Module 27303-14 describes the properties, characteristics, and uses of cement, aggregates, and other materials that, when mixed together, form different types of concrete. The text covers procedures for estimating concrete volume and for testing freshly mixed concrete as well as methods and materials for curing concrete.

Objectives

Learning Objective 1
- Identify various concrete ingredients and describe their purpose in a concrete mixture.
  a. Explain how portland cement affects a concrete mixture and list the types of portland cement.
  b. Describe the characteristics of aggregate used in a concrete mixture.
  c. List the characteristics of water used in a concrete mixture.
  d. List types of concrete admixtures and describe how they affect a concrete mixture.

Learning Objective 2
- Identify proper concrete mixture measurements and curing methods.
  a. Describe normal concrete-mix proportions and measurements.
  b. List special types of concrete.
  c. Describe the properties of air-entrained concrete.
  d. Describe how concrete is cured.

Learning Objective 3
- Describe the methods for testing concrete.
  a. Describe the proper procedure for sampling concrete.
  b. Explain the purpose of a slump test.
  c. Describe how a concrete compression test is performed.

Learning Objective 4
- Calculate concrete volume for rectangular or circular structures.
  a. Calculate rectangular volume.
  b. Calculate circular volume.

Performance Tasks

Performance Task 1 (Learning Objective 3)
- Perform a concrete slump test or create a concrete test cylinder.

Performance Task 2 (Learning Objective 4)
- Calculate concrete volume requirements using formulas, concrete tables, and/or concrete calculators, as applicable.

Teaching Time: 10 hours
(Four 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.
**Classroom Equipment and Materials**
- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- **Carpentry Level Three PowerPoint® Presentation Slides**
- Computer
- Copies of the Module Examination and Performance Profile Sheets
- Vendor-supplied videos/DVDs showing concrete mixing operations (optional)
- TV/DVD player

**Equipment and Materials for Laboratories and Performance Testing**
- Personal protective equipment
  - Eye protection
  - Gloves
  - Hard hat
- Construction calculator
- Containers of water
- Copies of a completed concrete test recording form
- Copies of or excerpts from ASTM C150, *Standard Specification for Portland Cement*
- Copy of performance specifications
- Cylindrical molds
- Digital thermometers
- Hand grips
- Materials used for concrete hydration, including waterproof curing paper, plastic sheeting, burlap mats, blankets, and curing compounds
- Metal tags and tag wires
- Nonabsorbent surface
- Samples of acceptable and unacceptable aggregates
- Samples of admixtures
- Samples of coloring agents
- Samples of fine and/or coarse aggregate
- Samples of portland cement
- Set of commercial construction drawings
- Set of residential construction drawings
- Shovel
- Sieve or filter
- Slide-rule concrete calculator
- Slump cone mold
- Straightedge
- Tamping rod
- Tape measure
- Water
- Wheelbarrow

**Safety Considerations**
This module requires that trainees work around cement. 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.

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

- American Concrete Institute. [www.concrete.org](http://www.concrete.org)


Cement Association of Canada. [www.cement.ca](http://www.cement.ca)


There are a number of online resources available for trainees who would like more information on the properties of concrete. A search for additional information may be assigned as homework to interested trainees.
Session Outline for Module 27303-14

PROPERTIES OF CONCRETE

The lesson plan for this module is divided into four 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

**SESSION ONE**

Session One introduces concrete ingredients and their impact on a concrete mixture.

1. Show Session One PowerPoint® presentation slides.
2. Introduce trainees to hydration and its various stages.
3. Introduce trainees to the various types of aggregates and admixtures that may be used in a concrete mixture.

**SESSION TWO**

Session Two introduces concrete mixture proportions, measurements, and concrete testing.

1. Show Session Two PowerPoint® presentation slides.
2. Introduce trainees to the procedure for determining the proper proportions for a concrete mixture.
3. Introduce trainees to the proper technique for properly obtaining concrete samples.
4. Introduce trainees to the proper technique for performing a slump test.

**SESSION THREE**

Session Three introduces concrete volume calculations.

1. Show Session Three PowerPoint® presentation slides.
2. Introduce trainees to the proper technique for determining the volume of rectangular and circular solids.
3. Introduce trainees to the proper technique for determining concrete volume.

**SESSION FOUR**

Session Four 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 Three.) 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.
## Materials Checklist for Module 27303-14, Properties of Concrete

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
<th>Personal protective equipment:</th>
<th>Eye protection</th>
<th>Gloves</th>
<th>Hard hat</th>
<th>Markers/chalk</th>
<th>Pencils and paper</th>
<th>Carpentry Level Three PowerPoint® Presentation Slides</th>
<th>Computer</th>
<th>Copies of the Module Examination and Performance Profile Sheets</th>
<th>Vendor-supplied videos/DVDs showing concrete mixing operations (optional)</th>
<th>TV/DVD player</th>
<th>Water</th>
<th>Wheelbarrow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction calculator</td>
<td>Construction calculator</td>
<td></td>
<td></td>
<td></td>
<td>Container of water</td>
<td>Samples of admixtures</td>
<td>Hitting and measuring tools</td>
<td>Samples of coloring agents</td>
<td>Containers of water</td>
<td>Samples of fine and/or coarse aggregate</td>
<td>Cylindrical molds</td>
<td>Set of commercial construction drawings</td>
<td>Cylindrical molds</td>
</tr>
</tbody>
</table>

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
Module 38101-11 describes the function and inspection of basic equipment and hardware used in rigging, including slings, wire rope, and chains, and attaching hardware such as shackles, eyebolts, and hooks. Sling capacities and angles are explained. The use of rigging knots, tuggers, jacks, hoists, and ratchet-lever hoists is also covered.

Objectives

Learning Objective 1
• Identify and describe the uses of common rigging hardware and equipment.

Learning Objective 2
• Perform a safety inspection on hooks, slings, and other rigging equipment.

Learning Objective 3
• Describe common slings and determine sling capacities and angles.

Learning Objective 4
• Select, inspect, use, and maintain special rigging equipment, including:
  – Block and tackle (bull rigging)
  – Chain hoists
  – Ratchet-lever hoists
  – Jacks
  – Base-mounted drum hoists (tuggers)

Learning Objective 5
• Inspect heavy rigging hardware.

Learning Objective 6
• Tie knots used in rigging.

Performance Tasks

Performance Task 1 (Learning Objective 2)
• Perform a safety inspection on hooks, slings, and other rigging equipment.

Performance Task 2 (Learning Objective 4)
• Select, inspect, use, and use special rigging equipment, including:
  – Block and tackle (bull rigging)
  – Chain hoists
  – Ratchet-lever hoists
  – Jacks
  – Base-mounted drum hoists (tuggers)

Performance Task 3 (Learning Objective 6)
• Tie knots used in rigging.

Teaching Time: 10 hours
(Four 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 select and inspect rigging hardware. 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
- *Carpentry Level Three PowerPoint® Presentation Slides*
- Computer
- Copies of the Module Examination and Performance Profile Sheets
- Vendor-supplied videos/DVDs showing rigging and lifting operations (optional)
- TV/DVD player

Equipment and Materials for Laboratories and Performance Testing
- Personal protective equipment:
  - Eye protection
  - Gloves
  - Hard hat
  - Base-mounted drum hoist
  - Beam clamps
  - Chain slings
  - Come-along
  - Complex block and tackle rig
  - Electric hoist
  - Eyebolts
  - Hooks
  - Hydraulic jack
  - Metal mesh slings
  - Plate clamps
- Ratchet jack
- Ratchet-lever hoist
- Rigging plates and links
- Rope (for tag lines)
- Screw jack
- Shackles and pins
- Simple block and tackle rig
- Spreader and equalizer beams
- Spur-gated chain hoist
- Synthetic rope
- Synthetic web and round slings
- Turnbuckles
- Wire rope
- Wire rope slings

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

**SESSION ONE**
Session One introduces rigging hardware, such as hooks, slings, and rigging equipment.
1. Show Session One PowerPoint® presentation slides.
2. Identify types of rigging hardware and how to properly inspect each type.

**SESSION TWO**
Session Two introduces slings, tag lines, and block and tackle rigs.
1. Show Session Two PowerPoint® presentation slides.
2. Discuss sling capacity and how the sling angle affects the tension on the sling.
3. Explain and demonstrate how to properly inspect various types of slings.
4. Discuss the use of tag lines when lifting or moving loads.
5. Explain and demonstrate how to properly tie rigging knots.
6. Explain and demonstrate how to properly inspect block and tackle rigs.

**SESSION THREE**
Session Three introduces chain hoists, ratchet-lever hoists, jacks, and drum hoists.
1. Show Session Three PowerPoint® presentation slides.
2. Explain and demonstrate how to properly inspect chain hoists.
3. Explain and demonstrate how to properly inspect a ratchet-lever hoist and come-along.
4. Explain and demonstrate how to properly inspect jacks.
5. Explain and demonstrate how to properly inspect drum hoists.

**SESSION FOUR**
Session Four 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 Three.) 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.
## Materials Checklist for Module 38101-11, Rigging Equipment

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
<th>Base-mounted drum hoist</th>
<th>Ratchet-lever hoist</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal protective equipment:</strong></td>
<td>Beam clamps</td>
<td>Rigging plates and links</td>
</tr>
<tr>
<td>Eye protection</td>
<td>Chain slings</td>
<td>Rope (for tag lines)</td>
</tr>
<tr>
<td>Gloves</td>
<td>Come-along</td>
<td>Screw jack</td>
</tr>
<tr>
<td>Hard hat</td>
<td>Complex block and tackle rig</td>
<td>Shackles and pins</td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
<td>Electric hoist</td>
<td>Simple block and tackle rig</td>
</tr>
<tr>
<td>Markers/chalk</td>
<td>Eyebolts</td>
<td>Spreader and equalizer beams</td>
</tr>
<tr>
<td>Pencils and paper</td>
<td>Hooks</td>
<td>Spur-geared chain hoist</td>
</tr>
<tr>
<td><strong>Carpentry Level Three PowerPoint® Presentation Slides</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer</td>
<td>Hydraulic jack</td>
<td>Synthetic rope</td>
</tr>
<tr>
<td>Copies of the Module Examination and Performance Profile Sheets</td>
<td>Metal mesh slings</td>
<td>Synthetic web and round slings</td>
</tr>
<tr>
<td>Vendor-supplied videos/DVDs showing rigging and lifting operations (optional)</td>
<td>Plate clamps</td>
<td>Turnbuckles</td>
</tr>
<tr>
<td>TV/DVD player</td>
<td>Ratchet jack</td>
<td>Wire rope</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wire rope slings</td>
</tr>
</tbody>
</table>

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
Module 38102-11 This module covers general rigging and crane hazards and related safety considerations. It provides an overview of verbal and nonverbal modes of communication, and describes emergency response procedures for rigging operations. Instructions for lifting with slings and how to rig and lift pipe are also included.

**Objectives**

**Learning Objective 1**
- Identify and use the correct ASME hand signals to guide a crane operator.

**Learning Objective 2**
- Identify basic rigging and crane safety procedures and determine the center of gravity of a load.

**Learning Objective 3**
- Identify the pinch points of a crane and explain how to avoid them.

**Learning Objective 4**
- Identify site and environmental hazards associated with rigging.

**Learning Objective 5**
- Properly attach rigging hardware for routine lifts and pipe lifts.

**Learning Objective 6**
- Explain the importance of sling tension calculations.

**Performance Tasks**

**Performance Task 1 (Learning Objective 1)**
- Use and interpret hand signals.

**Performance Task 2 (Learning Objective 2)**
- Determine the center of gravity of a load.

**Performance Task 3 (Learning Objective 5)**
- Properly attach rigging hardware for routine lifts and pipe lifts.

**Teaching Time: 10 hours**

(Four 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 properly attach rigging hardware for routine lifts and pipe lifts. 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
- *Carpentry Level Three* PowerPoint® Presentation Slides
- Computer
- Copies of the Module Examination and Performance Profile Sheets
- Vendor-supplied videos/DVDs showing rigging operations (optional)
- TV/DVD player

### Equipment and Materials for Laboratories and Performance Testing

- Personal protective equipment
  - Eye protection
  - Gloves
  - Hard hat
  - Hearing protection
  - Safety vest
  - Steel-toe work boots
- Beam clamps
- Chain slings
- Copies of blank job hazard analysis forms
- Copy of Subpart O (Motor Vehicles, Mechanized Equipment, and Marine Operations) of OSHA construction regulations
- Eyebolts
- Hooks
- Metal mesh slings
- Operator’s manual for a crane
- Plate clamps
- Portable radios and hardwired systems and accessories
- Rigging plates and links
- Rope (for tag lines)
- Shackles and pins
- Spreader and equalizer beams
- Synthetic rope
- Synthetic web and round slings
- Turnbuckles
- Wire rope
- Wire rope slings

### 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 rigging practices. A search for additional information may be assigned as homework to interested trainees.
The lesson plan for this module is divided into four 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

**SESSION ONE**

Session One introduces modes of verbal and nonverbal communication used in lifting operations.

1. Show Session One PowerPoint® presentation slides.
2. Discuss the advantages and disadvantages of modes of verbal communication used during rigging operations.
3. Discuss the advantages and disadvantages of modes of nonverbal communication used during rigging operations.
4. Explain and demonstrate the use of hand signals.

**SESSION TWO**

Session Two introduces rigging safety practices.

1. Show Session Two PowerPoint® presentation slides.
2. Discuss general rigging safety guidelines and precautions.
3. Review site restrictions and hazards, such as working near power lines, and the importance of timely and appropriate responses in emergency situations.

**SESSION THREE**

Session Three introduces routine lifts and pipe lifts.

1. Show Session Three PowerPoint® presentation slides.
2. Discuss the use of slings when lifting loads and the importance of finding the center of gravity of a load.
3. Introduce the procedures for rigging pipe.
4. Explain the requirements and procedures for rigging a valve.
5. Review the guidelines for unloading and yarding materials.

**SESSION FOUR**

Session Four 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 Three.) 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.
### Equipment and Materials

<table>
<thead>
<tr>
<th>Personal protective equipment:</th>
<th>Beam clamps</th>
<th>Portable radios and hardwired systems and accessories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye protection</td>
<td>Chain slings</td>
<td>Rigging plates and links</td>
</tr>
<tr>
<td>Hand protection</td>
<td>Copies of blank job hazard analysis forms</td>
<td>Rope (for tag lines)</td>
</tr>
<tr>
<td>Hard hat</td>
<td>Copy of Subpart O (Motor Vehicles, Mechanized Equipment, and Marine Operations) of OSHA construction regulations</td>
<td>Shackles and pins</td>
</tr>
<tr>
<td>Hearing protection</td>
<td>Eyebolts</td>
<td>Spreader and equalizer beams</td>
</tr>
<tr>
<td>Safety vest</td>
<td>Hooks</td>
<td>Synthetic rope</td>
</tr>
<tr>
<td>Steel-toe work boots</td>
<td>Metal mesh slings</td>
<td>Synthetic web and round slings</td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
<td>Operator's manual for a crane</td>
<td>Turnbuckles</td>
</tr>
<tr>
<td>Markers/chalk</td>
<td>Plate clamps</td>
<td>Wire rope</td>
</tr>
<tr>
<td>Pencils and paper</td>
<td>Wire rope slings</td>
<td></td>
</tr>
</tbody>
</table>

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
Lesson Plans for Module 27306-14

TRENCHING AND EXCAVATING

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 how surface water, groundwater, and rock are mitigated 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. 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
- 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**

Sessons 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.
### Materials Checklist for Module 27306-14, Trenching and Excavating

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
<th>Personal protective equipment:</th>
<th>Whiteboard/chalkboard</th>
<th>Markers/chalk</th>
<th>Pencils and paper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completed job hazard analysis form</td>
<td>Completed job hazard analysis form</td>
<td>Copies of a National Pollutant Discharge Elimination System (NPDES) stormwater permit</td>
<td>Copies of blank job hazard analysis forms</td>
<td>Copies of specifications from a construction project that specifies soil compaction requirements</td>
</tr>
<tr>
<td>Copies of the dewatering plans from a set of project specifications</td>
<td>Containers filled with a variety of soils of various levels of moisture</td>
<td>Requirements for a project that requires trenching or a foundation excavation, including safety hazards and proposed shoring, shielding, or sloping systems to be used</td>
<td>Sump pump</td>
<td></td>
</tr>
<tr>
<td>Copies of the latest edition of OSHA Publication 2226, Excavations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
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.
  - Describe how forces are resisted in concrete through the use of reinforcing bars.
  - List applications for reinforced structural concrete.
  - Discuss how posttensioned concrete is created.

**Learning Objective 2**
- Describe the general requirements for working with reinforcing steel, including tools, equipment, and fabricating methods.
  - List general safety precautions when working with reinforcing steel.
  - Describe the general characteristics of reinforcing steel.
  - Discuss how reinforcing steel is fabricated.
  - Explain the purpose of bar supports.
  - 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.
  - Describe how to cut rebar.
  - Describe how to bend rebar.

**Learning Objective 4**
- Explain the methods for placing reinforcing steel.
  - Discuss the proper method for tying and splicing reinforcing steel.
  - 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.ncsicr.com](http://www.ncsicr.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
Carpentry Level Three 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
- Plastic bar supports
- Pliers
- Plumb bob
- Precast concrete bar supports
- Sample bar list
- Samples of welded-wire fabric reinforcement
- Side-cutting pliers
- Sledgehammer
- Spliced rebar
- Standees
- Steel wire bar supports
- Tape measure
- Tie wire
- Tie-wire reel
- Tool pouch
- Unlabeled copies of Figures 9, 11, 17, and 23
- Welded-wire fabric

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.


Placing Reinforcing Bars, 2005. Concrete Reinforcing Steel Institute (CRSI).

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 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.

**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.

**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.
# Materials Checklist for Module 27304-14, Reinforcing Concrete

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
<th>2&quot; leather belt</th>
<th>Plumb bob</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal protective equipment:</td>
<td>2&quot; leather belt</td>
<td>Plumb bob</td>
</tr>
<tr>
<td>ANSI-approved footwear</td>
<td>ACI standards for concrete coverage</td>
<td>Precast concrete bar supports</td>
</tr>
<tr>
<td>Hard hat</td>
<td>Bar lists</td>
<td>Sample bar list</td>
</tr>
<tr>
<td>Leather-palm gloves</td>
<td>Bent bars</td>
<td>Samples of welded-wire fabric reinforcement</td>
</tr>
<tr>
<td>Safety glasses</td>
<td>Bolt cutters</td>
<td>Side-cutting pliers</td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
<td>Copies of ASTM standards</td>
<td>Sledgehammer</td>
</tr>
<tr>
<td>Markers/chalk</td>
<td>Deformed welded-wire fabric</td>
<td>Spliced rebar</td>
</tr>
<tr>
<td>Pencils and paper</td>
<td>Electric shears</td>
<td>Standees</td>
</tr>
<tr>
<td>Carpentry Level Three PowerPoint® Presentation Slides</td>
<td>Hickey bar and jigs</td>
<td>Steel wire bar supports</td>
</tr>
<tr>
<td>Computer</td>
<td>Hooks and spirals</td>
<td>Tape measure</td>
</tr>
<tr>
<td>Copies of the Module Examination and Performance Profile Sheets</td>
<td>Keel holder</td>
<td>Tie wire</td>
</tr>
<tr>
<td>Vendor-supplied videos/DVDs showing the reinforcement of concrete (optional)</td>
<td>Level</td>
<td>Tie-wire reel</td>
</tr>
<tr>
<td>TV/DVD player</td>
<td>Mechanically spliced rebar</td>
<td>Tool pouch</td>
</tr>
<tr>
<td></td>
<td>Pieces of marked rebar</td>
<td>Unlabeled copies of Figures 9, 11, 17, and 23</td>
</tr>
<tr>
<td></td>
<td>Plastic bar supports</td>
<td>Welded-wire fabric</td>
</tr>
<tr>
<td></td>
<td>Pliers</td>
<td></td>
</tr>
</tbody>
</table>

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
Lesson Plans for Module 27307-14

FOUNDATIONS AND SLABS-ON-GRADE

Module 27307-14 describes basic site layout tools and methods; layout and construction of deep and shallow foundations; layout and forming of slabs-on-grade; and forms used for curbing and paving.

Objectives

Learning Objective 1
- Identify the safety requirements when forming foundations and slabs.
  a. List safety rules pertaining to the use of hand tools when forming foundations and slabs.
  b. List safety rules pertaining to the use of power tools when forming foundations and slabs.
  c. Describe cement dermatitis and how it can be remedied.

Learning Objective 2
- Describe how to establish formwork locations and elevations.
  a. Describe how to use control points when establishing formwork locations and elevations.
  b. Explain how to use leveling instruments.
  c. Explain how to measure horizontal distances.
  d. Explain how to measure vertical distances.

Learning Objective 3
- Explain how to properly perform job-site layout.
  a. Describe how to establish building layout.
  b. Explain how to establish building lines with batter boards.
  c. Describe excavating and trenching processes.
  d. Explain how to lay out forms.
  e. Describe how to use templates.

Learning Objective 4
- Identify the various types of foundations and list appropriate uses for each.
  a. Identify the various types of deep-foundation elements.
  b. Identify the various types of shallow-foundation elements.

Learning Objective 5
- Identify various types of foundation forms and their proper removal.
  a. Describe how to erect and strip job-built wood forms.
  b. Explain how to erect manufactured forms.
  c. Describe how to strip forms.

Learning Objective 6
- Describe how slabs-on-grade are formed and finished.
  a. List slab-on-grade construction considerations.
  b. Describe how to form and finish a commercial slab-on-grade.
  c. Discuss the use of screeds when finishing slabs-on-grade.

Learning Objective 7
- Identify methods to create curbs and pavement.
  a. Discuss the use of curbing forms.
  b. Identify paving equipment used for commercial slabs-on-grade.

Performance Tasks

Performance Task 1 (Learning Objective 3)
- Establish elevations.

Performance Task 2 (Learning Objective 5)
- Lay out and construct an instructor-selected foundation using an established grid line.

Performance Task 3 (Learning Objective 6)
- Install templates, keyways, and embedments.

Performance Task 4 (Learning Objective 6)
- Form and strip pier foundation forms and prepare for resetting at another location.

Teaching Time: 20 hours
(Eight 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.nccerinc.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 establish elevations, lay out and construct an instructor-selected foundation, and install templates, keyways, and embedments. 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
- Carpenter Level Three PowerPoint Presentation Slides
- Computer
- Copies of the Module Examination and Performance Profile Sheets
- Vendor-supplied videos/DVDs showing foundations and slabs-on-grade (optional)
- TV/DVD player

Equipment and Materials for Laboratories and Performance Testing
- Personal protective equipment
  - Eye protection
  - Hand protection
  - Hard hat
  - Work boots
  - 2’ or 4’ level
  - Anchor bolts
  - Automatic leveling instruments
  - Batter boards
  - Brush for applying form-release compound or agent
  - Builder’s level
  - Circular saws
  - Color-coded stakes or markers
  - Container of form-release compound or agent
  - Copies of a safety data sheet (SDS) for portland cement
  - Copies of Figure 47 with the terms covered
  - Copies of foundation plans from sets of construction drawings
  - Copies of instruction manuals for a variety of power tools
  - Copies of manufacturers’ brochures or installation instructions for slip-form pavers
  - Copies of manufacturers’ instructions for manufactured forms
  - Copies of the manufacturer’s instructions for a leveling instrument
  - Copies of the section of the local applicable building code that addresses building foundations
  - Copies of, or excerpts from, the latest edition of the Concrete Reinforcing Steel Institute (CRSI) publication Manual of Standard Practice
- Direct elevation rod
- Field notebook
- Gammon reel
- Hammers
- Hub stakes
- Images of curbing forms
- Laser level and detector
- Ledger boards
- Lengths of dowel
- Leveling rods and accessories
- Marker stakes
- Measuring tapes
- Nails
- Pier foundation forms
- Pliers
- Plumb bobs and line
- Power drills
- Power nailers
- Project plans
- Reciprocating saws
- Samples of rebar and WWR
- Sanders
- Saws
- Shovels
- Stakes
- Steel tape (100’)
- String line
- Transit level
- Tripod
- Walers
- Wire cutters
- Wood or metal form
- Wood templates
Additional Resources and References
This module presents thorough resources for task training. The following resource material is suggested for further study:


American Concrete Institute. [www.concrete.org](http://www.concrete.org)


The Concrete Network. [www.concretenetwork.com](http://www.concretenetwork.com)

There are a number of online resources available for trainees who would like more information on foundations and slabs-on-grade. A search for additional information may be assigned as homework to interested trainees.
Session Outline for 27307-13

FOUNDATIONS AND SLABS-ON-GRADE

The lesson plan for this module is divided into eight 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

**SESSION ONE**
Session One introduces the safety requirements when forming foundations and slabs.
1. Show Session One PowerPoint® presentation slides.
2. Introduce trainees to hand and power tool safety rules.
3. Introduce trainees to the techniques used to prevent and treat cement dermatitis.

**SESSION TWO**
Session Two introduces techniques for using control points when establishing formwork locations and elevations.
1. Show Session Two PowerPoint® presentation slides.
2. Introduce trainees to the techniques for using leveling instruments.
3. Introduce trainees to the measurement of horizontal and vertical distances.

**SESSION THREE**
Session Three introduces job site layout.
1. Show Session Three PowerPoint® presentation slides.
2. Introduce trainees to the various elements of job site layout, such as building lines, excavations, forms, and templates.

**SESSION FOUR**
Session Four introduces the various types of foundations.
1. Show Session Four PowerPoint® presentation slides.
2. Introduce trainees to the various types of deep and shallow foundation elements.

**SESSION FIVE**
Session Five introduces the types of foundation forms and their proper removal.
1. Show Session Five PowerPoint® presentation slides.
2. Introduce trainees to job-built wood forms and manufactured forms, and explain how to strip forms.

**SESSION SIX**
Session Six introduces how slabs-on-grade are formed and finished.
1. Show Session Six PowerPoint® presentation slides.
2. Introduce trainees to slab-on-grade construction.
3. Introduce trainees to the techniques used to form and finish slabs-on-grade, including the use of screeds.
**SESSION SEVEN**

Session Seven introduces methods to create curbs and pavement.

1. Show Session Seven PowerPoint® presentation slides.
2. Introduce trainees to the use of curbing forms.
3. Introduce trainees to paving equipment used for commercial slabs-on-grade.

**SESSION EIGHT**

Session Eight 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 Seven.) 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.
## Materials Checklist for Module 27307-14, Foundations and Slabs-on-Grade

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
<th>Equipment and Materials</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal protective equipment:</strong></td>
<td>Copies of a safety data sheet (SDS) for portland cement</td>
<td>Copies of Figure 47 with the terms covered</td>
</tr>
<tr>
<td>Eye protection</td>
<td>Copies of foundation plans from sets of construction drawings</td>
<td>Copies of instruction manuals for a variety of power tools</td>
</tr>
<tr>
<td>Hand protection</td>
<td>Copies of manufacturers’ brochures or installation instructions for slip-form pavers</td>
<td>Copies of, or excerpts from, the latest edition of the Concrete Reinforcing Steel Institute (CRSI) publication Manual of Standard Practice</td>
</tr>
<tr>
<td>Hard hat</td>
<td>Copies of the manufacturer’s instructions for a leveling instrument</td>
<td>Copies of manufacturers’ instructions for manufactured forms</td>
</tr>
<tr>
<td>Work boots</td>
<td>Copies of the section of the local applicable building code that addresses building foundations</td>
<td>Power drills</td>
</tr>
<tr>
<td>Markers/chalk</td>
<td>Direct elevation rod</td>
<td>Power nailers</td>
</tr>
<tr>
<td>Pencils and paper</td>
<td>Field notebook</td>
<td>Project plans</td>
</tr>
</tbody>
</table>
\begin{tabular}{lcl}
\textit{Carpentry Level Three}                                & \\
PowerPoint® Presentation Slides                              & Gammon reel                                                 & Reciprocating saws                                          \\
Computer                                                     & Hammers                                                     & Samples of rebar and WWR                                    \\
\end{tabular}

\begin{tabular}{lcl}
\textit{Vendor-supplied videos/DVDs showing foundations and slabs-on-grade (optional)} & Images of curbing forms & Saws \end{tabular}

\begin{tabular}{lcl}
TV/DVD player                                                 & Laser level and detector                                    & Shovels                                                      \\
\end{tabular}

\begin{tabular}{lcl}
\textit{2’ or 4’ level}                                      & Lengths of dowel                                             & Steel tape (100’)                                           \\
Anchor bolts                                                 & Leveling rods and accessories                                & String line                                                 \\
Automatic leveling instruments                               & Marker stakes                                                & Transit level                                               \\
Batter boards                                                & Measuring tapes                                             & Tripod                                                       \\
Brush for applying form-release compound or agent            & Nails                                                       & Walers                                                      \\
Builder’s level                                              & Pier foundation forms                                        & Wire cutters                                                \\
Circular saws                                                & Pliers                                                      & Wood or metal form                                          \\
Color-coded stakes or markers                                & Plumb bob and line                                           & Wood templates                                              \\
Container of form-release compound or agent                  &                                                             &                                                               \\
\end{tabular}

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

**Learning 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](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 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.

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

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*
- Copies of the manufacturer’s instructions for form sections
- Copies of the manufacturer’s specifications for a door, window, or other opening
- Copies of the Scaffold, Shoring, and Forming Institute, Inc.’s publication *Guide to Safety Procedures for Vertical Concrete Formwork*
- Copies of the section of the local applicable building code that addresses requirements for stairways
- Form panels
- Form ties
- Levels
- Lifting equipment such as a forklift
- Nosing bars
- Plumb bobs
- Rebar pins
- Release agent
- Reveals
- Riser boards
- Shop drawings for a form
- Spreaders
- Stakes
- Strongbacks
- Walers

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 Outline for 27308-14  
VERTICAL FORMWORK

**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.
# Materials Checklist for Module 27308-14, Vertical Formwork

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
<th>Personal protective equipment:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Assembly hardware</td>
</tr>
<tr>
<td></td>
<td>Nosing bars</td>
</tr>
<tr>
<td>Eye protection</td>
<td>Assorted steel and wood panel system components, including spreader tie pins, alignment and plate clamps, 2-wedge bolts, and 2-pipe aligner hooks</td>
</tr>
<tr>
<td>Hand protection</td>
<td>Copies of the manufacturer’s specifications for a door, window, or other opening</td>
</tr>
<tr>
<td>Hard hat</td>
<td>Copies of a job hazard analysis (JHA) for a project involving the use of a personal fall arrest system (PFAS)</td>
</tr>
<tr>
<td>Work boots</td>
<td>Copies of the section of the local applicable building code that addresses requirements for stairways</td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
<td>Copies of construction drawings with design instructions</td>
</tr>
<tr>
<td>Markers/chalk</td>
<td>Copies of the manufacturer’s instructions for form sections</td>
</tr>
<tr>
<td>Pencils and paper</td>
<td>Copies of manufacturer’s specifications for plastic form systems</td>
</tr>
<tr>
<td>Computer</td>
<td>Copies of one or more of Concrete Network’s publications Concrete Stamping Today, Concrete Staining Today, Concrete Overlays Today, and Concrete Polishing Today</td>
</tr>
<tr>
<td>Computer</td>
<td>Plumb bobs</td>
</tr>
<tr>
<td>Copies of the Module Examination and Performance Profile Sheets</td>
<td>Copies of 29 CFR 1926.703</td>
</tr>
<tr>
<td>Vendor-supplied videos/DVDs showing vertical formwork (optional)</td>
<td>Shop drawings for a form</td>
</tr>
<tr>
<td>TV/DVD player</td>
<td>Form panels</td>
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<td>Spreader s</td>
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<td></td>
<td>Form ties</td>
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<td>Stakes</td>
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<td>Levels</td>
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<td></td>
<td>Strongbacks</td>
</tr>
<tr>
<td></td>
<td>Lifting equipment such as a forklift</td>
</tr>
<tr>
<td></td>
<td>Walers</td>
</tr>
</tbody>
</table>

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
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
- *Carpentry Level Three* PowerPoint® Presentation Slides
- Computer
- Copies of the Module Examination and Performance Profile Sheets
- Vendor-supplied videos/DVDs showing vertical formwork (optional)
- TV/DVD player

**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*
  - Copies of the manufacturer’s instructions for form sections
  - Copies of the manufacturer’s specifications for a door, window, or other opening
  - Copies of the Scaffolding, Shoring, and Forming Institute, Inc.’s publication *Guide to Safety Procedures for Vertical Concrete Formwork*
  - Copies of the section of the local applicable building code that addresses requirements for stairways
  - Form panels
  - Form ties
  - Levels
  - Lifting equipment such as a forklift
  - Nosing bars
  - Plumb bobs
  - Rebar pins
  - Release agent
  - Reveals
  - Riser boards
  - Shop drawings for a form
  - Spreaders
  - Stakes
  - Strongbacks
  - Walers

**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.
### Materials Checklist for Module 27308-14, Vertical Formwork

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
<th>Equipment and Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal protective equipment:</strong></td>
<td>Assembly hardware</td>
</tr>
<tr>
<td>Eye protection</td>
<td>Nosing bars</td>
</tr>
<tr>
<td>Assorted steel and wood panel system components, including spreader tie pins, alignment and plate clamps, 2-wedge bolts, and 2-pipe aligner hooks</td>
<td>Copies of the manufacturer’s specifications for a door, window, or other opening</td>
</tr>
<tr>
<td>Hand protection</td>
<td>Copies of the job hazard analysis (JHA) for a project involving the use of a personal fall arrest system (PFAS)</td>
</tr>
<tr>
<td>Hand protection</td>
<td>Copies of the Scaffolding, Shoring, and Forming Institute, Inc.’s publication <em>Guide to Safety Procedures for Vertical Concrete Formwork</em></td>
</tr>
<tr>
<td>Hand protection</td>
<td>Copies of a job hazard analysis (JHA) for a project involving the use of a personal fall arrest system (PFAS)</td>
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<tr>
<td>Hand protection</td>
<td>Copies of the Scaffolding, Shoring, and Forming Institute, Inc.’s publication <em>Guide to Safety Procedures for Vertical Concrete Formwork</em></td>
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<tr>
<td>Work boots</td>
<td>Copies of the manufacturer’s specifications for plastic form systems</td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
<td>Copies of the manufacturer’s instructions for form sections</td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
<td>Plumb bobs</td>
</tr>
<tr>
<td>Markers/chalk</td>
<td>Copies of one or more of Concrete Network’s publications <em>Concrete Stamping Today</em>, <em>Concrete Staining Today</em>, <em>Concrete Overlays Today</em>, and <em>Concrete Polishing Today</em></td>
</tr>
<tr>
<td>Markers/chalk</td>
<td>Bracing</td>
</tr>
<tr>
<td>Markers/chalk</td>
<td>Rebar pins</td>
</tr>
<tr>
<td>Pencils and paper</td>
<td>Clamps</td>
</tr>
<tr>
<td>Pencils and paper</td>
<td>Release agent</td>
</tr>
<tr>
<td>Carpentry Level Three PowerPoint® Presentation Slides</td>
<td>Cleats</td>
</tr>
<tr>
<td>Carpentry Level Three PowerPoint® Presentation Slides</td>
<td>Reveals</td>
</tr>
<tr>
<td>Computer</td>
<td>Concrete</td>
</tr>
<tr>
<td>Computer</td>
<td>Riser boards</td>
</tr>
<tr>
<td>Copies of the Module Examination and Performance Profile Sheets</td>
<td>Copies of 29 CFR 1926.703</td>
</tr>
<tr>
<td>Copies of the Module Examination and Performance Profile Sheets</td>
<td>Shop drawings for a form</td>
</tr>
<tr>
<td>Vendor-supplied videos/DVDs showing vertical formwork (optional)</td>
<td>Form panels</td>
</tr>
<tr>
<td>Vendor-supplied videos/DVDs showing vertical formwork (optional)</td>
<td>Spreaders</td>
</tr>
<tr>
<td>TV/DVD player</td>
<td>Form ties</td>
</tr>
<tr>
<td>TV/DVD player</td>
<td>Stakes</td>
</tr>
<tr>
<td>TV/DVD player</td>
<td>Levels</td>
</tr>
<tr>
<td>TV/DVD player</td>
<td>Strongbacks</td>
</tr>
<tr>
<td>Lifting equipment such as a forklift</td>
<td>Walers</td>
</tr>
</tbody>
</table>

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
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
*Carpentry Level Three* 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](http://www.concrete.org)
- Cement Association of Canada. [www.cement.ca](http://www.cement.ca)
- Portland Cement Association. [www.cement.org](http://www.cement.org)

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.
Session Outline for 27309-13

HORIZONTAL FORMWORK

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.
## Materials Checklist for Module 27309-14, Horizontal Formwork

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
<th>Adjustment screws</th>
<th>Manufacturers’ literature on shoring</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal protective equipment:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ANSI-approved footwear</td>
<td>Baseplates</td>
<td>Metal post shores</td>
</tr>
<tr>
<td>Gloves</td>
<td>Bracing materials</td>
<td>Plyform&lt;sup&gt;®&lt;/sup&gt;</td>
</tr>
<tr>
<td>Hard hat</td>
<td>Copies of 29 CFR 1926.703</td>
<td>Reshoring spring</td>
</tr>
<tr>
<td>Safety glasses</td>
<td>Copies of, or extracts from, American Concrete Institution (ACI) publication 347.3R-13, Guide to Formed Concrete Surfaces</td>
<td>Samples of exterior grade plywood</td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
<td></td>
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</tr>
<tr>
<td>Copies of section of the local applicable building code that addresses shoring systems</td>
<td></td>
<td>Shore heads</td>
</tr>
<tr>
<td>Markers/chalk</td>
<td>Edge forms</td>
<td>Shoring deck systems</td>
</tr>
<tr>
<td>Pencils and paper</td>
<td>Extension devices</td>
<td>Stringers</td>
</tr>
<tr>
<td><strong>Carpentry Level Three</strong></td>
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<td></td>
</tr>
<tr>
<td><strong>PowerPoint&lt;sup&gt;®&lt;/sup&gt; Presentation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slides</td>
<td>Hand tools</td>
<td>Strongbacks</td>
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<tr>
<td>Computer</td>
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<tr>
<td>Copies of the Module Examination and Performance Profile Sheets</td>
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</tr>
<tr>
<td>Joists</td>
<td></td>
<td>Unlabeled copies of Figures 18 and 21</td>
</tr>
<tr>
<td>Vendor-supplied videos/DVDs showing horizontal formwork (optional)</td>
<td>Manufacturers’ literature on flying decks</td>
<td>Wood shores</td>
</tr>
<tr>
<td>TV/DVD player</td>
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</tbody>
</table>

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
Module 27305-14 describes tools, equipment, and procedures for handling, placing, and finishing concrete. The text describes joints made in concrete structures, the use of joint sealants, and form removal procedures. Safety procedures for handling, placing, and finishing concrete are emphasized.

**Objectives**

**Learning Objective 1**
- List the safety precautions for handling, placing, and finishing concrete.
  a. List the rules for the care and safe use of hand tools when handling and placing concrete.
  b. List the rules for the care and safe use of power tools when handling and placing concrete.
  c. Explain how to prevent cement dermatitis.

**Learning Objective 2**
- Identify the methods of moving and handling concrete.
  a. Identify off-site equipment for mixing and conveying concrete.
  b. Identify on-site equipment for mixing and conveying concrete.
  c. Explain how to use hand and power tools for mixing and conveying concrete.

**Learning Objective 3**
- Explain the proper methods for placing and consolidating concrete into forms.
  a. Explain the proper method for placing concrete into forms.
  b. Explain the proper method for consolidating concrete.

**Learning Objective 4**
- Describe the proper methods for finishing and curing concrete.
  a. Explain the proper method for screeding concrete.
  b. Explain the proper method for leveling concrete.
  c. Explain the proper method for finishing concrete.
  d. Describe how to properly cure concrete.
  e. Describe the use of joint sealants.
  f. Identify the tools used to rub and patch concrete.

**Learning Objective 5**
- Identify the different kinds of joints in concrete structures.
  a. Identify construction joints.
  b. Identify isolation joints.
  c. Identify control joints.
  d. Identify decorative joints.

**Performance Tasks**

**Performance Task 1 (Learning Objective 3)**
- Properly place and consolidate concrete in selected concrete forms.

**Performance Task 2 (Learning Objective 4)**
- Use a screed to strike off and level a concrete surface.

**Performance Task 3 (Learning Objective 4)**
- Use a bull float and/or darby to level and smooth a concrete surface.

**Performance Task 4 (Learning Objective 4)**
- Use an edger to form a radius at the edges of a concrete pad, slab, etc.

**Performance Task 5 (Learning Objective 5)**
- Use a hand float and finishing trowel to level high spots, remove imperfections, and smooth a concrete surface.

**Performance Task 6 (Learning Objective 5)**
- Use a jointer to make control joints in a concrete surface.

**Teaching Time: 20 hours**
(Eight 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.

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**Safety Considerations**
This module requires that trainees place and consolidate concrete, use a screed and various tools to smooth a concrete surface, and make a control joint. 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
- *Carpentry Level Three* PowerPoint® Presentation Slides
- Computer
- Copies of the Module Examination and Performance Profile Sheets
- Vendor-supplied videos/DVDs showing the handling and placing of concrete (optional)
- TV/DVD player

**Equipment and Materials for Laboratories and Performance Testing**
- Personal protective equipment
- Coveralls and long-sleeved shirts
- Gloves
- Goggles or face mask
- Respirators or other breathing devices
- Work boots
- Boxes to contain wet sand
- Brooms
- Bulkheads
- Bush hammers
- Carborundum rubbing stones
- Chipping hammers
- Combination tools, such as edger/jointers, step-and-sidewalk tools, and cove-and-base tools
- Concrete
- Concrete forms
- Concrete-handling equipment
- Copies of instruction manuals for a variety of power tools
- Copies of safety data sheets (SDSs) for concrete and mortar
- Copies of the section of the local applicable building code that covers concrete finishing and curing requirements
- Darby floats/bull floats
- Drop chutes (if required)
- Edgers
- Embedded items such as anchor bolts, traps, pipe, and conduit
- Expansion-joint materials
- Hand floats
- Hand trowels
- Joint sealant
- Jointers (groovers)
- Knee boards
- Manual and power screeds
- Manual consolidation tools such as tamping rods, spades, and shovels
- Mechanical consolidation tools such as vibrators
- Pneumatic guns
- Pointing and margin trowels
- Power grinders
- Power saws
- Properly constructed concrete formworks
- Reinforcing mesh or rods
- Sand
- Sprayer
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
American Concrete Pumping Association. www.concretepumpers.com
Cement Association of Canada. www.cement.ca

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

**SESSION ONE**
Session One introduces moving and handling concrete.
1. Show Session One PowerPoint® presentation slides.
2. Introduce trainees to the safety precautions for handling, placing, and finishing concrete.
3. Introduce trainees to the methods of moving and handling concrete.

**SESSION TWO**
Session Two introduces placing and consolidating concrete.
1. Show Session Two PowerPoint® presentation slides.
2. Introduce trainees to the proper methods for placing and consolidating concrete into forms.

**SESSIONS THREE THROUGH SIX**
Sessions Three through Six introduce the process of finishing and curing concrete.
1. Show Sessions Three through Six PowerPoint® presentation slides.
2. Introduce trainees to the proper methods for finishing and curing concrete.
3. Introduce trainees to the proper methods for using a screed to strike off and level a concrete surface.
4. Introduce trainees to the proper methods for finishing and curing concrete.
5. Introduce trainees to the proper method for using a bull float and/or darby to level and smooth a concrete surface.
6. Introduce trainees to the proper methods for finishing and curing concrete.
7. Introduce trainees to the proper methods for using an edger to form a radius at the edges of a concrete pad, slab, etc.
8. Introduce trainees to the proper methods for using a hand float and finishing trowel.
9. Introduce trainees to the proper methods for finishing and curing concrete.

**SESSION SEVEN**
Session Seven introduces concrete joints.
1. Show Session Seven PowerPoint® presentation slides.
2. Introduce trainees to the different kinds of joints in concrete structures.
3. Introduce trainees to the proper methods for using a jointer to make control joints in a concrete surface.

**SESSION EIGHT**
Session Eight 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 Seven.) 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.
## Materials Checklist for Module 27305-14, Handling and Placing Concrete

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
<th>Personal protective equipment:</th>
<th>Concrete forms</th>
<th>Concrete-handling equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coveralls and long-sleeved shirts</td>
<td>Boxes to contain wet sand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gloves</td>
<td>Brooms</td>
<td>Concrete</td>
<td></td>
</tr>
<tr>
<td>Goggles or face mask</td>
<td>Bulkheads</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respirators or other breathing devices</td>
<td>Bush hammers</td>
<td>Darby floats/bull floats</td>
<td></td>
</tr>
<tr>
<td>Work boots</td>
<td>Chipping hammers</td>
<td>Edgers</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
<th>Whiteboard/chalkboard</th>
<th>Manual consolidation tools such as tamping rods, spades, and shovels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coveralls and long-sleeved shirts</td>
<td>Combination tools, such as edger/jointers, step-and-sidewalk tools, and cove-and-base tools</td>
<td></td>
</tr>
<tr>
<td>Goggles or face mask</td>
<td>Copies of or extracts from American Society for Testing and Materials (ASTM) E1155, Standard Test Method for Determining F, Floor Flatness and F, Floor Levelness Numbers</td>
<td>Copies of the section of the local applicable building code that covers concrete finishing and curing requirements</td>
</tr>
<tr>
<td>Respirators or other breathing devices</td>
<td>Carborundum rubbing stones</td>
<td>Drop chutes (if required)</td>
</tr>
<tr>
<td>Work boots</td>
<td>Chipping hammers</td>
<td>Edgers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
<th>Pencils and paper</th>
<th>Copies of instruction manuals for a variety of power tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coveralls and long-sleeved shirts</td>
<td>Embedded items such as anchor bolts, traps, pipe, and conduit</td>
<td></td>
</tr>
<tr>
<td>Goggles or face mask</td>
<td>Copies of, or extracts from American Society for Testing and Materials (ASTM) E1155, Standard Test Method for Determining F, Floor Flatness and F, Floor Levelness Numbers</td>
<td>Copies of the section of the local applicable building code that covers concrete finishing and curing requirements</td>
</tr>
<tr>
<td>Work boots</td>
<td>Chipping hammers</td>
<td>Edgers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
<th>Computer</th>
<th>Power grinders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coveralls and long-sleeved shirts</td>
<td>Hand floats</td>
<td>Pointing and margin trowels</td>
</tr>
<tr>
<td>Goggles or face mask</td>
<td>Hand trowels</td>
<td>Power grinders</td>
</tr>
<tr>
<td>Work boots</td>
<td>Mechanical consolidation tools such as vibrators</td>
<td>Power saws</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
<th>Vendor-supplied videos/DVDs showing the handling and placing of concrete (optional)</th>
<th>Properly constructed concrete formworks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coveralls and long-sleeved shirts</td>
<td>Mechanical consolidation tools such as vibrators</td>
<td>Reinforcing mesh or rods</td>
</tr>
<tr>
<td>Goggles or face mask</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work boots</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.
Module 27310-14 describes how tilt-up concrete construction is used and how tilt-up panels are formed, erected, and braced. The text reviews the installation of rebar and types of embedments used to lift and brace the panels. It also covers the methods used to achieve architectural and decorative finishes.

**Objectives**

**Learning Objective 1**

- Describe the tilt-up wall-forming process.
  a. Explain how to prepare the casting bed.
  b. Identify the different methods of forming tilt-up wall panels.
  c. Discuss how architectural treatments are added to wall panels.
  d. Explain the purpose of reinforcement in wall panels.
  e. Discuss how inserts and embedments are placed in tilt-up wall panels.
  f. Discuss the placement and finishing of concrete for tilt-up wall panels.

**Learning Objective 2**

- Explain the proper procedure for erecting and bracing tilt-up wall panels.
  a. List safety considerations when erecting tilt-up wall panels.
  b. Describe the procedures for erecting and bracing tilt-up wall panels.

**Performance Tasks**

**Performance Task 1 (Learning Objective 2)**

- Form a tilt-up panel in accordance with a drawing provided by the instructor.

**Performance Task 2 (Learning Objective 2)**

- Install inserts, reinforcement, and architectural features.

**Teaching Time: 17.5 hours**  
(Seven 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 form a tilt-up panel and install inserts, reinforcement, and architectural features. 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
- Carpentry Level Three PowerPoint® Presentation Slides
- Computer
- Copies of the Module Examination and Performance Profile Sheets
- Vendor-supplied videos/DVDs showing tilt-up wall systems (optional)
- TV/DVD player

Equipment and Materials for Laboratories and Performance Testing
- Personal protective equipment:
  - Face protection
  - Gloves
  - Hard hat
  - Work boots
  - An assortment of tools with damaged or worn cutting edges
  - Concrete mix
  - Copies of a layout drawing of a tilt-up panel
  - Embedments such as lift and brace inserts, weld plates, and beam-pocket liners
  - Fasteners
  - Lists of hand and power tools
  - Mechanical vibrator
  - Reinforcing bar
  - Sample panel section
  - Tilt-up panel layout drawing
  - Tools to mix and spread concrete
  - Water
  - Wheelbarrow or concrete mixer
  - Wood for building panel forms
  - Wood or other materials to form reveals
  - An assortment of tools with damaged or worn cutting edges
  - Concrete mix
  - Copies of the September 2002 OSHA report entitled “Investigation of the August 5, 2002, Collapse of Tilt-Up Precast Concrete Wall Panel in Greensboro, NC” or a similar report of an accident involving a tilt-up panel
  - Tilt-up panel layout drawing
  - Tools to mix and spread concrete
  - Water
  - Wheelbarrow or concrete mixer
  - Wood for building panel forms
  - Wood or other materials to form reveals

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

*Tilt-Up Concrete Construction Guide.* 2005. Farmington Hills, MI: American Concrete Institute


There are a number of online resources available for trainees who would like more information on tilt-up wall systems. A search for additional information may be assigned as homework to interested trainees.
TILT-UP WALL SYSTEMS

The lesson plan for this module is divided into seven 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

SESSIONS ONE THROUGH THREE
Sessions One through Three introduce the components and applications of tilt-up wall panels.

1. Show Sessions One through Three PowerPoint® presentation slides.
2. Introduce trainees to the procedures for preparing the casting bed.
3. Introduce trainees to the different methods of forming tilt-up wall panels.
4. Introduce trainees to the procedures for adding architectural treatments to wall panels.
5. Introduce trainees to the purpose of reinforcement in wall panels.
6. Introduce trainees to the procedures for placing inserts and embedments in tilt-up wall panels.
7. Introduce trainees to the placement and finishing of concrete for tilt-up wall panels.

SESSIONS FOUR THROUGH SIX
Sessions Four through Six introduce the proper procedure for erecting and bracing tilt-up wall panels.

1. Show Sessions Four through Six PowerPoint® presentation slides.
2. Introduce trainees to safety considerations when erecting tilt-up wall panels.
3. Introduce trainees to the procedures for erecting and bracing tilt-up wall panels.
4. Introduce trainees to the procedures for forming a tilt-up panel in accordance with a provided drawing.
5. Introduce trainees to the procedures for erecting and bracing tilt-up wall panels.
6. Introduce trainees to the procedures for installing inserts, reinforcement, and architectural features.

SESSION SEVEN
Session Seven 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 Six.) 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.
## Materials Checklist for Module 27310-14, Tilt-Up Wall Systems

### Equipment and Materials

| Personal protective equipment: | An assortment of tools with damaged or worn cutting edges | Sample panel section |
| Face protection | Copies of a layout drawing of a tilt-up panel | Tilt-up panel layout drawing |
| Gloves | Copies of the September 2002 OSHA report entitled "Investigation of the August 5, 2002, Collapse of Tilt-Up Precast Concrete Wall Panel in Greensboro, NC" or a similar report of an accident involving a tilt-up panel | Tools to mix and spread concrete |
| Work Boots | Embedments such as lift and brace inserts, weld plates, and beam-pocket liners | Water |
| Hard hat | Lists of hand and power tools | Wheelbarrow or concrete mixer |
| Whiteboard/chalkboard | Mechanical vibrator | Wood for building panel forms |
| Markers/chalk | Reinforcing bar | Wood or other materials to form reveals |
| Pencils and paper | Concrete mix | Fasteners |
| **Carpentry Level Three PowerPoint® Presentation Slides** | | |
| Computer | | |
| Copies of the Module Examination and Performance Profile Sheets | | |
| Vendor-supplied videos/DVDs showing tilt-up wall systems (optional) | | |
| TV/DVD player | | |

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