Building Trades and Construction Industry Sector

Career Pathways

- Cabinetmaking and Wood Products
- Engineering and Heavy Construction
- Mechanical Construction
- Residential and Commercial Construction

Building Trades and Construction Industry Sector

The Building Trades and Construction sector provides a foundation in the building trades and construction industry for secondary students in California. Students engage in an instructional program that integrates academic and technical preparation and focuses on career awareness, career exploration, and skill preparation in the building trades and construction industry. The sector encompasses four career pathways: Cabinetmaking and Wood Products, Engineering and Heavy Construction, Mechanical Construction, and Residential and Commercial Construction. These pathways emphasize processes, systems, and the way in which structures are built. The knowledge and skills are acquired in a sequential, standards-based pathway program that integrates hands-on, project-based, and work-based instruction as well as internship, community classroom, work experience, apprenticeship, and cooperative career technical education. Standards included in the Building Trades and Construction sector are designed to prepare students for technical training, postsecondary education, and entry to a career.

Foundation Standards

1.0 Academics

Students understand the academic content required for entry into postsecondary education and employment in the Building Trades and Construction sector.

(The standards listed below retain in parentheses the numbering as specified in the mathematics, science, history–social science, and visual and performing arts content standards adopted by the State Board of Education.)

1.1 Mathematics

Specific applications of Number Sense standards (grade seven):

(1.1) Read, write, and compare rational numbers in scientific notation (positive and negative powers of 10) with approximate numbers using scientific notation.

(1.2) Add, subtract, multiply, and divide rational numbers (integers, fractions, and terminating decimals) and take positive rational numbers to whole-number powers.

(1.3) Convert fractions to decimals and percents and use these representations in estimations, computations, and applications.

(1.4) Differentiate between rational and irrational numbers.

(1.5) Know that every rational number is either a terminating or a repeating decimal and be able to convert terminating decimals into reduced fractions.

(1.6) Calculate the percentage of increases and decreases of a quantity.

(1.7) Solve problems that involve discounts, markups, commissions, and profit and compute simple and compound interest.

Specific applications of Mathematical Reasoning standards (grade seven):

(2.1) Use estimation to verify the reasonableness of calculated results.

(2.2) Apply strategies and results from simpler problems to more complex problems.

(2.3) Estimate unknown quantities graphically and solve for them by using logical reasoning and arithmetic and algebraic techniques.

(2.4) Make and test conjectures by using both inductive and deductive reasoning.

(2.5) Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.

(2.6) Express the solution clearly and logically by using the appropriate mathematical notation and terms and clear language; support solutions with evidence in both verbal and symbolic work.

(2.7) Indicate the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy.

(2.8) Make precise calculations and check the validity of the results from the context of the problem.

(3.1) Evaluate the reasonableness of the solution in the context of the original situation.

(3.2) Note the method of deriving the solution and demonstrate a conceptual understanding of the derivation by solving similar problems.

(3.3) Develop generalizations of the results obtained and the strategies used and apply them to new problem situations.

Specific applications of Algebra I standards (grades eight through twelve):

(4.0) Students simplify expressions before solving linear equations and inequalities in one variable, such as $3(2x\text{-}5) + 4(x\text{-}2) = 12$.

(5.0) Students solve multistep problems, including word problems, involving linear equations and linear inequalities in one variable and provide justification for each step.

(15.0) Students apply algebraic techniques to solve rate problems, work problems, and percent mixture problems.

Specific applications of Geometry standards (grades eight through twelve):

(8.0) Students know, derive, and solve problems involving the perimeter, circumference, area, volume, lateral area, and surface area of common geometric figures.

(11.0) Students determine how changes in dimensions affect the perimeter, area, and volume of common geometric figures and solids.

(12.0) Students find and use measures of sides and of interior and exterior angles of triangles and polygons to classify figures and solve problems.

(15.0) Students use the Pythagorean theorem to determine distance and find missing lengths of sides of right triangles.

(16.0) Students perform basic constructions with a straightedge and compass, such as angle bisectors, perpendicular bisectors, and the line parallel to a given line through a point off the line.

(19.0) Students use trigonometric functions to solve for an unknown length of a side of a right triangle, given an angle and a length of a side.

1.2 Science

Specific applications of Physics standards (grades nine through twelve):

(3.a) Students know heat flow and work are two forms of energy transfer between systems.

(3.g) Students know how to solve problems involving heat flow, work, and efficiency in a heat engine and know that all real engines lose some heat to their surroundings.

(5.b) Students know how to solve problems involving Ohm's law.

Specific applications of Investigation and Experimentation standards (grades nine through twelve):

(1.a) Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.

(1.d) Formulate explanations by using logic and evidence.

1.3 History–Social Science

Specific applications of World History, Culture, and Geography: The Modern World standards (grade ten):

(10.3) Students analyze the effects of the Industrial Revolution in England, France, Germany, Japan, and the United States.

(10.3.5) Understand the connections among natural resources, entrepreneurship, labor, and capital in an industrial economy.

Specific applications of United States History and Geography: Continuity and Change in the Twentieth Century standards (grade eleven):

(11.5) Students analyze the major political, social, economic, technological, and cultural developments of the 1920s.

(11.5.7) Discuss the rise of mass production techniques, the growth of cities, the impact of new technologies (e.g., the automobile, electricity), and the resulting prosperity and effect on the American landscape.

Specific applications of Principles of Economics standards (grade twelve):

(12.1) Students understand common economic terms and concepts and economic reasoning.

(12.1.1) Examine the causal relationship between scarcity and the need for choices.

(12.1.2) Explain opportunity cost and marginal benefit and marginal cost.

(12.1.3) Identify the difference between monetary and nonmonetary incentives and how changes in incentives cause changes in behavior.

(12.1.4) Evaluate the role of private property as an incentive in conserving and improving scarce resources, including renewable and nonrenewable natural resources.

(12.1.5) Analyze the role of a market economy in establishing and preserving political and personal liberty (e.g., through the works of Adam Smith).

(12.2) Students analyze the elements of America's market economy in a global setting.

(12.2.1) Understand the relationship of the concept of incentives to the law of supply and the relationship of the concept of incentives and substitutes to the law of demand.

(12.2.2) Discuss the effects of changes in supply and/or demand on the relative scarcity, price, and quantity of particular products.

(12.2.3) Explain the roles of property rights, competition, and profit in a market economy.

(12.2.4) Explain how prices reflect the relative scarcity of goods and services and perform the allocative function in a market economy.

(12.2.5) Understand the process by which competition among buyers and sellers determines a market price.

(12.2.6) Describe the effect of price controls on buyers and sellers.

(12.2.7) Analyze how domestic and international competition in a market economy affects goods and services produced and the quality, quantity, and price of those products.

(12.2.8) Explain the role of profit as the incentive to entrepreneurs in a market economy.

(12.2.9) Describe the functions of the financial markets.

(12.2.10) Discuss the economic principles that guide the location of agricultural production and industry and the spatial distribution of transportation and retail facilities.

(12.3) Students analyze the influence of the federal government on the American economy.

(12.3.1) Understand how the role of government in a market economy often includes providing for national defense, addressing environmental concerns, defining and enforcing property rights, attempting to make markets more competitive, and protecting consumers' rights.

(12.3.2) Identify the factors that may cause the costs of government actions to outweigh the benefits.

(12.3.3) Describe the aims of government fiscal policies (taxation, borrowing, spending) and their influence on production, employment, and price levels.

(12.3.4) Understand the aims and tools of monetary policy and their influence on economic activity (e.g., the Federal Reserve).

(12.4) Students analyze the elements of the U.S. labor market in a global setting.

(12.4.1) Understand the operations of the labor market, including the circumstances surrounding the establishment of principal American labor unions, procedures that unions use to gain benefits for their members, the effects of unionization, the minimum wage, and unemployment insurance.

(12.4.2) Describe the current economy and labor market, including the types of goods and services produced, the types of skills workers need, the effects of rapid technological change, and the impact of international competition.

(12.4.3) Discuss wage differences among jobs and professions, using the laws of demand and supply and the concept of productivity.

(12.4.4) Explain the effects of international mobility of capital and labor on the U.S. economy.

(12.6) Students analyze issues of international trade and explain how the U.S. economy affects, and is affected by, economic forces beyond the United States's borders.

(12.6.1) Identify the gains in consumption and production efficiency from trade, with emphasis on the main products and changing geographic patterns of twentieth-century trade among countries in the Western Hemisphere.

(12.6.2) Compare the reasons for and the effects of trade restrictions during the Great Depression compared with present-day arguments among labor, business, and political leaders over the effects of free trade on the economic and social interests of various groups of Americans.

(12.6.3) Understand the changing role of international political borders and territorial sovereignty in a global economy.

(12.6.4) Explain foreign exchange, the manner in which exchange rates are determined, and the effects of the dollar's gaining (or losing) value relative to other currencies.

1.4 Visual and Performing Arts

Specific applications of Visual Arts standards at the proficient level (grades nine through twelve):

(1.4) Analyze and describe how the composition of a work of art is affected by the use of a particular principle of design.

(1.5) Analyze the material used by a given artist and describe how its use influences the meaning of the work.

(2.1) Solve a visual arts problem that involves the effective use of the elements of art and the principles of design.

(2.6) Create a two- or three-dimensional work of art that addresses a social issue.

Specific applications of Visual Arts standards at the advanced level (grades nine through twelve):

(2.1) Create original works of art of increasing complexity and skill in a variety of media that reflect their feelings and points of view.

(2.2) Plan and create works of art that reflect complex ideas, such as distortion, color theory, arbitrary color, scale, expressive content, and real versus virtual.

(4.6) Develop written criteria for the selection of a body of work from their portfolios that represents significant achievements.

2.0 Communications

Students understand the principles of effective oral, written, and multimedia communication in a variety of formats and contexts.

(The standards listed below retain in parentheses the numbering as specified in the English–language arts content standards adopted by the State Board of Education.)

2.1 Reading

Specific applications of Reading Comprehension standards (grades nine and ten):

(2.1) Analyze the structure and format of functional workplace documents, including the graphics and headers, and explain how authors use the features to achieve their purposes.

(2.2) Prepare a bibliography of reference materials for a report using a variety of consumer, workplace, and public documents.

(2.6) Demonstrate use of sophisticated learning tools by following technical directions (e.g., those found with graphic calculators and specialized software programs and in access guides to World Wide Web sites on the Internet).

Specific applications of Reading Comprehension standards (grades eleven and twelve):

(2.3) Verify and clarify facts presented in other types of expository texts by using a variety of consumer, workplace, and public documents.

2.2 Writing

Specific applications of Writing Strategies standards (grade eight):

(1.4) Plan and conduct multiple-step information searches by using computer networks and modems.

(1.5) Achieve an effective balance between researched information and original ideas.

(1.6) Revise writing for word choice; appropriate organization; consistent point of view; and transitions between paragraphs, passages, and ideas.

Specific applications of Writing Strategies standards (grades nine and ten):

(1.3) Use clear research questions and suitable research methods (e.g., library, electronic media, personal interview) to elicit and present evidence from primary and secondary sources.

(1.4) Develop the main ideas within the body of the composition through supporting evidence (e.g., scenarios, commonly held beliefs, hypotheses, definitions).

Specific applications of Writing Strategies and Applications standards (grades eleven and twelve):

(1.6) Develop presentations by using clear research questions and creative and critical research strategies (e.g., field studies, oral histories, interviews, experiments, electronic sources).

(1.7) Use systematic strategies to organize and record information (e.g., anecdotal scripting, annotated bibliographies).

(2.5) Write job applications and résumés:

a. Provide clear and purposeful information and address the intended audience appropriately.
b. Use varied levels, patterns, and types of language to achieve intended effects and aid comprehension.
c. Modify the tone to fit the purpose and audience.
d. Follow the conventional style for that type of document (e.g., résumé, memorandum) and use page formats, fonts, and spacing that contribute to the readability and impact of the document.

2.3 Written and Oral English Language Conventions

Specific applications of English Language Conventions standards (grades nine and ten):

(1.4) Produce legible work that shows accurate spelling and correct use of the conventions of punctuation and capitalization.

2.4 Listening and Speaking

Specific applications of Listening and Speaking Strategies and Applications standards (grade eight):

(1.1) Analyze oral interpretations of literature, including language choice and delivery, and the effect of the interpretations on the listener.

(1.2) Paraphrase a speaker's purpose and point of view and ask relevant questions concerning the speaker's content, delivery, and purpose.

(1.3) Organize information to achieve particular purposes by matching the message, vocabulary, voice modulation, expression, and tone to the audience and purpose.

(1.4) Prepare a speech outline based upon a chosen pattern of organization, which generally includes an introduction; transitions, previews, and summaries; a logically developed body; and an effective conclusion.

(1.5) Use precise language, action verbs, sensory details, appropriate and colorful modifiers, and the active rather than the passive voice in ways that enliven oral presentations.

(1.6) Use appropriate grammar, word choice, enunciation, and pace during formal presentations.

(1.7) Use audience feedback (e.g., verbal and nonverbal cues):
   a. Reconsider and modify the organizational structure or plan.
   b. Rearrange words and sentences to clarify the meaning.

(1.8) Evaluate the credibility of a speaker (e.g., hidden agendas, slanted or biased material).

(1.9) Interpret and evaluate the various ways in which visual image makers (e.g., graphic artists, illustrators, news photographers) communicate information and affect impressions and opinions.

(2.1) Deliver narrative presentations (e.g., biographical, autobiographical):
   a. Relate a clear, coherent incident, event, or situation by using well-chosen details.
   b. Reveal the significance of, and the subject's attitude about, the incident, event, or situation.
   c. Employ narrative and descriptive strategies (e.g., relevant dialogue, specific action, physical description, background description, comparison or contrast of characters).

(2.2) Deliver oral responses to literature:
   a. Interpret a reading and provide insight.
   b. Connect the students' own responses to the writer's techniques and to specific textual references.
   c. Draw supported inferences about the effects of a literary work on its audience.
   d. Support judgments through references to the text, other works, other authors, or personal knowledge.

(2.3) Deliver research presentations:
   a. Define a thesis.
   b. Record important ideas, concepts, and direct quotations from significant information sources and paraphrase and summarize all relevant perspectives on the topic, as appropriate.
   c. Use a variety of primary and secondary sources and distinguish the nature and value of each.
   d. Organize and record information on charts, maps, and graphs.

(2.4) Deliver persuasive presentations:
   a. Include a well-defined thesis (i.e., one that makes a clear and knowledgeable judgment).
   b. Differentiate fact from opinion and support arguments with detailed evidence, examples, and reasoning.
   c. Anticipate and answer listener concerns and counterarguments effectively through the inclusion and arrangement of details, reasons, examples, and other elements.
   d. Maintain a reasonable tone.

(2.5) Recite poems (of four to six stanzas), sections of speeches, or dramatic soliloquies, using voice modulation, tone, and gestures expressively to enhance the meaning.

Specific applications of Listening and Speaking Strategies and Applications standards (grades nine and ten):

(1.7) Use props, visual aids, graphs, and electronic media to enhance the appeal and accuracy of presentations.

(2.2) Deliver expository presentations:

a. Marshal evidence in support of a thesis and related claims, including information on all relevant perspectives.
b. Convey information and ideas from primary and secondary sources accurately and coherently.
c. Make distinctions between the relative value and significance of specific data, facts, and ideas.
d. Include visual aids by employing appropriate technology to organize and display information on charts, maps, and graphs.
e. Anticipate and address the listener's potential misunderstandings, biases, and expectations.
f. Use technical terms and notations accurately.

(2.5) Deliver persuasive arguments (including evaluation and analysis of problems and solutions and causes and effects):

a. Structure ideas and arguments in a coherent, logical fashion.
b. Use rhetorical devices to support assertions (e.g., by appeal to logic through reasoning; by appeal to emotion or ethical belief; by use of personal anecdote, case study, or analogy).
c. Clarify and defend positions with precise and relevant evidence, including facts, expert opinions, quotations, expressions of commonly accepted beliefs, and logical reasoning.
d. Anticipate and address the listener's concerns and counterarguments.

Specific applications of Speaking Applications standards (grades eleven and twelve):

(2.2) Deliver oral reports on historical investigations:

a. Use exposition, narration, description, persuasion, or some combination of those to support the thesis.
b. Analyze several historical records of a single event, examining critical relationships between elements of the research topic.
c. Explain the perceived reason or reasons for the similarities and differences by using information derived from primary and secondary sources to support or enhance the presentation.
d. Include information on all relevant perspectives and consider the validity and reliability of sources.

(2.4) Deliver multimedia presentations:

a. Combine text, images, and sound by incorporating information from a wide range of media, including films, newspapers, magazines, CD-ROMs, online information, television, videos, and electronic media-generated images.
b. Select an appropriate medium for each element of the presentation.
c. Use the selected media skillfully, editing appropriately and monitoring for quality.
d. Test the audience's response and revise the presentation accordingly.

2.5 Multimedia

Understand the importance of technical and computer-aided design and drawing technologies essential to the construction industry, including reading, interpreting, and creating drawings, sketches, and schematics by using the drawing conventions and standards of the construction industry; interpreting and understanding detailed information provided from technical documents (print and electronic) and experienced people; and using computers and calculators in a variety of applications.

3.0 Career Planning and Management

Students understand how to make effective decisions, use career information, and manage personal career plans:

3.1 Know the personal qualifications, interests, aptitudes, knowledge, and skills necessary to succeed in careers.
3.2 Understand the scope of career opportunities and know the requirements for education, training, and licensure.
3.3 Develop a career plan that is designed to reflect career interests, pathways, and postsecondary options.
3.4 Understand the role and function of professional organizations, industry associations, and organized labor in a productive society.
3.5 Understand the past, present, and future trends that affect careers, such as technological developments and societal trends, and the resulting need for lifelong learning.
3.6 Know important strategies for self-promotion in the hiring process, such as job applications, résumé writing, interviewing skills, and preparation of a portfolio.
3.7 Understand the nature of entrepreneurial activities.

4.0 Technology

Students know how to use contemporary and emerging technological resources in diverse and changing personal, community, and workplace environments:

4.1 Understand past, present, and future technological advances as they relate to a chosen pathway.
4.2 Understand the use of technological resources to gain access to, manipulate, and produce information, products, and services.

4.3 Understand the influence of current and emerging technology on selected segments of the economy.
4.4 Understand ways in which raw materials are collected and processed to produce industrial materials.

5.0 Problem Solving and Critical Thinking

Students understand how to create alternative solutions by using critical and creative thinking skills, such as logical reasoning, analytical thinking, and problem-solving techniques:

5.1 Apply appropriate problem-solving strategies and critical thinking skills to work-related issues and tasks.
5.2 Understand the systematic problem-solving models that incorporate input, process, outcome, and feedback components.
5.3 Use critical thinking skills to make informed decisions and solve problems.
5.4 Apply trouble-shooting strategies, including failure-analysis procedures, in three-dimensional product material and design work.
5.5 Apply the design process in the design, development, evaluation, and refinement of a prototype for a construction industry product.

6.0 Health and Safety

Students understand health and safety policies, procedures, regulations, and practices, including the use of equipment and handling of hazardous materials:

6.1 Know the policies, procedures, and regulations regarding health and safety in the workplace, including employers' and employees' responsibilities.
6.2 Understand critical elements of health and safety practices related to storing, cleaning, and maintaining tools, equipment, and supplies.
6.3 Know procedures for and regulations concerning the handling, storage, and disposal of hazardous materials.
6.4 Know how regulatory agency laws and regulations are created and enforced.
6.5 Evaluate past, present, and future impacts of technological developments on the environment.
6.6 Understand the importance of identifying health and safety problems as well as asking for help or approaching supervisors to discuss concerns.

7.0 Responsibility and Flexibility

Students know the behaviors associated with the demonstration of responsibility and flexibility in personal, workplace, and community settings:

7.1 Understand the qualities and behaviors that constitute a positive and professional work demeanor.

7.2 Understand the importance of accountability and responsibility in fulfilling personal, community, and workplace roles.
7.3 Understand the need to adapt to varied roles and responsibilities.
7.4 Understand that individual actions can affect the larger community.
7.5 Understand employer and employee responsibilities in the workplace.

8.0 Ethics and Legal Responsibilities

Students understand professional, ethical, and legal behavior consistent with applicable laws, regulations, and organizational norms:

8.1 Know the major local, district, state, and federal regulatory agencies and entities that affect the industry and how they enforce laws and regulations.
8.2 Understand the concept and application of ethical and legal behavior consistent with workplace standards.
8.3 Understand the role of personal integrity and ethical behavior in the workplace.
8.4 Understand how social, organizational, and technological systems work.

9.0 Leadership and Teamwork

Students understand effective leadership styles, key concepts of group dynamics, team and individual decision making, the benefits of workforce diversity, and conflict resolution:

9.1 Understand the characteristics and benefits of teamwork, leadership, and citizenship in the school, community, and workplace settings.
9.2 Understand the ways in which preprofessional associations, such as SkillsUSA, and competitive career development activities enhance academic skills, promote career choices, and contribute to employability.
9.3 Understand how to organize and structure work individually and in teams for effective performance and the attainment of goals.
9.4 Know multiple approaches to conflict resolution and their appropriateness for a variety of situations in the workplace.
9.5 Understand how to interact with others in ways that demonstrate respect for individual and cultural differences and for the attitudes and feelings of others.
9.6 Communicate ideas to justify positions, persuade and convince others, confirm responsibility, and evaluate existing policies and procedures.

10.0 Technical Knowledge and Skills

Students understand the essential knowledge and skills common to all pathways in the Building Trades and Construction sector:

10.1 Understand construction processes and systems and their importance in construction technology.
10.2 Maintain and troubleshoot equipment used in the construction industry.

10.3 Use, store, and allocate materials efficiently, and use space efficiently.
10.4 Understand the planning and design, construction, and servicing of structures and electromechanical systems in relation to construction activities.
10.5 Understand the resources used to transport people and goods in the construction industry.
10.6 Understand universal graphic conventions and symbols and technical manuals and specifications.
10.7 Understand the attributes of good design.
10.8 Understand the role of the construction industries sector in the California economy.
10.9 Understand the need to participate in sector-related professional improvement activities, SkillsUSA, other career technical education leadership and skill associations, and related career pathway specializations.
10.10 Understand the need to obtain and maintain industry-standard, technical certifications significant to an industry sector.
10.11 Understand the role of labor unions, both historically and currently, and the impact of unions on worker rights and protections, including wages, working conditions, health and safety, and benefits.

11.0 Demonstration and Application

Students demonstrate and apply the concepts contained in the foundation and pathway standards.

PATHWAY STANDARDS

A. Cabinetmaking and Wood Products Pathway

The Cabinetmaking and Wood Products Pathway provides learning opportunities for students interested in preparing for careers in cabinet construction, millwork, and wood products and covers the construction of both custom and production products.

A1.0 Students understand measurement systems in the planning and layout process used in the cabinetmaking and wood products industry:

- A1.1 Know design solutions to common problems in cabinetmaking and wood products.
- A1.2 Understand calculation procedures for materials and production requirements for wood product designs.
- A1.3 Convert scaled drawing measurements to full dimensional layout and template applications.
- A1.4 Know conventional measurement processes for cabinetmaking and wood products, linear measurements, and conversions of fractions and decimals.

A2.0 Students understand the safe and appropriate use of hand tools common to the cabinetmaking and wood products industry:

- A2.1 Use common hand tools and accessories, such as planers, shapers, clamping and gripping tools, pliers, wrenches, wood chisels, hammers, hand saws, and squares, safely and properly.
- A2.2 Maintain and care for common hand tools.

A3.0 Students understand the safe and appropriate use of portable power tools common to the cabinetmaking and wood products industry:

- A3.1 Use portable power tools, such as single and compound miter saws, drills, sanders, saber saws, and routers, safely and appropriately.
- A3.2 Use pneumatic tools, such as pneumatic clamps, grips, framing nail guns, and finishing and brad nail guns, safely and properly.
- A3.3 Maintain and care for portable power and pneumatic tools.

A4.0 Students understand the safe and appropriate use of stationary power machines and equipment common to the cabinetmaking and wood products industry:

- A4.1 Understand the proper and safe use of stationary power tools used in the milling process, such as shapers, sanders, joiners, table saws, and band saws.
- A4.2 Understand the proper and safe use of stationary power tools used in the assembly process, such as pneumatic table clamps, case clamps, case frame fasteners, and hardware fasteners.

A4.3 Understand the proper and safe use of stationary power tools used in the finishing process, such as glue applicators, laminate applicators, and lacquer and paint applicators.

A4.4 Know the basic care, maintenance, and lock-out procedures for stationary power tools.

A5.0 Students understand procedures and processes as they occur in the cabinetmaking and wood products industry:

A5.1 Know how to read, understand, design, and construct cabinets accurately from cabinetmaking fabrication and installation plans and specifications.

A5.2 Understand how to estimate a bill of materials from drawings and specifications for constructing cabinets.

A5.3 Understand how to create a job schedule in a cabinetmaking project.

A5.4 Solve common cabinetmaking problems by using construction codes and cabinet building standards stated in the *Manual of Millwork.*

A5.5 Understand recordkeeping procedures in all phases of cabinetmaking (e.g., time accounting, cost of goods).

A6.0 Students understand the value and necessity of practicing occupational safety in the cabinetmaking industry or shop:

A6.1 Know the safety rules in the cabinetmaking work environment.

A6.2 Use hand tools (wood chisels, drills, coping saws) and power tools (routers, sanders, planers) safely in the cabinet working environment.

A6.3 Understand how to handle and dispose of toxic materials safely and use protective clothing as needed when using lacquers, acetone, thinners, staining materials, and so forth in an environmentally responsible manner.

A7.0 Students understand the variety of production processes used in the cabinetmaking and wood products industry:

A7.1 Design and create cabinet and wood products.

A7.2 Develop a production plan, including the layout, bill of materials, and cost analysis, for the production of cabinets or wood products.

A7.3 Use stationary and portable power tools in milling the components for cabinets and wood products.

A7.4 Use stationary and portable power tools in the assembly of cabinet and wood product components.

A7.5 Use finish tools (e.g., airless sprayers, palm sanders) and techniques for finishing cabinets and wood products.

A7.6 Use installation tools and understand the processes for the installation of cabinets, millwork, and wood products.

A8.0 Students understand the impact of financial, technical, and environmental trends on the past and future of the cabinetmaking and wood products industry:

- A8.1 Understand significant historical trends in cabinetmaking and wood products technology.
- A8.2 Understand environmental regulations that influence the cabinetmaking and wood products industry.
- A8.3 Understand issues of the sustainable use of wood product resources.

A9.0 Students understand career preparation and how it applies across all standards for students planning to enter and advance successfully in the cabinetmaking and wood products industry:

- A9.1 Understand the careers that are available in cabinetmaking and wood products manufacturing and related occupations (e.g., custom crafts, furniture making, marketing).
- A9.2 Understand the need for professional growth across all aspects of the industry, including financial, leadership, and advancement elements.

B. Engineering and Heavy Construction Pathway

The Engineering and Heavy Construction Pathway provides learning opportunities for students interested in preparing for careers in engineering and heavy industrial construction (roads, highways, subdivisions). The pathway includes instruction in the way in which these structures are built.

B1.0 Students understand and apply measurement systems in the planning and layout process used in the engineering and heavy construction industry:

- B1.1 Identify design solutions to engineering and heavy construction problems.
- B1.2 Calculate the required materials, such as soils, aggregate, asphalt, concrete, and pipe, for engineering and heavy construction applications.
- B1.3 Understand the conversion of scaled blueprint measurements to full-size, on-site parameters.
- B1.4 Apply conventional engineering and heavy construction measurement processes accurately (e.g., laser transits, laser levels, GPS instruments) for surveying and plan development.
- B1.5 Know the use of conventional engineering and heavy construction mathematical functions to calculate on-site preparation and site development and improvement materials.

B2.0 Students understand the safe and appropriate use of hand tools common to the engineering and heavy construction industry:

- B2.1 Use the common hand tools of the trade, such as rebar cutters, metal stud cutters/pliers, concrete floats/fresnoes, sheet metal cutters/pliers, saws, hammers, chisels, and wrenches, safely and appropriately.
- B2.2 Maintain and care for common hand tools.

B3.0 Students understand the safe and appropriate use of portable power tools that are common to the engineering and heavy construction industry and are appropriate to the individual student's level:

- B3.1 Use portable power tools, such as circular saws, saber saws, reciprocating saws, and straight and right-angle drills, safely and appropriately.
- B3.2 Use pneumatic tools, such as jack hammers, rotary hammers, impact wrenches, concrete tampers, framing nail guns, roofing nail guns, and drills, safely and appropriately.
- B3.3 Maintain and care for portable power tools and pneumatic tools.
- B3.4 Understand the use of heavy equipment in engineering and heavy construction.

B4.0 Students understand project management procedures and processes as they occur in an engineering and heavy construction project:

- B4.1 Know how to read, understand, and construct projects accurately from commercial specifications and blueprints, ensuring compliance with state and local building codes.
- B4.2 Understand how to estimate the cost of supplies and materials for an engineering and heavy construction project.
- B4.3 Understand how to plan all construction phases, including subcontractor schedules, clearing, rough grading, wet and dry utilities, fine grading, concrete, and job closeout.
- B4.4 Solve common construction problems (e.g., grading, drainage) by using commercial construction codes and building standards.
- B4.5 Understand contract administration (e.g., invoicing vendors, subcontractors), including the "draw and voucher" accounting/record system used in construction project management.
- B4.6 Understand the roles in heavy construction of design engineers, estimators, superintendents, project managers, foremen, operators/drivers, administrators, and inspectors.

B5.0 Students understand the value and necessity of practicing occupational safety in the engineering and heavy construction laboratory or shop:

- B5.1 Understand the importance of scaffold and ladder safety.
- B5.2 Know the rules and responsibilities of the various governmental safety agencies and their impact on engineering and heavy construction.
- B5.3 Understand the importance of worksite safety as it pertains to hazardous waste disposal and procedures for containment of toxic and hazardous materials.
- B5.4 Understand the importance of safety and safe work practices (e.g., fire safety, protective clothing) in the welding phases of engineering and heavy construction and the safe operation of heavy equipment (e.g., earth movers, bladers, bulldozers).

B6.0 Students understand the variety of building phases, systems, and techniques used in engineering and heavy construction:

- B6.1 Understand the development of building plans and schedules using processes common to engineering and heavy construction.
- B6.2 Know the appropriate use of tools, processes, and materials in architectural design, project development, and engineering and heavy construction (e.g., structural, electrical, mechanical, and finish phases).

B7.0 Students understand the impact of financial, technical, and environmental trends on the past and future of the construction industry:

B7.1 Understand significant historical trends in engineering and heavy construction technology.

B7.2 Understand environmental regulations that influence engineering and heavy construction projects.

B8.0 Students understand career preparation and how it applies across all standards for students planning to enter and advance successfully in the engineering and heavy construction industry:

B8.1 Understand the careers that are available in the heavy construction industry, including careers in concrete masonry, ironworks, sheet metal sales and installation, plumbing, and construction technology.

C. Mechanical Construction Pathway

The Mechanical Construction Pathway provides learning opportunities for students interested in preparing for careers in mechanical construction (plumbing; electrical; heating, ventilation, air conditioning [HVAC]). The pathway includes instruction in the manner in which these systems work in structures.

C1.0 Students understand and apply measurement systems in the planning and layout process used in the mechanical construction industry:

- C1.1 Identify design solutions to given mechanical construction problems.
- C1.2 Calculate the required equipment and materials for mechanical construction applications.
- C1.3 Convert scaled blueprint drawing measurements to the full dimensions for a given mechanical construction project.
- C1.4 Apply conventional construction measurement processes accurately (geometric and trigonometric functions).
- C1.5 Know the use of conventional construction formulas to determine production requirements, such as converting linear measures to volumetric measures and calculating voltage drop/power requirements (electrical), by using specifications in the National Electrical Code.

C2.0 Students understand the safe and appropriate use of hand tools common to the mechanical construction industry:

- C2.1 Use the common hand tools of the trade, such as ladders and safety gear (fall protection), pliers, wire strippers, meters, pipe wrenches, torches, and sheet metal shears and benders, safely and appropriately.
- C2.2 Maintain and care for the common hand tools used in mechanical construction.

C3.0 Students understand the safe and appropriate use of portable power tools that are common to mechanical construction and are appropriate for the individual student's level:

- C3.1 Use portable power tools, such as reciprocating saws, saber saws, chain saws, drills, threaders, and benders, safely and appropriately.
- C3.2 Use portable pneumatic tools, such as rough framing nail guns, interior finishing and brad nail guns, hammers, impact wrenches, drills, and compressors, safely and appropriately.
- C3.3 Maintain and care for portable power tools and portable pneumatic tools.

C4.0 Students understand project management procedures and processes as they occur in a mechanical construction project:

- C4.1 Know how to read, understand, and construct projects accurately from mechanical construction blueprints and specifications.
- C4.2 Understand how to estimate equipment and materials from blueprints and specifications.

C4.3 Understand the sequencing of events for a specific mechanical construction project.

C4.4 Solve common mechanical construction problems by using Uniform Building Codes and *Air Conditioning and Refrigeration Institute Standards.*

C4.5 Understand industry conventions for the creation and maintenance of construction logs.

C4.6 Know the importance of customer service/relations as applied to project management and wholesale and retail sales.

C5.0 Students understand and practice occupational safety in the mechanical construction industry facility and job site:

C5.1 Understand the safe use of electrical materials and electrical connection procedures.

C5.2 Use appropriate safety procedures and practices in various work environment settings pertaining to mechanical construction (e.g., plumbing, electrical, HVAC).

C6.0 Students understand the variety of building phases, systems, and techniques used in mechanical construction:

C6.1 Develop building plans and schedules by using processes common to mechanical construction.

C6.2 Understand processes and materials appropriate to architectural design and mechanical construction (e.g., structural, electrical, mechanical, and finish phases).

C6.3 Understand the phases of mechanical construction, such as rough and finish, electrical, sheet metal ducting, and HVAC installation.

C7.0 Students understand the impact of financial, technical, and environmental trends on the past and future of the mechanical construction industry:

C7.1 Understand significant historical trends in the construction industry.

C7.2 Develop financial plans for construction projects.

C7.3 Understand environmental regulations that influence mechanical design.

C7.4 Understand and recognize indoor air quality issues and regulations.

D. Residential and Commercial Construction Pathway

The Residential and Commercial Construction Pathway provides learning opportunities for students interested in preparing for careers in construction (framing, plumbing, electrical, and so forth). The standards focus on the manner in which residential and commercial structures are built.

D1.0 Students understand and apply measurement systems in the planning and layout process used in the residential construction industry:

- D1.1 Identify design solutions for residential construction problems.
- D1.2 Calculate required materials for residential construction applications.
- D1.3 Convert scaled blueprint drawing measurements to full dimensions for a given construction project.
- D1.4 Apply conventional construction measurement processes accurately (geometric and trigonometric functions).
- D1.5 Know the use of conventional construction formulas to determine production requirements.

D2.0 Students understand the safe and appropriate use of hand tools common to the residential and commercial construction industry:

- D2.1 Use the common hand tools of the trade, such as hammers, torches, pliers, wire cutters, pipe cutters, saws, chisels (wood and concrete), and wrenches, safely and properly.
- D2.2 Maintain and care for hand tools used in residential and commercial construction.

D3.0 Students understand the safe and appropriate use of portable power tools that are common to the residential construction industry and are appropriate to the individual student's level:

- D3.1 Use portable power tools, such as circular saws, table saws, saber saws, drills, planers, and sanders, safely and properly.
- D3.2 Use portable pneumatic tools, such as rough framing nail guns, interior finishing and brad nail guns, hammers, impact wrenches, drills, and compressors, safely and appropriately.
- D3.3 Maintain and care for portable power tools and portable pneumatic tools.

D4.0 Students understand project management procedures and processes as they occur in a construction project:

- D4.1 Interpret and use residential construction blueprints and specifications.
- D4.2 Understand how to estimate materials from blueprints and specifications.
- D4.3 Understand the sequencing of events for specific construction projects.

D4.4 Solve common residential construction problems, such as framing, plumbing, and electrical, by using the official codes adopted by the state and local building standards commission.

D4.5 Understand industry conventions for the creation and maintenance of construction logs.

D4.6 Understand customer service/relations as applied to project management and wholesale and retail sales.

D5.0 Students understand the value and necessity of practicing occupational safety in the construction industry facility and job site:

D5.1 Understand the safe use of electrical connection methods and electrical wiring procedures.

D5.2 Know the safety procedures and practices in various work environment settings pertaining to residential and commercial construction.

D6.0 Students understand the variety of building phases, systems, and techniques used in residential and commercial construction:

D6.1 Develop building plans and schedules by using processes common to residential and commercial construction.

D6.2 Understand the processes and materials (e.g., structural, electrical, mechanical, finish) appropriate to the architectural design and residential construction.

D6.3 Prepare the site layout and the site, including the grading and engineering of the building pad.

D6.4 Understand the phases of residential and commercial construction.

D7.0 Students understand the impact of financial, technical, environmental, and labor trends on the past and future of the construction industry:

D7.1 Understand significant historical trends in the construction industry.

D7.2 Develop financial plans for construction projects.

D7.3 Understand the environmental regulations that influence residential and commercial design.