

# CA Career Technical Education Model Curriculum Standards Engineering and Architecture

This sector is designed to provide a foundation in engineering and architecture sector pathways and occupations for students in California. Students are engaged in an instructional program that integrates academic and technical preparation and focuses on career awareness, career exploration, and career preparation in four pathways that emphasize real-world, occupationally relevant experiences of significant scope and depth: Architectural Design; Engineering Technology; Engineering Design; and Environmental Engineering. To prepare students for continued training, advanced educational opportunities, and direct entry to a career, the Engineering and Architecture programs offer the following components: classroom, laboratory, and hands-on contextual learning; project- and work-based instruction; and leadership and interpersonal skills development.

<b>2.0 Communications</b>	<b>Acquire and accurately use Engineering and Architecture sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats. (Direct alignment with LS 9-10, 11-12.6)</b>
2.1	Recognize the elements of communication using a sender-receiver model.
2.4	Demonstrate elements of written and electronic communication, such as accurate spelling, grammar, and format.
2.5	Communicate information and ideas effectively to multiple audiences using a variety of media and formats.
2.6	Advocate and practice safe, legal, and responsible use of digital media information and communications technologies.
<b>3.0 Career Planning and Management</b>	<b>Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans. (Direct alignment with SLS 11-12.2)</b>
3.4	Research the scope of career opportunities available and the requirements for education, training, certification, and licensure.
3.6	Recognize the role and function of professional organizations, industry associations, and organized labor in a productive society.

<b>4.0 Technology</b>	<b>Use existing and emerging technology to investigate, research, and produce products and services, including new information, as required in the Engineering and Architecture sector workplace environment. (Direct alignment with WS 11-12.6)</b>
4.1	Use electronic reference materials to gather information and produce products and services.
4.2	Employ Web-based communications responsibly and effectively to explore complex systems and issues.
4.3	Use information and communication technologies to synthesize, summarize, compare, and contrast information from multiple sources.
4.4	Discern the quality and value of information collected using digital technologies, and recognize bias and intent of the associated sources.
<b>5.0 Problem Solving and Critical Thinking</b>	<b>Conduct short, as well as more sustained, research projects to create alternative solutions to answer a question or solve a problem unique to the Engineering and Architecture sector using critical and creative thinking; logical reasoning, analysis, inquiry, and problem-solving techniques. (Direct alignment with WS 11-12.7)</b>
5.1	Identify and ask significant questions that clarify various points of view to solve problems.
5.2	Solve predictable and unpredictable work-related problems using various types of reasoning (inductive, deductive) as appropriate.
5.3	Use systems thinking to analyze how various components interact with each other to produce outcomes in a complex work environment.
5.4	Interpret information and draw conclusions, based on the best analysis, to make informed decisions.
<b>7.0 Responsibility and Flexibility</b>	<b>Initiate, and participate in, a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the Engineering and Architecture sector workplace environment and community settings. (Direct alignment with SLS 9-10, 11-12.1)</b>
7.2	Explain the importance of accountability and responsibility in fulfilling personal, community, and workplace roles.
7.3	Understand the need to adapt to changing and varied roles and responsibilities.
7.4	Practice time management and efficiency to fulfill responsibilities.
7.5	Apply high-quality techniques to product or presentation design and development.

<b>8.0 Ethics and Legal Responsibilities</b>	<b>Practice professional, ethical, and legal behavior, responding thoughtfully to diverse perspectives and resolving contradictions when possible, consistent with applicable laws, regulations, and organizational norms. (Direct alignment with SLS 11-12.1d)</b>
8.6	Adhere to copyright and intellectual property laws and regulations, and use and appropriately cite proprietary information.
<b>9.0 Leadership and Teamwork</b>	<b>Work with peers to promote divergent and creative perspectives, effective leadership, group dynamics, team and individual decision making, benefits of workforce diversity, and conflict resolution as practiced in the SkillsUSA career technical student organization. (Direct alignment with SLS 11-12.1b)</b>
9.1	Define leadership and identify the responsibilities, competencies, and behaviors of successful leaders.
9.2	Identify the characteristics of successful teams, including leadership, cooperation, collaboration, and effective decision-making skills, as applied in groups, teams, and career technical student organization activities.
9.3	Understand the characteristics and benefits of teamwork, leadership, and citizenship in the school, community, and workplace setting.
9.5	Understand that the modern world is an international community and requires an expanded global view.
9.6	Respect individual and cultural differences and recognize the importance of diversity in the workplace.
9.7	Participate in interactive teamwork to solve real Engineering and Architecture sector issues and problems.
<b>10.0 Technical Knowledge and Skills</b>	<b>Apply essential technical knowledge and skills common to all pathways in the Engineering and Architecture sector, following procedures when carrying out experiments or performing technical tasks. (Direct alignment with WS 11-12.6)</b>
10.3	Construct projects and products specific to the Engineering and Architecture sector requirements and expectations.
<b>11.0 Demonstration and Application</b>	<b>Demonstrate and apply the knowledge and skills contained in the Engineering and Architecture anchor standards, pathway standards, and performance indicators in classroom, laboratory and workplace settings, and through the SkillsUSA career technical student organization.</b>
11.5	Create a portfolio, or similar collection of work, that offers evidence through assessment and evaluation of skills and knowledge competency as contained in the anchor standards, pathway standards, and performance indicators.

<b>Architectural Design Pathway</b>	<p>The Architectural Design pathway provides learning opportunities for students interested in preparing for careers in such areas as architecture, industrial design, and civil engineering. Sample occupations associated with this pathway:</p> <p style="text-align: center;"> <b>Drafter</b>  <b>Architect</b>  <b>Structural Designer</b>  <b>Building Department Plan Examiner</b>  <b>City Planner</b> </p>
A2.4	Analyze project design and compile a cost analysis.
A5.0	Compare the relationship between architecture and the external environment.
A5.1	Understand the significance of sustainable building design practices that incorporate beneficial energy and environmental design policies.
A5.2	Develop a site analysis that considers passive energy techniques, sustainability issues, and landscaping.

<b>Engineering Technology Pathway</b>	<p>The Engineering Technology pathway provides learning opportunities for students interested in preparing for careers in the design, production, or maintenance of mechanical, electrical, electronics, and computer and electromechanical systems and products. Sample occupations associated with this pathway:</p> <p style="text-align: center;"> <b>Surveyor</b>  <b>Research and Development Analyst</b>  <b>Engineering Technologist</b>  <b>Field Engineer</b>  <b>Operations Engineer</b> </p>
B3.7	Analyze, repair, or measure electrical and electronic systems, circuits, or components using appropriate electronic instruments.
B6.0	Employ the design process to solve analysis and design problems.
B6.1	Understand the steps in the design process.
B6.2	Determine what information and principles are relevant to a problem and its analysis.
B6.3	Choose between alternate solutions in solving a problem and be able to justify the choices made in determining a solution.
B6.5	Demonstrate the process of developing multiple details, within design constraints, into a single solution.

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C1.1	Know historical and current events that have relevance to engineering design.

<b>Environmental Engineering Pathway</b>	<b>The Environmental Engineering pathway includes design and development processes, equipment, and systems that are used to create, monitor, prevent, or correct environmental events and conditions. Sample occupations associated with this pathway: Environmental Safety Technician Environmental Specialist Environmental Analyst Environmental Scientist Air Pollution Control Engineer</b>
D2.0	Understand the design process and how to solve analysis and design problems.
D2.1	Understand the steps in the design process.
D2.2	Determine what information and principles are relevant to a problem and its analysis.
D2.3	Choose between alternate solutions in solving a problem and be able to justify choices in determining a solution.
D2.4	Understand the process of developing multiple details into a single solution.
D2.7	Evaluate and redesign a prototype on the basis of collected test data.
D4.0	Understand the effects of the weather, the hydrosphere, and the atmosphere on the environment.
D4.1	Know the common causes of atmospheric contamination.
D4.2	Understand the effects of weather fronts on regional air pollution.
D4.3	Understand the relationship between the health of the marine environment and climate control.
D4.4	Understand the effects of human activity on the atmospheric environment.
D6.0	Evaluate regional interactive systems and elements that create harmful environmental effects.
D6.1	Describe the sources of, and impacts attributable to, pollution and contamination.
D6.2	Recognize the actions that cause resource depletion.
D6.5	Identify the sources of, and impacts attributable to, habitat alteration.
D9.0	Identify the role and impact of waste management systems, and their operations, on the environment.
D9.1	Understand the role of waste and storm water management systems, their operation, and their impact on the environment.

D9.2	Explore the causes and effects of pollution linked to wastewater treatment facilities.
D9.3	Identify wastewater treatment processes that lessen environmental impacts and improve water reuse.
D9.5	Design solid waste disposal processes that lessen environmental impacts and improve recycling.
D10.0*	Understand the field of land use management and its potential for environmental impact.
D10.1*	Describe the need for and role of habitat preservation.
D10.4*	Demonstrate the need for, and methods of, land use planning.
D10.8*	Develop strategies to maximize the effectiveness of land use planning.
D11.1	Understand the elements that create outdoor air quality.
D11.2	Summarize the causes of air pollutants and their chemical composition.
D11.3	Research air pollutants and their threat to human health.
D11.4*	Understand U.S. and California laws and regulations related to air pollution control programs and health effects of air pollution.
D12.0*	Implement processes to support energy efficiency.
D12.1	Understand the relationship between power and energy efficiency.
D12.3	Compare costs of alternate/renewable energy sources, systems, and appliances and traditional energy sources, systems, and appliances.
D12.4	Conduct an energy audit.
D13.0	Research drinking-water sources, systems, treatment, and conservation.
D13.1	Understand water reuse: issues, strategies, technologies, and applications.
D13.3	Describe the role of environmental engineering and green energy in water systems.
D13.4	Understand the functions and operations of water storage, reservoirs, aqueducts, and dams.