

Colorado CTE Course – Scope and Sequence

Course Name	Construction Systems I		Course Details	Credit = 1.0	
			Course = 0.50 Carnegie Unit Credit		
Course Description	Students in this class will learn about various facets of construction in both a classroom and hands-on setting. This program of study is intended to prepare students for careers in construction by developing an understanding of the different phases of a construction project from start to finish. Upon completion of this course, proficient students will be able to demonstrate knowledge and skill in the earlier phases of building construction, including site layout, foundation systems, framing systems, and electrical systems.				
Note:	This is a suggested scope and sequence for the course content. The content will work with any textbook or instructional resource. If locally adapted, make sure all essential knowledge and skills are covered.				
SCED Identification #	17002	Schedule calculation based on 60 calendar days of a 90-day semester. Scope and sequence allows for additional time for guest speakers, student presentations, field trips, remediation, or other content topics.			
All courses taught in an approved CTE program must include Essential Skills embedded into the course content. The Essential Skills Framework for this course can be found at https://www.cde.state.co.us/standardsandinstruction/essentialskills					
Instructional Unit Topic	Suggested Length of Instruction	CTE or Academic Standard Alignment	Competency / Performance Indicator	Outcome / Measurement	CTSO Integration
Safety		Identify safety hazards on a jobsite and demonstrate practices for safe working. 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. Describe and apply health and safety regulations.	Perform safety measures according to OSHA regulations: - Identify, describe and demonstrate the use of SDS. - List and demonstrate shop dress code, safety procedures and location of emergency equipment in labor classroom. - Define and demonstrate safe storage and	Perform a hazard assessment for a given task such as working on a ladder to install roof framing components. Explain the steps necessary to safely perform the task, outlining steps to take in case of an emergency. Demonstrate the safe use, storage, and maintenance of every piece of equipment in the lab, shop and classroom, e.g., the OSHA Lockout/Tagout Program (LOTO). Evaluate an industry project for safety consideration noting the site-specific safety	

			maintenance of equipment and proper disposal or recycling of hazardous, flammable and combustible materials. Identify, describe and demonstrate the Universal Precautions set of guidelines.	standards; report on industry standards of best practice. Explain procedures for documenting and reporting hazards to appropriate authorities	
Career Exploration		Evaluate a wide range of career pathway opportunities for success in architecture and construction careers.	Understand the roles in heavy construction of design engineers, estimators, superintendents, project managers, foremen, operators/drivers, administrators, and inspectors. Demonstrate job search skills.	Referencing data from U.S. Department of Labor and other sources, articulate a career pathway for an inspector, project manager or site superintendent; include postsecondary training options and write an informative paper or develop an infographic identifying entry requirements for a specific apprenticeship or postsecondary program of study, and the secondary courses that will prepare students to be successful in the program.	ICAP- Develop and revise career plan annually based on workplace awareness and skill attainment.
Zoning and Code		Demonstrate an understanding of legal, ethical and social responsibility for businesses. Apply state and local building codes.	Identify state and federal laws and regulations related to managing a business. State the purpose of zoning regulations.	Investigate and report on the process for determining the zoning regulations of a building site: Describe how zone designation and regulations such as setbacks, ground	

			Compare the differences between residential and commercial codes. Understand inspection procedures used to enforce building codes during the construction of a residential or commercial building, outlining the roles and responsibilities of the building inspector and the contractor and the intervals at which inspections are performed.	coverage, and maximum height impact the design, placement, and use of a building on a given site, citing findings from the investigation. • Read and interpret zoning ordinances and other regulations impacting a given site (city, county, historic district, subdivision regulations, etc.). Explain how a building permit incorporates local building codes. Outline the building inspection process. Explain the purpose and procedure for obtaining a Certificate of Occupancy.	
Structural Systems		Understand the impact of financial, technical, and environmental trends on the past and future of the construction industry. Understand significant historical trends in engineering and heavy construction technology. Understand environmental regulations that influence engineering and heavy construction projects.	Recognize the variety of building phases, systems, and techniques used in engineering and heavy construction. Know the appropriate processes and materials in architectural design, project development, and engineering and heavy construction (e.g., structural, electrical, mechanical, and finish phases).	Compare and contrast types of structural framing systems, including wood light-frame, structural steel, and reinforced concrete, analyzing the factors influencing the selection of a structural system for given building functions: • Create a chart to define and compare the pros and cons of each type, citing examples of when each is used.	

		Identify, explain, and use specifications for a construction project.	Understand the layout of utilities in regards to underground electrical, sewer, water, phone, cable, etc.	Develop a complete set of the specifications for a residential or commercial building project.	
Foundations		Understand environmental impacts and considerations for construction projects. Identify, explain, and use specifications for foundations of a construction project.	Understand soil characteristics and properties. Understand the importance of knowing a site's water table and its effect on site preparation. Understand the lay out location and elevation of concrete/masonry structures based on construction drawings.	Read and interpret a soils report. Demonstrate the proper procedures to collect, prepare, and test soil samples. Prepare a sample report summarizing the procedures and findings. Argue the merits of site locations impact of environmental concerns and regulations in relation to building site preparation. Understand the importance for collecting and testing soil samples. Describe various geologic structures and land forms and determine the best approach for preparing a site for construction. Demonstrate foundation layout techniques to include setting forms, placing reinforcements, and placing concrete according to construction drawings, specifications, and building codes. Solve common construction problems (e.g., grading, drainage) by using commercial construction codes, building	

				standards, and appropriate mathematical calculations.	
Specifications and Blueprints		Inspect and interpret a full set of construction drawings and specifications for a construction project including civil, architectural, structural, mechanical, plumbing, electrical, and fire protection drawings and specifications. Read and interpret different drawing types including plan view drawings, elevation view drawings, section drawings, detail drawings, and schedules.	The student develops the basics of construction drawing. The student is expected to: (A) interpret and use drawing dimensions; (B) recognize and identify basic construction terms; (C) recognize and identify basic drawing components; (D) recognize and identify commonly used drawing symbols; (E) relate information on construction drawings to actual locations on the print; and (F) recognize different classifications of construction drawings. Understand how to construct projects accurately from commercial specifications and technical drawings ensuring compliance with state and local building codes.	Identify the lay out locations for reinforcements, expansion joints, openings, and embedded items based on construction drawings, specifications, and building codes. Explain the relationship between different types of drawing and the importance of cross-referencing different types of drawings with one another and cross-referencing drawings with specifications. For example, explain how a floor plan, elevation, and detail drawing may all be used to inform the reader about the layout and material of a given building component, such as a cabinet layout or an exterior wall.	
Light Frame Wood Construction		Identify, explain, and use specifications for a construction project.	Analyze the characteristics and uses of various types of wood	Drawing on resources such as textbooks and wood product retailers' catalogs, examine	

			products used in light frame construction. The students is expected to: (A) categorize types of wood as hardwood or softwood; (B) identify differences in woods used in interior and exterior applications. (C) identify grades of lumber, common lumber defects, and differences in treated and untreated lumber. (D) explain the difference between actual and nominal lumber sizes. (E) distinguish among the properties and uses of engineered wood products such as plywood, hardboard, particleboard, oriented strand board, mineral fiberboard, glulam lumber,	actual wood product samples and create a written description of each, identifying the type and grade of the product, noticing and naming any defects, and explaining common uses of the product. Work in teams to construct a wall frame and ceiling assembly by implementing required safety techniques, tools, and equipment. Evaluate the work for code considerations.	
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			and wood I-beams.		
Floor Framing Systems		Describe and apply the factors in the construction of floor framing systems.	Identify the components which make up a floor frame, analyzing the purpose of and interrelationships among each component and explaining the sequence in which each is constructed. Read and interpret construction drawings to determine floor system requirements, such as the proper girder and joist size for a given span and floor load, and estimate the amount of material needed to frame a floor assembly.	Implement geometric principles to square a building layout. Describe the procedures necessary to fasten sills to the foundation and construct a floor assembly. Apply the appropriate tools, equipment, and procedures to build a floor assembly; Work in teams to install girders, lay out and install floor joists, install bridging and blocking, and apply subflooring. Explain the importance of layout at 16 inches on center.	
Wall and Ceiling Framing Systems		Demonstrate practices related to framing exterior walls. Demonstrate practices related to framing interior walls. Demonstrate practices related to framing ceilings. Describe pre-fabricated panelized systems.	Read and interpret drawings to determine wall and ceiling frame requirements for a given residential or commercial structure. Students should be able to: (A) accurately measure and lay out the frame; (B) accurately level and plumb the walls; (C) calculate the length of a stud; (D) estimate the amount of material needed to frame a	Create an infographic that explains the procedure to lay out a wood frame wall, defining and describing the components such as plates, studs, partitions, door and window openings, bracing, and other components. Define modular as it pertains to panelized construction.	

			wall and ceiling assembly (E) Identify, define, and describe pre-fabricated construction systems; and (F) describe construction techniques for pre-fabricated building materials.		
Roof Systems		Demonstrate practices related to roofing systems.	Demonstrate understanding of roofing systems common in the construction industry. The student should be able to: (A) define and describe the framing components of gable and hip roofs such as the ridge board, plates, and types of rafters; (B) Read and interpret drawings to determine roof framing requirements, such as calculating the length of a rafter based on the desired pitch and estimating the materials needed to frame and sheath a roof	Compare and contrast different procedures to frame a roof. For example, describe the benefits of using prefabricated trusses in place of framing with rafters on site. Outline the major similarities and differences in each and write persuasively to describe why using either prefabricated trusses or framing with rafters is more beneficial for a specific project. Identify common roof types.	
Mechanical Systems		Describe HVAC&R principles, regulations and career opportunities.	Demonstrate an understanding of the methods and devices	Debate current issues and concerns, such as indoor air quality, the ozone layer, and computer technology, in the	

		Explain the importance of HVAC&R in modern society. Explain the basic principles of heating, ventilating, and air conditioning & refrigeration systems.	used to improve air quality and comfort. Explain the historical development and principals of air-conditioning and refrigeration. Identify various HVAC professional organizations, associations, and societies, and explain their purposes. Describe the purpose and importance of local, state, and federal heating, air- conditioning, and refrigeration codes and standards.	heating, air-conditioning, and refrigeration industry and in the environment and explain their future ramifications. Explain the differences in comfort applications (cooling/heating air) and process applications (improving air quality). List and describe the types of regulatory codes & licensing in the HVAC&R industry. Student will create a written composition based on the historical development and the importance of HVAC&R in modern society.	
Electrical Systems		Explain the purpose and history of the National Electrical Code (NEC) and its function in construction projects. Identify and describe safety procedures when dealing with electrical circuits according to current industry standards.	The student identifies the issues associated with electrical hazards found on a jobsite. The student is expected to: (A) demonstrate safe working procedures in a construction environment; (B) explain the purpose of the Occupational Safety and Health Administration (OSHA) and how it promotes safety on the job; (C) identify electrical hazards and how to avoid or minimize them in the workplace; and	Describe the relationship of National Electrical Codes (NEC) to Colorado's Department of Regulatory Agency (DORA). Research current OSHA standards and other regulations specific to job-site electrical safety to identify methods and equipment to reduce the risk of injury due to electrical shock. Identify basic electrical equipment and the licensed electrician's role in construction projects.	

			(D) explain safety issues concerning lockout and tagout procedures, personal protection using assured grounding and isolation programs, confined space entry, respiratory protection, and fall protection Understand the importance of the National Electrical Codes (NEC) and their relationship to local building code. The student is expected to: (A) explain the purpose and history of the National Electrical Code; (B) describe the layout of and explain how to navigate the National Electrical Code; (C) describe the purpose of the National Electrical Manufacturers Association and National Fire Protection Association; and (D) explain the role of testing laboratories	Cite specific examples of electrical project safety considerations and report on best practices in the industry.	
Building Envelope		Identify energy efficient materials and their use.	Analyze the components of a building envelope system, including building wrap, insulation, and various types of windows and exterior doors.	Describe how the selection and installation of various components affect the energy efficiency of the building, such as the impact of air sealing on energy efficiency. Identify materials and installation	

			Describe an energy efficient building envelope. Describe the installation procedures for pre-fabricated building materials	strategies used to minimize or prevent air infiltration. Describe the procedures necessary to prepare and install an energy efficient exterior wall: • Preparation of a rough opening and install windows and doors. • Cite considerations when selecting energy efficient materials.	
Heavy Equipment Considerations		Describe various geologic structures and land forms and determine the best approach for preparing a site for construction. Identify common types of heavy equipment and describe their unique features and uses.	Describe basic safety precautions taken into consideration while operating heavy equipment. Identify the common operating controls found on various pieces of heavy equipment. Identify and explain the different types of construction cranes. Describe crane operations and safety.	Understand the roles in heavy construction of design engineers, estimators, superintendents, project managers, foremen, operators/drivers, administrators, and inspectors. Perform basic prestart inspection, startup, operational movement, and shutdown for heavy equipment under the guidance of an instructor or employer.	
Basic Project Management		Demonstrate and understanding of project management practices in the Construction Industry. Communicate effectively using the language and vocabulary appropriate to a variety of audiences within the workplace including coworkers, supervisors and customers.	Understand the development of building plans and schedules using processes common to engineering and heavy construction. Demonstrate understanding of contract administration (e.g., invoicing vendors, subcontractors),	Demonstrate understanding of contract administration (e.g., invoicing vendors, subcontractors), including the “draw and voucher” accounting/record system used in construction project management. Write a basic contract for a construction job, such as a carpenter’s contract to complete a deck	

			including the “draw and voucher” accounting/record system used in construction project management. Understand project management procedures and processes as they occur in an engineering and heavy construction project.	addition for a residential client. Create a project calendar that includes all construction phases, including subcontractor schedules, clearing, rough grading, wet and dry utilities, fine grading, concrete, asphalt, inspections, and job closeout. Describe strategies used to promote collaboration, trust, and clear communication among internal and external parties on a job site. Log daily activities completed during a construction project over an extended period of time. Document important facts concisely in a daily report as would a project manager on a jobsite, including daily progress, equipment and materials used, personnel involved, and other work-related activities.	

Academic Standards Alignment

Colorado CTE courses are required to integrate academic and essential skills into course content. The following academic standards have been identified as aligned to this course and should be integrated throughout instruction.

[CO CTE Academic Standards Resources](#) (Rubrics, integration strategies, etc) [CDE Colorado Academic Standards Online](#) (Online standards lookup tool)

Reading, Writing, & Communicating

Standard 1: Oral Expression and Listening

- **Prepared Graduate 1:** Collaborate effectively as group members or leaders who listen actively and respectfully; pose thoughtful questions, acknowledge the ideas of others; and contribute ideas to further the group's attainment of an objective.
- **Prepared Graduate 2:** Deliver effective oral presentations for varied audiences and varied purposes.

Standard 2: Reading for All Purposes

- **Prepared Graduate 4:** Read a wide range of informational texts to build knowledge and to better understand the human experience.
- **Prepared Graduate 5:** Understand how language functions in different contexts, command a variety of word-learning strategies to assist comprehension, and make effective choices for meaning or style when writing and speaking.

Standard 3: Writing and Composition

- **Prepared Graduate 7:** Craft informational/explanatory texts using techniques specific to the genre.
- **Prepared Graduate 9:** Demonstrate mastery of their own writing process with clear, coherent, and error-free polished products.

Standard 4: Research Inquiry and Design

- **Prepared Graduate 10:** Gather information from a variety of sources; analyze and evaluate its quality and relevance; and use it ethically to answer complex questions.

Note: Mathematics and Science standards will be added in the future. Visit the [Colorado Academic Standards](#) page for the most current version.