Overview

There is far more to concrete than just cement and water. Anyone working with concrete should be familiar with various mix designs, as well as their uses and limitations. There are numerous admixtures and other ingredients used to alter the properties of concrete to meet specific project needs and environmental conditions. After the specifications for a concrete structure have been developed, steps must be taken during the construction process to ensure the concrete placed meets the specifications. This is done through various forms of testing. In this module, trainees are introduced to the properties of concrete and the many tools at our disposal to change those properties.

Learning Objective 1

Successful completion of this module prepares trainees to:
Identify and describe the primary components of concrete.

a. Describe portland cement and identify various types based on standardized designations.
b. Describe the characteristics of aggregate and water used in a concrete mixture.

Learning Objective 2

Successful completion of this module prepares trainees to:
Identify other concrete components and describe special types of concrete.

a. Describe chemical admixtures and how they influence concrete.
b. Describe supplementary cementitious materials and how they influence concrete.
c. Describe fiber-reinforced concrete and state related finishing considerations.
d. Identify and describe special types of concrete and their applications.

Learning Objective 3

Successful completion of this module prepares trainees to:
Identify normal concrete mix ratios and describe various concrete testing methods.
a. Identify normal concrete mix proportions and measurements.
b. Identify standards related to concrete testing and describe field sampling practices.
c. Explain how to conduct a field slump test.
d. Explain how to prepare samples for concrete compression testing.

**Performance Tasks**

1. Perform, or be able to identify the proper performance of, a proper concrete slump test.
2. Prepare, or be able to identify the proper preparation of, a concrete compression-test sample cylinder.

Recommended Teaching Time: 15 hours

**Classroom Equipment and Materials**

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 23212
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations

**Performance Task 1**

- Appropriate PPE
- Concrete and water
- Portable concrete mixer or wheelbarrow
- Slump test cones
- Scoop
- Smooth tamping rod
- Tape measure
- Performance Profile sheets

**Performance Task 2**

- Appropriate PPE
- Concrete and water
• Portable concrete mixer or wheelbarrow
• Compression-test sample cylinders
• Scoop
• Smooth tamping rod
• Straight edge
• Performance Profile sheets
Estimating Concrete Quantities

Concrete Construction

Overview

Estimating concrete quantities is an important part of the construction process. It is important that material estimates be as accurate as possible. When materials are overestimated, the remaining materials must be moved to another site, placed in storage, or wasted altogether, requiring more labor and increasing project costs. Underestimating, on the other hand, is also wasteful of time and results in a project that exceeds the budget.

To prepare accurate estimates, one must be comfortable with math in general, and be able to read drawings to gather the needed information. This module provides an opportunity to practice the necessary skills and estimate concrete quantities for various structures.

Learning Objective 1

Successful completion of this module prepares trainees to:

Calculate metric linear and weight conversions and work with denominate numbers to determine area and volume.

a. Convert linear measurements to and from the metric system.
b. Convert weight values to and from the metric system.
c. Make mathematical calculations with denominate numbers.
d. Define square measurement and calculate the area of squares and rectangles.
e. Calculate the area of various two-dimensional figures.
f. Calculate the volume of various three-dimensional figures.

Learning Objective 2

Successful completion of this module prepares trainees to:

Explain how to interpret construction drawings and estimate concrete quantities.

a. Identify and describe various parts of drawings.
b. Identify and describe how to use various types of residential drawings.
c. Explain how to calculate concrete volume and prepare a takeoff.
d. Explain how to calculate concrete volume for specific concrete structures.

**Performance Tasks**

1. Based on an instructor-provided drawing, estimate the volume of concrete required for a slab-on-grade.
2. Based on an instructor-provided drawing, estimate the volume of concrete required for a vertical concrete placement such as a stairway or structural support column.

Recommended Teaching Time: 12.5 hours

**Classroom Equipment and Materials**

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 23202
  - A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations

**Performance Task 1**
- A copy of a construction drawing for a slab-on-grade
- Paper and pencil
- Calculator (optional)
- Performance Profile sheets

**Performance Task 2**
- A copy of a construction drawing including a structural support column
- Paper and pencil
- Calculator (optional)
- Performance Profile sheets
Module 27310 describes how tilt-up concrete construction is used and how tilt-up panels are formed, erected, and braced. The text reviews the installation of rebar and types of embedments used to lift and brace the panels. It also covers the methods used to achieve architectural and decorative finishes.

### Objectives

**Learning Objective 1**
- Describe the tilt-up wall-forming process.
  - Explain how to prepare the casting bed.
  - Identify the different methods of forming tilt-up wall panels.
  - Discuss how architectural treatments are added to wall panels.
  - Explain the purpose of reinforcement in wall panels.
  - Discuss how inserts and embedments are placed in tilt-up wall panels.
  - Discuss the placement and finishing of concrete for tilt-up wall panels.

**Learning Objective 2**
- Explain the proper procedure for erecting and bracing tilt-up wall panels.
  - List safety considerations when erecting tilt-up wall panels.
  - Describe the procedures for erecting and bracing tilt-up wall panels.

### Performance Tasks

**Performance Task 1 (Learning Objective 2)**
- Form a tilt-up panel in accordance with a drawing provided by the instructor.

**Performance Task 2 (Learning Objective 2)**
- Install inserts, reinforcement, and architectural features.

### Teaching Time:
**17.5 hours**
(Seven 2.5-hour Classroom Sessions)

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

### Prerequisites

**Core curriculum**

### Interim Credentials

This curriculum provides the opportunity to earn interim credentials, which offer multiple training pathways in a specific occupational area of concrete construction.

### Before You Begin

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

Using your access code, download the Module Examinations and Performance Profile Sheets from [www.nccerirc.com](http://www.nccerirc.com). The passing score for submission into NCCER's Registry is 70 percent or above for the Module Examination; performance testing is graded pass or fail.
Safety Considerations
This module requires that trainees form a tilt-up panel and install inserts, reinforcement, and architectural features. Safety is paramount in the carpentry trade and safe habits and practices must be emphasized whenever possible. Performance Tasks must be completed under your supervision. Each trainee must use required PPE and follow safe tool practices and procedures.

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

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

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

**SESSIONS ONE THROUGH THREE**

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

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

**SESSIONS FOUR THROUGH SIX**

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

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

**SESSION SEVEN**

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

1. Have trainees complete the Module Examination. Any outstanding performance testing must be completed during this session.
2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
<table>
<thead>
<tr>
<th>Equipment and Materials</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal protective equipment:</strong></td>
<td>An assortment of tools with damaged or worn cutting edges</td>
</tr>
<tr>
<td>Face protection</td>
<td>Copies of a layout drawing of a tilt-up panel</td>
</tr>
<tr>
<td>Gloves</td>
<td>Copies of the September 2002 OSHA report entitled “Investigation of the August 5, 2002, Collapse of Tilt-Up Precast Concrete Wall Panel in Greensboro, NC” or a similar report of an accident involving a tilt-up panel</td>
</tr>
<tr>
<td>Work Boots</td>
<td>Embedments such as lift and brace inserts, weld plates, and beam-pocket liners</td>
</tr>
<tr>
<td>Hard hat</td>
<td>Lists of hand and power tools</td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
<td>Mechanical vibrator</td>
</tr>
<tr>
<td>Markers/chalk</td>
<td>Reinforcing bar</td>
</tr>
<tr>
<td>Pencils and paper</td>
<td>Concrete mix</td>
</tr>
<tr>
<td><strong>Carpentry Level Three PowerPoint® Presentation Slides</strong></td>
<td></td>
</tr>
<tr>
<td>Computer</td>
<td></td>
</tr>
<tr>
<td>Copies of the Module Examination and Performance Profile Sheets</td>
<td></td>
</tr>
<tr>
<td>Vendor-supplied videos/DVDs showing tilt-up wall systems (optional)</td>
<td></td>
</tr>
<tr>
<td>TV/DVD player</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 36108 describes paving operations, paving equipment, recycling processes, and quality control requirements for both concrete and hot-mix asphalt paving.

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Performance Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Learning Objective 1</strong></td>
<td><strong>Performance Task 1 (Learning Objective 1)</strong></td>
</tr>
<tr>
<td>• Describe concrete paving operations, processes, and procedures.</td>
<td>• Demonstrate setting the stringline to establish the grade for concrete slipform paving.</td>
</tr>
<tr>
<td>a. Explain the use of stringlines and other methods of grade control.</td>
<td><strong>Performance Task 2 (Learning Objective 1)</strong></td>
</tr>
<tr>
<td>b. Identify and describe various types of concrete joints.</td>
<td>• Correctly set up the slipform paver for operation.*</td>
</tr>
<tr>
<td>c. Describe hand-paving operations.</td>
<td><strong>Performance Task 3 (Learning Objective 1)</strong></td>
</tr>
<tr>
<td>d. Describe concrete reinforcement.</td>
<td>• Perform slipform paving.*</td>
</tr>
<tr>
<td>e. Describe concrete paving methods equipment.</td>
<td><strong>Performance Task 4 (Learning Objective 1)</strong></td>
</tr>
<tr>
<td>f. Describe the concrete recycling process.</td>
<td>• Perform a concrete slump test.</td>
</tr>
<tr>
<td>g. Identify methods and tests used to ensure quality control of concrete.</td>
<td><strong>Performance Task 5 (Learning Objective 2)</strong></td>
</tr>
<tr>
<td><strong>Learning Objective 2</strong></td>
<td>• At the discretion of your instructor, perform hot-mix asphalt paving.*</td>
</tr>
<tr>
<td>• Describe hot-mix asphalt paving operations, processes, and procedures.</td>
<td><strong>Performance Task 6 (Learning Objective 2)</strong></td>
</tr>
<tr>
<td>a. Describe asphalt paving preparations and procedures.</td>
<td>• Perform a quantitative analysis on the segregation of stone.</td>
</tr>
<tr>
<td>b. Explain the milling and recycling process.</td>
<td><em>These tasks require work site access.</em></td>
</tr>
<tr>
<td>c. Explain hot-mix asphalt paving quality control.</td>
<td></td>
</tr>
</tbody>
</table>

**Teaching Time: 12.5 hours**  
(Five 2.5-Hour Sessions)

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

**Interim Credentials**

This curriculum provides the opportunity to earn interim credentials, which offer multiple training pathways in a specific occupational area of concrete construction.

**Before You Begin**

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

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

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

Equipment, Materials, and Resources

<table>
<thead>
<tr>
<th>Whiteboard</th>
<th>Mesh</th>
<th>Mechanic’s tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Markers</td>
<td>Test cylinders</td>
<td>Concrete delivery system</td>
</tr>
<tr>
<td>Pencils and paper</td>
<td>Stringline pins</td>
<td>Concrete placing device</td>
</tr>
<tr>
<td>LCD projector and screen</td>
<td>Stringline or light cable</td>
<td>Texting and curing machine</td>
</tr>
<tr>
<td>PowerPoint® Presentations for Module 36108</td>
<td>End anchoring devices</td>
<td>Hot mix delivery system</td>
</tr>
<tr>
<td>Computer with Internet access</td>
<td>Concrete (fresh)</td>
<td>Appropriate personal protective equipment</td>
</tr>
<tr>
<td>Module Review answer key</td>
<td>Dowel baskets</td>
<td>Forming system components</td>
</tr>
<tr>
<td>Module Examinations</td>
<td>Straightedge</td>
<td>Molds</td>
</tr>
<tr>
<td>Examples of material used to make joints in concrete</td>
<td>Hand concrete finishing tools</td>
<td>Roller</td>
</tr>
<tr>
<td>Marked reference stakes</td>
<td>Tape measure</td>
<td>Slump cone</td>
</tr>
<tr>
<td>Sample concrete forms</td>
<td>Hand scoop</td>
<td>Cone base plate</td>
</tr>
<tr>
<td>Dowel bars</td>
<td>ASTM C143 test procedure</td>
<td>Rod</td>
</tr>
<tr>
<td>Tie bars</td>
<td>Hot mix hand tools</td>
<td>Asphalt samples</td>
</tr>
<tr>
<td></td>
<td>Total station surveying equipment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Slipform paver</td>
<td></td>
</tr>
</tbody>
</table>

Additional Resources

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

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


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

The following websites offer resources for products and training:

American Concrete Institute, www.concrete.org
American Concrete Pavement Association, www.pavement.com
The Concrete Network, www.concretenetwork.com

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

**Session One**

Session One covers the methods and machines used in placing concrete paving material. This session covers Sections 1.0.0 through 1.7.0.

1. Open the Session One presentation.
2. Use the Kickoff Activity to get trainees engaged and give them an idea of what they will learn from this module.
3. Describe how grade control is maintained during concrete paving.
4. Discuss the various types of joints used in concrete paving.
5. Discuss hand-paving operations.
6. Discuss concrete reinforcing materials and methods.
7. Discuss concrete paving methods and equipment.
8. Discuss concrete recycling.
9. Describe the quality control procedures that apply to concrete used for paving.

**Session Two**

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

1. Open the Session Two presentation.
2. Use the Kickoff Activity to get trainees engaged and give them an idea of what they will learn from this module.
3. Describe the how foundations are prepared for paving.
4. Describe how grade control is maintained during asphalt paving.
5. Discuss the types of joints used in asphalt paving.
6. Describe the equipment and procedures used in asphalt paving.
7. Explain the need for compaction and how it is performed.
8. Describe the equipment and methods used in recycling asphalt.
9. Describe the quality control procedures that apply to asphalt used for paving.
SESSIONS THREE AND FOUR

Sessions Three and Four are laboratory and performance testing sessions in which trainees will demonstrate their ability to perform concrete slipform and hot-mix asphalt paving. They will also set up a slipform paver, set a stringline for slipform paving, perform a slump test, and perform a quantitative analysis on the segregation of stone.

1. Explain the purpose and expected outcome of the lab session.
2. Demonstrate how to set the stringline to establish the grade for concrete slipform paving. Have trainees practice setting the stringline. This activity corresponds to Performance Task 1.
3. Demonstrate how to set up a slipform paver for operation. Have trainees practice setting up the slipform paver. This activity corresponds to Performance Task 2.
4. Demonstrate and have trainees practice slipform paving. This activity corresponds to Performance Task 3.
5. Demonstrate how to perform a concrete slump test, and then have trainees perform a slump test. This activity corresponds to Performance Task 4.
6. Demonstrate and have trainees practice hot-mix asphalt paving. This activity corresponds to Performance Task 5.
7. Demonstrate how to perform a quantitative analysis on the segregation of stone, and have trainees practice this analysis. This activity corresponds to Performance Task 6.
8. Record successful Performance Task completions for each trainee on the Performance Profile Sheet, and submit the results to your Training Program Sponsor.

SESSION FIVE

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

1. Administer the Module Examination.
2. Submit the results to your Training Program Sponsor through the Registry system.
Architectural Finishes

Course Planning Tools

Module 23205
Concrete Construction

Overview

Concrete can be finished in many ways to create an attractive, yet practical, structure. Finishing and preparing architectural concrete surfaces requires special skill and knowledge that goes beyond normal flatwork finishing procedures.

Architectural concrete broadly refers to placements that are exposed to public view and where special techniques are needed to achieve a specified appearance. Modern architectural concrete surfaces include walls and other vertically formed surfaces, as well as horizontal surfaces such as floors, sidewalks, and pavements. This module presents information on the classes of architectural concrete surfaces and the techniques commonly used to make them visually attractive.

Learning Objective 1

Successful completion of this module prepares trainees to:

Describe various approaches to coloring and texturing concrete surfaces.

a. Identify and describe concrete surface classes and the function of mockups.
b. Describe how colored and white cements are created.
c. Explain how concrete surfaces can be colored.
d. Explain how to create various textured surfaces.

Learning Objective 2

Successful completion of this module prepares trainees to:

Describe exposed aggregate finishes and explain how they are created.

a. Explain how the aggregates and other ingredients are selected.
b. Describe various methods used to place aggregates.
c. Describe various methods used to expose embedded aggregate.
Performance Tasks

1. Finish a stamped concrete slab using a color-shake hardener.
2. Use the water-washing technique to create an exposed aggregate finish with or without the use of surface retarders.

Recommended Teaching Time: 22.5 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 23205
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations

Performance Task 1

- Appropriate PPE
- Color-shake hardener of chosen color(s)
- Common hand, power, and layout tools
- Finishing tools
- Form materials for a mockup panel
- Site-mixed or ready-mix concrete
- Textured stamps
- Hand tamper
- Form release agent
- Performance Profile sheet

Performance Task 2

- Appropriate PPE
- Common hand, power, and layout tools
- Finishing tools
- Form materials for a mockup panel
- Site-mixed or ready-mix concrete
- Form release agent
• Surface retarder (optional)
• Pressure washer
• Appropriate broom
• Performance Profile sheet
23206
Industrial Floors
Concrete Construction

Overview
Industrial floors are finished to higher standards of levelness and flatness than lower classes of concrete floors. The work must be done with precision and intent. Concrete craftworkers must work together as a well-oiled team to succeed. The finish of these floors is critical because of the equipment and operations that rely on their quality and integrity. This module presents information about industrial floor construction and the techniques used to form, place, finish, and cure them.

Learning Objective 1
Successful completion of this module prepares trainees to:
Describe the characteristics of industrial concrete floors and explain how they are constructed.

a. Describe ACI-defined floor classes and the classes relevant to industrial floors.
b. Identify and describe pre-placement tasks and considerations for industrial floors.
c. Identify and describe industrial-floor reinforcement considerations.
d. Explain how to place and finish an industrial floor.

Performance Tasks
1. Using dimensional lumber, lay out, construct, and set an 8” deep concrete form to grade and elevation, with two placements separated by a construction joint.
2. Use drawings to correctly locate and place construction joint dowels.
3. Place a wet screed to grade.
4. Assist in placing, consolidating, and screeding an industrial floor slab to a given elevation.

Recommended Teaching Time: 27.5 hours

Classroom Equipment and Materials
- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 23206
• A variety of standard marker sizes
• Poster board
• Flip chart
• LCD projector and screen
• Computer with Internet access
• Module Review answer key
• Module Examinations

**Performance Tasks 1 through 4**

• Appropriate PPE
• Drawings for a concrete slab with specified dimensions, elevation, and location of construction joints to separate placements
• Area of prepared subgrade with one corner staked indicating proper location and elevation
• 8” lumber
• Form assembly hardware
• Stakes
• Common hand and power tools
• Instruments to set elevation and grade
• Dowels and related materials, such as dowel chairs and dowel pockets
• Materials for a wet screed
• Fresh concrete, either mixed on-site or ready-mix
• Vibrator
• Finishing tools
• Performance Profile sheets
according to American Concrete Institute (ACI) Publication 302.1R, Guide to Concrete Floor and Slab Construction, and its floor classification system, a Class 9 floor is also known as a superflat floor. These concrete floors have the most challenging flatwork specifications to meet and reflect the highest possible quality of horizontal concrete structures. They must be finished to specific values of flatness and levelness. As a result, they require extra care in their design, placement, and finishing, with advanced finishing equipment and skills typically required. This module introduces the concepts and tasks associated with placing and finishing superflat floors, as well as the fundamentals of flatness and levelness measurement.

Learning Objective 1

Successful completion of this module prepares trainees to:
Describe superflat floors and explain how they are constructed.

a. Describe superflat floors and the rigid specifications that define them.
b. Identify and describe various types of floor measuring devices.
c. Identify and describe pre-placement tasks and considerations for superflat floors.
d. Describe the approaches to placement used for superflat floors.
e. Describe the finishing and curing processes used for superflat floors.

Performance Tasks

1. Assist in setting a wooden superflat-floor edge form on grade to a specified elevation and check the top of the form for flatness with a highway straightedge, marking areas that are not true.
2. Use a highway straightedge behind a screed to level a superflat floor.

Recommended Teaching Time: 20 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
• PowerPoint® Presentations for Module 23207
• A variety of standard marker sizes
• Poster board
• Flip chart
• LCD projector and screen
• Computer with Internet access
• Module Review answer key
• Module Examinations

**Performance Task 1**
• Appropriate PPE
• Area of prepared subgrade and grade
• Form lumber
• Stakes
• Common hand and power tools
• Form assembly hardware, such as screws and nails
• Laser level
• Highway straightedge
• Performance Profile sheets

**Performance Task 2**
• Appropriate PPE
• Superflat floor under construction, or the form from *Performance Task 1*
• Highway straightedge
• Performance Profile sheets
Overview
Most overlays, coatings, and sealants require certain conditions for a successful application. There is often more than one method of surface preparation that will be effective for each type of surface treatment. The choice of the best method for each application will depend on time and cost constraints, the condition of the slab, and the amount of noise, vibration, and dust generated in the environment. This module introduces the concepts and tasks related to surface treatments for horizontal concrete surfaces such as floors and pads.

Learning Objective 1
Successful completion of this module prepares trainees to:
Identify and explain how to prepare concrete surfaces and apply various treatments.

   a. Identify and describe methods used to create a specific concrete surface profile.
   b. Identify and describe how to apply dry-shake surface treatments.
   c. Identify and describe how to apply self-leveling toppings and underlayments.
   d. Identify and describe how to apply protective sealants and coatings.
   e. Identify and describe how to apply epoxy compounds.

Performance Tasks
1. Create an evenly colored finish with a dry shake.
2. Use an instructor-selected tool or process to prepare a concrete surface to a specified surface profile.

Recommended Teaching Time: 15 hours

Classroom Equipment and Materials
• Whiteboard and markers
• Pencils and paper
• PowerPoint® Presentations for Module 23208
• A variety of standard marker sizes
• Poster board
• Flip chart
• LCD projector and screen
• Computer with Internet access
• Module Review answer key
• Module Examinations

**Performance Task 1**
• Appropriate PPE
• Freshly placed slab
• Ready-to-use color shake
• Shovel
• Power float
• Edger
• Trowel
• Performance Profile sheet

**Performance Task 2**
• Appropriate PPE
• Appropriate slab
• Common hand tools
• Selection of powered equipment required to create the chosen surface profile
• Concrete surface profile chip set
• Performance Profile sheets
Troubleshooting and Quality Control

Concrete Construction

Overview

Building owners and developers must ensure they get what they contracted for in terms of building quality. To that end, architects and engineers want to be sure the building is constructed to their specifications so that it performs as designed. Various concrete tests are the foundation of determining its quality and future serviceability. This module will review proactive steps taken by contractors and the field-testing procedures used by concrete craftworkers to deliver the best product possible.

Learning Objective 1

Successful completion of this module prepares trainees to:

Describe quality control processes and explain how to complete the necessary tasks to ensure compliance with project specifications.

a. Define quality control and explain how contractors are apprised of quality expectations.
b. Describe the scope of pre-placement inspections required to ensure acceptable results.
c. Explain how to organize and conduct a troubleshooting process.
d. Identify common problems encountered in fresh concrete and how they might be resolved.

Learning Objective 2

Successful completion of this module prepares trainees to:

Explain how to collect concrete samples, prepare specimens, and complete various field tests.

a. Explain how to organize and collect concrete field samples.
b. Explain how to prepare specimens for strength testing.
c. Explain how to perform a slump test.
d. Explain how to perform a yield test and calculate yield, unit weight, and gravimetric air content.
Performance Tasks

1. Collect a concrete sample according to ASTM Standard C172.
2. Prepare a concrete test cylinder according to ASTM Standard C31.
3. Perform a concrete slump test according to ASTM Standard C143.
4. Determine the temperature of a concrete sample according to ASTM Standard C1064.

Recommended Teaching Time: 15 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 23211
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations

Performance Task 1

- Appropriate PPE
- Concrete mix and water
- Portable mixer
- Wheelbarrows
- Shovel
- Performance Profile sheets

Performance Task 2

- Appropriate PPE
- Composite concrete samples from Performance Task 1
- Test sample cylinders
- Scoop
- Smooth tamping rod
- Mallet
• Performance Profile sheets

**Performance Task 3**
• Appropriate PPE
• Composite concrete samples from *Performance Task 1*
• Slump test cones
• Damp rag
• Scoop
• Smooth tamping rod
• Tape measure
• Performance Profile sheets

**Performance Task 4**
• Appropriate PPE
• Composite concrete sample from *Performance Task 1*
• Five-gallon bucket
• Thermometer with reported accuracy to 1°F and with temperature probe long enough to ensure proper coverage.
• Thermometer with reported accuracy to 0.5°F and with temperature probe long enough to ensure proper coverage.
• Ice bath
• Warm water bath
• Performance Profile sheets
Concrete Repair

Course Planning Tools

Module 23210
Overview

This module introduces the concepts and tasks related to the repair of concrete structures. Although there are many techniques and materials that can be used to make a repair, this module will focus on repairing concrete with concrete.

It is important to understand how to identify the source of concrete damage. Some problems are hidden, where they remain concealed until they affect the surface or, worse, contribute to a structural failure. The topic of concrete repair is far deeper than many craftworkers realize, and it cannot be covered in detail in a single module. However, this module will present the fundamental concepts of concrete repair and provide basic guidance in executing repairs.

Learning Objective 1

Successful completion of this module prepares trainees to:
Identify and describe sources of concrete damage and how to identify damaged and deteriorated concrete.

a. Identify common PPE and safety hazards relevant to working with cement and concrete.
b. Identify common causes of concrete damage and failure.
c. Describe methods used to identify and locate hidden damage and deterioration.

Learning Objective 2

Successful completion of this module prepares trainees to:
Describe the requirements for a successful concrete repair and how to achieve reliable results.

a. Explain how to remove concrete and prepare the surface for repair.
b. Explain how to clean steel reinforcement and evaluate apparent damage.
c. Explain how damaged reinforcement can be repaired.
d. Identify and describe common approaches to concrete placement for repairs.
e. Describe pre- and post-placement repair inspections.
Performance Tasks

1. Identify a delaminated area and remove the concrete necessary to fully expose the damage.
2. Prepare a removed area of reinforced concrete for repair and identify the resulting concrete surface profile.
3. Mix, place, and cure a concrete repair.

Recommended Teaching Time: 20 hours

Classroom Equipment and Materials

• Whiteboard and markers
• Pencils and paper
• PowerPoint® Presentations for Module 23210
• A variety of standard marker sizes
• Poster board
• Flip chart
• LCD projector and screen
• Computer with Internet access
• Module Review answer key
• Module Examinations

Performance Task 1

• Appropriate PPE
• Concrete slab with a delaminated area
• Hammers and dragging chains
• Chipping hammer and/or high-pressure water-jetting equipment
• Other power tools for concrete removal (optional)
• Common hand tools
• ICRI Publication 310.2R
• Performance Profile sheets

Performance Task 2

• Appropriate PPE
• Concrete slab from Performance Task 1
• Chipping hammer
• High-pressure water-jetting equipment
• Other power tools for concrete removal (optional)
• Common hand tools
• Wire brushes
- HEPA vacuum suitable for concrete
- Concrete saw
- ICRI Publication 310.2R
- Performance Profile sheets

**Performance Task 3**
- Appropriate PPE
- Concrete slab from *Performance Tasks 1 and 2*
- Appropriate concrete mix for the repair
- Portable mixer
- Concrete rake and shovel
- Vibrator
- Screed
- Floats and trowels
- Curing compound
- Hand-operated prayer
- Performance Profile sheets