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CTE Standards Unpacking
Building Trades

Course: Building Trades
Course Description: Students will gain insight into the career of building trades by developing practical skills such as safety on the jobsite, construction math, use of hand/power/pneumatic tools, basic residential blueprint reading, basic land surveying techniques, building construction, plumbing, electrical, concrete, employability skills and career exploration required to succeed in the construction industry.
Career Cluster: Architecture and Construction
Prerequisites: Introduction to Architecture and Construction
Program of Study Application: This is the third course in the suggested sequence of the Residential Construction Program of Study. It is recommended that it is preceded by (1) Foundation Courses, (2) Introduction to Architecture and Construction, and followed by (4) Residential Construction and (5) Capstone Experience.

INDICATOR #BT 1: **Understand and Apply Industry Safety Procedures**		
SUB-INDICATOR 1.1 (Webb Level: 2 Skill/Concept): Identify and demonstrate the proper industry safety standards.		
Knowledge (Factual): Occupational Safety and Health Administration (OSHA) 10 Safety Data Sheets (SDS) General shop safety Lockout/tag out procedures Basic first aid Protective clothing and safety equipment Safe work procedures around electrical hazards	**Understand (Conceptual):** Value of OSHA 10 requirements Importance of OSHA to employers Importance of lockout/tag out procedures Proper industry safety procedures should be practiced at all times	**Skills (Application):** Demonstrate general shop safety Demonstrate lockout/tag out procedures Demonstrate first aid Maintain a written portfolio record of written safety examinations and equipment examinations which the student has passed

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Benchmarks

Students will be assessed on their ability to:

- Examine basic construction safety using Occupational Safety Health Administration (OSHA) standards or equivalents.
- Demonstrate the use of protective clothing and safety equipment
- Inspect and care for various types of personal protective equipment
- Demonstrate basic first aid
- Explain the function of Material Safety Data Sheets (MSDS)
- Practice safe work procedures around electrical hazards
- Explain and practice safe lockout/tag out procedures
- Maintain a written portfolio record of written safety examinations and equipment examinations which the student has passed

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
SL4. Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range or formal and informal tasks **W2.** Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.	Students will orally explain the function of Safety Data Sheets and safe lockout/tag out procedures. Students will explain in writing safety and equipment procedures.

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INDICATOR #BT 2: **Utilize appropriate industry math skills and formulas**

SUB-INDICATOR 2.1 (Webb Level: 2 Skill/Concept): Understand and demonstrate basic math skills and formulas.

Knowledge (Factual):	**Understand (Conceptual):**	**Skills (Application):**
Measurement tools Whole numbers Fractions Decimals Percent Unit of measure for a building project Board feet Formulas (area and volume)	Why we convert fractions to decimals and decimals to fractions Why do we convert decimals to percent and percent to decimals? The relationship of square/cubic inches to square/cubic feet and square/cubic feet to square/cubic yards How to recognize the difference between linear and board feet	Read a tape measure Apply mathematical applications of and conversion of whole numbers, fractions, decimals, and percent Convert linear feet to board feet Calculate the necessary unit of measure for a building project Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.

Benchmarks

Students will be assessed on their ability to:

- Correctly read a tape measure to the nearest 1/16”
- Add, subtract, multiply, and divide whole numbers, fractions, decimals, and percent with and without a calculator
- Convert decimals to percent and percent to decimals
- Convert fractions to decimals and decimals to fractions
- Calculate the necessary unit of measure for a building project (examples: square inches/square feet, cubic inches/cubic feet)
- Convert linear feet to board feet
- Accurately calculate area and volume using formulas

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Academic Connections	
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard): **W2.** Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.	**Sample Performance Task Aligned to the Academic Standard(s):** Students will explain in writing the process of computing industry math skills and formulas

INDICATOR #BT 3: **Identify and correctly use appropriate hand, power, and pneumatic tools**		
SUB-INDICATOR 3.1 (Webb Level: 2 Skill/Concept): Demonstrate safe and proper use of hand tools.		
SUB-INDICATOR 3.2 (Webb Level: 2 Skill/Concept): Demonstrate safe and proper use of power tools.		
SUB-INDICATOR 3.3 (Webb Level: 2 Skill/Concept): Demonstrate safe and proper use of pneumatic tools.		
Knowledge (Factual): Hand, power, and pneumatic tools used in the construction trades Basic maintenance procedures of hand, power, and pneumatic tools used in the construction trades	**Understand (Conceptual):** Importance of proper operation of instruction tools Ramifications of improper and unsafe use of tools	**Skills (Application):** Visually inspect tools for safety hazards. Demonstrate safe and effective use of tools Demonstrate basic maintenance and storage of tools
Benchmarks *Students will be assessed on their ability to:* • Identify and report on the tools used in the construction trades • Demonstrate safe use of tools • Explain and demonstrate basic maintenance procedures of tools		

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Academic Connections	
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard): **SL4.** Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range or formal and informal tasks **W2.** Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.	**Sample Performance Task Aligned to the Academic Standard(s):** Students will orally or in writing identify tools used in construction trades. Students will orally or in writing explain basic maintenance procedures of tools.

INDICATOR #BT 4: **Understand blueprint reading and perform basic survey techniques**		
SUB-INDICATOR 4.1 (Webb Level: 3 Strategic Thinking): Demonstrate how to read blueprints.		
SUB-INDICATOR 4.2 (Webb Level: 3 Strategic Thinking): Demonstrate basic survey techniques.		
Knowledge (Factual): Basic blueprint terms and symbols Plot plan, building lines, survey equipment instruments, layout and running lines	**Understand (Conceptual):** Different classifications of construction drawings	**Skills (Application):** Read and understand blueprint terms and symbols Use a transit/level to find an elevation Interpret and use drawing dimensions

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Benchmarks

Students will be assessed on their ability to:

- Identify and recognize basic blueprint terms and symbols
- Relate information on prints to real parts and locations
- Define plot plan, building lines, care of instruments, layout and running lines
- Demonstrate surveying a project

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
G.SRT.6 Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles. **G.SRT.7** Explain and use the relationship between the sine and cosine of complementary angles. **G.SRT.8** Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. **G.SRT.9 (+)** Derive the formula A = 1/2 ab sin(C) for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side. **G.SRT.10 (+)** Prove the Laws of Sines and Cosines and use them to solve problems. **G.SRT.11 (+)** Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces). **G.GPE.6** Find the point on a directed line segment between two given points that partitions the segment in a given ratio.	Square activity: Define areas of different floor plans Shape activity: Find surface areas of three dimensional figures. Students will use blueprints to layout wall partitions and determine where windows and doors are located. Students will learn the three most common layouts in residential construction: (16" OC, 19 3/16" OC, and 24" OC) Identify and define rotations, reflections, and translations. (using hotel blueprints, school building blueprints, and wallpaper) Students will measure lengths of shadows to find heights of objects by using similar triangles and proportions. Similar triangle activity to find ratios of opp/hyp, adj/hyp, opp/adj. Compare answers with other groups. Students will use trigonometric ratios and the Pythagorean Theorem to indirectly measure tall objects and to find changes in elevation and slope. Surveying Activities: Students will use

G.GPE.7 Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. **G.MG.1** Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). **G.MG.3** Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). **SL4**. Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range or formal and informal tasks.	trigonometry (including the Law of Sines and the Law of Cosines) to find unknown measurements in triangles. This will include calculating the area of triangles. ($A = 1/2\ ab\ \sin(C)$) Pythagorean Rope Activity to discover 3/4/5 right triangles. Students will use the Pythagorean Theorem to determine the placement of the bottom sill plate. Students will find and use slope and length to fit an ADA certified ramp to go into a home based on existing elevations. Students will orally explain plot plan, building lines, care of instruments, layout and running lines.

INDICATOR #BT 5: **Apply basic organizational, spatial, structural and construction principles of carpentry**		
SUB-INDICATOR 5.1 (Webb Level: 3 Strategic Thinking): Demonstrate the understanding of the building process by the building of a construction project.		
Knowledge (Factual): Building process Building materials and fasteners and their uses Framing Pythagorean Theorem (3-4-5 rule) Estimation	**Understand (Conceptual):** Proper application and construction of building materials Importance of Pythagorean Theorem	**Skills (Application):** Layout and construct floor, wall, and roof assembly Use Pythagorean Theorem to determine square Perform estimate of materials

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Benchmarks

Students will be assessed on their ability to:

- Complete a construction of a utility shed from reading and understanding the blueprint to finishing the roof system and painting the project.
- Build a small scale model home
- Construct a community service project (Example: wheel chair ramp)

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
G.CO.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. **G.CO.8** Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions. **G.SRT.2** Given two figures, use the definition of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of anges and the proportionality of all corresponding pairs of sides. **G.SRT.6** Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles. **G.SRT.7** Explain and use the relationship between the sine and cosine of complementary angles. **G.SRT.8** Use trigonometric ratios and the Pythagorean Theorem to solve right	Triangle Manufacturing Activity: Discover and explain criteria for triangle congruence (ASA, SAS, SSS, HL) Students will find the surface area of roof and determine proper amount of material for sheeting and shingles. Students will be able to find the volume of attic space to determine proper amount of insulation and venting. Students will review the concept of slope. Using measurements and roof pitch (slope), students will calculate the correct angle on 4x8 sheets of OSB for the gable ends. Students will determine length and placement of triangular roof trusses when given the ASA, SAS, or SSS of the truss pattern. Students will have to demonstrate how to properly find and cut angles for gable ends Using surface area equations to determine proper amount of exterior wall finish from blueprints Students will find the surface area of a roof and determine the proper amount of material for sheeting and shingles.

triangles in applied problems. **G.MG.1** Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). **G.MG.2** Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). **G.MG.3** Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios)	Students will review the concept of slope. Determine proper angles of hips and valleys. Students will determine volume of attic space to determine proper amount of vents needed

INDICATOR #BT 6: **Study principles, standards and applications of plumbing**		
SUB-INDICATOR 6.1 (Webb Level: 1 Recall): Define safety procedures for plumbing		
SUB-INDICATOR 6.2 (Webb Level: 2 Skill/Concept): Distinguish pipe sizes, fittings, adapters, and coupling.		
SUB-INDICATOR 6.3 (Webb Level: 3 Strategic Thinking): Demonstrate the use of plumbing materials.		
Knowledge (Factual): Plumbing tools Soldering Plumbing materials Safety Plumbing codes	**Understand (Conceptual):** Plumbing hazards and liability factors Importance of following plumbing codes	**Skills (Application):** Demonstrate safe and proper use of plumbing tools Demonstrate safe and proper soldering techniques Measure, cut, and join plastic piping

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Benchmarks

Students will be assessed on their ability to:

- Show proper procedures for soldering which is common in the plumbing industry
- Explain uses of different plumbing materials
- Interpret code for different plumbing situations
- Select methods to properly thread pipe
- Make use of plumbing materials to build a bathroom mock-up
- Illustrate procedures of proper soldering and pipe fitting

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
G.MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). **G.MG.2** Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). **G.MG.3** Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). **SL4**. Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range or formal and informal tasks	Students will orally explain uses of different plumbing material and the code for different plumbing situations.

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INDICATOR #BT 7: **Employ basic knowledge and methods of electrical wiring**		
SUB-INDICATOR 7.1 (Webb Level: 1 Recall): Select electrical materials considering safety.		
SUB-INDICATOR 7.2 (Webb Level: 2 Skill/Concept): Identify electrical materials.		
SUB-INDICATOR 7.3 (Webb Level: 3 Strategic Thinking): Illustrate uses of electrical materials.		
Knowledge (Factual): Wiring components Electrical connections National Electric Safety Code (NESC)	**Understand (Conceptual):** Difference between conductors and insulators Basic characteristics of series and parallel circuits The importance of properly sizing electrical conductor	**Skills (Application):** Identify electrical hazards Define voltage and identify the ways in which it can be produced Proper use of ohm meter

Benchmarks

Students will be assessed on their ability to:

- Identify basic codes of electrical wiring
- Interpret proper and improper electrical connections
- Distinguish wire size, capacities, and characteristics
- Classify conductors and other electrical materials
- Manipulate switches, outlets and light fixtures
- Complete construction of electrical project(s)

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
SL4. Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range or formal and informal tasks	Students will orally explain basic codes of electrical wiring and proper/improper electrical connections.

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INDICATOR #BT 8: **Employ basic knowledge and methods of concrete technology**		
SUB-INDICATOR 8.1 (Webb Level: 1 Recall): Identify safe practice associated with concrete materials		
SUB-INDICATOR 8.2 (Webb Level: 3 Strategic Thinking): Calculate the various required ingredients used in concrete.		
SUB-INDICATOR 8.3 (Webb Level: 4 Extended Thinking): Employ application of concrete in different situations.		
Knowledge (Factual): Tools, Slump, Concrete materials, Ratios, and Cubic yard	**Understand (Conceptual):** The difference between concrete and cement Properties of concrete	**Skills (Application):** Identify the composition and characteristics of concrete Perform a slump test Describe how to safely handle concrete when forming, placing, curing, and finishing Describe the process of curing concrete Perform calculation for concrete placement

Benchmarks

Students will be assessed on their ability to:

- Name basic codes and techniques of concrete construction applications
- Describe safe use of concrete tools
- List concrete terminology and uses of concrete
- Convert formula for making concrete
- Interpret procedure for making cement mortar
- Concrete testing (slump test, cylinder test, etc.)
- Operate tools for placing concrete foundations and floors in different situations
- Solve finishing procedures for floors, sidewalks, and driveways
- Maintain proper maintenance of equipment when project is finished

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Academic Connections	
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
G.GMD.1 Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. **G.GMD.3** Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. **G.GMD.4** Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects **G.MG.1** Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). **SL4.** Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range or formal and informal tasks **W2.**Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.	Students will discover how the volume changes as 3D figures are enlarged/shrunk. Students will measure and calculate the volume and surface area of 3D shapes including prisms, cylinders, pyramids, cones, and spheres Calculate volume and of silos, grain bins, other buildings, and the amount of dirt needing to be removed from a site for a basement. Students will orally or in writing name basic codes and techniques of concrete construction applications and describe safe use of concrete tools. Students will orally or in writing describe how to safely handle concrete when forming, placing, curing, and finishing. Students will orally or in writing describe the process of curing concrete.

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INDICATOR #BT 9: **Student will participate in career exploration activities**		
SUB-INDICATOR 9.1 (Webb Level: 4 Extended Thinking): Research career opportunities in the architecture and construction fields.		
Knowledge (Factual): Career opportunities in residential construction and architectural and construction fields.	**Understand (Conceptual):** Knowledge of the various careers within A&C. Knowledge of the education required to obtain various careers within A&C.	**Skills (Application):** Explore, Investigate, Examine, and Research career opportunities

Benchmarks

Students will be assessed on their ability to:

- Utilizing career exploration software, research and write a report on career opportunities in the Architecture and Construction fields
- Utilize career exploration software to research educational requirements for chosen career path
- Utilizing career exploration software, update student's portfolio
- Utilize industry speaker

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
RI1. Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain. RI4.Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text	Students will utilize career exploration software, research and write a report on career opportunities in the Architecture and Construction fields. Students will utilize career exploration software to research educational requirements for chosen career path.

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Additional Resources

Please list any resources (e.g., websites, teaching guides, etc.) that would help teachers as they plan to teach these new standards.