



TENNESSEE DEPARTMENT OF

**EDUCATION**

FIRST TO THE TOP

## Fundamentals of Construction

<b>Primary Career Cluster:</b>	Architecture & Construction
<b>Consultant:</b>	Rachel Allen, (615) 532-2835, <a href="mailto:Rachel.Allen@tn.gov">Rachel.Allen@tn.gov</a>
<b>Course Code(s):</b>	6073
<b>Prerequisite(s):</b>	None
<b>Credit:</b>	1
<b>Grade Level:</b>	9
<b>Graduation Requirements:</b>	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Architecture & Construction courses.
<b>Programs of Study and Sequence:</b>	This is the first course in the <i>Residential &amp; Commercial Construction, Structural Systems, and Mechanical, Electrical, &amp; Plumbing Systems</i> programs of study.
<b>Necessary Equipment:</b>	Refer to the Teacher Resources page.
<b>Aligned Student Organization(s):</b>	SkillsUSA: <a href="http://site1.tnskillsusa.com/">http://site1.tnskillsusa.com/</a> Brandon Hudson, (615) 532-2804, <a href="mailto:Brandon.Hudson@tn.gov">Brandon.Hudson@tn.gov</a>
<b>Coordinating Work-Based Learning:</b>	Teachers who hold an active Work-Based Learning (WBL) Certificate issued by the Tennessee Department of Education may offer appropriate student placement. To learn more, please visit <a href="http://www.tn.gov/education/cte/work_based_learning.shtml">http://www.tn.gov/education/cte/work_based_learning.shtml</a> .
<b>Available Student Industry Certifications:</b>	NCCER Core Curriculum
<b>Dual Credit or Dual Enrollment Opportunities:</b>	There are no known dual credit/dual enrollment opportunities for this course. If interested in developing, reach out to a local postsecondary institution to establish an articulation agreement.
<b>Teacher Endorsement(s):</b>	501, 502, 522, 523, 524, 527, 532, 553, 554, 555, 556, 567, 575, 580, 584, 585, 592, 598
<b>Required Teacher Certifications/Training:</b>	None
<b>Teacher Resources:</b>	<a href="http://www.tn.gov/education/cte/ArchitectureConstruction.shtml">http://www.tn.gov/education/cte/ArchitectureConstruction.shtml</a>

### 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. Standards in this course are aligned with Tennessee State Standards for English Language Arts & Literacy in Technical Subjects, Tennessee State Standards in Mathematics, and the National Center for Construction Education and Research (NCCER) Curriculum.\*

## Program of Study Application

This is the foundational course in the *Residential & Commercial Construction, Structural Systems, and Mechanical, Electrical, & Plumbing Systems* programs of study. For more information on the benefits and requirements of implementing these programs in full, please visit the Architecture & Construction website at <http://www.tn.gov/education/cte/ArchitectureConstruction.shtml>.

## Course Standards

### Safety

- 1) 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. (TN Reading 3, 4, 6)
- 2) 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. (TN Reading 3, 4)
- 3) 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. (TN Reading 3, 4)

### History of Architecture & Construction

- 4) Investigate the evolution of architecture and construction across a variety of civilizations throughout history. Identify major architectural innovations, such as technological advances in materials or construction processes. Create an annotated timeline or visual graphic illustrating significant time periods in the development of construction. (TN Reading 2, 4, 7; TN Writing 2, 9)



## Introduction to the Construction Industry

- 5) Drawing on resources from textbooks, websites, and research centers such as the National Center for Construction Education and Research (NCCER), 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. For example, create a written report or infographic describing the basic steps of traditional building delivery for a construction project (from pre-design to post-construction), outlining who and what is involved in each step. (TN Reading 1, 2, 4, 5, 7; TN Writing 2)
- 6) 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. (TN Reading 2, 3, 4; TN Writing 2)
  - 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. (TN Reading 2, 3, 4; TN Writing 1)
- 7) 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. Integrate findings into a written summary; for example, write an informative essay on how the implementation of green construction practices (such as preventing waste and recycling waste) affects the environment and cost of a project. (TN Reading 2, 4, 8; TN Writing 2, 8, 9)

## Career Exploration

- 8) Research the major professions and trades within construction, such as electrician, carpenter, mason, plumber, HVAC technician, cost estimator, and construction manager. Produce a chart or other graphic detailing 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. (TN Reading 1, 2, 4, 7; TN Writing 2, 9)
- 9) 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. (TN Reading 1, 2, 4, 7; TN Writing 7, 9; TN Math S-ID)

## Introduction to Measurement

- 10) 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. (TN Reading 3; TN Math N-Q)

- 11) 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. (TN Reading 2, 3; TN Math N-Q)

### **Construction Math**

- 12) 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. (TN Math N-Q)
  - 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. (TN Math N-Q)
  - 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. (TN Math N-Q)
  - d. Calculating the area of two-dimensional spaces. Calculating surface area and volume for three-dimensional objects employing related geometric terminology. (TN Math G-GMD, G-MG)
  - e. Performing proportionate reasoning to estimate quantities. (TN Math N-Q)
  - f. Using basic rules of right triangles, such as the Pythagorean Theorem, to find missing lengths. (TN Math G-SRT)

### **Tools & Equipment**

- 13) 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. (TN Reading 2, 3, 4)
- 14) 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. (TN Reading 3; TN Math N-Q)

### **Introduction to Building Systems and Materials**

- 15) 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. (TN Reading 4)



- 16) Distinguish between the various types of fasteners commonly used in construction, such as nails, screws, and bolts, by creating a visual display outlining the properties and uses of each type. Demonstrate the ability to accurately select and install the appropriate fastener in a variety of situations. (TN Reading 2, 4, 7; TN Writing 2)
- 17) Using graphic illustrations and supporting text, 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. (TN Reading 2, 4, 5, 7, 9)

### **Construction Drawings & Specifications**

- 18) 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. (TN Reading 1, 2, 4, 6, 7)
- 19) 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. (TN Reading 1, 3, 4, 5, 6; TN Writing 2, 4, 8, 9)
- 20) 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. (TN Reading 3, 4; TN Math N-Q, G-MG)

### **Course Project**

- 21) 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 tool box. (TN Reading 1, 3, 7)

### **Portfolio**

- 22) 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. (TN Writing 4, 5, 6)



## Standards Alignment Notes

\*References to other standards include:

- TN Reading: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 9-10 Students (page 62).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standard 10 at the conclusion of the course.
- TN Writing: [Tennessee State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 9-10 Students (pages 64-66).
  - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 3 and 10 at the conclusion of the course.
- TN Math: [Tennessee State Standards for Mathematics](#); Math Standards for High School: Number and Quantity, Geometry, Statistics and Probability (pages 58-83).
  - Note: The standards in this course are not meant to teach mathematical concepts. However, the concepts referenced above may provide teachers with opportunities to collaborate with mathematics educators to design project based activities or collaborate on lesson planning. Students who are engaging in activities listed above should be able to demonstrate quantitative, geometric, and statistical reasoning as applied to specific technical concepts. In addition, students will have the opportunity to practice the habits of mind as described in the eight Standards for Mathematical Practice.
- 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.

