Masonry III

8514 36 weeks / 280 hours

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Acknowledgments

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Correlations to the Virginia Standards of Learning were reviewed and updated by:
Course Description

Suggested Grade Level: 12
Prerequisites: 8513

Students apply skills introduced in Masonry II to safely use a variety of hand tools, measuring tools, power tools, and lifting equipment that masons use on the job. Students will complete advanced projects in both residential and commercial masonry, including preparing job sites. Students focus on problem-solving and employability skills while performing advanced, hands-on, brick and block masonry projects. By the conclusion of the course, students reach the apprenticeship level, with the potential for placement in a supervised apprenticeship program.

“Masonry III” may be offered as a complement to an existing concentration sequence in any CTE program area. In some instances, where noted, it may be combined with specific courses to create concentration sequences.

As noted in Superintendent's Memo #058-17 (2-28-2017), this Career and Technical Education (CTE) course must maintain a maximum pupil-to-teacher ratio of 20 students to one teacher, due
to safety regulations. The 2016-2018 biennial budget waiver of the teacher-to-pupil ratio staffing requirement does not apply.

Task Essentials Table

- Tasks/competencies designated by plus icons (⊕) in the left-hand column(s) are essential
- Tasks/competencies designated by empty-circle icons (○) are optional
- Tasks/competencies designated by minus icons (⊖) are omitted
- Tasks marked with an asterisk (*) are sensitive.

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<thead>
<tr>
<th>Task Number</th>
<th>Tasks/Competencies</th>
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Performing Residential Masonry

- Install base, sill, and lintel flashing in a residential setting. |
- Build quoined corners. |
- Build arches. |
- Build stoops. |
- Build steps. |
- Install mortared paving. |
- Build a fireplace and chimney. |

Constructing Commercial Masonry

- Build a composite cavity wall system. |
- Install rigid wall insulation. |
- Identify bearing plates. |
- Inspect metal frames. |
- Describe grout procedures for high-lift and low-lift pours. |
- Demonstrate the procedures for installing base, sill, and lintel flashing in a commercial setting. |
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<td>Interpret blueprints and plans.</td>
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<td>Establish footing grades.</td>
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<td>Level walls, using a level (laser or transit).</td>
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<td>Lay a garden wall pattern.</td>
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<td>70</td>
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<td>Describe mortarless concrete masonry retaining wall systems.</td>
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<td>Explain mortarless concrete paver systems.</td>
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<td>Describe thin brick systems.</td>
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Legend: ✗ Essential 〇 Non-essential 〇 Omitted

**Curriculum Framework**

**Applying Basic Safety Standards (Core Safety)**

**Task Number 39**

**Comply with federal, state, and local safety requirements.**

**Definition**

Compliance should include

- understanding the roles of the Occupational Safety and Health Administration (OSHA), Virginia Occupational Safety and Health (VOSH), and the Environmental Protection Agency (EPA)
- identifying the OSHA Hazard Communication Standard (HCS)
- interpreting the information included on safety data sheets (SDS)
- describing the responsibilities of employers and employees under HCS.

**Process/Skill Questions**
Where should hazardous materials be stored?
What information can be found on an SDS?

NCCER Core Curriculum: Introductory Craft Skills, 2015

00101-15 Basic Safety
Module One (00101-15) explains the importance of safety in the construction and industrial crafts. Trainees will learn how to identify and follow safe work practices and procedures and how to properly inspect and use safety equipment. Trainees will be able to describe the safety practices associated with elevated work; energy release; and various hazards encountered on job sites.

NCCER Masonry Standards

Level One, Module Two (28106-13): Masonry Safety
This module describes how to identify the common causes of accidents and the hazards associated with masonry tools, equipment, mortar, and concrete. This module also provides information about how to prevent accidents and hazards on the job site by using personal protective equipment, working safely from elevated surfaces, properly using masonry tools and equipment, and handling masonry materials safely.

Task Number 40

Identify personal protective equipment (PPE) requirements.

Definition

Identification could include procedures for inspecting, wearing, and removing

- eye protection
- a respirator
- a hard hat
- gloves
- a safety harness
- hearing protection
- safety shoes.

Identification should also include explaining when particular PPE is required.

Process/Skill Questions

- What are some dangerous effects of sun exposure, and how can one significantly prevent these effects?
- Why is wearing jewelry prohibited while in the lab or on the jobsite?
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NCCER Masonry Standards

Level One, Module One (28101-13): Introduction to Masonry
This module provides information about basic masonry materials, tools, techniques, and safety precautions; explains how to mix mortar by hand and lay masonry units; and describes the skills, attitudes, and abilities of successful masons.

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Task Number 41
Maintain a safe working environment.

Definition
Maintaining safety should result in identifying potential hazards on a jobsite or in the lab, such as

- unstable or improperly erected scaffolding
- electrical hazards
- jobsite debris
- improperly stored materials
- air quality hazards.

When present, hazards must be remedied, in compliance with school and instructor guidelines.

Process/Skill Questions

- What are some examples of jobsite hazards?
- Why is it important to use good housekeeping standards on a jobsite?
- Why is it important to store materials and tools in their proper place?
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Task Number 42

Explain safe working practices around electrical hazards.

Definition

Explanation should include

- identifying equipment used to test electrical circuits
- describing safe working conditions (e.g., grounding, using ground-fault circuit interrupters [GFCI] and cords)
- demonstrating safe work habits.

Process/Skill Questions

- What is the definition of proximity work?
- What are safe working clearances according to the National Electrical Code (NEC)?
- What are considered safe working conditions and safe working habits?
- What is the unseen hazard with electrical work?
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Task Number 43

Identify emergency first-aid procedures.

Definition
Identification should include standard first-aid procedures and school policies regarding incidents involving

- bodily fluids
- electrical injuries
- eye injuries
- falls
- burns.

Process/Skill Questions

- What steps should be followed in the event of an accident?
- Why is knowing cardiopulmonary resuscitation (CPR) important?
- Why is it important to be certified to administer first aid?
- What are the different classifications (degrees) of electrical burns?

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Task Number 44

Identify the types of fires and the methods used to extinguish them.

Definition

Identification should include classifications of fires (e.g., Classes A, B, C, and D), causes and prevention of fires, types of extinguishers, and, when possible, the demonstrated use of a fire extinguisher, in accordance with government regulations and instructor guidelines.

Process/Skill Questions

- Why do fires have different classifications, and what are they?
- What is the fire triangle?
- What are the three things necessary to start a fire?
- Why is it important to know the classification of a fire when trying to extinguish it?
- Why and how often should extinguishers be inspected?
- What are the classifications of extinguishers?

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Task Number 45

Inspect course-specific hand and power tools to visually identify defects.

Definition

Inspection of tools should include

- identifying components of machinery (e.g., guards, blades, moving parts, start/stop switches)
- identifying standard safety procedures (i.e., lab practices and manufacturer recommendations)
- observing a demonstration of the safe operation and use of each piece of machinery in the lab
- identifying tool defects.

Process/Skill Questions

- What power tools are used in masonry?
- What are the proper actions to take before using a power circular saw?
- Why should a power tool always be grounded?

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Task Number 46

Demonstrate lifting and carrying techniques.

Definition

Demonstration should include

- lifting with the legs
- keeping the back straight
- holding the load close to the body
- getting help, if necessary.

Process/Skill Questions

- What are common injuries associated with improper lifting techniques?
- What can one do to prevent injury?
- How does proper positioning affect proper technique?

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Task Number 47

Demonstrate safe laddering techniques.

Definition

Demonstration should involve using appropriate conduct and safety procedures while

- using aluminum ladders (e.g., three-point contact)
- carrying ladders (e.g., two people at all times)
- erecting and setting ladders (e.g., using the 4:1 rule)
- identifying types of ladders and the components and safety features of each (e.g., wall or straight, extension, roof, attic, special-purpose, solid-beam, aluminum, wood/aluminum truss ladder, fiberglass).

Teacher resource: Parents and Educators Can Keep Young Workers Safe, U.S. Department of Labor

Process/Skill Questions

- Why are ladders rated for certain weights?
- Why is the apex (highest point) of a stepladder not considered a step?

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Task Number 48
Demonstrate safe scaffolding techniques.

Definition

Demonstration should include inspecting

- settings
- duty ratings
- safety tags.

Process/Skill Questions

- How can one determine the safe weight limit of any particular scaffolding?
- When is scaffolding preferred or required?

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Task Number 49

Report personal injuries and environmental and equipment safety violations to the appropriate authority.

Definition

Report should include

- identifying the violation
documenting the date when the incident or behavior was observed
submitting the report to the instructor, supervisor, or the local OSHA inspector.

Process/Skill Questions

- Why is it important to report injuries?
- What are common reporting procedures?
- What are the key components of a report?
- What ethical considerations might be involved when reporting coworkers?
- Why is it important to follow reporting procedures?
- What is liability?

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Task Number 50

Pass a safety exam for lab/site safety and the use of tools and equipment specific to masonry.

Definition

Passing should include use of an assessment that measures participation in safety training programs, including safety meetings and demonstrating knowledge and skills gained from program topics (e.g., interpretation of SDS).

Process/Skill Questions
• How often should one participate in safety training programs? Why?
• How does insurance affect the requirement of continuous retraining for safety?
• What is workers' compensation?

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Performing Residential Masonry

Task Number 51
Install base, sill, and lintel flashing in a residential setting.

Definition
Installation of flashing must be above grade level, at sills, and across openings to allow moisture to escape the cavity. Water must drain to the surface of the wall, either by way of weeps or wicking.

Process/Skill Questions
• What is flashing?
• What locations require flashing?
• Why is flashing necessary?

NCCER Masonry Standards

Level Two, Module Two (28202-14): Residential Masonry
This module describes the construction techniques for residential and small structure foundations, steps, patios, decks, chimneys, and fireplaces and work activities that the mason must perform, as well as those tasks that tie into the masonry work.

Task Number 52

Build quoined corners.

Definition

Building should result in a corner that is level and plumb and that maintains uniform racking and corbeling, according to plans.

Process/Skill Questions

• Where and when did quoined corners originate?
• How many bricks should there be per quoin, and how many should be placed between quoins?

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Task Number 53

Build arches.

Definition

Building should include

• jack
• segmental
• semicircular.

Bricks must have uniform joints, with the bottom edge of brick tangent to the arch form.

Process/Skill Questions

• What are types or styles of arches?
• Where is the skewback located on an arch?

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Task Number 54

Build stoops.

Definition

Building should include perimeter walls laid out to be level and plumb and tied into the foundation. The completed stoop must meet local building codes.

Process/Skill Questions

• What is a stoop?
• What is the typical slope of a stoop?
• What is the standard distance from the top of the stoop to the threshold?

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Task Number 55

Build steps.
Definition

Building should include uniform tread and riser dimensions according to plans. Completed steps must meet all local codes.

Process/Skill Questions

- What is the maximum height of a riser?
- What is the minimum width of a tread?

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Task Number 56

Install mortared paving.

Definition

Installation should include laying out the job and laying brick paving on a concrete surface according to the design in the plans. Joints must be uniform, and the surface must be flat.

Process/Skill Questions

- What is a grout bag?
- What is a grout gun?
- What type of mortar is recommended for mortared paving?

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Task Number 57
Build a fireplace and chimney.

Definition

Building should include all required elements according to plans. Completed construction must comply with local building codes.

Process/Skill Questions

- What are the requirements (i.e., size, materials) for mortar joints between firebrick?
- How tall should the chimney be above the peak of the house?

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Constructing Commercial Masonry

Task Number 58

Build a composite cavity wall system.

Definition

Building should include a 14-inch composite cavity wall, using 8-inch block and a single wythe of brick, with a 2-inch cavity between the two. Cavity must be kept clean of mortar to allow placement of rigid insulation. Wall must be built according to plans and include flashing and reinforcements to meet local building codes.

Process/Skill Questions

- What is the minimum width of a cavity in a composite cavity wall system?
- What is the purpose of the cavity?
Task Number 59

Install rigid wall insulation.

Definition

Installation includes

- identifying the types of insulation used with masonry construction
- explaining installation techniques
- measuring, cutting, and installing rigid insulation in a wall to fill the cavity according to specifications.

Process/Skill Questions

- Where should the insulation be placed?
- What should be insulated?
- What holds the insulation in place?

Task Number 60

Identify bearing plates.

Definition

Identification includes that a steel bearing plate must be placed at specified height and anchored with mortar or grout according to specifications.

Process/Skill Questions

- How are bearing plates anchored to a masonry wall?
- How is steel attached to a bearing plate?

Task Number 61

Inspect metal frames.

Definition
Inspection should include checking for proper alignment with the wall (square and plumb).

Process/Skill Questions

- How should metal frames be anchored?
- Why is it extremely important that a frame be square and plumb?
- What is the difference in a flush frame and a wrap-around frame?

NCCER Masonry Standards

Level Two, Module Four (28204-14): Masonry Openings and Metal Work
Module 28204-14 provides instruction on the methods and materials used to install masonry openings and to tie wythes together and to structural elements.

Level Two, Module Three (28203-14): Reinforced Masonry
This module describes the use of grout and other types of reinforcement, such as reinforcing steel, to strengthen and support masonry structures. The module also describes the locations where grout can be used and the techniques for placement.

Task Number 62

Describe grout procedures for high-lift and low-lift pours.

Definition

Description includes mixing grout to specified slump, filling the cavity, and consolidating the grout as specified, using both high-lift and low-lift grouting methods, according to local codes.

Process/Skill Questions

- What is the difference between a high-lift and a low-lift grout?
- What is the consistency of grout compared to that of mortar?

Task Number 63

Demonstrate the procedures for installing base, sill, and lintel flashing in a commercial setting.

Definition

Demonstration should include forming end dams above openings and corners and creating laps between sections.
Process/Skill Questions

- What is the purpose of flashing?
- How can water be diverted from the flashing to the exterior of the wall?
- What is the purpose of installing mortar-collection systems?

NCCER Masonry Standards

**Level Two, Module Four (28204-14): Masonry Openings and Metal Work**
Module 28204-14 provides instruction on the methods and materials used to install masonry openings and to tie wythes together and to structural elements.

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**Preparing the Building Site**

**Task Number 64**

**Interpret blueprints and plans.**

**Definition**

Interpretation includes

- estimating material quantities from plans and drawings
- locating and interpreting selected views or sections of the plan related to masonry construction.

**Process/Skill Questions**

- Which takes precedence, contract documents or architectural drawings? Why?
- What is the financial importance of making accurate material estimations?

NCCER Masonry Standards

**Level Two, Module One (28201-14): Residential Plans and Drawing Interpretation**
This module describes the information trainees will need in order to work with residential plans and construction drawings and convert that information into action on the job.

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**Task Number 65**
**Explain the need for and purpose of benchmarks.**

**Definition**

Explanation should include the concept that benchmarks establish a point of known elevation, which is then used as a reference in determining another elevation.

**Process/Skill Questions**

- What is a *benchmark*?
- Where is a benchmark located?

**Task Number 66**

**Establish footing grades.**

**Definition**

Establishment should include the use of leveling devices to determine top of continuous footing that provide a level surface throughout the footing. Grades must meet local building codes.

**Process/Skill Questions**

- What are *grade stakes*?
- Why is it important to consult building codes before grading?

**NCCER Masonry Standards**

**Level Two, Module Two (28202-14): Residential Masonry**

This module describes the construction techniques for residential and small structure foundations, steps, patios, decks, chimneys, and fireplaces and work activities that the mason must perform, as well as those tasks that tie into the masonry work.

**Task Number 67**

**Level walls, using a level (laser or transit).**

**Definition**

Leveling should include setting and adjusting builder's level according to instructor’s directions. Readings must be taken from wall height to ensure level coursing.
Process/Skill Questions

- What is the difference between a builder's level and a transit level?
- Why is it important to make a wall as level as possible?
- What could happen to a wall that is not level at construction?
- What natural elements can cause a wall to become uneven over time?
- What precautions should be taken when using a laser level to protect the operator and bystanders from the laser beam?

Performing Advanced Masonry

Task Number 68

Repair masonry work.

Definition

Repair should include damaged mortar joints and/or brick being removed, cleaned, and replaced to restore original quality of the wall.

Process/Skill Questions

- What are two methods of removing mortar from deteriorated mortar joins?
- What is meant by pre-hydrating the mortar?
- What safety precautions should be taken before removing mortar joints?
- Why is it important to know the age of the brick when selecting the mortar for repointing?

NCCER Masonry Standards

Level Two, Module Five (28205-14): Advanced Laying Techniques
This module contains detailed information that directs the mason in accomplishing the actual construction of walls, arches, and other useful structures. The text explains construction techniques, safety requirements, and interaction with structure components.

Task Number 69

Lay a garden wall pattern.
Definition

Laying should include adherence to plans provided. Garden wall patterns include, but are not limited to, diamond, basket weave, herringbone, and screen wall.

Process/Skill Questions

- What are common garden wall patterns?
- What bonding patterns are used to construct a garden wall?

NCCER Masonry Standards

Level Two, Module Five (28205-14): Advanced Laying Techniques
This module contains detailed information that directs the mason in accomplishing the actual construction of walls, arches, and other useful structures. The text explains construction techniques, safety requirements, and interaction with structure components.

Task Number 70

Describe mortarless concrete masonry retaining wall systems.

Definition

Description should include the following specifications:

- Trench must have a 6-inch gravel base.
- First course must be perfectly level, length and width.
- Each corresponding course must lap back by the unit standards.
- The back of the wall should be fortified with a minimum 12 inches of gravel.
- A plastic/vinyl membrane should be installed in accordance with manufacturer specifications.
- Wall should be capped with solid units provided, using exterior construction adhesive.

Process/Skill Questions

- What are the advantages of mortarless concrete masonry retaining walls over mortared retaining walls?
- What is the purpose of a retaining wall?

NCCER Masonry Standards

Level Two, Module Five (28205-14): Advanced Laying Techniques
Task Number 71

Explain mortarless concrete paver systems.

Definition

Explanation should comply with manufacturer installation specifications and guidelines.

Process/Skill Questions

- Where might one find mortarless concrete pavers?
- What kind of base should be used to support the pavers?

NCCER Masonry Standards

Level Two, Module Five (28205-14): Advanced Laying Techniques

Task Number 72

Describe thin brick systems.

Definition

Description should include the differences between adhered brick veneer and anchored brick veneer.

Process/Skill Questions

- What are advantages and disadvantages of using adhered brick veneer?

NCCER Masonry Standards

Level Two, Module Five (28205-14): Advanced Laying Techniques
This module contains detailed information that directs the mason in accomplishing the actual construction of walls, arches, and other useful structures. The text explains construction techniques, safety requirements, and interaction with structure components.

## SOL Correlation by Task

<table>
<thead>
<tr>
<th>Task</th>
<th>English: 12.5</th>
<th>History and Social Science: GOVT.7, GOVT.8, GOVT.9, GOVT.14, GOVT.15</th>
<th>Science: CH.1</th>
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<tbody>
<tr>
<td>Comply with federal, state, and local safety requirements.</td>
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<tr>
<td>Identify personal protective equipment (PPE) requirements.</td>
<td>English: 12.5</td>
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<td>Science: CH.1</td>
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<tr>
<td>Maintain a safe working environment.</td>
<td>English: 12.5</td>
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<td>Explain safe working practices around electrical hazards.</td>
<td>English: 12.5</td>
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<td>Identify emergency first-aid procedures.</td>
<td>English: 12.5</td>
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<tr>
<td>Identify the types of fires and the methods used to extinguish them.</td>
<td>English: 12.5</td>
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<td>Science: CH.1</td>
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<tr>
<td>Inspect course-specific hand and power tools to visually identify defects.</td>
<td>English: 12.5</td>
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<td>Demonstrate lifting and carrying techniques.</td>
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<td>Demonstrate safe laddering techniques.</td>
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<td>Demonstrate safe scaffolding techniques.</td>
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<tr>
<td>Report personal injuries and environmental and equipment safety violations to the appropriate authority.</td>
<td>English: 12.5, 12.6, 12.7</td>
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<tr>
<td>Pass a safety exam for lab/site safety and the use of tools and equipment specific to masonry.</td>
<td>English: 12.5</td>
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<tr>
<td>Install base, sill, and lintel flashing in a residential setting.</td>
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<td>Build quoined corners.</td>
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<td>Build arches.</td>
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<td>Build stoops.</td>
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<td>Build steps.</td>
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<td>Install mortared paving.</td>
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<td>Build a fireplace and chimney.</td>
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<td>Build a composite cavity wall system.</td>
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<td>Install rigid wall insulation.</td>
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<td>Identify bearing plates.</td>
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<td>Inspect metal frames.</td>
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<td>Describe grout procedures for high-lift and low-lift pours.</td>
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<td>Demonstrate the procedures for installing base, sill, and lintel flashing in a commercial setting.</td>
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<td>Interpret blueprints and plans.</td>
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**Entrepreneurship Infusion Units**

Entrepreneurship Infusion Units may be used to help students achieve additional, focused competencies and enhance the validated tasks/competencies related to identifying and starting a new business venture. Because the unit is a complement to certain designated courses and is not mandatory, all tasks/competencies are marked “optional.”

**Teacher Resources**

The National Center for Construction Education and Research (NCCER) provides competencies and objectives as well as modules and lesson plans. Refer to the [masonry craft page on the NCCER website](#) and access those resources on the right hand side under "Course Planning Tools."
Appendix: Credentials and Career Cluster Information

Industry Credentials: Only apply to 36-week courses

- College and Work Readiness Assessment (CWRA+)
- Construction Masonry—Block Assessment
- Construction Masonry—Brick Assessment
- Core: Introductory Craft Skills Entry-Level Assessment
- Customer Service Examination
- Customer Service Specialist (CSS) Examination
- Masonry Level One Entry-Level Assessment
- National Career Readiness Certificate Assessment
- Professional Communications Certification Examination
- Workplace Readiness Skills for the Commonwealth Examination

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<td>Design/Pre-Construction</td>
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