Module Overview

This module introduces the trainee to the basic concepts and procedures related to the use of heavy equipment to perform earthmoving work. It identifies the most appropriate types of equipment for a given task and describes the use of the equipment to perform the work.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Identify and explain earthmoving terms and methods.
2. Describe how to safely set up and coordinate earthmoving operations.
3. Identify and explain earthmoving operations.
4. Identify and explain soil stabilization methods.
5. Identify the best equipment for performing a given earthmoving operation.
6. List, in the correct order, the steps involved in an earthmoving operation.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Draw a plan for basic earthmoving operations:
   - Clearing and grubbing
   - Excavating the foundation
   - Constructing embankments
   - Backfilling
   - Compacting
2. Lay out a basic earthmoving operation.
3. Identify and select the proper equipment for a given earthmoving operation.

Materials and Equipment

| Markers/chalk | Appropriate personal protective equipment |
| Pencils and paper | Jars with different types of soil |
| Whiteboard/chalkboard | Set of site plans including excavation drawings |
| Heavy Equipment Operations Level One | Marked grade and finish stakes |
| PowerPoint® Presentation Slides | Example of an NPDES stormwater permit |
| (ISBN 978-0-13-292167-1) | Trade Terms Quiz* |
| Multimedia projector and screen | Module Examinations** |
| Computer | Performance Profile Sheets** |

* Located at the back of the Trainee Guide module
** Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with working on or around heavy equipment. Emphasize the importance of proper housekeeping.
Additional Resources

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


United States Environmental Protection Agency (EPA) web site, National Pollutant Discharge Elimination System (NPDES): www.epa.gov.

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 12½ hours are suggested to cover Introduction to Earthmoving. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

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<td>A. Introduction</td>
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<td>4. Determining Logistics</td>
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<td>6. Compacting</td>
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<td>7. Checking Quality</td>
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E. Safety Guidelines

1. Personal Safety
2. Safeguarding Property
3. Underground Utilities

Session IV. PT/Laboratory

A. PT/Laboratory

1. Have trainees draw a plan for basic earthmoving operations, including:
   - Clearing and grubbing
   - Excavating the foundation
   - Constructing embankments
   - Backfilling
   - Compacting

   This laboratory corresponds to Performance Task 1.

2. Have trainees lay out a basic earthmoving operation. This laboratory corresponds to Performance Task 2.

3. Have trainees identify and select the proper equipment for a given earthmoving operation. This laboratory corresponds to Performance Task 3.

Session V. Review and Testing

A. Review

B. Module Examination

1. Trainees must score 70% or higher to receive recognition from NCCER.
2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.

C. Performance Testing

1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.
Module Two (22307-14) provides training on common types of equipment and instruments used for finish grading, materials and methods used to stabilize soils and control soil erosion, and finishing and grading methods used for various applications.

Objectives

Learning Objective 1
• Describe the types of equipment used for finish grading.
  – Identify equipment used in finish grading.
  – Describe how laser instruments are used in finish grading.
  – Describe how a Global Positioning System (GPS) and a robotic total station are used in finish grading.

Learning Objective 2
• Explain methods used to stabilize soils and control soil erosion.
  – Identify soil stabilizers and binders.
  – Describe methods used in the application of soil binders.
  – Describe methods used to control soil erosion.

Learning Objective 3
• Describe finish grading methods.
  – Describe the use of grading specifications.
  – Explain how finish grade is established for slopes.
  – Explain how the finish subgrade and base are established.
  – Describe grading methods used for ditches and trenches.
  – Describe grading methods used on parking lots, sidewalks, and curbs.

Performance Task

Performance Task 1 (Learning Objective 3)
• Establish a finish grade after a rough grade has been performed, according to instructions.

Teaching Time: 25 hours
(Ten 2.5-Hour Classroom Sessions)
Session time may be adjusted to accommodate your class size, schedule, and teaching style.

Prerequisites
Core Curriculum; Heavy Equipment Operations Level One; Heavy Equipment Operations Level Two.

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 that trainees work with and in the vicinity of grading equipment and, possibly, other types of heavy equipment commonly found on construction sites. Safe working habits in the vicinity of heavy equipment must be emphasized at all times. Trainees should be carefully observed to ensure that they wear the proper PPE and follow all safe heavy equipment operating procedures. Any deficiencies must be corrected to ensure future trainee safety as they begin working with other heavy equipment later in their training and career. All practice sessions and performance tasks must be completed under your direct supervision.

Classroom Equipment and Materials
Whiteboard/chalkboard
Markers/chalk
Pencils and paper
Heavy Highway Construction Level Two PowerPoint® Presentation Slides
DVD player or a computer with a DVD drive
Computer with Internet access
A set of site specifications for a construction project that includes grading specifications such as slope information and the locations of ditches
An operator’s manual for the grading equipment in use

Equipment and Materials for Laboratories and Performance Testing
Standard eye protection
Work 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
A functional motor grader or, if no grader is available, a functional dozer
A suitable facility at which to operate the grading equipment and practice basic maneuvers
A suitable area on which to perform finish grading operations
A method of two-way communications with hands-free characteristics
Examples of laser equipment, including carpenter’s level, handheld distance meter, laser transmitter and laser receiver that can be used for determining grade
Three containers of soil
Three containers of soil binders, one each of cement, lime, and calcium chloride
A piece of geotextile material approximately 2 feet by 2 feet in size
A container of soil dissolved in water for pouring through textile
An empty container to collect water
Some examples of grade stakes that are commonly used for finish grading

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 rollers/compactors and related equipment in OSHA 29 CFR Standard 1926, found at www.osha.gov.

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

An effective way for trainees to see grading equipment 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. This video can also be used to test the trainees on their knowledge of correct and incorrect operation.

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.
The Lesson Plan for this module is divided into ten 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 grader or dozer can be done continuously without interruption. As a result, Sessions One through Six are designed exclusively for the classroom environment, while Sessions Seven through Nine include demonstrations, practice, and the execution of performance tasks.

**SESSION ONE**

Session One begins with coverage of common types of grading equipment used for finish grading. The manner in which motor graders, dozers, scrapers, and telescoping excavators perform finish grading is examined.

1. Show the Session One PowerPoint® presentation.
2. Use the Kickoff Activity to get trainees engaged and give them an idea of what they will learn in this module.
3. Identify and discuss how motor graders, dozers, scrapers, and telescoping excavators are used in finish grading work.

**SESSION THREE**

Session Three covers how a Global Positioning System (GPS) is used in some grade control systems. Another type of grade control system called a robotic total station is also examined.

1. Show the Session Three PowerPoint® presentation.
2. Discuss how a GPS-based grade control system works and explain how it is used for finish grading.
3. Discuss how a robotic total station works and explain how it is used for finish grading.

**SESSION TWO**

Session Two focuses on laser-based instruments that are used for automatic grade control. The various components of a laser-based system are identified and described, and the function of the system is examined.

1. Show the Session Two PowerPoint® presentation.
2. Identify and describe the major components of a laser-based grade control system.
3. Discuss how a laser-based grade control system is used for finish grading.

**SESSION FOUR**

Session Four covers different types of soil stabilizers and binders that are often used during finish grading. Methods used for applying the stabilizers and binders and for controlling soil erosion are also discussed.

1. Show the Session Four PowerPoint® presentation.
2. Identify and discuss materials commonly used as soil stabilizers and binders.
3. Discuss methods used for applying soil binders.
4. Discuss methods used for controlling soil erosion.
SESSION FIVE

Session Five focuses on finish grading methods. It examines how grading specifications are used for various finish grading jobs, describes how a finish grade is established for slopes, and discusses how a finish subgrade and base are established.

1. Show the Session Five PowerPoint® presentation.
2. Discuss how grading specifications are used.
3. Explain how a finish grade is established for slopes.
4. Discuss how to establish a finish subgrade and base.

SESSION SIX

Session Five focuses on grading methods used for ditches, trenches, parking lots, sidewalks, and curbs.

1. Show the Session Five PowerPoint® presentation.
2. Discuss grading methods used for ditches and trenches.
3. Discuss grading methods used for parking lots, sidewalks, and curbs.

SESSION SEVEN THROUGH NINE

Sessions Seven through Nine are set aside for lab work needed to satisfy the module performance task. The labs involve establishing a finish grade after a rough grade has been performed, according to instructions. You can allocate lab time for these activities based on class size and available facilities and equipment.

1. Have the trainees establish a finish grade after a rough grade has been performed, according to instructions.

SESSION TEN

Session Ten 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 Nine.) Answer any questions that the trainees may have.

1. Have trainees complete the written examination. Any outstanding performance testing must be completed by the end of this session.
2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
Module 27306-14 introduces trainees to the techniques required for working in and around excavations, particularly when preparing building foundations, including the types and bearing capacities of soils; procedures used in shoring, sloping, and shielding trenches and excavations; trenching safety requirements; and mitigation of groundwater and rock when excavating foundations.

### Objectives

**Learning Objective 1**
- List safety considerations for trenches and excavations.
  - a. List safety guidelines when working in and around foundation excavations.
  - b. Identify safety hazards when working in and around trenches.
  - c. Describe various shoring, shielding, and sloping systems used for trenches and excavations.

**Learning Objective 2**
- Identify the different types, bearing capacities, and classifications of soils.
  - a. Explain how soils are classified.
  - b. Describe soil composition and how it relates to density.
  - c. Explain the purpose of fill in a construction project.

**Learning Objective 3**
- Describe the methods of compacting and testing soil.
  - a. Describe how moisture content affects soil compaction.
  - b. Explain why soil is compacted in lifts.
  - c. Describe how soil compaction is tested.

**Learning Objective 4**
- Explain surface water, groundwater, and rock mitigation as related to concrete.
  - a. Describe how surface water and groundwater are mitigated.
  - b. Describe how rock is mitigated.

### Performance Tasks

**Performance Task 1 (Learning Objective 1)**
- Draft a job hazard/safety analysis for an excavation according to instructor’s specifications.

### Teaching Time: 15 hours

(Six 2.5-hour Classroom Sessions)
Session time may be adjusted to accommodate your class size, schedule, and teaching style.

### Prerequisites

*Core Curriculum, Carpentry Level One, and Carpentry Level Two*

### 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 Module Examinations and Performance Profile Sheets from [www.nccerirc.com](http://www.nccerirc.com). The passing score for submission into NCCER’s Registry is 70 percent or above for the Module Examination; performance testing is graded pass or fail.
Safety Considerations
This module requires that trainees work in trenches and excavations. Safety is paramount in the carpentry trade and safe habits and practices must be emphasized whenever possible. Performance Tasks must be completed under your supervision. Each trainee must use required PPE and follow safe tool practices and procedures.

Classroom Equipment and Materials
- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- Heavy Highway Construction Level Two PowerPoint® Presentation Slides
- Computer
- Copies of the Module Examination and Performance Profile Sheets
- Vendor-supplied videos/DVDs showing trenching and excavating (optional)
- TV/DVD player

Equipment and Materials for Laboratories and Performance Testing
- Completed job hazard analysis form
- Containers filled with a variety of soils of various levels of moisture
- Copies of a National Pollutant Discharge Elimination System (NPDES) stormwater permit
- Copies of blank job hazard analysis forms
- Copies of 29 CFR (Code of Federal Regulations) 1926.652 (c)(3) and (c)(4)
- Copies of specifications from a construction project that specifies soil compaction requirements
- Copies of the dewatering plans from a set of project specifications
- Copies of the latest edition of OSHA Publication 2226, Excavations
- Requirements for a project that requires trenching or a foundation excavation, including safety hazards and proposed shoring, shielding, or sloping systems to be used
- Sump pump

Additional Resources and References
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 trenching and excavating. A search for additional information may be assigned as homework to interested trainees.
The lesson plan for this module is divided into six 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

**SESSIONS ONE AND TWO**

Sessions One and Two introduce trainees to trench and deep foundation safety.

1. Show Sessions One and Two PowerPoint® presentation slides.
2. Introduce trainees to trench and deep foundation excavation safety.

**SESSION THREE**

Session Three introduces trainees to the types, bearing capacities, and classifications of soils.

1. Show Session Three PowerPoint® presentation slides.
2. Introduce trainees to the various types, bearing capacities, and commonly used classifications of soils.

**SESSION FOUR**

Session Four introduces trainees to methods of compacting and testing soil.

1. Show Session Four PowerPoint® presentation slides.
2. Introduce trainees to the various methods of soil compaction and testing.

**SESSION FIVE**

Session Five introduces groundwater and rock mitigation.

1. Show Session Five PowerPoint® presentation slides.
2. Introduce trainees to mitigation techniques used for surface water, groundwater, and rock.

**SESSION SIX**

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

1. Have trainees complete the Module Examination. Any outstanding performance testing must be completed during this session.
2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
Module Four (36107-17) describes the aggregates used in the making of concrete and asphalt paving and the plants used to manufacture concrete and asphalt paving.

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<th>Objectives</th>
<th>Learning Objective 2</th>
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<tr>
<td><strong>Learning Objective 1</strong></td>
<td>• Explain the operation of a concrete plant and</td>
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<td>the operation of a hot mix plant.</td>
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<tr>
<td>• Explain aggregate extraction and processing.</td>
<td>a. Explain the operation of a concrete plant.</td>
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<tr>
<td>a. Describe aggregate extraction.</td>
<td>b. Explain the operation of a hot mix plant.</td>
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<td>b. Describe the processing of aggregates.</td>
<td>c. Explain the operation of a pug mill.</td>
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**Performance Tasks**

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

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**Teaching Time: 7.5 hours**

(Three 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 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](http://www.nccerirc.com). For information and updates about accessing the Module Examinations, visit [www.nccer.org/testing](http://www.nccer.org/testing). 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.

If trainees are exposed to concrete or portland cement, they must wear the proper protective clothing and respiratory equipment.

Classroom Equipment and Materials

Whiteboard
Markers
Pencils and paper
LCD projector and screen
PowerPoint® presentations for Module 36107-17
Computer with Internet access
Samples of gravel, sand, and crushed stone
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 US Department of Labor website offers resources for products and training. “Mine Safety and Health Administration (MSHA).” www.msha.gov

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 36107-17

PLANT OPERATIONS

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 covers the various types of aggregates, how they are obtained, and how they are processed for use. This session covers Sections 1.0.0 through 1.2.4.

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 how aggregates are obtained.
4. Discuss the types of aggregates and their uses.
5. Describe the various methods in which material is processed to obtain aggregates for use in paving material.
6. Discuss the importance of quality control in aggregate processing.

**SESSION TWO**

Session Two describes the facilities and equipment used in producing asphalt and concrete for use as paving material. This session covers Sections 2.1.0 through 2.3.3.

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 plants used to produce concrete and how the concrete is processed.
4. Describe the plants used to produce asphalt and how the asphalt is processed.
5. Explain the purpose of a pug mill and describe how it operates.

**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 36108-17

PAVING

Module Five describes paving operations, paving equipment, recycling processes, and quality control requirements for both concrete and hot-mix asphalt paving.

### Objectives

**Learning Objective 1**
- Describe concrete paving operations, processes, and procedures.
  - a. Explain the use of stringlines and other methods of grade control.
  - b. Identify and describe various types of concrete joints.
  - c. Describe hand-paving operations.
  - d. Describe concrete reinforcement.
  - e. Describe concrete paving methods equipment.
  - f. Describe the concrete recycling process.
  - g. Identify methods and tests used to ensure quality control of concrete.

**Learning Objective 2**
- Describe hot-mix asphalt paving operations, processes, and procedures.
  - a. Describe asphalt paving preparations and procedures.
  - b. Explain the milling and recycling process.
  - c. Explain hot-mix asphalt paving quality control.

### Performance Tasks

**Performance Task 1 (Learning Objective 1)**
- Demonstrate setting the stringline to establish the grade for concrete slipform paving.

**Performance Task 2 (Learning Objective 1)**
- Correctly set up the slipform paver for operation.*

**Performance Task 3 (Learning Objective 1)**
- Perform slipform paving.*

**Performance Task 4 (Learning Objective 1)**
- Perform a concrete slump test.

**Performance Task 5 (Learning Objective 2)**
- At the discretion of your instructor, perform hot-mix asphalt paving.*

**Performance Task 6 (Learning Objective 2)**
- Perform a quantitative analysis on the segregation of stone.

*These tasks require work site access.

### Teaching Time: 12.5 hours

(Five 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 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. For information and updates 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 written 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.

If trainees are exposed to concrete or portland cement, they must wear the proper protective clothing and respiratory equipment.

Equipment, Materials, and Resources

Whiteboard  
Markers  
Pencils and paper  
LCD projector and screen  
PowerPoint® Presentations for Module 36108-17  
Computer with Internet access  
Module Review answer key  
Module Examinations  
Examples of material used to make joints in concrete  
Marked reference stakes  
Sample concrete forms  
Dowel bars  
Tie bars  

Mesh  
Test cylinders  
Stringline pins  
Stringline or light cable  
End anchoring devices  
Concrete (fresh)  
Dowel baskets  
Straightedge  
Hand concrete finishing tools  
Tape measure  
Hand scoop  
ASTM C143 test procedure  
Hot mix hand tools  
Total station surveying equipment  
Slipform paver  
Mechanic’s tools  
Concrete delivery system  
Concrete placing device  
Texturing and curing machine  
Hot mix delivery system  
Appropriate personal protective equipment  
Forming system components  
Molds  
Roller  
Slump cone  
Cone base plate  
Rod  
Asphalt samples

Additional Resources

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

ACI 315, Details and Detailing of Concrete Reinforcement. Latest Edition. Farmington Hills, MI: American Concrete Institute.


Placing Reinforcing Bars, Concrete Reinforcing Steel Institute (CRSI). 2005. Available at www.crsi-webstore.org

The following websites offer resources for products and training:

American Concrete Institute, www.concrete.org  
American Concrete Pavement Association, www.pavement.com  
The Concrete Network, www.concretenetwork.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 covers the methods and machines used in placing concrete paving material. This session covers Sections 1.0.0 through 1.7.0.

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 how grade control is maintained during concrete paving.
4. Discuss the various types of joints used in concrete paving.
5. Discuss hand-paving operations.
6. Discuss concrete reinforcing materials and methods.
7. Discuss concrete paving methods and equipment.
8. Discuss concrete recycling.
9. Describe the quality control procedures that apply to concrete used for paving.

**SESSION TWO**

Session Two describes the equipment and methods used in paving with hot-mix asphalt. This session covers Sections 2.1.0 through 2.3.0.

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 how foundations are prepared for paving.
4. Describe how grade control is maintained during asphalt paving.
5. Discuss the types of joints used in asphalt paving.
6. Describe the equipment and procedures used in asphalt paving.
7. Explain the need for compaction and how it is performed.
8. Describe the equipment and methods used in recycling asphalt.
9. Describe the quality control procedures that apply to asphalt used for paving.
Module 27309-14 describes elevated decks and formwork systems and methods used in their construction. The text covers joist, pan, metal deck, and flat slab systems and provides instructions for the use of flying forms, as well as shoring and reshoring systems.

**Objectives**

**Learning Objective 1**
- Identify safety hazards associated with elevated deck formwork.

**Learning Objective 2**
- Identify the various types of structural-concrete floor and roof slabs.
  a. Describe how one-way solid slabs are constructed.
  b. Describe how two-way flat slabs are constructed.
  c. Explain the difference between two-way flat plate slabs and two-way flat slabs.
  d. Describe how one-way joist slabs are constructed.
  e. Describe how two-way joist slabs are constructed.
  f. Describe how composite slabs are constructed.
  g. Describe how posttensioned concrete slabs are constructed.

**Learning Objective 3**
- Describe the different types of form systems.
  a. Describe applications for pan forms.
  b. Describe applications for I-joist pan forms.
  c. Describe applications for one- and two-way beam and slab forms.
  d. Describe applications for flat-slab or flat-plate forms.
  e. Describe applications for composite-slab deck forms.

**Learning Objective 4**
- Identify types of elevated decks.
  a. List the materials used for deck surfaces.
  b. Explain the use of hand-set multicomponent decks.
  c. Describe applications for hand-set panelized decks.
  d. Explain the use of outriggers.
  e. Describe applications for flying decks.

**Learning Objective 5**
- Identify the different types of shores and describe applications for each.
  a. Explain how adjustable wood shores are installed.
  b. Explain how manufactured shores are installed.

**Learning Objective 6**
- Identify specialty form systems.
  a. Explain how bridge decks are formed.
  b. Explain how tunnels and culverts are formed.

**Performance Tasks**

**Performance Task 1 (Learning Objective 4)**
- Erect, plumb, brace, and level a hand-set deck form.

**Performance Task 2 (Learning Objective 4)**
- Install edge forms, including instructor-selected blockouts, embedments, and bulkheads.

**Teaching Time: 15 hours**
(Six 2.5-hour Classroom Sessions)
Session time may be adjusted to accommodate your class size, schedule, and teaching style.

**Prerequisites**
Core Curriculum, Carpentry Level One, and Carpentry Level Two

**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 Module Examinations and Performance Profile Sheets from www.nccerirc.com. The passing score for submission into NCCER’s Registry is 70 percent or above for the Module Examination; performance testing is graded pass or fail.
Safety Considerations
This module requires that trainees erect a hand-set deck form and install edge forms. Safety is paramount in the carpentry trade and safe habits and practices must be emphasized whenever possible. Performance Tasks must be completed under your supervision. Each trainee must use required PPE and follow safe tool practices and procedures.

Classroom Equipment and Materials
Whiteboard/chalkboard
Markers/chalk
Pencils and paper
Heavy Highway Construction Level Two PowerPoint® Presentation Slides
Computer
Copies of the Module Examination and Performance Profile Sheets
Vendor-supplied videos/DVDs showing horizontal formwork (optional)
TV/DVD player

Equipment and Materials for Laboratories and Performance Testing
Personal protective equipment
ANSI-approved footwear
Gloves
Hard hat
Safety glasses
Adjustment screws
Baseplates
Bracing materials
Copies of 29 CFR 1926.703
Copies of, or extracts from, American Concrete Institution (ACI) publication 347.3R-13, Guide to Formed Concrete Surfaces
Copies of section of the local applicable building code that addresses shoring systems
Edge forms
Extension devices
Hand tools
Joists
Levels
Manufacturers’ literature on flying decks
Manufacturers’ literature on shoring
Metal post shores
Plyform®
Reshoring spring
Samples of exterior grade plywood
Shore heads
Shoring deck systems
Stringers
Strongbacks
Unlabeled copies of Figures 18 and 21
Walers
Wood shores

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

American Concrete Institute (ACI). www.concrete.org
Cement Association of Canada. www.cement.ca

There are a number of online resources available for trainees who would like more information on horizontal formwork. A search for additional information may be assigned as homework to interested trainees.
The lesson plan for this module is divided into six 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

**SESSION ONE**

Session One introduces elevated decks and formwork safety.
1. Show Session One PowerPoint® presentation slides.
2. Introduce trainees to the safety hazards associated with elevated deck formwork.
3. Introduce trainees to the various types of structural-concrete floor and roof slabs.

**SESSION TWO AND THREE**

Session Two introduces elevated deck formwork.
1. Show Sessions Two and Three PowerPoint® presentation slides.
2. Introduce trainees to the different types of form systems.

**SESSION FOUR**

Session Four introduces elevated decks.
1. Show Session Four PowerPoint® presentation slides.
2. Introduce trainees to the different types of elevated decks.
3. Introduce trainees to the steps required to erect, plumb, brace, and level a handset deck form.
4. Introduce trainees to the steps required to install edge forms.

**SESSION FIVE**

Session Five introduces shoring and specialty formwork.
1. Show Session Five PowerPoint® presentation slides.
2. Introduce trainees to the different types of shoring, and describe applications for each.

**SESSION SIX**

Session Six is a review and testing session. Have trainees complete the module Review Questions and Trade Terms Quiz. (Alternatively, these may be assigned as homework at the end of Session Five.) Answer any questions that trainees may have.
1. Have trainees complete the Module Examination. Any outstanding performance testing must be completed during this session.
2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
Module 27308-14 describes the applications and construction methods for types of forming and form hardware systems for walls, columns, and stairs, as well as slip forms, climbing forms, and shaft forms. The text provides an overview of the assembly, erection, and stripping of gang forms.

Objectives

Learning Objective 1
• Identify the basic types of concrete wall forms.
  a. Explain the importance of formwork planning.
  b. List the parts and accessories of concrete wall forms.
  c. Describe applications of panel form systems.
  d. Describe applications of gang forms.

Learning Objective 2
• Describe applications for patented wall-form systems.
  a. List applications for curved forms.
  b. Describe how to frame wall openings.

Learning Objective 3
• Explain how to properly assemble and set forms.
  a. Explain how to assemble forms.
  b. Explain how to set forms.

Learning Objective 4
• Identify the types of column forms.
  a. List applications for fiber and steel column forms.
  b. List applications for job-built column forms.

Learning Objective 5
• List applications of vertical slipforming and describe each.
  a. Identify slip-form components.
  b. Describe applications of climbing forms.

Learning Objective 6
• Describe how to construct stair forms.

Learning Objective 7
• List various vertical architectural and specialty forms, and describe applications for each.
  a. Describe how smooth finishes are created.
  b. Describe how textured surfaces are created.
  c. Explain the use of insulating concrete forms (ICFs).

Performance Tasks

Performance Task 1 (Learning Objective 3)
• Erect, plumb, and brace an instructor-selected wall form.

Performance Task 2 (Learning Objective 4)
• Erect, plumb, and brace an instructor-selected column form.

Performance Task 3 (Learning Objective 6)
• Erect, plumb, and brace a stair form.

Teaching Time: 22.5 hours
(Nine 2.5-hour Classroom Sessions)
Session time may be adjusted to accommodate your class size, schedule, and teaching style.

Prerequisites
Core Curriculum, Carpentry Level One, and Carpentry Level Two

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 Module Examinations and Performance Profile Sheets from www.nccerirc.com. The passing score for submission into NCCER’s Registry is 70 percent or above for the Module Examination; performance testing is graded pass or fail.
**Safety Considerations**

This module requires that trainees erect, plumb, and brace a wall form, a column form, and a stair form. Safety is paramount in the carpentry trade and safe habits and practices must be emphasized whenever possible. Performance Tasks must be completed under your supervision. Each trainee must use required PPE and follow safe tool practices and procedures.

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**Classroom Equipment and Materials**

- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- *Heavy Highway Construction Level Two* PowerPoint® Presentation Slides
- Computer
- Copies of the Module Examination and Performance Profile Sheets
- Vendor-supplied videos/DVDs showing vertical formwork (optional)
- TV/DVD player

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

- Personal protective equipment:
  - Eye protection
  - Hand protection
  - Hard hat
  - Work boots
  - Assembly hardware
  - Assorted steel and wood panel system components, including spreader tie pins, alignment and plate clamps, 2-wedge bolts, and 2-pipe aligner hooks
  - Bracing
  - Clamps
  - Cleats
  - Concrete
  - Copies of 29 CFR 1926.703
  - Copies of a job hazard analysis (JHA) for a project involving the use of a personal fall arrest system (PFAS)
  - Copies of construction drawings with design instructions
  - Copies of manufacturer’s specifications for plastic form systems
  - Copies of one or more of Concrete Network’s publications *Concrete Stamping Today*, *Concrete Staining Today*, *Concrete Overlays Today*, and *Concrete Polishing Today*

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**Additional Resources and References**

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

- Scaffold, Shoring, and Forming Institute. [www.ssfi.org](http://www.ssfi.org)

There are a number of online resources available for trainees who would like more information on vertical formwork. A search for additional information may be assigned as homework to interested trainees.
The lesson plan for this module is divided into nine 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

**Sessions One and Two**

Sessions One and Two introduce the basic types of concrete wall forms.

1. Show Sessions One and Two PowerPoint® presentation slides.
2. Introduce trainees to the fundamentals of planning formwork and the cost-efficiencies related to planning.
3. Introduce trainees to the different types of forms, parts, and accessories used in installing concrete wall forms.
4. Introduce trainees to the different types of panel form systems commonly used in construction.
5. Introduce trainees to the different types of gang forms commonly used in construction.

**Session Three**

Session Three introduces applications for patented wall-form systems.

1. Show Session Three PowerPoint® presentation slides.
2. Introduce trainees to the topic of patented wall-form systems.
3. Introduce trainees to the fundamentals of curved wall forms.
4. Introduce trainees to the process for framing wall openings.

**Sessions Four and Five**

Sessions Four and Five introduce how to properly assemble and set forms.

1. Show Sessions Four and Five PowerPoint® presentation slides.
2. Introduce trainees to the fundamentals of assembling and setting forms.
3. Introduce trainees to the steps involved in assembling forms.
4. Introduce trainees to the steps involved in lifting forms and moving them into place on a foundation.
5. Introduce trainees to the procedures for erecting, plumbing, and bracing a wall form.

**Session Six**

Session Six introduces the types of column forms.

1. Show Session Six PowerPoint® presentation slides.
2. Introduce trainees to the fundamentals of column forms.
3. Introduce trainees to the characteristics and applications of fiber and steel column forms.
4. Introduce trainees to the characteristics and applications of job-built column forms.
5. Introduce trainees to the procedures for erecting, plumbing, and bracing a column form.
SESSION SEVEN
Session Seven introduces the applications of vertical slipforming.

1. Show Session Seven PowerPoint® presentation slides.
2. Discuss the fundamentals of vertical slipforming.
3. Introduce trainees to the various components of slip-form systems.
4. Introduce trainees to the purpose and characteristics of climbing forms.
5. Introduce trainees to the requirements for stairways and handrails as specified by the International Building Code® and the International Residential Code®.
6. Introduce trainees to the procedures for erecting, plumbing, and bracing a stair form.

SESSION EIGHT
Session Eight introduces vertical architectural and specialty forms.

1. Show Session Eight PowerPoint® presentation slides.
2. Introduce trainees to the function and options available for architectural concrete.
3. Introduce trainees to the methods used to create a smooth finish.
4. Introduce trainees to the fundamentals of creating textured surfaces.
5. Introduce trainees to the use of insulating concrete forms in forming concrete structures.

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

1. Have trainees complete the Module Examination. Any outstanding performance testing must be completed during this session.
2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
Lesson Plans for Module 27304-14

REINFORCING CONCRETE

Module 27304-14 describes the selection and uses of different types of reinforcing materials. The text discusses requirements for cutting, bending, splicing, and tying reinforcing steel and the placement of steel in footings, columns, walls, and slabs.

Objectives

Learning Objective 1
- List applications of reinforced concrete.
  a. Describe how forces are resisted in concrete through the use of reinforcing bars.
  b. List applications for reinforced structural concrete.
  c. Discuss how posttensioned concrete is created.

Learning Objective 2
- Describe the general requirements for working with reinforcing steel, including tools, equipment, and fabricating methods.
  a. List general safety precautions when working with reinforcing steel.
  b. Describe the general characteristics of reinforcing steel.
  c. Discuss how reinforcing steel is fabricated.
  d. Explain the purpose of bar supports.
  e. Explain how welded-wire fabric reinforcement is used to reinforce concrete.

Learning Objective 3
- Describe methods by which reinforcing bars may be bent and cut in the field.
  a. Describe how to cut rebar.
  b. Describe how to bend rebar.

Learning Objective 4
- Explain the methods for placing reinforcing steel.
  a. Discuss the proper method for tying and splicing reinforcing steel.
  b. Explain the proper procedure for placing reinforcing steel.

Performance Tasks

Performance Task 1 (Learning Objective 3)
- Use appropriate tools to cut and bend reinforcing bars.

Performance Task 2 (Learning Objective 4)
- Demonstrate five types of ties for reinforcing bars.

Performance Task 3 (Learning Objective 4)
- Demonstrate proper lap splicing of reinforcing bars using wire ties.

Performance Task 4 (Learning Objective 4)
- Demonstrate the proper placement, spacing, tying, and support for reinforcing bars.

Teaching Time: 15 hours
(Six 2.5-hour Classroom Sessions)
Session time may be adjusted to accommodate your class size, schedule, and teaching style.

Prerequisites
Core Curriculum, Carpentry Level One, and Carpentry Level Two

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 Module Examinations and Performance Profile Sheets from www.nccerirc.com. The passing score for submission into NCCER’s Registry is 70 percent or above for the Module Examination; performance testing is graded pass or fail.
Safety Considerations
This module requires that trainees cut, bend, tie, splice, and place reinforcing bars. Safety is paramount in the carpentry trade and safe habits and practices must be emphasized whenever possible. Performance Tasks must be completed under your supervision. Each trainee must use required PPE and follow safe tool practices and procedures.

Classroom Equipment and Materials
Whiteboard/chalkboard
Markers/chalk
Pencils and paper
Heavy Highway Construction Level Two PowerPoint® Presentation Slides
Computer
Copies of the Module Examination and Performance Profile Sheets
Vendor-supplied videos/DVDs showing the reinforcement of concrete (optional)
TV/DVD player

Equipment and Materials for Laboratories and Performance Testing
Personal protective equipment:
ANSI-approved footwear
Hard hat
Leather-palm gloves
Safety glasses
2” leather belt
ACI standards for concrete coverage
Bar lists
Bent bars
Bolt cutters
Copies of ASTM standards
Deformed welded-wire fabric
Electric shears
Hickey bar and jigs
Hooks and spirals
Keel holder
Level
Mechanically spliced rebar
Pieces of marked rebar

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

ACI 315, Details and Detailing of Concrete Reinforcement, Latest Edition. Farmington Hills, MI: American Concrete Institute.

There are a number of online resources available for trainees who would like more information on reinforcing concrete. A search for additional information may be assigned as homework to interested trainees.
The lesson plan for this module is divided into six 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

**SESSION ONE**

Session One introduces the various applications of reinforced concrete.

1. Show Session One PowerPoint® presentation slides.
2. Introduce trainees to applications requiring reinforcing bars in concrete.
3. Introduce trainees to applications requiring reinforced structural concrete.
4. Introduce trainees to applications requiring post-tensioned concrete.

**SESSIONS TWO AND THREE**

Sessions Two and Three introduce the general requirements for working with reinforcing steel.

1. Show Sessions Two and Three PowerPoint® presentation slides.
2. Introduce trainees to the safety precautions required when working with reinforcing steel.
3. Introduce trainees to the general characteristics of reinforcing steel.
4. Introduce trainees to the process of fabricating reinforcing steel.
5. Introduce trainees to the purpose of bar supports.
6. Introduce trainees to applications requiring welded-wire fabric reinforcement.

**SESSIONS FOUR AND FIVE**

Sessions Four and Five introduce tying, bending cutting, and splicing reinforcing bars.

1. Show Sessions Four and Five PowerPoint® presentation slides.
2. Introduce trainees to the process of cutting and bending reinforcing bars.
3. Introduce trainees to the process of lap splicing reinforcing bars using wire ties.
4. Introduce trainees to the placement of reinforcing steel.

**SESSION SIX**

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

1. Have trainees complete the Module Examination. Any outstanding performance testing must be completed during this session.
2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
Module Six (36112-17) introduces the trainees to the safety concerns associated with concrete, as well as concrete testing, concrete admixtures, and the proper procedure for placing concrete.

### Objectives

**Learning Objective 1**
- Describe safety concerns associated with concrete.
  - a. Identify rules for the care and safe use of hand tools when handling and placing concrete.
  - b. Identify rules for the care and safe use of power tools when handling and placing concrete.
  - c. Describe cement dermatitis and explain how to prevent it.

**Learning Objective 2**
- Explain concrete testing.
  - a. Describe a slump test.
  - b. Describe air entrainment testing.
  - c. Describe how time and temperature can affect the concrete and testing.

**Learning Objective 3**
- Identify concrete admixtures and explain how they are used.
  - a. Describe chemical admixtures.
  - b. Describe mineral and special admixtures.

**Learning Objective 4**
- Explain the proper procedure for placing concrete.
  - a. Describe the proper method for depositing concrete into forms.
  - b. Describe how concrete should be consolidated and finished.

### Performance Tasks

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

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**Teaching Time: hours**
(Six 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 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](http://www.nccerirc.com). For information and updates about accessing the Module Examinations, visit [www.nccer.org/testing](http://www.nccer.org/testing). The passing score for submission into NCCER’s Registry is % 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.

If trainees are exposed to concrete or portland cement, they must wear the proper protective clothing and respiratory equipment.

Classroom Equipment and Materials
Whiteboard
Markers
Pencils and paper
LCD projector and screen
PowerPoint® presentations for Module 36112-17
Computer with Internet access
Module Review answer key
Module Examinations
Appropriate PPE
Hand tools used in concrete finishing
Slump cone
Selection of chemical and mineral concrete admixtures

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

American Concrete Institute, www.concrete.org

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 ONE

Session One reviews the safety precautions associated specifically with concrete, including tool-related safety and the causes and effects of cement dermatitis. This session covers Sections 1.0.0 through 1.3.0.

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 hand tools used in working with concrete and the safety practices associated with these tools.
4. Describe the power tools used in working with concrete and the safety practices associated with these tools.
5. Describe the causes and effects of cement dermatitis and explain how to avoid this condition.

SESSION TWO

Session Two describes the various methods of testing concrete to ensure that it meets the standards for the project. This session covers Sections 2.0.0 through 2.3.0.

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. Explain the purpose of slump testing and describe how it is performed.
4. Explain the purpose of air entrainment testing and describe how it is performed.
5. Explain how time and temperature can affect concrete testing and durability.

SESSION THREE

Session Three covers the various admixtures that are used to affect the properties of concrete. It also covers the methods used to place and finish concrete. This session covers Sections 3.0.0 through 4.2.0.

1. Open the Session Three presentation.
2. Use the Kickoff Activity to get trainees engaged.
3. Describe the chemical admixtures used to affect the properties of concrete.
4. Describe the mineral admixtures used to affect the properties of concrete.
5. Describe the equipment and methods used place concrete in forms.
6. Describe the tools and methods used in consolidating concrete.

The Lesson Plan for this module is divided into six 2.5-hour sessions. This time includes minutes for administrative tasks and a-minute break per session.
SESSIONS FOUR AND FIVE

These two sessions are reserved for a field trip to a site where concrete is being placed and finished. Trainees must wear all required PPE in order to participate in this field trip.

SESSION SIX

Session Six 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 and any outstanding performance testing.

2. Submit the results to your Training Program Sponsor through the Registry System.
Module Overview

The ironworker uses drawings in all kinds of construction. These drawings contain structural details pertaining to loading conditions, fastening, and erection as well as general framework design and materials. Most drawings are computer-generated.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed Core Curriculum and Ironworking Level One, Modules 30101-11 through 30107-11.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Identify the materials used in steel-frame buildings.
2. Name the parts of steel frames.
3. Interpret symbols used on plans and drawings, including symbols for:
   • Structural steel
   • Ornamental ironwork
   • Welding

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Identify job plans and drawings used for ironworking jobs.
2. Identify the symbols used on selected ironworking plans and drawings.
3. Identify selected structural steel symbols and applications on job plans and drawings.
4. Identify selected ornamental ironwork and welding symbols and applications on job plans and drawings.

Materials and Equipment

Multimedia projector and screen
Ironworking Level One
PowerPoint® Presentation Slides
Computer
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
A set of structural drawings for a steel frame building

Actual drawings showing the following:
Shape details
Channels, H beams, and angles
Various structural details
Horizontal beam
Ornamental ironwork drawings
Welding drawings
If available, a section of a steel beam with an identifier marking
Copies of the Quick Quiz*
Module Examinations**
Performance Profile Sheets**

* Located in the back of this module.
**Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.
Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with trade drawings. Emphasize the importance of proper housekeeping.

Additional Resources

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

- AASHTO HB-17, Standard Specifications for Highway Bridges.
- ASTM A6, General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 12½ hours are suggested to cover Trade Drawings One. You will need to adjust the time required for testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Planned Time</th>
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<tbody>
<tr>
<td><strong>Session I. Introduction; Steel Structures</strong></td>
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<tr>
<td>A. Introduction</td>
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<td>B. Steel Structures</td>
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<td>1. Steel Shapes</td>
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<td>2. Detail Drawings</td>
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<td>3. Frames</td>
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<td>4. Roofs</td>
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<td>C. Laboratory</td>
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<tr>
<td>Have trainees practice identifying materials used in steel-frame buildings and interpreting symbols used on plans and drawings.</td>
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<td><strong>Session II. Assembly Drawings</strong></td>
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<tr>
<td>A. Assembly Drawings</td>
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<tr>
<td>1. Base Plate Drawings</td>
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<td>2. Framing Plan</td>
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<td>3. Fabrication Shop Drawings</td>
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<tr>
<td>B. Laboratory</td>
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<tr>
<td>Have trainees identify plans and drawings used for ironworking jobs. This laboratory corresponds to Performance Task 1.</td>
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<tr>
<td><strong>Session III. Ornamental Ironwork; Welding Drawings</strong></td>
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<tr>
<td>A. Ornamental Ironwork Drawings</td>
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<tr>
<td>B. Welding Symbols</td>
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</tbody>
</table>
Session IV. Laboratory
A. Laboratory
1. Have trainees identify the symbols used on selected ironworking plans and drawings, including symbols for:
   • Structural steel
   • Ornamental ironwork
   • Welding
   This laboratory corresponds to Performance Task 2.
2. Have trainees read basic structural drawings. This laboratory corresponds to Performance Task 3.

Session V. Review and Testing
A. Review
B. Module Examination
1. Trainees must score 70 percent or higher to receive recognition from NCCER.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.
C. Performance Testing
1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.
Module Overview

This module introduces the trainee to the types of structures that involve structural ironwork, such as bridges and multistory buildings. Structural ironworkers may also install decking and direct crane operators in hoisting structural components and maneuvering them into position.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed Core Curriculum and Ironworking Level One, Modules 30101-11 through 30108-11.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Identify the types of construction that use structural steel.
2. Describe the steel structure erection process.
3. State the principles of structural stresses.
4. Identify the components of common steel structures.
5. Explain the requirements of bolted connections.
6. List the advantages of pre-engineered structures.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Describe different uses for structural steel.
2. Identify selected types, shapes, and grades of structural steel.
3. Identify different types of structural-steel beams.
4. Make bolted connections on structural steel.

Materials and Equipment

<table>
<thead>
<tr>
<th>Multimedia projector and screen</th>
<th>Multimedia projector and screen</th>
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<tr>
<td>Computer</td>
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<td>Whiteboard/chalkboard</td>
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<td>Markers/chalk</td>
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<td>Pencils and scratch paper</td>
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<td>Appropriate personal protective equipment</td>
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<td>Photographs of structures built with structural steel, both finished and in process</td>
<td>Photographs of structures built with structural steel, both finished and in process</td>
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<td>Small sections of different shapes of steel</td>
<td>Small sections of different shapes of steel</td>
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<td>Selection of bolts</td>
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<td>Hardened washers</td>
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<tr>
<td>SMAW, GMAW, and FCAW electrodes</td>
<td>SMAW, GMAW, and FCAW electrodes</td>
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<td>Selection of typical structural ironworker tools</td>
<td>Selection of typical structural ironworker tools</td>
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<td>Sufficient number of the following for bolting girder to steel:</td>
<td>Sufficient number of the following for bolting girder to steel:</td>
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<td>• General-use bolts</td>
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<td>• Washers</td>
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<tr>
<td>• Piece of structural steel</td>
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<td>• Small section of girder</td>
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<td>• Appropriate tools</td>
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<td>Module Examinations**</td>
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<tr>
<td>Performance Profile Sheets**</td>
<td>Performance Profile Sheets**</td>
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</tbody>
</table>

* Located in the back of this module.
**Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with working on or around structural steel. Emphasize the importance of proper housekeeping.
Additional Resources

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


www.seaonc.org is a structural engineering website.


Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2 1⁄2 hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 7 1⁄2 hours are suggested to cover *Structural Ironworking One*. You will need to adjust the time required for testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Planned Time</th>
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<tbody>
<tr>
<td><strong>Session I. Introduction; Steel; Steel Beams; Uses of Structural Steel</strong></td>
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<tr>
<td>A. Introduction</td>
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<td>B. Steel</td>
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<td>1. Steel Products</td>
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<td>2. Steel Shapes</td>
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<td>3. Grades</td>
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<td>C. Steel Beams</td>
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<td>D. Use of Structural Steel</td>
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<td>1. Pre-Engineered Buildings</td>
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<td>2. Bridges</td>
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<td>E. Laboratory</td>
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<tr>
<td>1. Have trainees describe different uses for structural steel. This laboratory corresponds to Performance Task 1.</td>
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<tr>
<td>2. Have trainees identify selected types, shapes, and grades of structural steel. This laboratory corresponds to Performance Task 2.</td>
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<tr>
<td>3. Have trainees identify different types of structural-steel beams. This laboratory corresponds to Performance Task 3.</td>
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<tr>
<td><strong>Session II. Work Processes; Erection; Connections; Tools</strong></td>
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<td>A. Work Processes</td>
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<td>B. Erection of Structural Members</td>
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<td>1. Columns</td>
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<td>2. Girders/Joists</td>
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<td>3. Trusses</td>
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<td>4. Bracing</td>
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<td>C. Connections</td>
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<td>1. Bolted Connections</td>
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<td>2. Welded Connections</td>
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<tr>
<td>D. Tools</td>
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<tr>
<td>E. Laboratory</td>
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<tr>
<td>Have trainees make bolted connections on structural steel. This laboratory corresponds to Performance Task 4.</td>
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</tbody>
</table>
Session III. Review and Testing

A. Review

B. Module Examination

1. Trainees must score 70 percent or higher to receive recognition from NCCER.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

C. Performance Testing

1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.
Module Twelve (36201-17) describes the common types of bridges, along with the components that make up the substructure and superstructure of a bridge. The module discusses the types of materials used in bridge construction, presents basic surveying equipment and practices, and explains how to interpret bridge drawings.

### Objectives

**Learning Objective 1**
- Identify types of bridges and the components and materials used in bridge construction.
  a. Identify and describe types of bridges.
  b. Describe bridge substructures.
  c. Describe bridge superstructures.
  d. Explain how concrete is used in bridge construction.
  e. Explain how structural steel is used in bridge construction.

**Learning Objective 2**
- Describe basic surveying practices.
  a. Explain the use of control points and stationing.
  b. Describe surveying instruments used in bridge construction.
  c. Describe how to establish elevations using a benchmark.

**Learning Objective 3**
- Describe information provided in a bridge plan.
  a. Identify and describe the major elements of a drawing package.
  b. Explain how to perform a takeoff for quantity checks.

**Performance Tasks**

**Performance Task 1 (Learning Objective 3)**
- Use a bridge plan to explain the details of a project.

**Performance Task 2 (Learning Objective 3)**
- Perform layout based on a plan sheet.

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**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 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](http://www.nccerirc.com). For information and updates about accessing the Module Examinations, visit [www.nccer.org/testing](http://www.nccer.org/testing). 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 trainee safety in the future. All practice sessions and Performance Tasks must be completed under your direct supervision.

If trainees will be exposed to concrete or portland cement, they must wear the required protective clothing and respiratory equipment.

Equipment, Materials, and Resources
Whiteboard
Markers
Pencils and paper
LCD projector and screen
Powerpoint® presentations for Module 36201-17
Computer with Internet access
Drift pins
Bull pins
Graded bolts, nuts, and washers
Surveying stakes
Automatic level and tripod
Leveling rod
Total station
Takeoff sheets
One or more sets of bridge drawings
Module Examinations
Auto level
Tripod
Leveling rod
Grade stakes
Performance Profile Sheets

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

Bridge Construction and Deck Repair (PDF), Indiana Department of Transportation. 2014. 


North Carolina Department of Transportation (NCDOT). “Types of Bridges.”
http://www.ncdot.gov/projects/ncbridges/historic/types

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 36201-17

BRIDGE CONSTRUCTION

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 describes different types of bridges and their uses. This session covers Sections 1.0.0 through 1.1.7.

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 different types of bridges, their characteristics, and suitable applications for each type.
4. Explain how moveable bridges are used, and describe drawbridges, lift bridges, and swing bridges.
5. Discuss applications for specialized bridges such as temporary bridges, floating bridges, and flat slab bridges, and describe the methods used to build them.

SESSION TWO

Session Two covers the structural components of bridge substructures and superstructures. This session covers Sections 1.2.0 through 1.3.9.

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. Identify the function of a bridge substructure and introduce substructure components.
4. Describe spread footings and pile footings and explain how each type is built.
5. Describe the different methods used to construct bridge bents. Explain the function of piers and columns, bent caps, and bearings.
6. Explain the purpose and construction of bridge abutments.
7. Identify and describe the major components of a bridge superstructure. Emphasize safety hazards and fall protection requirements for work performed on superstructures.
8. Discuss the function and fabrication of bridge decks, beams and girders, trusses, rails, and deck drain systems. Describe the use of approach slabs, MSE walls, and deck finishers.
SESSION THREE

Session Three describes how concrete and steel are used in bridge construction. This session covers Sections 1.4.0 through 1.5.2.

1. Open the Session Three presentation.

2. Use the Kickoff Activity to get trainees engaged and give them an idea of what they will learn from this module.

3. Explain how concrete is used in bridge construction. Discuss forms used for cast in place components and briefly explain how the concrete must be poured and cured.

4. Explain that precast concrete for bridge construction is normally-reinforced or pre-stressed. Define pre-tensioned and post-tensioned concrete and explain how each type is made.

5. Explain how precast concrete connections are made, and the proper way to deliver and store concrete.

6. Describe how structural steel is used for bridge components. Describe common steel shapes and explain how steel is classified.

7. Discuss the connection methods for structural steel and stress the importance of accurate alignment.

SESSION FOUR

Session Four describes basic surveying practices used in bridge construction. This session covers Sections 2.0.0 through 2.3.2.

1. Open the Session Four presentation.

2. Use the Kickoff Activity to get trainees engaged and give them an idea of what they will learn from this module.

3. Define the terms benchmark, control point, and stationing and explain the role of each in the surveying process.

4. Explain how primary, secondary, and working control points are established and used.

5. Describe the surveying instruments commonly used in site layout.

6. Explain how to establish an elevation using differential leveling. Discuss differential leveling terminology and procedures.

SESSION FIVE

Session Five describes how to interpret bridge construction drawings. This session covers Sections 3.0.0 through 3.2.0.

1. Open the Session Five presentation.

2. Use the Kickoff Activity to get trainees engaged and give them an idea of what they will learn from this module.

3. Referring to the supplied example drawing sheets in the Trainee Guide, identify and discuss the sections of a set of bridge drawings.

4. Describe the content and use of the bridge location and general drawing sheets.

5. Describe the content and use of the superstructure, substructure, and approach slab sheets.

6. Explain how to perform a quantity takeoff.
Session Six is a laboratory and performance testing session in which the trainees will demonstrate their ability to interpret bridge drawings.

1. Explain the purpose and expected outcome of the lab session.
2. Demonstrate how to use bridge plans to identify bridge details.
3. Have the trainees practice interpreting bridge plans. This can be done by having them locate specific items on a drawing or by performing a material takeoff using the drawings. This activity corresponds to Performance Task 1.
4. Document successful Performance Task completions for each trainee on the Performance Profile sheet and submit the results to the Training Program Sponsor.

Session Seven is a laboratory and performance testing session in which the trainees will demonstrate their ability to perform basic site layout procedures based on a plan sheet.

1. Explain the purpose and expected outcome of the lab session.
2. Demonstrate how to use plan sheets to lay out a job site.
3. Have the trainees practice performing site layout procedures. This activity corresponds to Performance Task 2.
4. Document successful Performance Task completions for each trainee on the Performance Profile sheet and submit the results to the Training Program Sponsor.

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 Five. 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 and any outstanding performance testing.
2. Submit the results to your Training Program Sponsor through the Registry System.
Module Thirteen (36202-17) describes the types of footings used to support bridges, as well as various types of piles and pile-driving methods. Safety practices associated with pile driving on land and in marine environments are also covered, along with environmental protection issues.

**Objectives**

**Learning Objective 1**
- Describe the elements of bridge foundations.
  a. Describe the types of piles.
  b. Explain footings.
  c. Explain the use of cofferdams.

**Learning Objective 2**
- Identify types of pile-driving equipment.
  a. Identify types of hammers and leads.
  b. Identify vehicles used to drive piles.

**Learning Objective 3**
- Explain pile installation.
  a. Explain site evaluation procedures.
  b. Explain pile-driving techniques.

**Learning Objective 4**
- Identify safety concerns associated with bridge foundations.
  a. Explain safety concerns associated with constructing bridge foundations on land.
  b. Explain safety concerns associated with constructing bridge foundations on water.

**Learning Objective 5**
- Describe environmental concerns associated with bridge construction.
  a. Describe the role of federal, state, and local regulations on environmental issues.
  b. Describe methods used to control stormwater on a job site.
  c. Identify methods used to mitigate groundwater problems at a job site.
  d. Identify ways to prevent erosion and sedimentation.

**Performance Tasks**

**Performance Task 1 (Learning Objective 5)**
- Lay out pile locations according to drawings.

**Performance Task 2 (Learning Objective 5)**
- Create a template in accordance with drawings provided.

**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 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. For information and updates 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 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 trainee safety in the future. All practice sessions and Performance Tasks must be completed under your direct supervision.

If trainees are exposed to concrete or portland cement, they must wear the proper protective clothing and respiratory equipment.

Classroom Equipment and Materials
- Whiteboard
- Markers
- Pencils and paper
- LCD projector and screen
- Powerpoint® presentations for Module 36202-17
- Computer with Internet access
- A set of bridge plans
- Module Review answer key
- Module Examinations
- Performance Profile Sheets

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

- **Deck Barge Safety** (PDF), Occupational Safety and Health Administration. 2009. [www.osha.gov](http://www.osha.gov)

The following websites offer resources for products and training:
- American Pile Driving Equipment, Inc., [www.apevibro.com](http://www.apevibro.com)
- International Construction Equipment, Inc., [www.iceusa.com](http://www.iceusa.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.
Session Outline for Module 36202-17

BRIDGE FOUNDATIONS

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 covers different types of piles and footings, and the equipment used to drive piles. This session covers Sections 1.0.0 through 2.2.3.

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 types of piles and their uses.
4. Describe the different types of footings.
5. Explain what cofferdams are and how they are used.
6. Describe pile hammers and leads and explain how they are used.
7. Identify the different types of drivers used in pile driving.

**SESSION TWO**

Session Two describes pile-driving equipment, pile installation practices, and the safety procedures associated with pile driving. This session also covers the environmental issues associated with working in a maritime environment and describes the methods used to control groundwater and soil erosion during construction. This session covers Sections 3.0.0 through 5.4.2.

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 how to evaluate a site and prepare for pile driving.
4. Discuss the equipment used in pile driving.
5. Describe the techniques used in driving piles.
6. Discuss the safety hazards associated with pile driving.
7. Discuss the safety hazards associated with working around water.
8. Discuss the environmental issues related to bridge construction.
**SESSION THREE**

Session Three is a laboratory and performance testing session in which the trainees will lay out pile locations and prepare a layout for a pile-driving template.

1. Note that no slide presentation is associated with this laboratory session.
2. Using a set of bridge drawings, demonstrate how to lay out pile locations. Show trainees how to develop a layout for a related template.
3. Have trainees practice and complete the requirements of Performance Tasks 1 and 2.
4. Document successful Performance Task completions for each trainee on the Performance Profile sheet and submit the results to the Training Program Sponsor.

**SESSION FOUR**

Session Four 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 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 and any outstanding performance testing.
2. Submit the results to your Training Program Sponsor through the Registry System.
Objectives

Learning Objective 1
• Describe the types of formwork used in bridge building.
  a. Describe the types of manufactured forms.
  b. Describe how site-built forms are used.

Learning Objective 2
• Describe how to use and maintain forms.
  a. Explain how forms are used to build footings, columns, and caps.
  b. Explain how forms are used to build walls.
  c. Explain how forms are used to build approach slabs and bridge decks.
  d. Describe how to properly clean and store forms after use.

Performance Tasks

Performance Task 1 (Learning Objective 2)
• Prepare a material takeoff for concrete formwork.

Performance Task 2 (Learning Objective 2)
• Build a small cap form at least 4' × 3' (1.3 m × 1 m) with walers, form ties, and headers. Include a beam seat and anchor bolts, as well as a blockout for pipe.

Teaching Time: 22.5 hours
(Nine 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 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. For information and updates 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 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 trainee safety in the future. All practice sessions and Performance Tasks must be completed under your direct supervision.

If trainees will be exposed to concrete or portland cement, they must wear the required protective clothing and respiratory equipment.

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**Equipment, Materials, and Resources**

- Whiteboard
- Markers
- Pencils and paper
- Powerpoint® presentations for Module 36203-17
- LCD projector and screen
- Computer with Internet access
- Form hardware, including ties and clamps
- Module Review answer key
- Module Examinations
- A drawing of the small cap form referenced in Performance Task 2
- Sample of a completed material takeoff for a concrete form
- Form ties
- Plywood panels
- 2 × 4 lumber for walers and strongbacks
- Double-headed nails
- Hammer
- Circular saw
- Performance Profile Sheets

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**Additional Resources**

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

- Scaffold, Shoring, and Forming Institute website offers resources for products and training, [www.ssfi.org](http://www.ssfi.org)

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 nine 2.5-hour sessions. This time includes 10 minutes for administrative tasks and a 10-minute break per session.

**Session One**

Session One covers the different types of manufactured and site-built bridge forms and their uses. 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 different types of concrete forms used in bridge construction.
4. Discuss different types of manufactured form systems and their uses.
5. Describe how site-built (stick-built) forms are used in bridge construction.

**Session Two**

Session Two covers the application of concrete forms in building walls, columns, piers, footings, and caps. This session covers Sections 2.0.0 through 2.4.0.

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 uses of forms in building footings, columns, and caps.
4. Discuss the different types of column forms.
5. Explain how concrete pile caps and bent caps are formed.
6. Describe the different types of manufactured forms used in building concrete walls.
7. Discuss the formwork used in pouring bridge decks and approach slabs.
8. Explain how to maintain and properly store forms for future use.

**Sessions Three through Eight**

Sessions Three through Eight are laboratory sessions in which the trainees will prepare a material takeoff and build a concrete form to satisfy the Performance Tasks.

1. Explain the purpose and expected outcome of the lab session.
2. Provide the trainees with a drawing of the form referenced in Performance Task 2 in sufficient detail to support preparation of a material takeoff.
3. Have each trainee use the drawing provided to prepare a material takeoff for the form. Evaluate their work. This activity corresponds to Performance Task 1.
4. Under your supervision and using the drawing and materials provided, have each trainee build the form and evaluate their work. This activity corresponds to Performance Task 2.
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 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 and any outstanding performance testing.
2. Submit the results to your Training Program Sponsor through the Registry System.