Massachusetts Career Technical Education

Construction Craft Laborer Framework

2014

DESE is in the process of updating all CTE Frameworks. This framework was adopted in 2014. More information about the process to update frameworks will be provided in DESE’s CCTE Newsletter.

### [Strand 2: Technical Knowledge and Skills](#_bookmark0)

* 1. Construction Craft Laborer Safety and Health Knowledge and Skills
		1. Complete safety training on all related equipment and materials.
			1. Demonstrate use of all related hand, power and pneumatic tools according to current industry and OSHA standards.
			2. Describe safety procedures related to line and grading equipment, including appropriate use of both verbal and hand communication methods.
			3. Demonstrate use and maintenance of ladders, scaffolding, and fall protection according to current industry and OSHA standards.
			4. Identify hazardous materials and demonstrate handling in accordance with workplace requirements and instructions according to current industry and OSHA standards.
			5. Select appropriate type and size of hoisting and rigging components, and demonstrate use of selected equipment according to current industry and OSHA standards.
	2. Technical Plans and Prints
		1. Accurately interpret technical plans and prints.
			1. Explain the basic layout of a set of prints and the importance of the accompanying job specification documents.
			2. Recognize and identify basic print terms, abbreviations, line types, symbols and notes.
			3. Describe and demonstrate the use of an Architect’s ruler.
			4. Interpret and follow drawing dimensions.
			5. Determine true measurements from a print using an Architect’s scale.
			6. Read and interpret plan, elevation, section and detail views and schedules.
			7. Identify, develop and complete material quantity takeoff sheets.
			8. Describe how state and/or local code requirements apply to prints.
	3. Hand, Power and Pneumatic Tools
		1. Performance Examples:
			+ Prepare an application for a designated permit.
			+ Develop a material quantity takeoff for the project/job.
			+ Draw designated cross sections and/or details.
			+ Perform shop/job site projects/work from appropriate sets of prints/drawings.
		2. Determine appropriate tools for specified tasks.
			1. Use and maintain layout, marking and measuring tools.
			2. Use and maintain fastening, clamping and dismantling tools.
			3. Use and maintain sawing, drilling and boring tools.
			4. Use and maintain planing, shaping, and smoothing tools.
			5. Use and maintain portable circular saws, portable drills, screw guns and equipment.
			6. Set up and operate diamond-blade wet saws, electric and gas-powered mixers.
			7. Use and maintain masonry tools for tending.
			8. Use and maintain surveying and pneumatic equipment.
	4. Line and Grading Equipment
		1. Performance Examples:
			+ Describe the types and functions of hand and power tools to be used for a specific project.
			+ Operate hand and power tools for a specific project from job standards and specifications, and manufacturer’s instructions.
			+ Calculate the areas and materials needed for a specific project using appropriate measuring tools.
		2. Demonstrate practices related to line and grading equipment.
			1. Follow written and verbal instructions.
			2. Give verbal instructions.
			3. Use various hand signals.
			4. Read job site drawings and blueprints.
			5. Maintain accurate and current field book.
			6. Identify measuring devices, grade rods, GPS receivers, plumb bobs, laser auto levels, and engineer’s rules and describe their use.
		3. Performance Examples:
			+ Set up tripod and level on predetermined benchmark.
			+ Adjust instrument on tripod to assure instrument is level and turns freely.
			+ Determine the difference in grade between 5 predetermined points and the benchmark in a specified area.
	5. Ladders and Scaffolds
		1. Demonstrate usage, set-up and maintenance techniques of ladders and scaffolding.
			1. Select and inspect scaffolding and components to ensure integrity.
			2. Use load tables to determine expected load on scaffold and supporting structure.
			3. Identify site access and egress.
			4. Establish adequate footing in accordance with OSHA regulations.
			5. Perform daily inspection of critical structural and safety areas for damage, corrosion, and wear, making alterations or repairs as needed.
		2. Performance Examples:
			+ Calculate the required scaffolding from given plans and prepare a scaffolding component list.
			+ Erect scaffold true to print including dimensions from structure.
			+ Upon completion of installation, disassemble scaffolding and store according to industry and OSHA standards..
	6. Masonry Skills
		1. Describe and apply fundamental masonry skills to support a Mason.
			1. Identify and describe characteristics of bricklaying and blocklaying materials.
			2. Identify and check bricklaying and blocklaying materials for conformity to material schedule, plans and specifications.
			3. Use mechanical lifting devices to load, move, unload, locate or install materials.
			4. Prepare and operate mixing equipment according to manufacturer’s instructions.
			5. Mix mortar to specifications.
			6. Assist in cleaning brick/block work surfaces and cavities of excess mortar.
			7. Identify and set up appropriate signage and barricades.
		2. Performance Examples:
			+ Students will gather material required to construct a masonry wall according to given print..
			+ Students will set up mortar mixing station, and all materials needed for wall erection.
	7. Concrete Placement
		1. Prepare, level and finish vertical and horizontal concrete placement.
			1. Set up and use differential leveling equipment.
			2. Explain and apply principles of soil compaction in operation of compaction equipment.
			3. Explain and apply soil density and testing practices and procedures.
			4. Identify and use appropriate tools.
			5. Set up and use fall protection equipment.
			6. Set up and use lasers, levels and transits.
			7. Read specifications and determine appropriate materials for forming, scaffold and concrete placement.
			8. Clean and prepare surfaces for application of appropriate bonding.
		2. Performance Examples:
			+ Students will build formwork with dimensions 10’ long 5’ wide and 6” thick.
			+ Students will tie and assemble reinforcing steel to place within form.
			+ Students will calculate amount of concrete needed.
			+ Students will remove forms, clean area, and backfill where required.
	8. Hoisting and Rigging Skills
		1. Display understanding of hoisting and rigging practices.
			1. Identify features and purposes of a variety of rigging components.
			2. Use rigging component charts to identify the appropriate type and size of components for a specific job.
			3. Determine and apply appropriate sling angle for conform to industry standards.
			4. Use correct hand signals for collaborating with the crane operator during a lift.
			5. Use appropriate terminology to communicate with the crane operator by headset or radio.
			6. Follow visual instructions on posted signs.
			7. Climb ladders safely.
			8. Practice accurate depth perception within established parameters.
		2. Performance Examples:
			+ Calculate weight and center of gravity of materials to be hoisted.
			+ Select appropriate slings and rigging hardware.
			+ Rig material to crane.
			+ Move material to predetermined area, using appropriate hand signals.
			+ Remove rigging from moved material.
	9. Trenching and Excavation Skills
		1. Utilize trenching and excavations skills appropriate to various job sites.
			1. Locate and mark indented excavation areas.
			2. Identify service markers or taped areas.
			3. Dig post holes, small pits and trenches to the specified dimensions.
			4. Apply trench collapse prevention procedures.
			5. Collaborate with machine operator to ensure predetermined route, line and depth.
		2. Performance Examples:
			+ Upon completion of trench excavation, have students select and properly place trench box within excavation.
			+ Students provide means of access and egress within protected area of said trench.
	10. Pipelaying Skills and Techniques
		1. Describe and demonstrate differentiated use of pipelaying skills and techniques.
			1. Identify and describe pipelayer types, characteristics, technical capabilities and limitations.
			2. Explain the basic principles of soil technology for civil works.
			3. Explain pipelayer and attachment operating techniques.
			4. Identify site isolation and traffic control responsibilities and authorities.
			5. Define civil construction terminology.
			6. Use various methods of changing machine attachments.
			7. Describe the characteristics of groundwater.
			8. Describe the characteristics of various soil types.
			9. Operate various types of drills.
			10. Maintain inventories of explosives and associated materials.
			11. Read instrumentation.
			12. Identify the various types of valves and their functions.
			13. Test for and repair shorted casings.
			14. Identify characteristics of various coating systems.
			15. Use appropriate equipment to apply various methods of cleaning.
		2. Performance Examples:
			+ Students assemble a live waterline using ductile iron pipe and mechanical fittings including a T, hydrant, and gate, pressurizing the entire system.
			+ Students will then tap live pipe using Mueller equipment to install corporation fittings for water service.
	11. Demolition Sites
		1. Access and demonstrate the practices of demolition.
			1. Interpret the specifications of the site demolition plan.
			2. Select tools and equipment consistent with the requirements of the demolition site.
			3. Identify hazardous materials for handling in accordance with workplace requirements, current industry and OSHA standards..
			4. Obtain confirmation that all existing services have been disconnected.
		2. Performance Examples:
			+ Students set up air compressor hoses, pneumatic tools and various safety equipment in preparation to demolish pre-poured reinforced concrete slab.
			+ Students will demonstrate techniques for demolition and disposal of materials according to current industry and OSHA standards..
	12. Metal Arc Welding
		1. Apply shielded metal arc welding skills.
			1. Identify welding safety and set-up.
			2. Identify, place and use fire extinguishers.
			3. Describe the fundamentals of basic electricity.
			4. Identify the various polarities used in welding operations.
			5. Apply preventive strategies to avoid safety hazards posed by welding in a wet environment or by exposed current-carrying elements.
			6. Describe and demonstrate the operation and safety procedures of Oxy- Acetylene welding.
		2. Performance Examples:
			+ Students attach test plate vertically, horizontally and overhead to work area.
			+ Set up and demonstrate the use of the Oxy-Acetylene cutting torch.
	13. Weatherization
		1. Apply weatherization skills and techniques.
			1. Explain the practices related to Basic Building Science Learning.
			2. Explain what is meant by the whole house approach to weatherization.
			3. Describe the different types of energy systems and how they work.
			4. Describe how energy and energy conservation principals work.
			5. Differentiate between the Thermal Envelope and the Pressure Envelope.
			6. Explain and describe R-Values and U-Values.
			7. Demonstrate and explain the practices of sealing the Building Envelope.
			8. Describe the tools and materials used to construct and seal a new home.
			9. Explain the importance of proper ventilation in a home.
			10. Explain and demonstrate how to locate air leakage in a home.
			11. Explain the different products used to seal leaks.
		2. Performance Examples:
			+ Students will measure frame and cut weather-stripping to required length.
			+ Students will install door sweep according to manufacturer’s directions.

# [Strand 3: Embedded Academics](#_bookmark0)

Strand 3: Embedded Academics, a critical piece of a Vocational Technical Education Framework, are presented as Crosswalks between the Massachusetts Vocational Technical Education Frameworks and the Massachusetts Curriculum Frameworks. These Crosswalks are located in the Appendix of this Framework.

###### Academic Crosswalks

[Appendix A: English Language Arts](#_bookmark20) [Appendix B: Mathematics](#_bookmark20)

[Appendix C: Science and Technology/Engineering](#_bookmark22) Earth and Space Science

Life Science (Biology)

Physical Science (Chemistry and Physics) Technology/Engineering

# [Embedded Academic Crosswalks](#_bookmark0)

#### [Embedded English Language Arts and Literacy](#_bookmark0)

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| CTELearning Standard Number | Strand Coding Designation Grades ELAsLearning Standard Number | Text of English Language Arts Learning Standard |
| 2.B.012.F.012.G.012.K.01 | RI Grades 9-10 #4 | Determine the meaning of words and phrases as they are used in atext, including figurative, connotative, and technical meanings;analyze the cumulative impact of specific word choices on meaningand tone.Performance Example:Students will perform shop/job site projects/work from appropriate set of prints/drawings/instructions. |
| 2.B.012.F.012.I.012.K.012.L.01 | W Grades 9-10 #4 | Produce clear and coherent writing in which the development,organization, and style are appropriate to task, purpose, andaudience.Performance Example:Students will prepare an application for an appropriate permit and/or develop a material quantity takeoff for the project/job. |
| 2.B.012.D.012.I.012.K.012.L.01 | SL Grades 9-10 #4 | 4. Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line ofreasoning and the organization, development, substance, and styleare appropriate to purpose, audience, and task.6. Adapt speech to a variety of contexts and tasks, demonstratingcommand of formal English when indicated and appropriate.Performance Example:Students will discuss state and local building code requirements for a given project. |
| 2.C.012.D.012.E.012.G.012.H.012.I.012.J.01 | RST Grades 9-12 #4 | Determine the meaning of symbols, key terms, and other domain- specific words or phrases as they are used in a specific scientific ortechnical context relevant to grades 9-12 texts and topics.Performance Example:* Students will identify and define various symbols, key terms, and abbreviations on a variety of technical plans and prints. Students will describe the types and functions of hand and power tools to be used for a specific project. Given a set of job standards and specifications, students will operate hand and power tools is a safe and appropriate manner.
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| 2.D.012.H.012.I.01 | WHST Grades 9-10 #2(d, e) | D) Use precise language and domain-specific vocabulary to managethe complexity of the topic and convey a style appropriate to thediscipline and context as well as to the expertise of likely readers.E) Establish and maintain a formal style and objective tone whileattending to the norms and conventions of the discipline in which they are writing.Performance Example:Students will demonstrate a command of precise language and domain-specific vocabulary while giving verbal instructions related to line and grading equipment, explaining civil construction terminology, and explaining pipelayer |

#### [Embedded Mathematics](#_bookmark0)

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| CTELearning Standard Number | Math Content Conceptual Category and Domain Code Learning Standard Number | Text of Mathematics Learning Standard |
| 2.B.01 | N-Q1G-SRT1 | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.Verify experimentally the properties of dilations given by a center and a scale factor.Performance Example:Students will draw a polygon on a coordinate grid. Given different scale factors (larger and smaller), students will re-draw polygon given different scale factors. |
| 2.C.01 | G-GPE7 | Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, using the distance formula.Performance Example:Students will draw a rectangle, triangle, and a square on a coordinate grid, determining perimeter and area of each. |
| 2.D.01 | S-ID7G-GPE5 | Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems.Performance Example:Students will measure various staircases, both interior and exterior, record the data, and determine the slope of each. |
| 2.E.01 | G-CO12 | Make formal geometric constructions with a variety of tools and methods.Performance Example:Students will construct paper rectangular prisms, estimate the amount of weight each prism can support, and determine accuracy by stacking prisms until collapse. |
| 2.F.01 | N-Q1 | Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs anddata displays.Performance Example:Students will compute area for project and volume of material needed to complete. |
| 2.G.01 | G-GPE5 | Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems.Performance Example:Students will determine the equations of parallel and perpendicular lines that pass through a given point on a coordinate plane. |
| 2.H.01 | G-CO9 S-ID1 | Prove theorems about lines and angles.Represent data with plots on the real number line (dot plots, histograms, and box plots).Performance Example:Students will determine the angle measurements of right triangles given various side lengths. |
| 2.I.01 | G-MG2 MA.4 | Apply concepts of density based on area and volume in modeling situations.Use dimensional analysis for unit conversions to confirm that expressions and equations make sense.Performance Example:Students will determine the area and volume of cylinders, triangular prisms, and rectangular prisms. |

#### [Embedded Science and Technology/Engineering](#_bookmark0)

##### Earth and Space Science

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| CTELearning Standard Number | Subject Area, Topic Heading andLearning Standard Number | Text of Earth and Space Learning Standard |
| 2.G.01 | 3 Earth Process and Cycles 3.1 | Explain how physical and chemical weathering leads to erosion and the formation of soils and sediments, and creates various types oflandscapes. Give examples that show the effects of physical and chemical weathering on the environment.Performance Example:Students will build formwork for sidewalk with dimensions 10’ long, 5’ wide and 6” thick. |
| 2.I.01 | Earth Processes and Cycles 3.6 | Describe the rock cycle, and the processes that are responsible for the formation of igneous, sedimentary, and metamorphic rocks.Compare the physical properties of theses rock types and the physical properties of common rock forming minerals.Performance Example:Students will identify basic concrete framework principles and applications. Students will provide proper means of access and egress within protected area of a trench. |
| 2.I.01 | 3 Earth Processes and Cycles 3.4 | Explain how water flows into and through a watershed. Explain the roles of aquifers, wells, porosity, permeability, water table, andrunoff.Performance Example:Upon completion of trench excavation, students will select and properly place trench box within the excavation site. |
| 2.J.01 | 2 Energy Resources in the Earth System 2.1 | Recognize, describe, and compare renewable energy resources (e.g.solar, wind, water, biomass and nonrenewable energy resources: fossil fuels, nuclear energy).Performance Example:Students will be able to compare and contrast different types of energy systems, and describe how energy conservation principles work. |
| 2.L.01 | 1 Matter and Energy in the Earth System 1.1 | Identify Earth’s principal sources of internal and external energy, such as radioactive decay, gravity and solar energy.Performance Example:Students will describe the different types of energy systems, and apply energy conservation principles to a residential structure. |
| 2.L.01 | 2. Energy Resources in the Earth System 2.2 | Describe the effects on the environment and on the carbon cycle of using both renewable and nonrenewable sources of energy.Performance Example:Students will demonstrate an understanding of the carbon cycle, as it relates to proper ventilation in a home. |

##### [Life Science (Biology)](#_bookmark0)

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| CTELearning Standard Number | Subject Area, Topic Heading andLearning Standard Number | Text of Biology Learning Standard |
| 2.G.01 | Life Science, Energy and Living Things 15 | Explain how dead plants and animals are broken down by other living organisms and how this process contributes to the system as a whole.Performance Example:Students will demonstrate an understanding of soil density and perform soil quality and density tests. |

##### [Physical Science (Chemistry)](#_bookmark0)

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| CTELearning Standard Number | Subject Area, Topic Heading andLearning Standard Number | Text of Chemistry Learning Standard |
| 2.F.01 | 7. Solutions, Rates of Reaction, and Equilibrium 7.1, 7.3 | 7.1 Describe the process by which solutes dissolve in solvents.7.3 Identify and explain the factors that affect the rate of dissolving (e.g. temperature, concentration, surface area, pressure, mixing).Performance Example:Students will demonstrate an understanding of the process by which solutes dissolve in solvents by mixing mortar to specifications. |
| 2.F.012.G.01 | 6. States of Matter, KineticMolecular Theory, and Thermochemistry 6.4 | Describe the law of conservation of energy. Explain the difference between an endothermic process and an exothermic process.Performance Example:Students will identify basic concrete principles and understand process is exothermic. |
| 2.G.01 | 8. Acids and Bases and Oxidation-Reduction Reactions 8.4 | Describe oxidation and reduction reactions and give some everyday examples, such as fuel burning and corrosion. Assign oxidation numbers in a reaction.Performance Example:Students will demonstrate an understanding of soil density and perform soil quality and density tests. |

##### [Physical Science (Physics)](#_bookmark0)

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| CTELearning Standard Number | Subject Area, Topic Heading andLearning Standard Number | Text of Physics Learning Standard |
| 2.F.01 | 1 Motion and Force 1.5 | Use a free-body force diagram to show forces acting on a system consisting of a pair of interacting objects. For a diagram with only co-linear forces, determine the net force acting on a system andbetween the objects.Performance Example:Students will set up mortar mixing station, and all the materials needed for wall erection. |
| 2.G.01 | 1 Motion and Force 1.2 | Distinguish between displacement, distance, velocity, speed, andacceleration. Solve problems involving displacement, distance velocity, speed, and constant acceleration.Performance Example:Students will demonstrate an understanding of displacement by tying and assembling reinforcing steel to place within form. |
| 2.H.01 | 1 Motion and Force 1.1 | Compare and contrast vector quantities (e.g. displacement, velocity,acceleration force, linear momentum) and scalar quantities (e.g. distance, speed, energy, mass, work).Performance Example:To demonstrate hoisting and rigging skills, students will be able to define and apply appropriate sling angle to conform to industry standards. |
| 2.K.01 | 5 Electromagnetism 5.5, 5.6 | 5.5 Explain how electric current is a flow of charge caused by a potential difference (voltage), and how power is equal to current multiplied by voltage.5.6 Recognize that moving electric charges produce magnetic forces and moving magnets produces electric forces. Recognize that theinterplay of electric and magnetic forces is the basis for electric motors, generators, and other technologies.Performance Example:Students will set up air compressor hoses, pneumatic tools and various safety equipment in preparation to demolish pre-poured reinforced concrete slab. |

##### [Technology/Engineering](#_bookmark0)

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| CTELearning Standard Number | Subject Area, Topic Heading andLearning Standard Number | Text of Technology/Engineering Learning Standard |
| 2.B.012.C.012.D.01 | 1. Materials, Tools, and Machines 1.2, 1.3 | * 1. Identify and explain appropriate measuring tools, hand tools, and power tools used to hold, lift, carry, fasten, and separate, and explain their safe and proper use.
	2. Identify and explain the safe and proper use of measuring tools, hand tools, and machines (e.g., band saw, drill press, sander, hammer, screwdriver, pliers, tape measure, screws, nails, and other

mechanical fasteners) needed to construct a prototype of an engineering design.Performance Example:Students will safely and properly use a variety of measuring, hand, power and pneumatic tools, including the following: Architect’s ruler, drills, clamps, circular saws, and screw guns.. |
| 2.B.01 | 3. CommunicationTechnologies 3.4 | 3.4 Identify and explain how symbols and icons (e.g., international symbols and graphics) are used to communicate a message.Performance Example:* Students will recognize and identify basic print terms, abbreviations, lines symbols and notes on technical plans and prints. Doing so will demonstrate an understanding of how symbols and icons are used to communicate a message.
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| 2.E.01 | 7 ManufacturingTechnologies 7.2 | Identify the criteria necessary to select safe tools and procedures for a manufacturing process (e.g. properties of materials, required tolerances, end-uses).Performance Example:* Students will demonstrate the safe and proper use of a variety of measuring, hand, power and pneumatic tools. Students will accurately calculate how much scaffolding is needed and will develop a scaffold component list.
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| 2.F.01 | 7 ManufacturingTechnologies 7.1 | Describe the manufacturing processes of casting and molding, forming, separating, conditioning, assembling, and finishing.Performance Example:Students will identify and describe the characteristics of bricklaying, and will gather material needed to construct a masonry wall. |
| 2.B.01 | 1Engineering Design 1.5 | Interpret plans, diagrams, and working drawings in the construction of prototypes or models.Performance Example:Students will recognize and identify basic print terms, abbreviations, lines symbols and notes on technical plans and prints. Students will interpret and follow drawing dimensions. |
| 2.B.01 | 1 Engineering Design 1.4 | Interpret and apply scale and proportion to ortho- graphic projections and pictorial drawings (e.g., ¼”= 1’0”. 1 cm = 1m).Performance Example:Students will draw appropriate cross sections and/or details. |
| 2.B.01 | 2 Construction Technologies2.6 | Recognize the purposes of zoning laws and building codes in the design and use of structures.Performance Example:Students will prepare an application for an appropriate permit. |
| 2.C.01 | 2 Construction Technologies2.5 | Identify and demonstrate the safe and proper use of common hand tools, power tools, and measurement devices used in construction.Performance Example:Describe the types and functions of hand and power tools to be used for a specific project. |
| 2.D.01 | 1 Engineering Design 1.3 | Produce and analyze multi-view drawings (orthographic projections) and pictorial drawings (isometric, oblique, perspective), using various techniques.Performance Example:Students will set up tripod and level on predetermined benchmark. |

[Industry Recognized Credentials (Licenses and Certifications/Specialty Programs)](#_bookmark0)

Licenses and Certifications Earned by Qualifying High School Graduates (HS) and Apprenticeship Program Graduates (AP) and Related Technical Courses:

CCHS = Technical Course Completed in High School

IHS = Technical Course Introduced in High School, but completed in the Apprenticeship Program

* Scaffold Builder – User (HS) (CCHS)
* OSHA 10 Hour Construction Outreach (HS) (CCHS)
* OSHA 30 Hour Construction Outreach (HS, or AP) (CCHS)
* American Welding Society – Vertical Fill-it Certification (AP) (IHS)
* American Welding Society – Horizontal Fill-it Certification (AP) (IHS)
* American Welding Society – Overhead Fill-it Certification (AP)(IHS)
* American Crane Institute Hoisting & Rigging Certification – (AP)(IHS)
* Microbial Remediation (AP)(IHS)
* Department of Transportation Flagging (AP)(IHS)
* Masonry Contractors Association of America (AP)
* Forklift Trainer Certification – Rough Terrain (AP)
* Marr Elevator Work Platform Certification (AP)

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