Module 28301-14 describes the activities and techniques involved in organizing and implementing masonry construction in high-rise construction, with an emphasis on safety and logistics.

Objectives

Learning Objective 1
- Identify the proper personal protective equipment and safety precautions related to elevated masonry.
  a. Describe safety precautions related to an elevated work area.
  b. Discuss fall protection related to elevated work areas.

Learning Objective 2
- Describe how to properly brace a wall.
  a. Describe how to properly brace a concrete masonry wall for wind.
  b. Describe how to properly brace a wall for backfill.

Learning Objective 3
- Describe elevated masonry systems.
  a. List the construction sequence for elevated masonry systems.
  b. Describe how elevated masonry systems are designed.
  c. Identify common exterior walls used for elevated masonry systems.
  d. Identify common interior walls used for elevated masonry systems.

Learning Objective 4
- Describe how to properly handle materials at elevations.
  a. Explain safety precautions to be observed when working around cranes.
  b. Explain safety precautions to be observed when working around materials hoists.
  c. Explain safety precautions to be observed when moving and stocking materials.
  d. Explain safety precautions to be observed when working at elevated workstations.
  e. Explain how disposal chutes and waste bins are used when working from elevated workstations.

Performance Tasks

Performance Task 1 (Learning Objective 2)
- Properly brace a wall.

Performance Task 2 (Learning Objective 4)
- Demonstrate hand signals used for lifting materials.

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, Masonry Level One, and Masonry 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 with fall protection equipment designed for use on elevated surfaces, and power tools. Safety is paramount in the masonry 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
- *Masonry Level Three PowerPoint® Presentation Slides*
- Computer
- Copies of the Module
- Examination and Performance Profile Sheets
- Vendor-supplied videos/DVDs showing elevated masonry (optional)
- TV/DVD player

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

**Personal Protective Equipment:**
- Eye protection
- Gloves
- Hard hat
- Safety shoes
- 2 × 4s and 2 × 6s
- Copies of news stories about masonry wall collapses
- Copies of the OSHA publication “Materials Handling and Storage”
- Hammer

**Handsaw**
- Hitch used on a tower crane
- Lanyard with shock absorber
- Local applicable building code
- Local ordinances governing material delivery
- Mobile radios
- Nails
- Samples of structural clay tile
- Secure container designed for the disposal of combustible waste

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**The following materials and equipment are recommended, but optional:**

- Buckles, clamps, or ties for tying down loads
- Copies of the OSHA construction regulations
- Copies of, or excerpts from, the *Masonry Contractors Association of America’s Standard Practice for Bracing Masonry Walls under Construction*
- Electrical tool with double insulation
- Examples of flexible anchors
- Ground fault circuit interrupter (GFCI)
- Grounded three-prong plug
- Guardrail
- High-power handheld radios

- OSHA-approved fall protection equipment
- Personal fall arrest system
- Portable radios fitted with microphones with noise-canceling features
- Portable radios fitted with microphones without noise-canceling features
- Safety net
- Safety straps for securing loads to hoists
- Stations with loose masonry units of various types and sizes
- Variety of oddly shaped or uncubed materials
Additional Resources and References

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


* “Online Safety Library: Scaffold Safety.” Oklahoma State University. [www.ehs.okstate.edu](http://www.ehs.okstate.edu)


* **WorkSAFE masonry safety resources.** [www.worksafecenter.com](http://www.worksafecenter.com)

There are a number of online resources available for trainees who would like more information on elevated masonry. A search for additional information may be assigned as homework to interested trainees.
Session Outline for 28301-14

ELEVATED MASONRY

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 trainees to the safety precautions and fall protection that are required when working in an elevated environment.

1. Show Session One PowerPoint® presentation slides.
2. Review the requirements for working safely on a high-rise job.
3. Discuss the personal protective equipment used to ensure work-area safety on a high-rise construction site.
4. Emphasize the electrical and fire hazards that workers may encounter when working on a high-rise construction site, and their prevention.
5. Review the steps required to ensure clean work areas during elevated work.
6. Describe the requirements for the following:
   – Personal fall arrest systems
   – Protection against falling objects
   – Personnel lifts
   – Controlled and limited access zones

SESSION TWO

Session Two introduces the proper procedures for bracing masonry walls for wind and backfill.

1. Show Session Two PowerPoint® presentation slides.
2. Provide an overview of how to properly brace concrete masonry walls.
3. Explain the requirements for bracing masonry walls for wind.
4. Explain the requirements for bracing masonry walls for backfill.

SESSIONS THREE AND FOUR

Sessions Three and Four introduce the design and construction of elevated masonry systems.

1. Show Sessions Three and Four PowerPoint® presentation slides.
2. Review the procedures for identifying and following construction sequences in high-rise masonry construction.
3. Discuss the concepts of building design that masons need to understand when working in elevated conditions.
4. Describe the various types of exterior walls used in high-rise construction and how they are constructed.
5. Discuss the various types of interior walls used in high-rise construction and how they are constructed.
<table>
<thead>
<tr>
<th><strong>SESSION FIVE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Session Five introduces safety precautions to be observed when working around cranes and materials hoists, when moving and stocking materials, and when working at elevated workstations. The use of standard hand signals is also presented</td>
</tr>
<tr>
<td>1. Show Session Five PowerPoint® presentation slides.</td>
</tr>
<tr>
<td>2. Review the procedures for materials handling and working around cranes in high-rise construction.</td>
</tr>
<tr>
<td>3. Describe the verbal modes of communication commonly used in high-rise construction.</td>
</tr>
<tr>
<td>4. Describe the nonverbal modes of communication commonly used in high-rise construction.</td>
</tr>
<tr>
<td>5. Discuss the requirements for the following:</td>
</tr>
<tr>
<td>- Working around materials hoists</td>
</tr>
<tr>
<td>- Moving and stocking materials in high-rise construction.</td>
</tr>
<tr>
<td>- Safe use of elevated workstations, disposal chutes, and waste bins.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>SESSION SIX</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
<tr>
<td>1. Have trainees complete the Module Examination. Any outstanding performance testing must be completed during this session.</td>
</tr>
<tr>
<td>2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.</td>
</tr>
</tbody>
</table>
### Equipment and Materials

<table>
<thead>
<tr>
<th>Personal protective equipment:</th>
<th>2 × 4s and 2 × 6s</th>
<th>The following materials and equipment are recommended, but optional:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gloves</td>
<td>Hammer</td>
<td>Buckles, clamps, or ties for tying down loads.</td>
</tr>
<tr>
<td>Eye protection</td>
<td>Nails</td>
<td>Guardrail</td>
</tr>
<tr>
<td>Hard hat</td>
<td>Lanyard with shock absorber</td>
<td>Examples of flexible anchors.</td>
</tr>
<tr>
<td>Safety shoes</td>
<td>Local ordinances governing material delivery</td>
<td>Safety net.</td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
<td>Copies of the OSHA publication “Materials Handling and Storage”</td>
<td>Portable radios fitted with microphones without noise-canceling features</td>
</tr>
<tr>
<td>Markers/chalk</td>
<td>Secure container designed for the disposal of combustible waste</td>
<td>Grounded three-prong plug</td>
</tr>
<tr>
<td>Pencils and chalk</td>
<td>Mobile radios</td>
<td>Ground fault circuit interrupter (GFCI).</td>
</tr>
<tr>
<td><strong>Masonry Level Three</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PowerPoint® Presentation Slides</strong></td>
<td>Handsaw</td>
<td>Copies of the OSHA construction regulations.</td>
</tr>
<tr>
<td>TV/DVD player</td>
<td>Hitch used on a tower crane</td>
<td>Personal fall arrest system.</td>
</tr>
<tr>
<td>Computer</td>
<td>Local applicable building code</td>
<td>Electrical tool with double insulation.</td>
</tr>
<tr>
<td>Copies of the Module Examination and Performance Profile Sheet</td>
<td>Copies of news stories about masonry wall collapses</td>
<td>High-power handheld radios.</td>
</tr>
<tr>
<td>Vendor-supplied videos/DVDs showing elevated masonry (optional)</td>
<td>Samples of structural clay tile</td>
<td>OSHA-approved fall protection equipment.</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 28302-14 covers the materials and techniques required for specialized masonry applications such as sound-barrier walls, arches, acid brick, refractories, glazed masonry units, and glass block.

### Objectives

**Learning Objective 1**
- Describe applications for sound-barrier walls.
  - Identify pier-and-panel barrier walls.
  - Identify continuous walls.

**Learning Objective 2**
- Describe the use of masonry arches.
  - Identify common types of arches.
  - Explain how to calculate and lay out common arches.
  - Explain how to construct formed arches.
  - Explain how to construct a jack arch.

**Learning Objective 3**
- Describe applications for acid brick.
  - Explain uses of acid brick.
  - Identify acid brick materials.
  - Describe how to lay an acid brick floor.

**Learning Objective 4**
- Describe applications for refractories.
  - Identify refractory brick shapes and sizes.
  - Explain how to lay refractory brick.
  - Describe the curing and heat-up process for refractory brick.

**Learning Objective 5**
- Identify the types and uses of glazed masonry units.
  - Describe structural glazed tile and its applications.
  - Describe glazed block and its applications.

**Learning Objective 6**
- Identify the types and uses of glass block.
  - Describe applications and uses of glass block.
  - Identify variations in glass block.
  - Explain how to install glass block.

### Performance Tasks

**Performance Task 1 (Learning Objective 2)**
- Lay out each of the following arches:
  - Semicircular arch
  - Segmental arch
  - Gothic arch
  - Multicentered arch

**Performance Task 2 (Learning Objective 2)**
- Build one of the following arches:
  - Semicircular arch
  - Segmental arch
  - Gothic arch
  - Multicentered arch

**Performance Task 3 (Learning Objective 5)**
- Construct a 4-foot × 4-foot wall from glazed masonry units.

**Performance Task 4 (Learning Objective 6)**
- Construct a 4-foot × 4-foot wall from glass block.

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**Teaching Time: 60 hours**
(Twenty-four 2.5-hour classroom sessions)

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

**Prerequisites**
*Core Curriculum, Masonry Level One, and Masonry 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 use masonry saws, mix mortar and lay masonry units, and use hammers and nails. Safety is paramount in the masonry 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

<table>
<thead>
<tr>
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<td>Vendor-supplied videos/DVDs showing materials and techniques</td>
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<tr>
<td>required for specialized masonry applications such as sound-</td>
</tr>
<tr>
<td>barrier walls, arches, acid brick, refractories, glazed</td>
</tr>
<tr>
<td>masonry units, and glass block (optional)</td>
</tr>
</tbody>
</table>

Appropriate Personal Protective Equipment:
- Eye protection
- Gloves
- Hard hat
- Safety shoes
- Hearing protection
- Respiratory protection
- Acid brick, including red-shale brick, fireclay brick, and carbon brick
- Arch template (completed)
- Articles from newspapers or the internet about structural failures due to improperly designed masonry arches
- Asphalt used in membrane application
- Bags of preblended masonry mortar
- Brick
- Brushes
- Chemical-resistant mortars including resin, furan, polyester-resin, and epoxy mortars
- Concrete
- Container of water-soluble wax used in acid brick masonry construction
- Copies of ASTM C652, Standard Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale)
- Copies of excerpts from ASTM C126, Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units
- Copies of manufacturer’s catalogs showing structural glazed tile products
- Dry mortar-mix materials including portland cement, lime, a waterproofing admixture, and sand
- Expansion-joint materials
- Fiberglass fabric used in membrane application
- Finishing nails
- Floats
- Glass block in various shapes and sizes, including block with and without patterns and solid glass block (glass brick)
- Glazed block
- Hammers
- Level
- Local applicable building code
- Mason’s rules or modular steel tapes
- Mortar containers
- Natural rubber or neoprene sheets
- Permanent markers
- Photo of a completed masonry arch
- Photos of jack, semicircular, segmental, multicentered, Gothic, and bull’s-eye arches
- Photos of steel reinforcement anchors for sections of continuous barrier wall
- Plugging chisel
- Plumb bobs
- Pogo stick
- Preblended masonry mortar (or dry mortar-mix materials including portland cement, lime, a waterproofing admixture, and sand)
- Primer used in membrane application
- Refractory brick, including standard brick and hearth block, firebrick, low-, medium-, and high-duty brick, and curved units
- Rubber-faced trowel
- Rules or steel tapes
- Safety data sheets (SDSs) for chemicals used in acid brick masonry construction
- Safety data sheets (SDSs) for mortars used in acid brick masonry construction and in standard block and brick construction
- String
- Structural glazed tile, including loadbearing and nonbearing tile, bull-nose tile, and tile with scored and smooth backs
- Tape measure
- Trowels
- Universal mortar spacers
- Wall reinforcing
- Water
- Wood arch form (completed)
The following materials and equipment are recommended, but optional:

- 2 x 4 and 2 x 6s
- Abrasive and diamond blades
- Brushes suitable for applying thinned mortar as a coating
- Copies of manufacturers’ catalogs, handbooks, or product sheets for refractory brick, including special shapes
- Copies of performance specifications for refractory brick
- Copies of excerpts from ASTM C744, Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units
- Copies of excerpts from ASTM C90, Standard Specification for Loadbearing Concrete Masonry Units

- Curing compound
- Discarded or damaged clay brick
- Dry concrete mix
- Dry premixed refractory mortar
- Handsaws
- Lines
- Mixing instructions for mortar used in acid brick masonry construction
- Nails
- Ordinary block
- Ordinary clay brick
- Photos of jack arches in the community
- Plywood panels
- Safety data sheet (SDS) for a water-based asphalt emulsion
- Safety data sheets (SDSs) for mortar used in glass block masonry construction
- Safety data sheets (SDSs) for mortars
- Squeegee (wood or metal)
- Stations with small wood-framed stretches of flooring
- Support legs for an arch template made from 2-inch lumber
- Water-based asphalt emulsion
- Wood wedges

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 specialized masonry applications such as sound-barrier walls, arches, acid brick, refractories, glazed masonry units, and glass block. A search for additional information may be assigned as homework to interested trainees.
The lesson plan for this module is divided into twenty-four 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

**Session One**

Session One introduces applications for pier-and-panel and continuous sound-barrier walls.

1. Show Session One PowerPoint® presentation slides.
2. Explain how pier-and-panel barrier walls are installed.
3. Explain how continuous walls are installed.

**Sessions Two through Six**

Sessions Two through Six introduce the procedures involved in laying out common types of masonry arches.

1. Show Sessions Two through Six PowerPoint® presentation slides.
2. Review the basic principles of arch design. Discuss common types of arches.
3. Describe the steps for laying out a semicircular arch.
4. Describe the steps for laying out a segmental arch.
5. Describe the steps for laying out an equilateral Gothic arch. Explain that the spring line must first be found.
6. Describe the steps for laying out a multicentered arch.

**Sessions Seven through Ten**

Sessions Seven through Ten introduce the procedures involved in constructing common types of masonry arches.

1. Show Sessions Seven through Ten PowerPoint® presentation slides.
2. Explain how to construct the arch template.
3. Discuss how to mark arch brick on the centering face.
4. Explain how to lay arch brick using an arch template.
5. Explain how to remove the arch template from a formed arch.
6. Review the steps for laying out a jack arch, and then laying the jack arch in mortar.

**Sessions Eleven through Thirteen**

Sessions Eleven through Thirteen introduce acid brick applications, materials, and construction techniques.

1. Show Sessions Eleven through Thirteen PowerPoint® presentation slides.
2. Review acid brick applications.
3. Discuss the design and physical characteristics of masonry materials used in acid brick structures.
4. Review the characteristics of membranes, mortars, and support structures used in acid brick structures.
5. Describe the characteristics of expansion joints used in acid brick floors.
6. Review the steps involved in laying acid brick floors.
Session Outline for 28302-14

**SPECIALIZED MATERIALS AND TECHNIQUES**

**SESSIONS FOURTEEN THROUGH SIXTEEN**

Sessions Fourteen through Sixteen introduce refractory brick applications, materials, and construction techniques.

1. Show Sessions Fourteen through Sixteen PowerPoint® presentation slides.
2. Review the applications of refractory brick.
3. Describe commonly used shapes and sizes of refractory brick.
4. Discuss the characteristics of refractory mortars and refractory brick.
5. Describe the characteristics of rotary-kiln linings in refractory brick masonry construction.
6. Review the steps involved in the kiln jack method and the arch-form method of installing refractory brick.
7. Review the process of curing and heating up refractory brick.

**SESSIONS SEVENTEEN THROUGH NINETEEN**

Sessions Seventeen through Nineteen introduce structural glazed tile applications, materials, and construction techniques.

1. Show Sessions Seventeen through Nineteen PowerPoint® presentation slides.
2. Describe the properties of structural glazed tile.
3. Review the steps involved in laying structural glazed tile.
4. Describe the properties of glazed block.
5. Discuss the bonding and coursing requirements for glazed block.
6. Review the steps involved in laying glazed block.

**SESSIONS TWENTY THROUGH TWENTY-THREE**

Sessions Twenty through Twenty-Three introduce glass block applications, materials, and construction techniques.

1. Show Sessions Twenty through Twenty-Three PowerPoint® presentation slides.
2. Discuss the applications and uses of glass block.
3. Review the methods for installing glass block in masonry walls.
4. Describe the requirements for mortar used in laying glass block.
5. Review the installation procedures for glass block in straight and curved masonry walls.

**SESSION TWENTY-FOUR**

Session Twenty-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 Twenty-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 28302-14, Specialized Materials and Techniques

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal protective equipment:</strong></td>
<td><strong>Equipment and Materials</strong></td>
</tr>
<tr>
<td>Brushes</td>
<td>Rules or steel tapes</td>
</tr>
<tr>
<td>Brick</td>
<td>Arch template (completed)</td>
</tr>
<tr>
<td>Concrete</td>
<td>Wall reinforcing</td>
</tr>
<tr>
<td>Concrete</td>
<td>Wall reinforcing</td>
</tr>
<tr>
<td>Hard hat</td>
<td>Pogo stick</td>
</tr>
<tr>
<td>Trowels</td>
<td>Pogo stick</td>
</tr>
<tr>
<td>Plugging chisel</td>
<td>Plumb bobs</td>
</tr>
<tr>
<td>Rubber-faced trowel</td>
<td>Preblended masonry mortar</td>
</tr>
<tr>
<td>String</td>
<td>Tape measure</td>
</tr>
<tr>
<td>Primer used in membrane application</td>
<td>Refractory brick, including standard brick and hearth block</td>
</tr>
<tr>
<td>Glazed block</td>
<td>Water</td>
</tr>
<tr>
<td>Dry concrete mix</td>
<td>Permanent markers</td>
</tr>
<tr>
<td>Acid brick, including red-shale brick, fireclay brick, and carbon brick</td>
<td>Container of water-soluble wax used in acid brick masonry construction</td>
</tr>
<tr>
<td>Mason’s rules or modular steel tapes</td>
<td>Bags of preblended masonry mortar</td>
</tr>
<tr>
<td>Chemical-resistant mortars including resin, furan, polyester-resin, and epoxy mortars</td>
<td>Articles from newspapers or the Internet about structural failures due to improperly designed masonry arches</td>
</tr>
<tr>
<td>Asphalt used in membrane application</td>
<td>Fiberglass fabric used in membrane application</td>
</tr>
<tr>
<td>Local applicable building code</td>
<td>Mortar containers</td>
</tr>
<tr>
<td>Copies of manufacturer’s catalogs showing structural glazed tile products</td>
<td>Safety data sheets (SDSs) for chemicals used in acid brick masonry construction</td>
</tr>
<tr>
<td>Photos of jack, semicircular, segmental, multicentered, Gothic, and bull’s-eye arches</td>
<td>Photos of steel reinforcement anchors for sections of continuous barrier wall</td>
</tr>
<tr>
<td>Dry mortar-mix materials including portland cement, lime, a waterproofing admixture, and sand</td>
<td>Refractory brick, including firebrick, low-, medium-, and high-duty brick, and curved units</td>
</tr>
<tr>
<td>Preblended masonry mortar (or dry mortar-mix materials including portland cement, lime, a waterproofing admixture, and sand)</td>
<td>Structural glazed tile, including loadbearing and nonbearing tile, bull-nose tile, and tile with scored and smooth backs</td>
</tr>
<tr>
<td>Glass block in various shapes and sizes, including block with and without patterns and solid glass block (glass brick)</td>
<td>Copies of ASTM C652, Standard Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale)</td>
</tr>
<tr>
<td>Item</td>
<td>Recommended Materials or Equipment</td>
</tr>
<tr>
<td>-------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Natural rubber or neoprene sheets</td>
<td>Plywood panels</td>
</tr>
<tr>
<td>Floats</td>
<td>Abrasive and diamond blades</td>
</tr>
<tr>
<td>Copies of manufacturers’ catalogs, handbooks, or product sheets for refractory brick, including special shapes</td>
<td></td>
</tr>
<tr>
<td>Finishing nails</td>
<td>Water-based asphalt emulsion</td>
</tr>
<tr>
<td>Photo of a complete masonry arch</td>
<td>Stations with small wood-framed stretches of flooring</td>
</tr>
<tr>
<td>Level</td>
<td>Safety data sheet (SDS) for a water-based asphalt emulsion</td>
</tr>
<tr>
<td>Safety data sheets (SDSs) for mortars used in acid brick masonry construction and in standard block and brick construction</td>
<td>Safety data sheets (SDSs) for mortar used in glass block masonry construction</td>
</tr>
<tr>
<td>Discarded or damaged clay brick</td>
<td>Copies of excerpts from ASTM C744, Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units</td>
</tr>
<tr>
<td>Handsaws</td>
<td>Curing compound</td>
</tr>
<tr>
<td>Lines</td>
<td>Nails</td>
</tr>
<tr>
<td>Ordinary clay brick</td>
<td>Ordinary block</td>
</tr>
<tr>
<td>Mixing instructions for mortar used in acid brick masonry construction</td>
<td>Safety data sheets (SDSs) for mortars</td>
</tr>
<tr>
<td>Wood wedges</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 28303-14 describes the most common problems that appear in masonry structures and the techniques that can be used to repair them, including tuckpointing, brick replacement, crack sealing, waterproofing, and stain removal.

**Objectives**

**Learning Objective 1**
- Explain how to inspect and identify common masonry problems.
  a. Identify common types of masonry deterioration and their causes.
  b. Explain how to inspect existing masonry structures.

**Learning Objective 2**
- Describe common masonry repair techniques.
  a. Explain how to tuck-point a masonry structure.
  b. Describe how to remove efflorescence.
  c. Describe how to repair masonry cracks.

**Learning Objective 3**
- Describe how to restore brick walls.
  a. Identify staining problems.
  b. Explain how to remove old paint.
  c. Describe how to clean brick.
  d. Explain how to replace brick and mortar joints.

**Learning Objective 4**
- Describe how to repair a foundation wall.
  a. Explain how to repair water intrusion.
  b. Explain how to repair cracks and localized problems.

**Learning Objective 5**
- Describe how to repair and rebuild chimneys and fireplaces.
  a. Explain how to repair chimneys.
  b. Explain how to repair fireplaces.

**Performance Tasks**

**Performance Task 1 (Learning Objective 2)**
- Repair mortar joints by tuckpointing.

**Performance Task 2 (Learning Objective 3)**
- Clean a masonry wall with a bucket and brush.

**Performance Task 3 (Learning Objective 3)**
- Replace a damaged masonry unit in a wall.

**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, Masonry Level One, and Masonry 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
- *Masonry Level Three* PowerPoint® Presentation Slides
- Computer
- Copies of the Module Examination and Performance Profile Sheets
- Vendor-supplied videos/DVDs showing masonry repair and restoration *(optional)*
- TV/DVD player

### Equipment and Materials for Laboratories and Performance Testing

**Appropriate Personal Protective Equipment:**
- Corrosives-resistant gloves
- Eye protection
- Face shield
- Gloves
- Hard hat
- Respiratory protection
- Safety shoes
- Brick-cleaning brushes
- Buckets
- Chisels
- Clean cloths
- Containers of muriatic acid solution
- Containers of Type I and Type II portland cement paint
- Copies of the brick inspection checklist
- Drawings of fireplaces that identify a variety of problems with their smoke chambers, dampers, throats, and fireboxes
- Drawings of rooms in a variety of sizes and configurations
- Drills
- Fiber optic camera scope
- Liquid applicators such as eyedroppers
- Local applicable ordinances regarding disposal of excess chemicals
- Mortar
- Photos of foundation walls with various types of cracks
- Proprietary cleaners for use on smoke stains
- Replacement brick
- Safety data sheets (SDSs) for a variety of proprietary cleaners designed to treat efflorescence
- Safety data sheets (SDSs) for a variety of proprietary cleaners for masonry surfaces
- Scaffold
- Stations with a variety of smoke-stained brick
- Stations with brick in a variety of colors and with a variety of finishes
- Stations with brick or photographs of brick that show various types of stains such as lime run, white scum, green or yellow stains, and brown stains
- Stations with sections of single-wythe masonry walls, both brick and CMU
- Plugging chisels
- Trowels
- Tuckpoint grinders
- Variety of brick masonry units that have been discolored by green stain
- Variety of masonry units that show signs of spalling, cracking, and surface erosion
- Water

**The following materials and equipment are recommended, but optional:**

- Adhesive
- Video “Working on the Past” with the Secretary of the Interior’s Standards for the Treatment of Historic Properties
- Manufacturers’ instructions for a variety of masonry cleaners
- Masonry-cleaning brushes
- Proprietary cleaner for the treatment of efflorescence
- Proprietary cleaners for new masonry
- Sealants used on foundation walls
- Stations with a variety of brick masonry units showing evidence of efflorescence
- Thin sheets of bright tin

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### Safety Considerations

This module requires that trainees work with power tools and caustic chemicals. Safety is paramount in the masonry 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.
Addison 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 masonry repair and restoration. 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 the procedures for inspecting masonry structures and identifying common problems such as deterioration.

1. Show Session One PowerPoint® presentation slides.
2. Discuss the types of weathering damage that can cause deterioration in masonry structures.
3. Describe the types of water penetration and stain damage that can cause deterioration in masonry structures.
4. Provide an overview of the inspection requirements for various types of existing masonry structures.

**Sessions Two and Three**

Sessions Two and Three introduce trainees to the techniques required for tuckpointing and removing efflorescence from masonry structures.

1. Show Sessions Two and Three PowerPoint® presentation slides.
2. Discuss the tools and techniques required to repair masonry structures using tuckpointing.
3. Discuss the tools and techniques required to remove efflorescence from masonry structures.
4. Describe the tools and techniques required for the repair of cracks in exterior concrete masonry walls.
5. Describe the tools and techniques required for the repair of cracks in stucco.
6. Describe the tools and techniques required for the repair of cracks in foundation walls.

**Session Four**

Session Four introduces the materials and techniques for restoring brick walls.

1. Show Session Four PowerPoint® presentation slides.
2. Provide an overview of the techniques used on brick walls to remove lime run, white scum, green or yellow stains, brown stains, and stains caused by external sources.
3. Describe the tools and techniques used to remove old paint from masonry surfaces and for cleaning masonry surfaces properly.
4. Describe the tools and techniques used to replace brick and mortar joints in a masonry structure.

**Session Five**

Session Five introduces the procedures for repairing water intrusion, cracks, and other localized problems in foundation walls.

1. Show Session Five PowerPoint® presentation slides.
2. Discuss the procedures for repairing water intrusion in foundation and basement walls.
3. Discuss the procedures for repairing cracks and localized problems in foundation and basement walls.
**Sessions Six and Seven**

Sessions Six and Seven introduce the procedures for repairing and rebuilding chimneys and fireplaces.

1. Show Sessions Six and Seven PowerPoint® presentation slides.
2. Review the general procedures for repairing and rebuilding chimneys.
3. Discuss the procedures for repairing and rebuilding chimney tops and racked faces, and appliance chimneys.
4. Describe the procedures for repairing and rebuilding fireplaces.

**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 28303-14, Repair and Restoration

## Equipment and Materials

<table>
<thead>
<tr>
<th>Personal protective equipment:</th>
<th>Brick-cleaning brushes</th>
<th>Plugging chisels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrosives-resistant gloves</td>
<td>Buckets</td>
<td>Chisels</td>
</tr>
<tr>
<td>Eye protection</td>
<td>Clean cloths</td>
<td>Drills</td>
</tr>
<tr>
<td>Face shield</td>
<td>Fiber optic camera scope</td>
<td>Mortar</td>
</tr>
<tr>
<td>Gloves</td>
<td>Replacement brick</td>
<td>Scaffold</td>
</tr>
<tr>
<td>Respiratory protection</td>
<td>Tuckpoint grinders</td>
<td>Water</td>
</tr>
<tr>
<td>Hard hat</td>
<td>Trowels</td>
<td>Stations with a variety of smoke-stained brick</td>
</tr>
<tr>
<td>Safety shoes</td>
<td>Copies of the brick inspection checklist</td>
<td>Containers of Type I and Type II portland cement paint</td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
<td>Proprietary cleaners for use on smoke stains</td>
<td>Variety of brick masonry units that have been discolored by green stain</td>
</tr>
<tr>
<td>Markers/chalk</td>
<td>Stations with brick or photographs of brick that show various types of stains such as lime run, white scum, green or yellow stains, and brown stains</td>
<td>Drawings of fireplaces that identify a variety of problems with their smoke chambers, dampers, throats, and fireboxes</td>
</tr>
<tr>
<td>Pencils and paper</td>
<td>Liquid applicators such as eyedroppers</td>
<td>The following materials and equipment are recommended, but optional:</td>
</tr>
<tr>
<td><em>Masonry Level Three</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PowerPoint® Presentation Slides</td>
<td>Stations with brick in a variety of colors and with a variety of finishes</td>
<td>Adhesive</td>
</tr>
<tr>
<td>TV/DVD player</td>
<td>Photos of foundation walls with various types of cracks</td>
<td>Sealants used on foundation walls</td>
</tr>
<tr>
<td>Computer</td>
<td>Containers of muriatic acid solution</td>
<td>Video “Working on the Past” with the Secretary of the Interior’s Standards for the Treatment of Historic Properties</td>
</tr>
<tr>
<td>Copies of the Module Examination</td>
<td>Local applicable ordinances regarding disposal of excess chemicals</td>
<td>Stations with a variety of brick masonry units showing evidence of efflorescence</td>
</tr>
<tr>
<td>Vendor-supplied videos/DVDs showing masonry repair and restoration (<em>optional</em>)</td>
<td>Safety data sheets (SDSs) for a variety of proprietary cleaners designed to treat efflorescence</td>
<td>Manufacturers’ instructions for a variety of masonry cleaners</td>
</tr>
<tr>
<td></td>
<td>Stations with sections of single-wythe masonry walls, both brick and CMU</td>
<td>Thin sheets of bright tin</td>
</tr>
<tr>
<td></td>
<td>Safety data sheets (SDSs) for a variety of proprietary cleaners for masonry surfaces</td>
<td>Masonry-cleaning brushes</td>
</tr>
<tr>
<td></td>
<td>Variety of masonry units that show signs of spalling, cracking, and surface erosion</td>
<td>Proprietary cleaners for new masonry</td>
</tr>
<tr>
<td></td>
<td>Drawings of rooms in a variety of sizes and configurations</td>
<td>Proprietary cleaner for the treatment of efflorescence</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 28304-14 describes the format and content of commercial drawings and their use in conveying specific construction requirements, including the standard format for specifications.

**Objectives**

**Learning Objective 1**
- Identify the requirements for and contents of commercial drawings.
  a. Explain the requirements for commercial drawings.
  b. List the contents of commercial plans and describe the purpose of each.

**Learning Objective 2**
- Read and interpret commercial drawings.
  a. Identify common views used in commercial drawings.
  b. Explain how to read and interpret architectural drawings.
  c. Explain how to read and interpret structural drawings.
  d. Explain how to read and interpret shop drawings.
  e. Define building information modeling and describe its applications.

**Learning Objective 3**
- Explain the purpose of written specifications.
  a. Describe how specifications are written.
  b. Explain the format of specifications.

**Performance Tasks**

**Performance Task 1 (Learning Objective 2)**
- Locate 10 items contained in a set of instructor-chosen commercial drawings, including all of the following:
  - Wall height from finished floor
  - Entire wall elevation length
  - Wall composition
  - Wall-reinforcement size and spacing
  - Section view

**Performance Task 2 (Learning Objective 3)**
- Locate the section of a set of specifications that shows the type of mortar to be used.

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

**Prerequisites**
*Core Curriculum, Masonry Level One, and Masonry 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.
**Classroom Equipment and Materials**
- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- *Masonry Level Three* PowerPoint®
- Presentation Slides
- Computer
- Copies of the Module Examination and Performance Profile Sheets
- Vendor-supplied videos/DVDs showing how to use commercial drawings and standards to convey specific construction requirements *(optional)*
- TV/DVD player

**Equipment and Materials for Laboratories and Performance Testing**
- CAD and/or BIM software
- Computer
- Construction drawings, including:
  - Architectural drawings
  - Building and wall sections
  - Exterior and interior elevations
  - Floor plans (including floor plans drawn with grid sections, and the accompanying door and window schedules)
  - Material symbols key *(optional)*
  - Mechanical, electrical, and plumbing drawings
  - Obsolete revisions
  - Roof plans
  - Shop drawings for rebar, embedded materials, post-tensioned locations, precast materials, doors and windows, and flashing
  - Site plans
  - Structural drawings
- Structural drawings, including foundation plans, floor framing plans, and roof framing plans, and the accompanying schedules or notes
- Copies of a request for information (RFI) form
- Copies of manufacturers’ submittal drawings
- Copies of specifications for a commercial project
- Copies of the division breakdown of the current edition of the MasterFormat™ standard
- On-screen estimator software *(optional)*
- Copies of blank material takeoff sheets *(optional)*

**Safety Considerations**
Safety is paramount in the masonry 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:


There are a number of online resources available for trainees who would like more information on use of commercial drawings and specifications to convey specific construction requirements. A search for additional information may be assigned as homework to interested trainees.
Session Outline for 28304-14

COMMERCIAL DRAWINGS

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

**SESSION ONE**

Session One introduces the requirements for commercial plans and the contents of site plans, architectural drawings, structural drawings, shop drawings, mechanical drawings, electrical drawings, and plumbing drawings.

1. Show Session One PowerPoint® presentation slides.
2. Review the requirements for commercial plans.
3. Describe the typical contents of commercial plan sets.
4. Review the features of site plans.
5. Discuss the features of architectural and structural drawings.
6. Explain the features of shop drawings and mechanical, electrical, and plumbing (MEP) drawings.

**SESSIONS TWO THROUGH FOUR**

Sessions Two through Four cover how to read and interpret plan, elevation, section, and detail views, floor and roof plans, exterior and interior elevations, building and wall sections, and architectural drawing schedules.

1. Show Sessions Two through Four PowerPoint® presentation slides.
2. Discuss the requirements for reading and interpreting the following types of drawings:
   - Plan views
   - Elevation, section, and detail views
   - Floor plans
   - Roof plans
   - Exterior and interior elevations
   - Building and wall sections
   - Architectural drawing schedules

**SESSIONS FIVE THROUGH SEVEN**

Sessions Five through Seven cover how to read and interpret foundation plans and details, framing plans, structural plan schedules, and shop drawings, as well as how to use emerging commercial drawing technologies.

1. Show Sessions Five through Seven PowerPoint® presentation slides.
2. Discuss the requirements for reading and interpreting the following drawings:
   - Structural drawings
   - Foundation plans and details
   - Framing plans
   - Structural plan schedules
   - Rebar and embed shop drawings
   - Precast, door and window, and flashing shop drawings
3. Review the emerging digital and online technologies that are being used in masonry construction today.
SESSIONS EIGHT AND NINE

Sessions Eight and Nine introduce how specifications are written and the formats used for specifications.

1. Show Sessions Eight and Nine PowerPoint® presentation slides.
2. Explain how the special-conditions, general-conditions, and technical-aspects sections of written specifications are written.
3. Describe the MasterFormat™ specification format used to prepare the specifications in most commercial drawings in North America.

SESSION TEN

Session Ten 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 Nine.) 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.
<table>
<thead>
<tr>
<th>Equipment and Materials</th>
<th>None Required</th>
<th>Architectural drawings</th>
<th>Copies of a request for information (RFI) form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal protective equipment:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction drawings, including:</td>
<td></td>
<td>Architectural drawings</td>
<td>Copies of a request for information (RFI) form</td>
</tr>
<tr>
<td>None Required</td>
<td>Architectural drawings</td>
<td>Copies of blank material takeoff sheets (optional)</td>
<td></td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
<td>Building and wall sections</td>
<td>Copies of manufacturers’ submittal drawings</td>
<td></td>
</tr>
<tr>
<td>Markers/chalk</td>
<td>Exterior and interior elevations</td>
<td>Copies of specifications for a commercial project</td>
<td></td>
</tr>
<tr>
<td>Pencils and paper</td>
<td>Floor plans (including floor plans drawn with grid sections, and the accompanying door and window schedules)</td>
<td>Copies of the division breakdown of the current edition of the MasterFormat™ standard</td>
<td></td>
</tr>
<tr>
<td>Masonry Level Three PowerPoint® Presentation Slides</td>
<td>Material symbols key (optional)</td>
<td>On-screen estimator software (optional)</td>
<td></td>
</tr>
<tr>
<td>TV/DVD player</td>
<td>Mechanical, electrical, and plumbing drawings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer</td>
<td>Roof plans</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copies of the Module Examination and Performance Profile Sheet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vendor-supplied videos/DVDs showing how to use commercial drawings and standards to convey specific construction requirements (optional)</td>
<td>Shop drawings for rebar, embedded materials, post-tensioned locations, precast materials, doors and windows, and flashing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site plans</td>
<td>Structural drawings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structural drawings</td>
<td>Structural drawings, including foundation plans, floor framing plans, and roof framing plans, and the accompanying schedules or notes</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.
Lesson Plans for Module 28305-14

ESTIMATING

Module 28305-14 describes the basic procedures for using a variety of estimating methods to estimate quantities of masonry units, mortar, grout, and accessories for projects.

<table>
<thead>
<tr>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Learning Objective 1</strong></td>
</tr>
<tr>
<td>• Explain how to estimate block, mortar, and grout.</td>
</tr>
<tr>
<td>a. Describe how to use the coursing method for block.</td>
</tr>
<tr>
<td>b. Describe the square-foot method for block.</td>
</tr>
<tr>
<td>c. Explain how to estimate openings and lintels.</td>
</tr>
<tr>
<td>d. Explain how to estimate mortar for single-wythe walls.</td>
</tr>
<tr>
<td>e. Explain how to estimate mortar for multiwythe walls.</td>
</tr>
<tr>
<td>f. Explain how to estimate grout.</td>
</tr>
<tr>
<td><strong>Learning Objective 2</strong></td>
</tr>
<tr>
<td>• Explain how to estimate brick and mortar.</td>
</tr>
<tr>
<td>a. Explain the coursing method for brick.</td>
</tr>
<tr>
<td>b. Explain the square-foot method for brick.</td>
</tr>
<tr>
<td>c. Describe how to allow for openings in an estimate.</td>
</tr>
<tr>
<td>d. Explain how to estimate mortar for brick.</td>
</tr>
<tr>
<td><strong>Learning Objective 3</strong></td>
</tr>
<tr>
<td>• Describe how to estimate accessory items.</td>
</tr>
<tr>
<td>a. Explain how to estimate joint reinforcement.</td>
</tr>
<tr>
<td>b. Explain how to estimate structural reinforcement.</td>
</tr>
<tr>
<td>c. Explain how to estimate masonry ties.</td>
</tr>
<tr>
<td>d. Explain how to estimate other masonry units.</td>
</tr>
<tr>
<td>e. Explain how to estimate other masonry accessories.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Performance Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Performance Task 1 (Learning Objective 1)</strong></td>
</tr>
<tr>
<td>• Estimate the amounts of block, mortar, and grout required for a hypothetical backing wall, using plans provided by the instructor.</td>
</tr>
<tr>
<td><strong>Performance Task 2 (Learning Objective 2)</strong></td>
</tr>
<tr>
<td>• Estimate the amounts of brick and mortar required for a hypothetical veneer wall, using plans provided by the instructor.</td>
</tr>
<tr>
<td><strong>Performance Task 3 (Learning Objective 3)</strong></td>
</tr>
<tr>
<td>• Estimate the amounts of rebar and ties required for hypothetical walls, using plans provided by the instructor.</td>
</tr>
</tbody>
</table>

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

**Prerequisites**
*Core Curriculum, Masonry Level One, and Masonry 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

Safety is paramount in the masonry 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
Masonry Level Three PowerPoint®
Presentation Slides
Computer
Copies of the Module Examination and Performance Profile Sheets
Vendor-supplied videos/DVDs showing tips and techniques for estimating (optional)
TV/DVD player

Equipment and Materials for Laboratories and Performance Testing

4-inch modular brick
Blank quantity takeoff sheets
Blank recapitulation sheets
Blank summary sheets
Colored pencils
Construction calculators, such as the ConcreteCalc™ Pro, or equivalent smartphone apps
Construction drawings for a simple brick masonry project such as a garden wall or small house
Construction drawings for masonry projects that involve the use of masonry ties
Construction drawings showing collar joints
Construction drawings, including drawings for a simple block masonry project such as a garden wall or small house
Copies of extracts from ASTM A1064/A1064M, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
Glass block
Structural glazed tile
Masonry ties
Plans for a hypothetical backing wall that requires the estimation of block, mortar, and grout
Plans for a hypothetical veneer wall
Plans for hypothetical walls that require the use of rebar and ties
Rebar of different lengths, designs, and finishes
Rebar positioners (optional)
Manufacturers’ tables for estimating grout volumes (optional)
Mason’s rulers (optional)

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 the basic procedures for using a variety of estimating methods to estimate quantities of masonry units, mortar, grout, and accessories for projects. A search for additional information may be assigned as homework to interested trainees.
The lesson plan for this module is divided into ten 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

### Session Outline for 28305-14

#### Estimating

#### Sessions One through Three

Sessions One through Three introduce the coursing and square-foot methods for estimating block, as well as the methods used to estimate openings and lintels, mortar for single-wythe and multiwythe walls, and grout.

1. Show Sessions One through Three PowerPoint® presentation slides.
2. Discuss the general considerations for estimating masonry material quantities.
3. Review the steps involved in the following:
   - Using the square-foot method to estimate block.
   - Estimating openings and lintels in masonry structures.
   - Using the rule-of-thumb and table methods to estimate mortar for single-wythe block walls.
   - Estimating mortar for multiwythe block and brick walls.
   - Estimating grout for masonry structures.

#### Sessions Four through Six

Sessions Four through Six introduce the coursing and square-foot methods for estimating brick, the methods used for allowing for openings in brick masonry estimates, and the methods used to estimate mortar for brick.

1. Show Sessions Four through Six PowerPoint® presentation slides.
2. Review the steps involved in the following:
   - Using the coursing method to estimate brick.
   - Using the square-foot method to estimate brick.
   - Estimating openings in brick masonry structures.
   - Using the rule-of-thumb method to estimate mortar for brick masonry construction.
   - Using the table method to estimate mortar for brick masonry construction.
   - Estimating mortar for collar joints in brick masonry construction.
SESSIONS SEVEN THROUGH NINE

Sessions Seven through Nine introduce the methods used to estimate continuous joint reinforcement, structural reinforcement, masonry ties, other masonry units, and additional items.

1. Show Sessions Seven through Nine PowerPoint® presentation slides.

2. Review the steps involved in the following:
   - Using the linear-foot method to estimate continuous joint reinforcement for block masonry construction.
   - Using the square-foot method to estimate continuous joint reinforcement for block masonry construction.
   - Estimating rebar quantities for masonry construction.
   - Estimating accessories for masonry construction.
   - Estimating masonry ties for masonry construction.
   - Estimating other types of masonry units for masonry construction.
   - Estimating miscellaneous items for masonry construction.

SESSION TEN

Session Ten 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 Nine.) 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 28305-14, Estimating

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
<th>4-inch modular brick</th>
<th>Blank recapitulation sheets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal protective equipment:</td>
<td>None Required</td>
<td>Blank quantity takeoff sheets</td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
<td>Blank summary sheets</td>
<td>Glass block</td>
</tr>
<tr>
<td>Markers/chalk</td>
<td>Masonry ties</td>
<td>Structural glazed tile</td>
</tr>
<tr>
<td>Pencils and paper</td>
<td>Rebar positioners <em>(optional)</em></td>
<td>Mason's rulers <em>(optional)</em></td>
</tr>
<tr>
<td>Masonry Level Three PowerPoint® Presentation Slides</td>
<td>Construction calculators, such as the ConcreteCalc™ Pro, or equivalent smartphone apps</td>
<td>Construction drawings for masonry projects that involve the use of masonry ties</td>
</tr>
<tr>
<td>TV/DVD player</td>
<td>Construction drawings showing collar joints</td>
<td>Plans for a hypothetical veneer wall</td>
</tr>
<tr>
<td>Computer</td>
<td>Rebar of different lengths, designs, and finishes</td>
<td>Plans for hypothetical walls that require the use of rebar and ties</td>
</tr>
<tr>
<td>Copies of the Module Examination</td>
<td>Manufacturers’ tables for estimating grout volumes <em>(optional)</em></td>
<td>Construction drawings, including drawings for a simple block masonry project such as a garden wall or small house</td>
</tr>
<tr>
<td>Vendor-supplied videos/DVDs showing tips and techniques for estimating <em>(optional)</em></td>
<td>Construction drawings for a simple brick masonry project such as a garden wall or small house</td>
<td>Plans for a hypothetical backing wall that requires the estimation of block, mortar, and grout</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 28306-14 describes the principles, equipment, and methods used to perform the site layout tasks of distance measurement and differential leveling; the layout responsibilities of surveyors, field engineers, and masons; the use of site plan drawings; and methods used for on-site communication.

### Objectives

**Learning Objective 1**  
- Describe the elements of site plans and topographic maps.  
  a. List characteristics of contour lines.

**Learning Objective 2**  
- Describe layout control points.  
  a. Explain how to convert between distance measurement systems.  
  b. Identify the types of control points.  
  c. Explain how to place control points and other markers.  
  d. Describe how to communicate information on control points and other markers.  
  e. Discuss how control markers are color-coded.

**Learning Objective 3**  
- Identify distance measurement tools and equipment.  
  a. Explain how to use tapes.  
  b. Explain how to use range poles.  
  c. Explain how to use plumb bobs and gammon reels.  
  d. Explain how to use hand sight levels.

**Learning Objective 4**  
- Describe how to make distance measurements.  
  a. Explain how to estimate distances by pacing.  
  b. Describe how to measure distances electronically.

**Learning Objective 5**  
- Identify differential-leveling tools and equipment.  
  a. Identify leveling instruments.  
  b. Describe the use of tripods.  
  c. Describe the use of leveling rods.  
  d. Explain how to set up and adjust leveling instruments.  
  e. Explain how to test the calibration of leveling instruments.

**Learning Objective 6**  
- Explain the basics of differential leveling.  
  b. Explain the differential-leveling procedure.  
  c. Explain how field notes are recorded and used.

**Learning Objective 7**  
- Identify leveling applications.  
  a. Explain how to transfer elevations up a structure.  
  b. Explain profile, cross-section, and grid leveling.

**Learning Objective 8**  
- Describe how to lay out building corners.  
  a. Explain how to construct batter boards.  
  b. Describe how to use the 3-4-5 rule.

### Performance Tasks

**Performance Task 1 (Learning Objective 1)**  
- Interpret a construction site plan and relate the man-made and topographic features and other project information to the layout and topography of the actual site.

**Performance Task 2 (Learning Objective 2)**  
- Convert measurements stated in feet and inches to equivalent decimal measurements stated in feet, tenths, and hundredths, and vice versa.

**Performance Task 3 (Learning Objective 5)**  
- Set up, adjust, and field-test a leveling instrument.

**Performance Task 4 (Learning Objective 5)**  
- Use a builder’s level and leveling rod to determine site and building elevations.

**Performance Task 5 (Learning Objective 7)**  
- Use differential-leveling and distance-measurement procedures to transfer elevations up a structure.

**Performance Task 6 (Learning Objective 8)**  
- Check and/or establish 90-degree angles using the 3-4-5 rule.
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, Masonry Level One, and Masonry 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 with lasers and hand tools. Safety is paramount in the masonry 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
Masonry Level Three PowerPoint® Presentation Slides
Calculator
Computer
Copies of the Module Examination and Performance Profile Sheets
Vendor-supplied videos/DVDs showing distance measuring and leveling tools and techniques (optional)
TV/DVD player

Equipment and Materials for Laboratories and Performance Testing
Appropriate Personal Protective Equipment:
Eye protection
Gloves
Hard hat
Safety shoes
2 x 4s or 2 x 6s
Automatic level
Blank hubs, stakes, and laths
Builder’s levels
Copies of the site plan for the property where this class is being taught
Electronic distance-measuring instruments (EDMIs)
Field books (electronic and paper)
Gammon reel with plumb bob
Hammers
Nails
Hand sight levels
Handsaws
Laser-beam detectors
Laser-beam levels
Leveling rods, including architect’s and engineer’s leveling rods
Local applicable building code (optional)
Nylon line
Permanent markers
Print field notes
Range poles
Reflectors used with EDMIs
Site plans
Steel, fiberglass, or cloth measuring tapes
Taping pins
Targets for leveling rods
Topographic maps
Total station
Transit level
Tripods
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 the principles, equipment, and methods used to perform the site layout tasks of distance measurement and differential leveling. A search for additional information may be assigned as homework to interested trainees.
### Session Outline for 28306-14

**Site Layout—Distance Measurement and Leveling**

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.

<table>
<thead>
<tr>
<th><strong>Session One</strong></th>
<th><strong>Session Three</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Session One introduces the elements of site plans and topographic maps, and describes how to identify and place control points.</td>
<td>Session Three introduces the methods that masons use to make distance measurements.</td>
</tr>
<tr>
<td>1. Show Session One PowerPoint® presentation slides.</td>
<td>1. Show Session Three PowerPoint® presentation slides.</td>
</tr>
<tr>
<td>2. Review the various elements of site plans and topographic maps.</td>
<td>2. Explain how to estimate distances by pacing.</td>
</tr>
<tr>
<td>3. Describe the principles and characteristics of contour lines.</td>
<td>3. Describe how to measure distances using electronic distance-measurement instruments.</td>
</tr>
<tr>
<td>4. Explain layout control points and the techniques for converting between distance measurement systems.</td>
<td></td>
</tr>
<tr>
<td>5. Describe the identification and placement of control points.</td>
<td></td>
</tr>
<tr>
<td>6. Discuss the requirements for communicating information and color-coding various types of marker.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Session Two</strong></th>
<th><strong>Session Four</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Session Two introduces trainees to the tools and equipment used in distance measurement.</td>
<td>Session Four introduces trainees to the tools and equipment used by masons in differential leveling.</td>
</tr>
<tr>
<td>1. Show Session Two PowerPoint® presentation slides.</td>
<td>1. Show Session Four PowerPoint® presentation slides.</td>
</tr>
<tr>
<td>2. Describe the use of tapes and range poles in distance measurements.</td>
<td>2. Provide an overview of the various leveling tools, as well as their care and proper handling.</td>
</tr>
<tr>
<td>3. Discuss the use of plumb bobs, gammon reels, and hand sight levels in distance measurements.</td>
<td>3. Provide an overview of how tripods are used, as well as their care and proper handling.</td>
</tr>
<tr>
<td></td>
<td>4. Provide an overview of leveling rods, and their use, care, and proper handling.</td>
</tr>
<tr>
<td></td>
<td>5. Discuss the initial setup and adjustment of leveling instruments.</td>
</tr>
<tr>
<td></td>
<td>6. Review the two methods used to calibrate leveling instruments.</td>
</tr>
</tbody>
</table>
Session Outline for 28306-14

SITE LAYOUT—DISTANCE MEASUREMENT AND LEVELING

SESSION FIVE

Session Five introduces the basics of differential leveling.

1. Show Session Five PowerPoint® presentation slides.
2. Discuss the principles of differential leveling and the terminology used in differential leveling.
3. Review the steps involved in the differential-leveling procedure.
4. Review the guidelines for writing and keeping field notes.

SESSION SIX

Session Six introduces the applications for leveling.

1. Show Session Six PowerPoint® presentation slides.
2. Describe the process required to transfer elevations up a structure.
3. Discuss the processes required to perform profile, cross section, and grid leveling.

SESSION SEVEN

Session Seven introduces the procedures for laying out building corners.

1. Show Session Seven PowerPoint® presentation slides.
2. Review the steps involved in constructing batter boards.
3. Describe the process of using the 3-4-5 rule for laying out and checking right angles.

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 28306-14, Site Layout—Distance Measurement and Leveling

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal protective equipment:</strong></td>
</tr>
<tr>
<td>Eye protection</td>
</tr>
<tr>
<td>Gloves</td>
</tr>
<tr>
<td>Hard hat</td>
</tr>
<tr>
<td>Safety shoes</td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
</tr>
<tr>
<td>Markers/chalk</td>
</tr>
<tr>
<td>Pencils and paper</td>
</tr>
<tr>
<td>Masonry Level Three PowerPoint® Presentation Slides</td>
</tr>
<tr>
<td>TV/DVD player</td>
</tr>
<tr>
<td>Computer</td>
</tr>
<tr>
<td>Copies of the Module Examination and Performance Profile Sheets</td>
</tr>
<tr>
<td>Calculator</td>
</tr>
<tr>
<td>Vendor supplied videos/DVDs showing distance measuring and leveling tools and techniques (optional)</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 28308-14 describes the tools and techniques masons use for estimating, cutting, lifting, and installing natural and manufactured stone in structural and veneer applications.

Objectives

Learning Objective 1
- Describe types of stone and the quarrying, cutting, and finishing processes used on them.
  a. Identify the types of stone.
  b. Describe how stone is quarried.
  c. Explain how stone is cut and finished.

Learning Objective 2
- Identify the tools and devices used in stone masonry.
  a. Identify hand tools used in stone masonry.
  b. Identify power tools used in stone masonry.
  c. Identify lifting devices used in stone masonry.
  d. Identify fasteners and connectors used in stone masonry.

Learning Objective 3
- Describe how to estimate various types of stone.
  a. Describe how to estimate stone veneers.
  b. Describe how to perform stone volume estimates.

Learning Objective 4
- Identify stone installation techniques.
  a. Describe how to install stone using anchors.
  b. Describe how to install stone using mortar.
  c. Describe how to install adhered stone veneers.

Performance Tasks

Performance Task 1 (Learning Objective 3)
- Estimate quantities of stone and stone materials.

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

Prerequisites
Core Curriculum, Masonry Level One, and Masonry 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 an environment that may involve exposure to respiratory hazards, flying debris, and caustic materials. Safety is paramount in the masonry 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
- Masonry Level Three PowerPoint® Presentation Slides
- Computer
- Copies of the Module Examination and Performance Profile Sheets
- Vendor-supplied videos/DVDs showing estimating, cutting, lifting, and installing natural and manufactured stone in structural and veneer applications (optional)
- TV/DVD player

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

- Abrasive materials (optional)
- Acid solutions (optional)
- Assortment of flashing used in adhered stone veneer
- Brick hammers (optional)
- Calculator
- Chisels
- Circular saw
- Clamp
- Containers of nonstaining sealant
- Containers of water
- Copies of manufacturers’ instructions for installing manufactured stone veneer (optional)
- Eyedroppers (optional)
- Hammer drill
- Hammers (optional)
- Hand clamps
- Local applicable building code
- Mortar suitable for stone (optional)
- Pitching tools
- Rod anchors
- Samples of igneous, sedimentary, and metamorphic stone, including various types of marble and an assortment of variously sized rubble from quarried stone
- Set of construction drawings for a project that incorporates stone veneer
- Shop ticket (optional)
- Skids, spacers, A-frames, and nails sufficient to allow trainees to practice storing slabs in a variety of configurations
- Stations with a variety of ashlar stone, random rectangular stone, and fieldstone
- Stations with various types of block and slabbed stone
- Stations with various types of slabbed stone, including stone that exhibits damage such as chips, cracks, or staining (optional)
- Stone grinders
- Stone guillotines (optional)
- Stone masonry hammers
- Stone that has been finished with the five commonly used types of finishes
- Strap anchors
- Strapmaster (optional)
- Trowels (optional)
- Vacuum cups
- Vacuum lifters
- Variety of veneer stone (optional)
- Worm-drive saw
**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 the tools and techniques masons use for estimating, cutting, lifting, and installing natural and manufactured stone in structural and veneer applications. A search for additional information may be assigned as homework to interested trainees.
The lesson plan for this module is divided into six 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

**SESSIONS ONE AND TWO**

Sessions One and Two introduce the various types of stone; how natural stone is quarried, cut, and finished; and the hand and power tools, lifting devices, fasteners, and connectors used in stone masonry.

1. Show Sessions One and Two PowerPoint® presentation slides.
2. Review the properties of igneous, sedimentary, and metamorphic stone and their applications in masonry construction.
3. Review the steps involved in quarrying, cutting, and finishing natural stone.
4. Provide an overview of the hand and power tools that are used to cut, carry, clean, align, and level stone masonry units.
5. Review the types of mechanical lifting devices that masons use to lift and move stone masonry units around the work site.
6. Review the various fasteners and connectors that masons use to anchor stone masonry units.

**SESSION THREE**

Session Three introduces trainees to techniques for estimating for stone masonry, including adhered stone veneer, and the various methods for performing volume estimates.

1. Show Session Three PowerPoint® presentation slides.
2. Review the procedures for estimating adhered stone veneer.
3. Review the procedures for performing stone volume estimates using the cubic-yard and ton methods.

**SESSIONS FOUR AND FIVE**

Sessions Four and Five introduce the techniques for installing stone with mechanical anchors and mortar, and the techniques for installing adhered stone veneers.

1. Show Sessions Four and Five PowerPoint® presentation slides.
2. Provide an overview of the requirements and techniques for installing stone in a masonry project.
3. Review the proper use of mechanical strap and rod anchors for installing stone masonry units.
4. Review the requirements and steps for installing stone with mortar.
5. Review the requirements and steps for installing adhered stone veneers.

**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 28308-14, Stone Masonry

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal protective equipment:</strong></td>
<td></td>
</tr>
<tr>
<td>Eye protection</td>
<td>Abrasive materials (optional)</td>
</tr>
<tr>
<td>Gloves</td>
<td>Brick hammers (optional)</td>
</tr>
<tr>
<td>Hard hat</td>
<td>Containers of water</td>
</tr>
<tr>
<td>Safety shoes</td>
<td>Stone grinders</td>
</tr>
<tr>
<td>Hearing protection</td>
<td>Worm-drive saw</td>
</tr>
<tr>
<td>Respiratory protection</td>
<td>Stone masonry hammers</td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
<td>Strap anchors</td>
</tr>
<tr>
<td>Markers/chalk</td>
<td>Pitching tools</td>
</tr>
<tr>
<td>Pencils and paper</td>
<td>Hammers (optional)</td>
</tr>
<tr>
<td>Masonry Level Three</td>
<td>Hand clamps</td>
</tr>
<tr>
<td>Computer</td>
<td>Hand clamps</td>
</tr>
<tr>
<td>TV/DVD player</td>
<td>Local applicable building code</td>
</tr>
<tr>
<td>Copies of the Module Examination and Performance Profile Sheets</td>
<td>Mortar suitable for stone (optional)</td>
</tr>
<tr>
<td>Vendor-supplied videos/ DVDs showing estimating, cutting, lifting, and installing natural and manufactured stone in structural and veneer applications (optional)</td>
<td>Samples of igneous, sedimentary, and metamorphic stone, including various types of marble and an assortment of variously sized rubble from quarried stone</td>
</tr>
<tr>
<td>Containers of nonstaining sealant</td>
<td>Variety of veneer stone (optional)</td>
</tr>
<tr>
<td>Rod anchors</td>
<td>Stations with various types of block and slabbled stone</td>
</tr>
<tr>
<td>Copies of manufacturers’ instructions for installing manufactured stone veneer (optional)</td>
<td>Stations with a variety of ashlar stone, random rectangular stone, and fieldstone</td>
</tr>
<tr>
<td>Skids, spacers, A-frames, and nails sufficient to allow trainees to practice storing slabs in a variety of configurations</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 11 (46101-11) teaches the skills needed to become an effective crew leader. It will help a crew leader who wants to become more effective, as well as a crew member who aspires to become a crew leader. The module covers basic leadership skills, safety, and project control.

# Objectives

## Section One
1. Describe the opportunities in the construction and power industries.
2. Describe how workers’ values change over time.
3. Explain the importance of training and safety for the leaders in the construction and power industries.
4. Describe how new technologies are beneficial to the construction and power industries.
5. Identify the gender and minority issues associated with a changing workforce.
6. Describe what employers can do to prevent workplace discrimination.
7. Differentiate between formal and informal organizations.
8. Describe the difference between authority, responsibility, and accountability.
9. Explain the purpose of job descriptions and what they should include.
10. Distinguish between company policies and procedures.

## Section Two
1. Describe the role of a crew leader.
2. List the characteristics of effective leaders.
3. Be able to discuss the importance of ethics in a supervisor’s role.
4. Identify the three styles of leadership.
5. Describe the forms of communication.
6. Describe the four parts of verbal communication.
7. Describe the importance of active listening.
8. Explain how to overcome the barriers to communication.
9. List ways that leaders can motivate their employees.
10. Explain the importance of delegating and implementing policies and procedures.
11. Distinguish between problem solving and decision making.

## Section Three
1. Explain the importance of safety.
2. Give examples of direct and indirect costs of workplace accidents.
3. Identify safety hazards of the construction industry.
4. Explain the purpose of OSHA.
5. Discuss OSHA inspection procedures.
6. Identify the key points of a safety program.
7. List steps to train employees on how to perform new tasks safely.
8. Identify a crew leader’s safety responsibilities.
9. Explain the importance of having employees trained in first aid and cardiopulmonary resuscitation (CPR).
10. Describe the indications of substance abuse.
11. List the essential parts of an accident investigation.
12. Describe ways to maintain employee interest in safety. Distinguish between company policies and procedures.

## Section Four
1. Describe the three phases of a construction project.
2. Define the three types of project delivery systems.
3. Define planning and describe what it involves.
4. Explain why it is important to plan.
5. Describe the two major stages of planning.
6. Explain the importance of documenting job site work.
7. Describe the estimating process.
8. Explain how schedules are developed and used.
9. Identify the two most common schedules.
10. Explain how the critical path method (CPM) of scheduling is used.
11. Describe the different costs associated with building a job.
12. Explain the crew leader’s role in controlling costs.
13. Illustrate how to control the main resources of a job: materials, tools, equipment, and labor.
14. Explain the differences between production and productivity and the importance of each.

# Performance Tasks

**Performance Task 1 (Section Four)**
- Develop and present a look-ahead schedule.

**Performance Task 2 (Section Four)**
- Develop an estimate for a given work activity.
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
The prerequisites for this module are dependent upon the structure of the specific craft training program in which trainees are specifically enrolled.

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

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

Safety Considerations
This module should be conducted in a classroom or conference room environment. Therefore, no special safety precautions are required.

Classroom Equipment and Materials
Whiteboard/chalkboard
Markers/chalk
Pencils and paper
Masonry Level Three PowerPoint® Presentations
DVD player
LCD projector and screen
Computer
Internet access during class (optional)
A drawing marked to show as-built changes.
Copies of the Module Examination and Performance Profile Sheets
Additional Resources
This module presents thorough resources for task training. The following resources are suggested for further study.

National Institute of Occupational Safety and Health (NIOSH), www.cdc.gov/niosh.
NCCER Publications:
   Your Role in the Green Environment
   Sustainable Construction Supervisor
Occupational Safety and Health Administration (OSHA), www.osha.gov.

There are a number of online resources, including video, available for trainees who would like more information on crew leadership. A search for additional information may be assigned as homework to interested trainees.

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

Instructors are also encouraged to locate additional audiovisual aids available on the internet, make personal videos, and take photos related to the relevant trade and add them to the PowerPoint® presentations throughout the program.
Session Outline for 46101-11

**FUNDAMENTALS OF CREW LEadership**

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

### Session One

Session One introduces the trainees to the basic elements of leadership. It covers an overview of industry and the need for a trained workforce; gender and cultural issues; and the structure and dynamics of business organizations.

1. Show the Session One PowerPoint® presentation.
2. Use the Kickoff Activity to get trainees engaged and give them an idea of what they will learn in this module.
3. Describe how to understand and motivate crew members.
4. Discuss the importance of gender and cultural issues in the workplace.
5. Describe the various types of organizational structures found in businesses.
6. Discuss the relationships of authority, responsibility, and accountability.

### Session Two

Session Two covers leadership skills. It focuses on the role of the crew leader and the transition from crew member. It discusses the characteristics of good leaders, leadership styles, and ethics. Key elements of this session are effective communication; motivating others; team building; delegating; and problem solving. A number of exercises will allow the trainees to test their leadership skills.

1. Show the Session Two PowerPoint® presentation.
2. Describe the qualities of an effective leader.
3. Discuss methods of communication and the importance of listening.
4. Describe how to motivate others.
5. Discuss the elements of team building and delegating.
6. Describe how to deal with problems on the job.
7. Discuss how to resolve special problems that often confront a crew leader.

### Session Three

Session Three focuses on safety. It presents the role of the crew leader in maintaining crew safety. Trainees will learn the relationship between safety and cost and will learn to view safety from a leadership perspective. Included in this lesson are discussions of company and crew leader responsibility for safety and accident investigation, as well as methods of promoting safety among the workforce.

1. Show the Session Three PowerPoint® presentation.
2. Describe how safety issues can directly and indirectly affect a company’s cost of doing business.
3. Discuss OSHA inspections and penalties for safety violations.
4. Describe how an employer safety program is structured and the role of the crew leader in the program.
5. Explain how a crew leader is involved in day-to-day safety issues such as conducting safety training sessions and assisting in accident investigations.
6. Describe how crew leaders can promote safe work practices within their crews.
Session Four introduces the subject of project control. It deals with the fundamentals, including project phases, project scheduling, cost estimating, and planning. It introduces the trainee to the contractual aspects of a project and the steps in completing a project, from its initial concept through the final delivery. Trainees will learn how to estimate labor and materials.

1. Show the Session Four PowerPoint® presentation.
2. Describe the different types of contracts and the three phases of a project.
3. Explain how to estimate the manpower and materials required for a project.
4. Discuss the function of planning and the planning process.
5. Describe how to plan the various resources such as manpower, tools, equipment and materials required for a project.

Session Five continues to focus on project control. It introduces trainees to various types of schedules and how they are used. Included in this session are discussions of project control methods related to cost and the crew leader’s role in controlling project cost. Also covered in this session are methods used in controlling labor, material, tools, and equipment on the job site.

1. Show the Session Five PowerPoint® presentation.
2. Discuss the different project scheduling methods.
3. Explain how to prepare project schedules.
4. Describe the tools and methods used to control project cost.
5. Describe the tools and methods used to control resources during a job.
6. Explain the difference between production and productivity and explain why these concepts are an important part of project planning and control.

Sessions Six and Seven are laboratory sessions in which the trainees will practice the development of a project schedule and a cost estimate.

1. Note that there is no PowerPoint® presentation associated with this session.
2. Using an instructor-prepared scenario appropriate for the trade, trainees complete the tasks associated with Performance Tasks 1 and 2.

Session Eight is a review and testing session.

1. Review any material that has not been fully presented and answer any questions that the trainees may have.
2. Have the trainees complete the written examination. Any outstanding performance testing must be completed during this session as well.
3. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
**Materials Checklist for Module 46101-11, Fundamentals of Crew Leadership**

<table>
<thead>
<tr>
<th>Equipment and Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal protective equipment:</strong></td>
</tr>
<tr>
<td>[None]</td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
</tr>
<tr>
<td>Markers/chalk</td>
</tr>
<tr>
<td>Pencils and paper</td>
</tr>
<tr>
<td><em>Masonry Level Three</em> PowerPoint® Presentations</td>
</tr>
<tr>
<td>DVD player</td>
</tr>
<tr>
<td>LCD projector and screen</td>
</tr>
<tr>
<td>Computer</td>
</tr>
<tr>
<td>Internet access during class (optional)</td>
</tr>
<tr>
<td>A drawing marked to show as-built changes.</td>
</tr>
<tr>
<td>Copies of the Module Examination and Performance Profile Sheets</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.