hand signals.

Performance Task 4 (Learning Objective 2)
- Direct an operator to move and place a load using voice communication.

Recommended Teaching Time: 10 Hours

This Lesson Plan (LP) is divided into sections that correspond to the sections in the Trainee Guide module. As you plan your class times, review the objectives, content, and lesson plan outline for the section you plan to teach. Allow sufficient class time for demonstrations, laboratories, field trips, and testing. Each class period should also include time for administrative tasks and periodic breaks.

Be sure to gather the required equipment, materials, visual aids, and answer keys. Using your access code, download the PowerPoint® presentations and Performance Profile Sheets for this module from NCCER’s Instructor Resource Center at www.nccerirc.com.

It is advisable to assign the reading of a module section prior to the classroom instruction. The Section Review and Module Review questions may be assigned as homework. At their discretion, instructors may assign additional homework to meet the teaching objectives.

Performance Testing may be administered at any suitable time in the course of the module training. Tasks are graded pass/fail. Trainee performance and proficiency during practice sessions that meets or exceeds the standards for a task can be accepted as Performance Task completion. Complete the Performance Profile Sheet for each trainee.

The final class is generally reserved for a brief review of the module and administering the module examination. For information about accessing the Module Examinations, visit www.nccer.org/testing. The passing score for submission into NCCER’s Registry is 70% or above for the module exam. Submit the testing results for each trainee to your Training Program Sponsor through the Registry system.

Prerequisites

Core Curriculum
Safety Considerations
This module requires that trainees work with and around mobile cranes. Safety must be emphasized at all times. Trainees should be carefully observed to ensure that they wear the proper PPE, follow safe practices, and give due respect to unseen hazards related to the mobile crane environment. Any deficiencies must be corrected to ensure the future safety of all trainees. All practice sessions and Performance Tasks must be completed under your direct supervision.

Equipment, Materials, and Resources
- Whiteboard
- Dry-erase markers
- Pencils and paper
- PowerPoint® presentations for Module 53101-18
- LCD projector and screen
- Computer (Internet access optional)
- Module Review answer key
- Module Examinations
- Performance Profile sheets
- Handheld radios or other acceptable verbal-communication devices
- Appropriate PPE as directed by the instructor or training facility provider, such as but not limited to:
  - Hard hat
  - Hearing protection
  - Proper footwear
  - Safety glasses
  - Safety vest
- Operational mobile crane and qualified crane operator
- Staged load (optional)

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

- **NCCER Module 00107-15, Basic Communication Skills.**

There are a number of online resources available for trainees who would like more information on crane communications or cranes in general. A search for additional information may be assigned as homework to interested trainees.

Instructors should view any videos that may be identified in the lesson plan to ensure their usability before using them. The videos can provide teachable moments in both proper and improper work processes and behaviors. Be prepared to stop the videos at appropriate times to point out and discuss both proper and improper conduct and techniques.

Numerous videos related to the topic are available on the Internet. These can be located by searching crane signal person, OSHA crane safety, or similar terms, and using the Video tab on the results page of your preferred search engine.

Instructors are encouraged to locate additional audiovisual aids available on the Internet, make personal videos, and take still pictures related to the subject matter and add them to the presentations throughout the program.