CONSTRUCTION TECHNOLOGIES 46.0415.00 TECHNICAL STANDARDS

Arizona CTE's Construction Technologies Program Technical Standards are updated and adopted from the National Center for Construction Education Research (NCCER), the leading provider of construction education for industry and career and technical education programs. The Arizona Career and Technical Education Quality Commission, the validating authority for the Arizona Skills Standards Assessment System, reviewed these standards on May 27, 2025.

Note: Arizona's Professional Skills are taught as an integral part of the Construction Technologies program.

The Technical Skills Assessment for Construction Technologies is available 2026-2027.

Note: In this document i.e. explains or clarifies the content and e.g. provides examples of the content that must be taught.

STANDARD 1.0 MAINTAIN A SAFE WORK ENVIRONMENT

1.1 Comply with OSHA's (Occupational Health and Safety Administration) safety and health standards [e.g., safe work attire and PPE (personal protective equipment); fall protection requirements; lifting procedures; stuck-by, caught-in, and caught between hazards; lockout tagout (LOTO) procedure; fire protection plan; emergency plan; and Safety Data Sheets (SDS)]

1.2 Explain safe work procedures around electrical hazards

1.3 Identify types of fires and the appropriate use of fire extinguishers

1.4 Describe methods to establish work zone safety per Standard, U.S. Code of Federal Regulations 1926 (i.e., danger signs, caution signs, information signs, safety instruction signs, barricades and barriers, etc.)

1.5 Practice safe use, maintenance, and storage of hand tools, power tools, and equipment according to manufacturer guidelines

1.6 Follow good housekeeping procedures for the worksite (e.g., keeping the work area clean, storing materials properly, eliminating hazards, performing safety checks, and reporting injuries, incidents, and near misses)

STANDARD 2.0 APPLY CONSTRUCTION MATH SKILLS

2.1 Add, subtract, multiply, and divide whole numbers

2.2 Add, subtract, multiply, and divide fractions

2.3 Add, subtract, multiply, and divide decimals

2.4 Convert decimals, fractions, and percentages

2.5 Use English and metric rulers and measuring tapes

2.6 Identify common length, weight, volume, and temperature units in inch-pounds and metric systems and convert them into other comparable units

2.7 Identify angle types

2.8 Identify common geometric shapes and summarize their qualities

2.9 Calculate the area of two-dimensional shapes

2.10 Calculate the volume of three-dimensional shapes

2.11 Calculate the quantities of materials needed for a job

2.12 Calculate cost estimate based on the job specifications (i.e., timeline, materials, equipment, labor, etc.)

STANDARD 3.0 USE CONSTRUCTION DOCUMENTS AND TECHNOLOGY TOOLS

3.1 Describe guidelines and details provided by construction documents (i.e., blueprint, diagrams, drawings, specification sheets, site layout plans, cutting list, schedule, etc.)

3.2 Identity six types of construction drawings and explain their use (e.g., civil plans, architectural plans, structural plans, mechanical plans, plumbing/piping, and electrical plans)

3.3 Explain the basic components of a construction drawing (e.g., title block, border, drawing area, revision block, legend, and north arrow)

3.4 Explain drawing elements (i.e., lines, symbols, keynotes, etc.)

3.5 Explain how dimensions relate to drawing scales

3.6 Use scales to interpret drawing dimensions (e.g., engineer's scales, architect's scales, and metric scale)

3.7 Explain the importance of building codes (i.e., National Electric Code, IBC, Plumbing Code, state/county/city codes, Americans with Disabilities Act, etc.)

3.8 Identify software applications and technology tools used in construction [i.e., electronic software (email, operating system, spreadsheet, word processing, text messaging, instant messaging), radios, intercoms, smartphone, drones, robots, AI, etc.]

STANDARD 4.0 USE HAND, POWER, AND PNEUMATIC TOOLS

4.1 Identify and explain the use of common hand tools (i.e., hammers and demolition tools, chisels and punches, screwdrivers, socket wrenches, plyers, etc.)

4.2 Identify and explain the use of layout, marking, and measurement tools (i.e., metal rule, carpenter's square, engineer's square, marking gauge, sliding T-bevel, marking knife, etc.)

4.3 Identify and describe how to use common power/pneumatic tools [i.e., electric drill, jack hammer, saws (jigsaw, circular, reciprocating, cutoff, miter, table) grinders (portable, bench), sanders, wrenches, nail and staple guns, etc.]

STANDARDS 5.0 DEMONSTRATE MASONRY WORK

5.1 Describe the benefits of masonry construction (i.e., structural integrity, durability, fire resistance, aesthetic appeal, thermal efficiency, etc.)

5.2 Identify basic masonry materials (i.e., stone, bricks, concrete blocks, glass bricks, stucco, etc.)

5.3 Explain basic masonry techniques (e.g., bricklaying, dry-stone masonry, rubble masonry, bonding, pointing, and ashlar masonry)

5.4 Explain the primary functions of mortar and grout in masonry construction

5.5 Mix mortar and grout for masonry installation

5.6 Use masonry tools (i.e., wire brush, hammer, jointers, masonry square, masonry saw, plumb bob, chisel, mortar board, straight edge, etc.)

5.7 Calculate masonry work according to project specifications (i.e., volume of brick, brick size, number of bricks, quantity of mortar, etc.)

5.8 Lay brick block to specification

5.9 Clean brick/block work surfaces and cavities and remove excess mortar

5.10 Use a level to evaluate masonry work

STANDARD 6.0 DEMONSTRATE FLOOR AND CEILING FRAMING

6.1 Identify the components of a floor system (e.g., floor covering, underlayment, subfloor, and floor joists)

6.2 Explain the function of the floor plan (e.g., to illustrate a property's design and structural details such as walls, windows, doors, and stairs of a property)

6.3 Describe what the floor framing plan shows (i.e., the layout of the supporting features such as bearing walls, columns, beams, girders, etc.)

6.4 Identify types of floor frames (i.e., floor joist, head joist, blocking, beam, sill plate, subfloor, etc.)

6.5 Identify fasteners used in floor systems (i.e., screws, nuts and bolts, washers, self-drilling screws, anchor bolts, rivets, etc.)

6.6 Identify ceiling components (i.e., joists, noggins or struts, lateral restraints, insulation and ceiling board, coving, etc.)

6.7 Identify ceiling accessories (i.e., trim, crown molding, adhesive, etc.)

6.8 Calculate the amount of material needed to frame a floor and the ceiling

6.9 Layout and construct a floor system

6.10 Layout and construct ceiling framing

STANDARD 7.0 DEMONSTRATE INTERIOR AND EXTERIOR WALL FRAMING

7.1 Define wall framing (e.g., the vertical and horizontal members of exterior walls and interior partitions)

7.2 Identify wall framing specifications and building requirements (i.e., IRC custom and standard codes, stud size for interior load, wall weight, location of windows, doors, electrics, plumbing, HVAC, etc.)

7.3 Layout wall lines including plates, corner posts, door and window openings, pony/half wall, partition Ts, bracing, and firestops

7.4 Calculate the materials, fasteners, and adhesives required to frame walls

7.5 Calculate lumber, panel, and concrete quantities

7.6 Assemble wood and metal stud walls

7.7 Assemble, erect, and brace exterior walls for a framed building

STANDARD 8.0 DEMONSTRATE ROOF FRAMING AND FINISHING

8.1 Describe the components of a roof plan [i.e., roof design (e.g., gable, gambrel, hip, mansard, flat), rafters vs trusses, roofing application, roofing sheathing, and roofing finish]

8.2 Identify the common layers of a roof (i.e., shingles, flashing, underlayment, ice and water protector, roof frame, roof's edge, etc.)

8.3 Describe the common roofing applications (e.g., self-adhered, heat-applied, liquid or cold applied, and mechanically attached)

8.4 Discuss the factors that determine what roofing application to use (i.e., cost, local building codes, energy efficiency, maintenance, lifespan, etc.)

8.5 Define roof sheathing and explain its importance

8.6 Explain the main framing structures of a roof (e.g., rafters and trusses) and the roof framing parts (e.g., rafters, trusses, and joists)

8.7 Estimate the materials used in framing and sheathing a roof

8.8 Calculate lumber and panel quantities

8.9 Frame and finish a roof

STANDARD 9.0 ANALYZE GREEN BUILDING SUSTAINABILITY

9.1 Explain a green or sustainable building (e.g., a physical barrier separates the interior of the building from the outside environment to protect the building from the weather, to separate conditioned space to the unconditioned space, and to save energy)

9.2 Identify the elements of building envelope (e.g., foundation, exterior walls, windows, doors, and roof)

9.3 Identify insulation materials for optimizing energy efficiency and maintaining comfortable indoor temperatures

9.4 Describe tools and materials used to construct and seal a new home or building

9.5 Explain procedures to seal the building envelope (i.e., renewable energy sources, rainscreen systems, self-cleaning technology, materials with good thermal inertia, metal roofs, windows located to capture natural light, facades that reduce energy inputs, etc.)

9.6 Compare, select, and use products to seal leaks and maximize energy efficiency

STANDARD 10.O INSTALL EXTERIOR FINISHES

10.1 Differentiate among finishes, trim, and molding

10.2 Explain the functional and aesthetic purposes of exterior finishes applied around openings, windows, doors, attic vents, crawl space vents, shutters, etc.

10.3 Identify examples of exterior molding and trim [i.e., gable pediment, brackets, polyvinyl chloride (PVC), wood, etc.]

10.4 Explain common exterior trim terms (i.e., fascia, frieze, rake, barge, soffit, box end, gutters, etc.)

10.5 Describe types and applications of exterior finishing materials (e.g., stucco, wood siding, vinyl and metal siding, fiber cement siding, and brick veneer)

10.6 Apply exterior finishes according to the plan (i.e., stucco, siding, soffits, wainscot, etc.)

STANDARD 11.O INSTALL INTERIOR TRIM AND STAIRS

11.1 Identify types of millwork (i.e., floors, doors, panels, stair parts, cabinets, moldings, cornices and archways, etc.)

11.2 Define interior trim (e.g., the edge material used around doors, windows, between different floors, and on walls and ceilings)

11.3 Identify types of interior trim (i.e., wood, fiberboard, vinyl, fiber cement, wood-plastic, etc.)

11.4 Explain the Rule of 25 for safe comfortable stairs

11.5 Identify types of stair railings (i.e., steel, aluminum, and wrought iron for commercial and industrial settings; wood provides a more classic appearance, etc.)

11.6 Design and layout ideas for staircases

11.7 Calculate the cost to install a small stair unit

STANDARD 12.0 ASSEMBLE PIPING, WASTE, AND VENTING SYSTEMS

12.1 Identify basic piping systems (e.g., water supply, drainage, and venting)

12.2 Identify the major components of a water distribution system (i.e., pipes, valves, vents, traps, sewer lines, pumps, etc.)

12.3 Explain how a plumbing venting system works (e.g., ensures fresh air gets into the drainage pipes so that water can move from the toilet, sink, or shower)

12.4 Explain the function of plumbing fixtures and equipment (i.e., boilers, water heaters, etc.)

12.5 Measure, cut, and join plastic and copper piping

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12.6 Explain how an efficient drainage and water distribution system affects the usage of water

12.7 Assemble a soil waste and vent (plumbing) system

12.8 Assemble a water distribution system

STANDARD 13.0 INSTALL ELECTRICAL COMPONENTS/SYSTEM

13.1 Refer to the NFPA 70E Standard for Electrical Safety in the Workplace (i.e., minimum approach distance, arc flash boundaries, lockout/tagout, appropriate PPE, etc.)

13.2 Explain Ohm's law of basic electrical theory (e.g., the relationship among voltage, resistance, and amperage in a circuit)

13.3 Define electrical system (e.g., box containing electrical components that transport electrical power for electrical outlets, lights, and switches)

13.4 Identify and explain types of electrical systems (i.e., three-phase, single-phase, medium voltage, line voltage, low voltage, etc.)

13.5 Identify major components of an electrical system (i.e., resistor, capacitor, inductor, etc.)

13.6 Identify electrical materials used in construction projects (i.e., electrical box, wiring system, circuit breaker, power strip, digital multimeter, etc.)

13.7 Identify electrical tools and testing equipment (e.g., battery testers, voltage testers, wire tracers, outlet testers, circuit testers, multimeters, oscilloscopes, and generators)

13.8 Rough in electrical enclosures (e.g., switch boxes, outlet boxes, conduit fabrication, wire pulling, raceway, and box capacity)

13.9 Demonstrate the termination of electrical devices, appliances, light fixtures, and ceiling fans

STANDARD 14.0 INSTALL INTERIOR WALL AND CEILING FINISH

14.1 Identify types of wall and ceiling finishes (i.e., drywall, hardwood, fiberboard, particleboard, wood paneling, etc.)

14.2 Identify finishing tools (i.e., trowels, silica, sanders, screw guns, plastering tools, utility knife, dust mask, tape measure, etc.)

14.3 Describe and demonstrate techniques for handling, staging, storing, and cutting drywall and drywall materials

14.4 Use fasteners, anchors, and adhesives to fasten drywall

14.5 Demonstrate drywall finishing techniques (i.e., use Portland or gypsum plaster, use tape and apply joint compound, use tape/mesh, install corner bead, etc.)

14.6 Demonstrate appropriate order, material use, and paint application for walls, trims, and ceilings

STANDARD 15.0 PREPARE, PLACE, AND FINISH CONCRETE

15.1 Identify uses of concrete (i.e., driveways, sidewalks, patios, foundation, floors, walls, etc.)

15.2 Refer to job specifications for materials needed to form, scaffold, and place concrete

15.3 Explain the ingredients of concrete (e.g., cement, water, and sand and gravel aggregates)

15.4 Identify the properties of concrete (e.g., workability, strength, curability, creep, shrinkage, unit weight, modular ratio, and Poisson's ratio)

15.5 Identify equipment and tools for moving and handling concrete (i.e., wheelbarrows, belt conveyors, forklifts, trolleys, manual lifting, etc.)

15.6 Mix, convey, and finish concrete

15.7 Explain the concrete leveling process [e.g., when/why leveling is required, needed equipment (automatic level, tripod, leveling rod, and benchmark)]