Department of Education | College, Career and Technical Education

Published May 2022

Fundamentals of Construction

Primary Career Cluster:	Architecture & Construction
Course Contact:	CTE.Standards@tn.gov
Course Code(s):	C17H15
Prerequisite(s):	None
Credit:	1
Grade Level:	9
Elective Focus -Graduation Requirements:	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Architecture & Construction courses.
POS Concentrator:	This course satisfies one out of two required courses that meet the Perkins V concentrator definition, when taken in sequence in the approved program of study.
Programs of Study and Sequence:	This is the first course in the *Residential & Commercial Construction, Structural Systems,* and *Mechanical, Electrical, & Plumbing (MEP) Systems* programs of study.
Aligned Student Organization(s):	SkillsUSA: https://www.skillsusatn.org/
Coordinating Work-Based Learning:	Teachers are encouraged to use embedded WBL activities such as informational interviewing, job shadowing, and career mentoring. For information, visit https://www.tn.gov/content/tn/education/career-and-technical-education/work-based-learning.html.
Promoted Tennessee Student Industry Credentials:	Credentials are aligned with postsecondary and employment opportunities and with the competencies and skills that students acquire through their selected program of study. For a listing of promoted student industry credentials, visit https://www.tn.gov/education/career-and-technical-education/student-industry-certification.html
Teacher Endorsement(s):	501, 502, 522, 523, 524, 527, 532, 553, 554, 555, 556, 567, 575, 580, 584, 585, 592, 598, 701, 702, 703, 705, 706, 707
Required Teacher Certifications/Training:	None
Teacher Resources:	https://www.tn.gov/education/career-and-technical-education/career-clusters/cte-cluster-architecture-construction.html Best for All Central: https://bestforall.tnedu.gov/

Approved Jan. 30, 2015; Amended Jan. 31, 2018, Nov. 2021

Course-At-A-Glance

CTE courses provide students with an opportunity to develop specific academic, technical, and 21st century skills necessary to be successful in career and in life. In pursuit of ensuring every student in Tennessee achieves this level of success, we begin with rigorous course standards which feed into intentionally designed programs of study.

Students engage in industry relevant content through general education integration and experiences such as career & technical student organizations (CTSO) and work-based learning (WBL). Through these experiences, students are immersed with industry standard content and technology, solve industry-based problems, meaningfully interact with industry professionals and use/produce industry specific, informational texts.

Using a Career and Technical Student Organization (CTSO) in Your Classroom

CTSOs are a great resource to put classroom learning into real-life experiences for your students through classroom, regional, state, and national competitions, and leadership opportunities. Below are CTSO connections for this course, note this is not an exhaustive list.

- Participate in CTSO Fall Leadership Conference to engage with peers by demonstrating logical thought processes and developing industry specific skills that involve teamwork and project management.
- Participate in contests that highlight job skill demonstration. These include Career Pathways Showcase, Job Interview, Carpentry, Electrical Wiring, Plumbing, and Masonry.

Using a Work-based Learning (WB) in Your Classroom

Sustained and coordinated activities that relate to the course content are the key to successful work-based learning. Possible activities for this course include the following. This is not an exhaustive list.

- **Standards 1.1-1.3** | Include a safety briefing in a visit to an industry partner/job site.
- **Standards 3.1-3.3 |** Guest speaker.
- **Standards 4.1-4.2** | Visit a local company and discuss career options with those employees.
- **Standards 5.1-6.1** | Ask an industry rep to discuss how important measurement and math is in construction.
- **Standards 9.1-9.3** | Ask an industry rep to discuss the impact of drawings and specifications on the job.
- **Standard 10.1** | Do a project that is used by a local industry or evaluated by local industry managers.

Course Description

Fundamentals of Construction is a foundational course in the Architecture & Construction cluster covering essential knowledge, skills, and concepts required for careers in construction. Upon completion of this course, proficient students will be able to describe various construction fields and outline the steps necessary to advance in specific construction careers. Students will be able to employ tools safely and interpret construction drawings to complete projects demonstrating proper measurement and application of mathematical concepts. Standards in this course also include an overview of the construction industry and an introduction to building systems and materials. Students will begin compiling artifacts for inclusion in their portfolios, which they will carry with them throughout the full sequence of courses in their selected program of study.

Course Standards

1. Safety

1.1 Safety Rules: Identify **safety hazards on a jobsite** and demonstrate **practices for safe working conditions**. Accurately read, interpret, and demonstrate adherence to safety rules, including but not limited to rules pertaining to electrical safety, Occupational Safety and Health Administration (OSHA) guidelines, and state and national code requirements. Be able to distinguish between the rules and explain **why certain rules apply**.

1.2 Safety Practices: Define and demonstrate adherence to **industry-standard practices regarding general machine safety, tool safety, equipment safety, electrical safety, and fire safety** to protect all personnel and equipment. For example, when operating tools and equipment, regularly inspect and carefully employ the appropriate personal protective equipment (PPE), as recommended by Occupational, Safety & Health Administration (OSHA) regulations. Incorporate **safety procedures when operating tools and equipment**, such as hand and power tools, ladders, scaffolding, and lifting equipment. Complete safety test with 100 percent accuracy.

1.3 Materials Safety: Follow **procedures to work safely around materials**. Adhere to responsibilities for employees in material safety as outlined by the **Hazard Communication Standard** (HazCom), such as locating and interpreting **material safety data sheets (MSDS**). Demonstrate **safe procedures to move materials** by planning the movement, properly lifting, stacking, and storing materials, and selecting proper materials-handling equipment.

2. History of Architecture & Construction

2.1 History of Architecture and Construction: Investigate the **evolution of architecture and construction** across a variety of civilizations throughout history. Identify **major architectural and construction innovations**, such as technological advances in materials or construction processes.

3. Introduction to the Construction Industry

3.1 Construction Industry: Analyze the **organization of the modern construction industry**. Distinguish among the **various personnel** involved in the industry and explain the **roles of each in the construction process**, including but not limited to the owner, developer, architects, engineers, building officials, contractors, suppliers, unions, and professional craftsmen. Describe the **basic steps of traditional building delivery for a construction projec**t (from pre-design to post-construction), outlining who and what is involved in each step.

3.2 Construction Regulations: Research **basic regulations affecting today's construction industry**.

a. Investigate and report on the process for securing a building permit for a selected location in the community.
b. Explain what a building code is and where to find published local building codes. Write persuasively to defend why a particular building code is necessary.

3.3 Impact of Construction: Investigate the **social, economic, and environmental impact of construction work** at the local, national, and global levels. Analyze **current and emerging trends** in the construction industry such as LEED certification and green building design, critically examining each source consulted for its validity and reasoning.

4. Career Exploration

4.1 Construction Professions: Research the **major professions and trades within construction**, such as electrician, carpenter, mason, plumber, HVAC technician, cost estimator, and construction manager. Analyze the **aptitudes and training needed** for at least three careers of interest. For example, outline the typical steps needed to become a journeyman electrician, such as completing postsecondary training and obtaining on-the-job training through an apprenticeship, and devise a tentative **career plan to reach employment goals**.

4.2 Employment Opportunities: Evaluate **jobs data and employment projections** in the construction industry from sources such as O*Net OnLine, synthesizing findings from each source. Determine **areas of largest growth** and discuss the **significance of construction to the national and global economy**. Articulate **why construction is considered a STEM field**, citing the specific knowledge, skills, and abilities required to be successful in a variety of construction occupations.

5. Introduction to Measurement

5.1 Measuring: Use **physical measurement devices** typically employed in construction to complete **accurate field measurements.** Determine the **appropriate units and record accurate measurements of lengths and angles.** Tools should include but are not limited to fractional rule, metric rule, measuring tape, architect's scale, engineer's scale, dial caliper, micrometer, protractor, and square.

5.2 Dimensions: Interpret given **linear and angular dimensions** to accurately **set up layouts to complete a project.** For example, use an architect's scale to measure distance on a construction drawing, and then use a measuring tape to lay out cuts in dimensional lumber to an accuracy of 1/16 inch.

6. Construction Math

6.1 Math: Apply **mathematics concepts to solve construction problems**, distinguishing which principles apply to a given construction problem. Concepts should include, but are not limited to:

a. Operating with whole numbers, fractions, and decimals.
b. Performing conversions between fractions, decimals, and percent. For example, convert a decimal to a fraction to prepare a unit for measurement on a fractional scale to the precision of 1/16 of an inch.
c. Working with units such as feet, inches, meters, centimeters, and millimeters, and determining appropriate units for a given construction task. For example, determine how many pieces of 2 ft. 4 in. PVC pipe may be cut from a 10 ft. piece and how much pipe will be left over.
d. Calculating the area of two-dimensional spaces. Calculating surface area and volume for three-dimensional objects employing related geometric terminology.
e. Performing proportionate reasoning to estimate quantities.
f. Using basic rules of right triangles, such as the Pythagorean Theorem, to find missing lengths.

7. Tools & Equipment

7.1 Identify Tools: Accurately identify a wide range of **hand and power tools** used in the construction trades, such as striking tools, cutting tools, torque producing tools, leveling and squaring tools, grinding and shaping tools, clamping tools, and pulling and lifting tools. Explain **when each is used** and describe **the characteristics** that make each appropriate for a given task.

7.2 Use Tools and Equipment: Assess a variety of **situations requiring the use of hand tools,** power tools, and equipment. Select the **proper tool and accessories,** critique the **readiness of the tool,** use the **tool to accomplish the desired task**, and then return the tool and accessories to their proper storage. For example, demonstrate the ability to safely use a crosscut saw to cut a straight square to specified dimensions on dimensional lumber.

8. Introduction to Building Systems and Materials

8.1 Construction Materials: Compare and contrast the **properties and uses of basic construction materials** employed in building construction processes, such as aggregates, asphalt, concrete, steel, wood, and masonry materials.

8.2 Fasteners: Distinguish between the **various types of fasteners commonly used in construction,** such as nails, screws, and bolts, outlining the properties and uses of each type. Demonstrate the ability to accurately select and install the appropriate fastener in a variety of situations.

8.3 Building Systems: Identify and describe **major building systems** (i.e. foundation, structural, mechanical, electrical, and plumbing systems) to establish a basic knowledge of **their purpose, structure, and function**. Discriminate between the **different types of construction drawings** related to these systems, analyze how those drawings are organized, and interpret the **common symbols** used in each.

9. Construction Drawings & Specifications

9.1 Construction Drawings: Inspect and interpret **construction drawings, diagrams, and written specifications for construction projects**. Explain **how pictorial representations relate to a physical layout**. Use an architect's scale and the given dimensions on a construction document to determine an unknown dimension. For example, interpret electrical schedules and single-pole or three-way light switch symbols in electrical plans to determine the types, quantities, and exact physical locations of the light switches to be installed in a construction project.

9.2 Specifications: Describe the **purpose of specifications in a construction document set.** Examine how specifications are organized according to the **Construction Specifications Institute's (CSI) *Master Format***. Select an assortment of building products and classify them according to *Master Format*. Analyze actual specifications and create a list of items commonly included in a specification. Following CSI models and format, write a specification for a given component of a building project.

9.3 Create Drawings: Create **two-dimensional scale drawings** using **accepted dimensioning rules and measurement systems**. For example, as part of a project to build a simple structure, develop the complete drawings that specify the dimensional details for each step of the construction process, annotating all drawings such that another person could replicate the work.

10. Course Project

10.1 Course Project: Interpret **construction drawings** to determine the **correct materials, tools, and equipment needed to complete a basic construction project**. Plan and

implement the steps needed to complete the project, attending to precise details and employing safe practices throughout. For example, read and interpret a technical document to build a simple toolbox.

11. Portfolio

11.1 Portfolio: Compile important artifacts to create a portfolio connecting personal career preparation to concepts learned in this course. Continually update and reflect upon artifacts produced, including written products, to strengthen work samples over time, using technology where appropriate.

Standards Alignment Notes

*References to other standards include:

- NCCER Curriculum: National Center for Construction Education and Research
    - Note: NCCER accreditation is required to offer NCCER credentials to students. Instructors trained through the NCCER Instructor Certification Training Program (ICTP) may use the NCCER curricula to teach the listed standards. By doing so, their students will receive a certificate of completion for the NCCER Core Curriculum and be placed in NCCER's National Registry Database.
- P21: Partnership for 21st Century Skills Framework for 21st Century Learning
    - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.