Course of Study

Environmental Controls Technology (HVAC)

Warren County Career Center

3525 North State Route 48
Lebanon, Ohio 45036

Adopted July 17, 2008

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Acknowledgements

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Warren County Career Center

We would like to take this opportunity to express our gratitude to the following people for their guidance and support in the preparation of this course of study:

Warren County Career Center Administrative Team
Warren County Educational Service Center
Mr. Chuck Ramsey
Mr. David Watkins
Mr. Gregory McAfee
Mr. Joe Couture
Mr. Mark Pearce
Mr. Roger Dyer
Mr. Steve Logan
Mr. Steven Spears
Mr. Tom Grothous

Warren County Career Center
Resolution Of School Board Approval

WHEREAS, representatives of Career-Technical Advisory Committee of the Warren County Career Center have reviewed the Environmental Controls Technology (HVAC) Course of Study; and

WHEREAS, this Course of Study is based upon Integrating Technical and Academic Competencies adopted by the State of Ohio for the Environmental Controls Technology (HVAC) program; and

WHEREAS, the Environmental Controls Technology (HVAC) faculty and the Career-Technical Advisory Committee have reviewed and added competencies as needed to address local labor market needs and trends in the industry;

NOW, THEREFORE, BE IT RESOLVED, in accordance with the Superintendent's recommendation, that the Warren County Career Center adopt the Environmental Controls Technology (HVAC) Course of Study.

_____

District Superintendent Date

_____

President, Board of Education Date

Statement of Recommendation

The Career-Technical Advisory Committee at Warren County Career Center has reviewed this course of study and recommends it for use as the foundation for instruction in the ENVIRONMENTAL CONTROLS TECHNOLOGY (HVAC) class.

The developers of this course of study have considered local labor market needs and the school's ability to offer specialized programs. The competencies have been reviewed and accepted as being congruent with our school's vision, mission, and strategic goals. When appropriate, additional competencies related to the program area have been incorporated into this course of study.

Achievement of technical competencies, utilizing proper attitudes, and demonstrating appropriate values are critical for successful employment and for furthering educational opportunities within a student's chosen field. We believe that this course of study adequately and correctly focuses upon student development.

This course of study is recommended on: July 17, 2008

Warren County Career Center Vision Statement

WCCC is the valued partner of choice within the educational and economic systems of our communities, by providing quality academic and career technical education.

We pave the way for a future of opportunities unique to each of our learners.

Warren County Career Center Mission Statement

To prepare youths and adults to make informed career choices and to successfully enter, compete, and advance in a changing work world.

Warren County Career Values

- Treating each other with respect, dignity, trust and mutual value
- Communicating openly and honestly
- Taking ownership of personal actions and being held accountable for results
- Upholding and demonstrating high ethical, educational and fiscal standards
- Exhibiting high levels of professionalism
- Providing high quality instruction and highly qualified staff to ensure success for all learners
- Making quality customer service a high priority
- Promoting partnerships and a team environment
- Celebrating team and individual achievements
- Using data to drive planning, decision making and actions
- Embracing educational opportunities for change and diversity

Course Design

Courses are designed to reflect career-focused education, which combines high-level academics with real-life technical skills. The intent is to maximize a student's present and future academic and career success.

Career-focused education enhances the integration of academic and technical skills, designs programs that prepare students with transferable skills and promotes each student's career opportunities.

Course Philosophy

We believe that the Environmental Controls Technology (HVAC) Program will give the student the opportunity to gain experience in many areas of heating, ventilation, air conditioning and refrigeration. Many areas of residential and commercial ENVIRONMENTAL CONTROLS TECHNOLOGY (HVAC) will be covered. Hands on experience will play a major part in the learning experience. In this program topics that will be taught are Safety, Tools and Equipment, Soldering/Brazing/Tubing, Piping, Mechanical Refrigeration, Electrical Fundamentals and Controls/Components, Schematics/Diagrams, Motors & Applications, Heat Pumps, Air Flow/Duct Design, AC Load Calc, and Boilers & Chillers. Commitment to this program and yourself will make you successful.

Course Goals

The course goals for the ENVIRONMENTAL CONTROLS TECHNOLOGY (HVAC) program are to:

- Study residential and commercial cooling and heating systems in a cutting-edge facility
- Apply repair and servicing techniques through trouble-shooting and work on live equipment
- Earn valuable certifications

Course Description

WCCC's Environmental Controls Technology (Heating, Ventilation, and Air Conditioning/Refrigeration) program provides a solid background for attractive employment in a very stable industry. You will study both residential and commercial cooling and heating systems in a cutting-edge facility. You will learn about hydronic systems, air duct sizing, air and water balancing procedures, psychometrics of heating, ventilation. And air conditioning systems. Heat pumps and installation procedures. You will develop diagnostic skills as well as apply repair and servicing techniques through troubleshooting and work on live equipment. With the opportunity to earn valuable industry certifications, you may enter the workforce or opt to apply credit toward an associate degree or beyond.

Academic and Technical Integration

Expectations of curriculum must be aligned with what is written, taught, assessed, and reported. Student expectations focus on active, project-centered learning—an approach to learning that emphasizes a connection between ideas in a discipline and the outside world. Educational programming and course content will clearly connect career and post-secondary opportunities. At the Warren County Career Center, the main goal is to design courses and projects that use strategies for authentic instruction. These characteristics of instruction focus on deep understanding, established opportunities for concept connections, provide anticipatory and abstract thinking, and emphasize genuine application.

The academic courses at the WCCC follow the state model curricula. They are designed to meet both associate school and state requirements. These standards respond to the need to improve student achievement, quality of curriculum and instruction, and strengthen school and community relationships.

Technology

The Warren County Career Center board and staff believe that technology skills are essential for all students to achieve in the 21st century. It is the goal of this district to infuse technology into all facets of education:

- Instruction
- Assessment
- Administration
- Career planning
- Course design
- Professional development

Strategies to incorporate technology into all facets of education are a priority of the district and there is commitment to a continual process to provide updated hardware, software, and professional development for staff members for the purpose of providing a high quality education, with the integration of technology, for all students.

Job Shadowing

Job Shadowing is designed to give the student a short-term overview of the many opportunities within a career field. Career-technical instructors confer with students to determine appropriate experiences.

Internships and Job Placement vary somewhat, but during each experience students should accomplish the following goals:

1. Work with mentors, supervisors, co-workers, and others to accomplish assigned tasks that contribute to the long- and short-term goals of the student. All aspects of the internship/placement (including dates, times, responsibilities, evaluations, etc.) will be outlined in an approved Internship Learning Plan that is coordinated by the career-technical instructor.

2. Apply basic skills and knowledge to "real world" business settings and learn new skills that are relevant to the career path.

3. Demonstrate a solid understanding of the basic skills outlined in the Internship Learning Plan.

4. Reflect upon the internship/placement/job shadowing in terms of post-secondary education/career options.

The criterion for participation in career-based learning experiences is included in the approved packet for each activity and may be obtained by the instructor from the Career Pathways office.

The specifics of how these opportunities are offered in this career-technical program or statement of academic support are:

Students that meet the requirements set forth by the Early Placement Committee are eligible to work with local businesses during the second semester of their senior year. This allows the student to work during designated lab time with the approval of the Instructor. The Instructor will monitor academic eligibility along with the status of their field progress using contractor evaluations. In addition, parent approval and a written contract with the student for certain goals to be achieved will be required.

Students Served

The population served by this program is juniors and seniors.

Scope and Sequence

Competency	12	AD	ApT	BIL
CONSTRUCTION TECHNOLOGIES CORE BODY OF KNOWLEDGE				
Unit 1: Career Exploration and Development				
1.1 Explore career pathways in construction technology	P	R	R	E
1.2 Explore professional development opportunities for a construction technology professional	I	P	P	E
1.3 Examine the physical aptitudes necessary to perform critical work functions	P	R	R	E
1.4 Demonstrate sufficient ability to complete essential work functions (e.g., completing a full shift, walking, carrying objects for extended periods)	P	R	R	E
1.5 Prepare for career advancement in construction technology (e.g., extended college)	I	P	P	E
1.6 Examine licensing, certification, and credentialing at the state, national and local level	P	R	R	E
1.7 Explain apprenticeships and their role in the construction industry	P	R	R	E
1.8 Determine the apprenticeship best suited to a career goal	P	R	R	R
1.9 Explain the rights and responsibilities of participants in a construction industry and training programs	I	P	P	E
Unit 2: Materials				
2.1 Examine the various materials used in construction	P	R	R	E
2.2 Explain the various material finishing techniques	I	P	P	E
2.3 Explain the various material testing techniques	I	P	P	R
2.4 Select materials for various construction applications	P	R	R	R
2.5 Describe the handling and use of basic construction materials	P	R	R	E
2.6 Analyze the physical and chemical principles critical to the construction industry	I	P	P	R
Unit 3: Estimating				
3.1 Demonstrate mathematical calculations necessary to estimate time, material, equipment and design needs	P	R	R	E
3.2 Estimate needed materials and equipment	P	R	R	E
3.3 Estimate the amount of labor needed and the respective costs	I	P	R	E
3.4 Analyze the economic impact of various work functions	P	R	R	E
3.5 Describe estimating techniques and responsibilities	I	P	P	R
Unit 4: Inter-relational Systems				
4.1 Explore diverse organizational structures and goals within the construction industry	I	P	P	E
4.2 Differentiate between residential, commercial, industrial and institutional construction segments	P	R	R	R
4.3 Analyze the relationships among various construction stakeholders	P	R	R	E
4.4 Investigate factors that may affect various construction organizational structures	P	R	R	E
4.5 Explain typical construction contract relationships	I	P	P	R
4.6 Apply industry standards and practices to maintain project quality	I	P	P	E
Unit 5: Communications				
5.1 Apply active listening skills to obtain and clarify information provided in oral communications	P	R	R	E

Competency	12	AD	ApT	BIL
5.2 Listen and speak effectively to contribute to group discussions and meetings	P	R	R	E
5.3 Deliver formal and informal presentations that demonstrate organization and delivery skills	P	R	R	E
5.4 Write coherent and focused communications that support a defined perspective	P	R	R	E
5.5 Utilize communication technology	P	R	R	E
5.6 Employ computer technology in construction operations	I	P	P	R
5.7 Explain the impact of emerging electronic technology in construction	I	P	P	E
5.8 Utilize written contract documents to direct the work	I	P	P	E
5.9 Explain the fundamentals of schematics, specifications and construction drawings	P	R	R	E
5.10 Read and interpret construction drawings, specifications and other contractual documents	P	R	R	E
Unit 6: Leadership and Teamwork				
6.1 Demonstrate the ability to work on a team in a construction environment	P	R	R	E
6.2 Perform responsibly as a team member	P	R	R	E
6.3 Use mentoring skills to inspire others to achieve	I	P	P	E
6.4 Describe the basic origins of conflict and the needs that motivate behavior	I	P	P	E
6.5 Examine the different responses to conflict as they relate to results	I	P	P	E
6.6 Resolve conflicts to maintain a smooth workflow	P	R	R	E
Unit 7: Safety				
7.1 Maintain general safety in accordance with government regulations and health standards	P	R	R	E
7.2 Evaluate the ergonomic factors associated with the construction industry	P	R	R	E
7.3 Survey state, federal and local worker safety, health and environmental regulations	P	R	R	E
7.4 Demonstrate practices that contribute to an accident free environment	P	R	R	E
7.5 Explain emergency response plans in a variety of industry settings	P	R	R	E
7.6 Complete the requirements for First Aid and CPR certification	P	R	R	E
7.7 Examine access and egress procedures	P	R	R	E
7.8 Analyze structural issues related to worker safety and health	P	R	R	E
7.9 Process safety documentation	P	R	R	E
7.10 Demonstrate the American National Standards Institute (ANSI) hand signals to communicate with other workers	I	P	P	E
7.11 Utilize universal signs and symbols that apply to given workplace situations	I	P	P	E
Unit 8: Health and Environment				
8.1 Survey state, federal and local worker health and environmental regulations	I	P	P	E
8.2 Demonstrate practices that contribute to a healthy environment	P	R	R	E
8.3 Explain the environmental aspects of work sites with contaminated soil and water	P	R	R	E
8.4 Analyze design and construction elements to control mold	I	P	P	E
8.5 Handle hazardous materials in accordance with government regulations and health standards	P	R	R	E
Unit 9: Legal and Ethical Aspects				
9.1 Differentiate between legal and ethical issues	P	R	R	E

Competency	12	AD	ApT	BIL
9.2 Complete work related duties within an ethical framework	P	R	R	E
9.3 Assess the implications of ethical and unethical behavior	P	R	R	E
9.4 Survey mandated standards	P	R	R	E
9.5 Comply with governmental regulations and applicable codes	I	P	P	E
9.6 Explain employee and employer liability	I	P	P	E
9.7 Perform duties according to regulations, policies, laws, legislated rights and contract provisions	I	P	P	E
9.8 Explain accessibility issues	I	P	P	E
Unit 10: Problem Solving and Critical Thinking				
10.1 Employ critical thinking and problem solving skills to formulate solutions to problems	P	R	R	E
10.2 Apply problem solving and critical thinking techniques to the conflict between available resources, requirements of the project and construction time lines	I	P	P	E
10.3 Combine critical thinking and team building skills to solve problems	P	R	R	E
10.4 Evaluate and adjust plans and schedules to respond to unexpected events and conditions	I	P	P	E
Unit 11: Tools and Equipment				
11.1 Identify the hand and power tools and equipment appropriate to the task	P	R	R	E
11.2 Demonstrate the appropriate uses of tools to complete work functions	P	R	R	E
11.3 Maintain hand and power tools appropriate to the work site	P	R	R	E
11.4 Use appropriate personal protective equipment (PPE)	P	R	R	E
Unit 12: Business Practices				
12.1 Develop a management plan for business	I	P	P	E
12.2 Identify basic procedures in the accounting cycle	P	R	R	E
12.3 Compare and contrast business side versus practice side licenses, insurance, bonds and certifications	I	R	R	R
Unit 13: Basic Construction Skills				
13.1 Explore performance skills in carpentry	P	R	R	E
13.2 Explore performance skills of electricians	P	R	R	E
13.3 Explore performance skills in environmental controls technology	P	R	R	E
13.4 Explore performance skills in brick, block and cement masonry	P	R	R	E
13.5 Explore performance skills in plumbing and pipefitting	P	R	R	E
13.6 Explore performance skills in heavy equipment operations	P	R	R	E
13.7 Explore performance skills in interior construction	P	R	R	E
13.8 Explore performance skills in wood technology products and cabinetry	P	R	R	E
13.9 Explore performance skills in architecture	P	R	R	E
13.10 Explore performance skills in construction management	P	R	R	E
Unit 14: Environmental Controls Technology				
14.1 Appraise the fundamental concepts of human comfort	P	R	R	E
14.2 Analyze and measure electrical values	P	R	R	E
14.3 Troubleshoot single phase, split phase and three phase circuits and devices	I	P	P	E
14.4 Explain the physical laws as applied to refrigeration	P	R	R	R
14.5 Analyze the mechanical refrigeration cycle and components	I	P	P	E
14.6 Explain the refrigeration cycle and its components	P	R	R	E
14.7 Identify and perform soldering and brazing procedures	I	P	P	E
14.8 Demonstrate the proper use of piping materials, fabrication and application	I	P	P	E
14.9 Perform leak detection procedures	I	P	P	E

Competency		12	AD	ApT	BIL
14.10	Demonstrate specialized environmental controls technology test equipment and tools	I	R	P	E
14.11	Install refrigeration and air conditioning equipment	I	P	P	E
14.12	Perform service maintenance (SM) on related environmental controls technology equipment	I	P	P	E
14.13	Troubleshoot refrigeration and air conditioning equipment	I	P	P	E
14.14	Service and repair refrigeration and air conditioning equipment (secure EPA refrigerant certification)	I	P	P	E
14.15	Identify and install forced air heating systems	I	P	P	E
14.16	Troubleshoot and service heating systems	I	P	P	E
14.17	Explain the fundamentals of hot water and chilled water systems (hydronics)	P	R	R	R
14.18	Explain the application, selection and installation of hydronic system components	P	R	R	E
14.19	Explain the application, selection and installation of low pressure steam systems		I	P	E
14.20	Assess sheet metal standards and materials	I	P	P	R
14.21	Demonstrate different sheet metal fabrication procedures	I	P	P	E
14.22	Create work sequences for tasks and units of work	I	R	P	E
14.23	Create work assignments for crew and individuals	I	R	P	E
14.24	Clarify client expectations	I	R	P	E
14.25	Employ positive client relationships	I	R	P	E

Unit 1: Career Exploration and Development

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 1.1: Explore career pathways in Construction Technologies

Descriptors:

1.1.1 Identify current and future career options for a person trained in Construction Technologies
1.1.2 Research the historical evolution of the various careers in Construction Technologies
1.1.3 Experience specific construction interests (e.g., shadowing, professional readings, community service, internship)
1.1.4 Identify education and training needed for a career in Construction Technologies

Correlated English Language Arts Academic Content Benchmarks

- *Evaluate the usefulness and credibility of data and sources.* (Research B, 8-10)
- *Compile, organize and evaluate information, take notes and summarize findings.* (Research B, 11-12)
- *Formulate open-ended research questions suitable for investigations and adjust questions as necessary while research is conducted.* (Research A, 8-10; Research A 11-12)
- *Use multiple resources to enhance comprehension of vocabulary.* (Vocabulary F, 8-10)

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 1.2: Explore professional development opportunities for a Construction Technologies professional

Descriptors:

1.2.1 Research continuing education courses or programs available to enhance skills, to remain current in the profession, and for career advancement (e.g., governing organizations and requirements)
1.2.2 Participate in professional organizations, associations, trades shows and seminars
1.2.3 Establish professional relationships with Construction Technologies professionals

Correlated English Language Arts Academic Content Benchmarks

- *Synthesize the content from several sources on a single issue or written by a single author, clarifying ideas and connecting them to other sources and related topics.* (Informational Text D, 11-12)
- *Evaluate the usefulness and credibility of data and sources.* (Research B, 8-10)
- *Compile, organize and evaluate information, take notes and summarize findings.* (Research B, 11-12)
- *Evaluate the usefulness and credibility of data and sources, and synthesize information from multiple sources.* (Research C, 11-12)
- *Formulate open-ended research questions suitable for investigations and adjust questions as necessary while research is conducted.* (Research A, 8-10; Research A, 11-12)
- *Use context clues and text structures to determine the meaning of new vocabulary.* (Vocabulary A, 8-10)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 1.3: Examine the physical aptitudes necessary to perform critical work functions

Descriptors:

1.3.1 Demonstrate manual dexterity, balance and eye-hand coordination
1.3.2 Discuss the various types of physical requirements needed by workers for performing various tasks
1.3.3 Compare different physical aptitudes necessary for different construction areas
1.3.4 Differentiate between healthy and unhealthy behaviors

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 1.4: Demonstrate sufficient ability to complete essential work functions (e.g., completing a full shift, walking, carrying objects for extended periods)

Descriptors:

1.4.1 Demonstrate ways to conserve energy and strength in order to achieve stamina for entire work shifts
1.4.2 Identify safe practices that reduce wear and tear on muscles
1.4.3 Demonstrate exercises that can build strength for the kind of work performed for various skilled trades
1.4.4 Discuss ways to pace activity on the job to ensure maintenance of productivity
1.4.5 Define self-motivation and describe how it affects critical work functions

Correlated English Language Arts Academic Content Benchmarks

- *Use multiple resources to enhance comprehension of vocabulary.* (Vocabulary F, 8-10; Vocabulary E, 11-12)

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	

Competency 1.5: Prepare for career advancement in Construction Technologies (e.g., extended college)

Descriptors:

1.5.1 Identify advancement opportunities in Construction Technologies (e.g., internally and externally)
1.5.2 Remain current with changes in the Construction Technologies profession
1.5.3 Demonstrate quality work as measured by performance evaluations
1.5.4 Maintain a résumé, a list of references and a portfolio

Correlated English Language Arts Academic Content Benchmarks

- *Edit to improve sentence fluency, grammar and usage.* (Writing Process D, 8-10)
- *Apply tools to judge the quality of writing.* (Writing Process E, 8-10)
- *Prepare writing for publication that is legible, follows an appropriate format and uses techniques such as electronic resources and graphics.* (Writing Process F, 8-10)
- *Use a variety of strategies to revise content, organization and style, and to improve word choice, sentence variety, clarity and consistency of writing.* (Writing Process C, 11-12)
- *Produce functional documents that report, organize and convey information and ideas accurately, foresee readers' problems or misunderstandings and include formatting techniques that are user friendly.* (Writing Applications C, 11-12)
- *Edit to improve sentence fluency, grammar and usage.* (Writing Process D, 11-12)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 1.6: Examine licensing, certification and credentialing at the state, national and local level

Descriptors:

1.6.1 Identify licenses, certifications and credentials applicable to career goals
1.6.2 Review the requirements for the various licenses, certifications and credentials
1.6.3 Document sources and agencies for licensing, certification and credentialing information
1.6.4 Review and identify accredited postsecondary education institutions
1.6.5 Maintain a portfolio of work experiences, licenses, certifications and education

Correlated English Language Arts Academic Content Benchmarks

- *Formulate open-ended research questions suitable for investigations and adjust questions as necessary while research is conducted.* (Research A 8-10; Research A 11-12)
- *Evaluate the usefulness and credibility of data and sources.* (Research B, 8-10)
- *Communicate findings, reporting on the substance and processes orally, visually and in writing or through multimedia.* (Research E, 8-10)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 1.7: Explain apprenticeships and their role in the construction industry

Descriptors:

1.7.1 Define apprentice, apprenticeships, and apprenticeable occupations (e.g., Architectural Internship Development Program- AIDP, Engineer in Training-EIT)
1.7.2 Define journeyperson and indentured
1.7.3 Contrast registered and non-registered apprenticeships
1.7.4 Distinguish related instruction from on-the-job training in an apprenticeship pathway

Correlated English Language Arts Academic Content Benchmarks

- *Use context clues and text structures to determine the meaning of new vocabulary.* (Vocabulary A, 8-10)

- *Use multiple resources to enhance comprehension of vocabulary.* (Vocabulary F, 8-10; Vocabulary E, 11-12)

BIL: **Recommended**

EDU:	12	AD	ApT
	P	R	R

Competency 1.8: Determine the apprenticeship best suited to a career goal

Descriptors:

1.8.1 Survey different apprenticeship programs through research, community service, field trips or shadowing
1.8.2 Compare work process schedules
1.8.3 Identify working conditions appropriate to an apprenticeship area
1.8.4 Examine apprenticeship program requirements
1.8.5 Develop a time line for the application process
1.8.6 Research labor market information and employment opportunities for selected apprenticeship programs

Correlated English Language Arts Academic Content Benchmarks

- *Determine the usefulness of organizers and apply appropriate pre-writing tasks*. (Writing Process B, 8-10)
- *Formulate open-ended research questions suitable for investigations and adjust questions as necessary while research is conducted.* (Research A, 8-10; Research A, 11-12)
- *Compile, organize, and evaluate information, take notes and summarize findings.* (Research B, 11-12)

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 1.9: Explain the rights and responsibilities of participants in a construction industry and training programs

Descriptors:

1.9.1 Describe the principles of Equal Employment Opportunity (EEO) regulations
1.9.2 Differentiate job descriptions and duties between various construction industry and training programs
1.9.3 Describe the career ladder requirements for identified construction industry and training programs
1.9.4 Explain the employment issues associated with specific construction industry and training programs (e.g., benefits, pay range, loss of work)
1.9.5 Discuss the need to enroll and complete construction industry and training programs

Unit 2: Materials

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 2.1: Examine the various materials used in construction

Descriptors:

2.1.1 Identify the various materials used in the construction industry

2.1.2 Describe the structure and properties of each material
2.1.3 Discuss similarities and differences between materials that are the same general type (e.g., lumber, pipe fittings, fasteners)
2.1.4 Identify incompatible materials
2.1.5 Identify inherent characteristics of different materials (e.g., wearability, maintenance, ease of use)
2.1.6 Describe standards for materials and approved materials
2.1.7 Identify professional organizations that provide information on materials and standards, e.g., Construction Specification Institute (CSI), American National Standards Institute (ANSI), American Society for Testing Materials (ASTM)

Correlated Mathematics Academic Content Benchmarks

- *Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions.* (Number G, 8-10)

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 2.2: Explain the various material finishing techniques

Descriptors:

2.2.1 Identify the various finishing techniques
2.2.2 Describe the appropriate applications for finishing techniques
2.2.3 Apply finishing techniques

BIL: **Recommended**

EDU:	12	AD	ApT
	I	P	P

Competency 2.3: Explain the various material testing techniques

Descriptors:

2.3.1 Identify the various material testing techniques (e.g., hardness, tensile strength, ductility, wear resistance)
2.3.2 Describe the appropriate testing applications for different materials
2.3.3 Identify regulatory codes related to health, safety and welfare of the material testing process

Correlated Mathematics Academic Content Benchmarks

- *Translate information from one representation (words, table, graph or equation) to another representation of a relation or function.* (Algebra C, 8-10)
- *Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations.* (Algebra D, 8-10)
- *Analyze and compare functions and their graphs using attributes, such as rates of change, intercepts and zeros.* (Algebra E, 8-10)
- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data F, 8-10)
- *Describe sampling methods and analyze the effects of method chosen on how well the resulting sample represents the population.* (Data G, 8-10)
- *Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators*. (Data A, 11-12)

BIL: **Recommended**

EDU:	12	AD	ApT
	P	R	R

Competency 2.4: Select materials for various construction applications

Descriptors:

2.4.1 Describe criteria used for material selection
2.4.2 Identify and evaluate alternative materials
2.4.3 Prepare and communicate a summary of material options to the client
2.4.4 Explain the process necessary to select approved materials
2.4.5 Discuss comparative analysis cost versus quality
2.4.6 Identify code requirements for material choices (e.g., fire safety, toxicity hazard)

Correlated English Language Arts Academic Content Benchmarks

- *Communicate findings, reporting on the substance and processes orally, visually and in writing or through multimedia.* (Research E, 8-10)

Correlated Mathematics Academic Content Benchmarks

- *Make predictions based on theoretical probabilities and experimental results.* (Data K, 8-10)
- *Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators.* (Data A, 11-12*)*
- *Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlation and variability.* (Data B, 11-12)
- *Design and perform a statistical experiment, simulation or study; collect and interpret data; and use descriptive statistics to communicate and support predictions and conclusions.* (Data C, 11-12)
- *Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonableness of solutions.* (Measurement F, 8-10)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 2.5: Describe the handling and use of basic construction materials

Descriptors:

2.5.1 Identify the specific handling and storage characteristics of different materials
2.5.2 Discuss appropriate transport methods for various materials
2.5.3 Identify fastening or joining applications characteristic to different materials
2.5.4 Describe the hazardous properties of materials (e.g., toxicity, flammability, reactivity, corrosiveness)

BIL: **Recommended**

EDU:	12	AD	ApT
	I	P	P

Competency 2.6: Analyze the physical and chemical principles critical to the construction industry

Descriptors:

2.6.1 Differentiate between compatible and incompatible substances (e.g. acids and bases, epoxies, poisonous gases)
2.6.2 Explain weight and mass, and describe how they relate to rigging, wind and structural supports
2.6.3 Describe simple and complex machines such as levers and pulleys
2.6.4 Identify basic engineering and architectural principles in structures
2.6.5 Explain how soil properties, profiles, and types affect construction
2.6.6 Explain the use of hydraulics and pneumatics
2.6.7 Describe the physical properties of materials (e.g., metal, rock, plastic, masonry)

Correlated English Language Arts Academic Content Benchmarks

- *Use context clues and text structures to determine the meaning of new vocabulary.* (Vocabulary A, 8-10)

Correlated Mathematics Academic Content Benchmarks

- *Solve increasingly complex non-routine measurement problems and check for reasonableness of results.* (Measurement A, 8-10)
- *Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonableness of solutions.* (Measurement F, 8-10)
- *Solve problem situations involving derived measurement; e.g., density, acceleration.* (Measurement D, 11-12)
- *Design and perform a statistical experiment, simulation or study; collect and interpret data; and use descriptive statistics to communicate and support predictions and conclusions.* (Data C, 11-12)

Unit 3: Estimating

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency: 3.1: Demonstrate mathematical calculations necessary to estimate time, material, equipment and design needs

Descriptors:

3.1.1 Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions
3.1.2 Find the square root of perfect squares, and the approximate square root of non-perfect squares
3.1.3 Demonstrate fluency in operations with real numbers using mental computation or paper and pencil calculations for simple cases and technology for more complicated cases

3.1.4 Solve increasingly complex non-routine measurement problems and check for reasonableness of results
3.1.5 Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified precision
3.1.6 Write and solve real-world, multi-step problems involving money and elapsed time
3.1.7 Apply various measurement scales to solve problems
3.1.8 Estimate and compute areas and volume in increasingly complex problem situations
3.1.9 Identify and apply appropriate estimating techniques for the level of design
3.1.10 Identify the impact of budget scope and scheduling on estimating

Correlated Mathematics Academic Content Benchmarks

- *Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions.* (Number G, 8-10)
- *Estimate, compute and solve problems involving scientific notation, square roots and numbers with integer exponents.* (Number I, 8-10)
- *Solve increasingly complex non-routine measurement problems and check for reasonableness of results.* (Measurement A, 8-10)
- *Demonstrate fluency in operations with real numbers, vectors and matrices, using mental computation or paper and pencil calculations for simple cases and technology for more complicated cases.* (Number D, 11-12)
- *Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision.* (Measurement E, 8-10)
- *Explain the differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations.* (Measurement A, 11-12)
- *Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonableness of solutions.* (Measurement F, 8-10)
- *Formulate a problem or mathematical model in response to a specific need or situation, determine the information required to solve the problem, choose a method for obtaining this information, and set limits for an acceptable solution.* (Mathematics. Process A, 8-10)
- *Apply mathematical knowledge and skills routinely in other content areas and practical situations.* (Mathematics. Process B, 8-10)
- *Use a variety of mathematical representations flexibly and appropriately to organize, record, and communicate mathematical ideas.* (Mathematics. Process E, 8-10)
- *Use precise mathematical language and notations to represent problem situations and mathematical ideas.* (Mathematics. Process F, 8-10)
- *Apply mathematical modeling to workplace and consumer situations, including problem formulation, identification of a mathematical model, interpretation of solution with the model, and validation to original problem situation.* (Mathematics. Process J, 11-12)

BIL: **Essential**

EDU:	**12**	**AD**	**ApT**
	P	**R**	**R**

Competency 3.2: Estimate needed materials and equipment

Descriptors:

3.2.1 Discuss the importance of estimating materials correctly
3.2.2 Describe the concept of profit used in estimations (e.g., the impact of proper layout)
3.2.3 Calculate the amount of material needed for given dimensions
3.2.4 Apply various formulas for calculating materials
3.2.5 Estimate equipment-related costs
3.2.6 Introduce the concepts of life cycle cost analysis; for example, Life Cycle Assessment (LCA)

Correlated Mathematics Academic Content Benchmarks

- *Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators.* (Data A, 11-12)
- *Explain differences among accuracy, precision, and error, and describe how each of those can affect solutions in measurement situations.* (Measurement A, 11-12)
- *Estimate and compute areas and volume in increasingly complex problem situations.* (Measurement C, 11-12)
- *Solve increasingly complex non-routine measurement problems and check for reasonableness of results.* (Measurement A, 8-10)
- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data F, 8-10)
- *Find, use and interpret measures of center and spread, such as mean and quartiles, and use those measures to compare and draw conclusions about sets of data.* (Data D, 8-10)

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	R

Competency 3.3: Estimate the amount of labor needed and the respective costs

Descriptors:

3.3.1 Factor labor needs in relation to job requirements
3.3.2 Calculate time factors (e.g., labor hours, project schedules, project completion)
3.3.3 Estimate the cost of labor and overhead based on the contractual documents

Correlated Mathematics Academic Content Benchmarks

- *Formulate a problem or mathematical model in response to a specific need or situation, determine the information required to solve the problem, choose a method for obtaining this information, and set limits for an acceptable solution.* (Mathematics. Process A, 8-10)
- *Apply mathematical knowledge and skills routinely in other content areas and practical situations.* (Mathematics. Process B, 8-10)
- *Use formulas to find surface area and volume for specified three-dimensional objects accurate to a specified level of precision.* (Measurement B, 8-10)
- *Use a variety of mathematical representations flexibly and appropriately to organize, record and communicate mathematical ideas.* (Mathematics. Process E, 8-10)
- *Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner.* (Mathematics. Process H, 8-10)
- *Communicate mathematical ideas orally and in writing with a clear purpose and appropriate for a specific audience.* (Mathematics. Process I, 11-12)
- *Apply mathematical modeling to workplace and consumer situations, including problem formulation, identification of a mathematical model, interpretation of solution with the model, and validation to original problem situation.* (Mathematics. Process J, 11-12)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 3.4: Analyze the economic impact of various work functions

Descriptors:

3.4.1 Identify factors related to overhead cost (e.g., permits, bonds, weather, material shortages)
3.4.2 Discuss the impact of overhead cost to clients and contractors

3.4.3	Compare and contrast costs associated with different construction equipment
3.4.4	Discuss costs associated with providing a safe working environment
3.4.5	Gather sample costs for permits, approvals, bonds and licensing
3.4.6	Discuss the responsibilities of the estimator
3.4.7	Differentiate between project cost, escalation cost and construction cost

Correlated Mathematics Academic Content Benchmarks

- *Formulate a problem or mathematical model in response to a specific need or situation, determine the information required to solve the problem, choose a method for obtaining this information, and set limits for acceptable solution.* (Mathematics. Process A, 8-10)
- *Construct algorithms for multi-step and non-routine problems.* (Mathematics. Process A, 11-12)
- *Apply mathematical modeling to workplace and consumer situations, including problem formulation, identification of a mathematical model, interpretation of a solution with the model, and validation to the original problem situation.* (Mathematics. Process J, 11-12)

Correlated English Language Arts Academic Content Benchmarks

- *Formulate open-ended research questions suitable for investigations and adjust questions as necessary while research is conducted.* (Research A, 8-10; Research A, 11-12)
- *Evaluate the usefulness and credibility of data and sources.* (Research B, 8-10)
- *Organize information from various resources and select appropriate sources to support central ideas, concepts and themes.* (Research C, 8-10)
- *Evaluate the usefulness and credibility of data and sources and synthesize information from multiple sources.* (Research C, 11-12)
- *Communicate findings, reporting on the substance and processes orally, visually and in writing or through multimedia*. (Research E, 8-10)

BIL: **Recommended**

EDU:	**12**	**AD**	**ApT**
	I	**P**	**P**

Competency 3.5: Describe estimating techniques and responsibilities

Descriptors:

3.5.1	Discuss estimating techniques or methods (e.g., manual vs. software)
3.5.2	Describe how estimating software practices affect take-off efficiency
3.5.3	Describe methods appropriate to project design and construction phases
3.5.4	Discuss concepts of value engineering (e.g., alternative systems and materials)

Correlated Mathematics Academic Content Benchmarks

- *Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations.* (Measurement A, 11-12)

Unit 4: Inter-relational Systems

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 4.1: Explore diverse organizational structures and goals within the construction industry

Descriptors:

4.1.1 Identify various structures and populations within construction organizations (e.g., unions, independents, contractors, subcontractors, management, customers, designers, requisitions officials, financial and regulatory)

4.1.2 Compare and contrast the roles and missions of predominant construction organizations

4.1.3 Examine the impact of interaction among organizations in the construction industry

Correlated English Language Arts Academic Content Benchmarks

- *Formulate open-ended research questions suitable for investigations and adjust questions as necessary while research is conducted.* (Research A, 8-10; Research A , 11-12)
- *Evaluate the usefulness and credibility of data and sources.* (Research B, 8-10)
- *Compile, organize and evaluate information, take notes and summarize findings.* (Research B, 11-12)
- *Organize information from various resources and select an appropriate source to support central ideas, concepts and themes*. (Research C, 8-10)
- *Evaluate the usefulness and credibility of data and sources and synthesize information from multiple sources*. (Research C, 11-12)

BIL: **Recommended**

EDU:	12	AD	ApT
	P	R	R

Competency 4.2: Differentiate between residential, commercial, industrial and institutional construction segments

Descriptors:

4.2.1 Describe the differences in the decision-making processes

4.2.2 Describe the differences in the decision makers and participants

4.2.3 Describe the skills and construction methodologies appropriate to each segment

Correlated English Language Arts Academic Content Benchmarks

- *Use a variety of strategies to enhance listening comprehension.* (Communication A, 8-10; Communication A, 11-12)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 4.3: Analyze the relationships among various construction stakeholders

Descriptors:

4.3.1 Identify the roles and goals of construction professionals within a given delivery system (e.g., skilled trades, architects and engineers, suppliers, supervisors, consultants, regulators)

4.3.2 Define duties, responsibilities, and contributions of individual professionals within each of the identified professions

4.3.3 Identify the typical chain of communication for the project

4.3.4 Describe issues and responsibilities managed by each level of supervision

4.3.5 Discuss the issues of teamwork and collaboration among all stakeholders

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 4.4: Investigate factors that may affect various construction organizational structures

Descriptors:

4.4.1 Identify current credentials, certifications, apprenticeships and standards

4.4.2 Identify historic, current and emerging trends and issues (e.g., economic, technological, demographic)

4.4.3 Describe how changes affect the organizational structure of the industry

4.4.4 Describe the elements and involved stakeholders in developing and completing a successful project

4.4.5 Describe the economic, environmental, social and political impact of construction projects

Correlated English Language Arts Academic Content Benchmarks

- *Evaluate the usefulness and credibility of data and sources.* (Research B, 8-10)
- *Compile, organize and evaluate information, take notes and summarize findings.* (Research B, 11-12)
- *Communicate findings, reporting on the substance and processes orally, visually and in writing or through multimedia.* (Research E, 8-10)
- *Select and use an appropriate organizational structure to refine and develop ideas for writing.* (Writing Process B, 11-12)
- *Use appropriate self-monitoring strategies for comprehension.* (Reading Process C, 8-10; Reading Process C, 11-12)

BIL: **Recommended**

EDU:	12	AD	ApT
	I	P	P

Competency 4.5: Explain typical construction contract relationships

Descriptors:

4.5.1 Investigate direct hire methods and organizations involved

4.5.2 Differentiate different construction delivery methods

4.5.3 Identify sources of contracting information, such as the American Institute of Architects (AIA), the Associate General Contractors (AGC), the National Association of Home Builders (NAHB)

Correlated English Language Arts Academic Content Benchmarks

- *Use appropriate self-monitoring strategies for comprehension.* (Reading Process C, 8-10; Reading Process C, 11-12)
- *Use a variety of strategies to enhance listening comprehension.* (Communication A, 8-10; Communication A, 11-12)

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 4.6: Apply industry standards and practices to maintain project quality

Descriptors:

4.6.1	Describe how quality improves profitability
4.6.2	Maintain records and reports on issues that affect quality
4.6.3	Adhere to industry standards and practices to ensure a quality outcome

Unit 5: Communications

(Industry-Driven Authentic Assessment, See Appendix.)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 5.1: Apply active listening skills to obtain and clarify information provided in oral communications

Descriptors:

5.1.1	Paraphrase and repeat information to confirm understanding
5.1.2	Record and summarize information in written notes
5.1.3	Ask questions to seek or confirm understanding

Correlated English Language Arts Academic Content Benchmarks

- *Use a variety of strategies to enhance listening comprehension.* (Communication A, 8-10; Communication A, 11-12)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 5.2: Listen and speak effectively to contribute to group discussions and meetings

Descriptors:

5.2.1	Clarify the purpose and goals of a discussion or meeting
5.2.2	Demonstrate respect for diverse cultures
5.2.3	Stay on subject and task
5.2.4	Summarize the results of the meeting, including agreements and disagreements
5.2.5	Speak succinctly and clearly to convey information
5.2.6	Describe terminology spoken on a construction site
5.2.7	Discuss slang and jargon related to the different trades

Correlated English Language Arts Academic Content Benchmarks

- *Demonstrate an understanding of effective speaking strategies by selecting appropriate language and adjusting presentation techniques.* (Communication D, 8-10)
- *Give informational presentations that present ideas in a logical sequence, include relevant facts and details from multiple sources, and use a consistent organizational structure.* (Communication E, 8-10)
- *Select and use effective speaking strategies for a variety of audiences, situations and purposes.* (Communication C, 11-12)
- *Use a variety of strategies to enhance listening comprehension.* (Communication A, 8-10; Communication A, 11-12)

- *Analyze the techniques used by speakers and media to influence an audience, and evaluate the effect this has on the credibility of a speaker or media message.* (Communication B, 8-10)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 5.3: Deliver formal and informal presentations that demonstrate organization and delivery skills

Descriptors:

5.3.1 Demonstrate appropriate usage of grammar, diction and sentence structure
5.3.2 Communicate main ideas and supporting facts to achieve the purpose of communication
5.3.3 Use visual aids and presentation technology to support formal presentations
5.3.4 Use proper organization and structure to achieve coherence
5.3.5 Use technical terms, references and quoted material properly
5.3.6 Communicate mathematical ideas orally with a clear purpose and appropriate for a specific audience

Correlated English Language Arts Academic Content Benchmarks

- *Demonstrate an understanding of effective speaking strategies by selecting appropriate language and adjusting presentation techniques.* (Communication D, 8-10)
- *Give informational presentations that present ideas in a logical sequence, include relevant facts and details from multiple sources, and use a consistent organizational structure.* (Communication E, 8-10; Communication E, 11-12)
- *Provide persuasive presentations using varied speaking techniques and strategies and including a clear controlling idea or thesis.* (Communication F, 11-12)
- *Give presentations using a variety of delivery methods, visual displays and technology.* (Communication G, 8-10; Communication F 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Communicate mathematical ideas orally and in writing with a clear purpose and appropriate for a specific audience.* (Mathematics. Process I, 11-12)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 5.4: Write coherent and focused technical communications that support a defined perspective

Descriptors:

5.4.1 Structure ideas and arguments in an organized manner that are supported by relevant documentation and/or examples
5.4.2 Use correct spelling, grammar, capitalization and punctuation
5.4.3 Identify positions from relevant research and resources
5.4.4 Calculate and interpret descriptive statistics to communicate and support predictions and conclusions
5.4.5 Utilize tables, charts and graphs to clarify textual explanations and support arguments

Correlated Mathematics Academic Content Benchmarks

- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data F, 8-10)
- *Design and perform a statistical experiment, simulation or study; collect and interpret data; and use descriptive statistics to communicate and support predictions and conclusions.* (Data C, 11-12)
- *Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner.* (Mathematics. Process H, 8-10)

Correlated English Language Arts Academic Content Benchmarks

- *Formulate writing ideas, and identify a topic appropriate to the purpose and audience.* (Writing Process A, 8-10; Writing Process A, 11-12)
- *Prepare writing for publication that is legible, follows an appropriate format and uses techniques such as electronic resources and graphics.* (Writing Process F, 8-10; Writing Process F, 11-12)
- *Edit to improve sentence fluency, grammar and usage. (Writing Process D, 8-10)*
- *Select and use an appropriate organizational structure to refine and develop ideas for writing.* (Writing Process B, 11-12)
- *Use documented textual evidence to justify interpretations of literature or to support a research topic.* (Writing Applications D, 8-10)
- *Produce functional documents that report, organize and convey information and ideas accurately, foresee readers' problems or misunderstandings and include formatting techniques that are user friendly.* (Writing Applications C, 11-12)
- *Use correct spelling conventions.* (Conventions A, 8-10; Conventions A, 11-12)
- *Use correct punctuation and capitalization.* (Conventions B, 8-10; Conventions B, 11-12)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 5.5: Utilize communication technology

Descriptors:

5.5.1 Communicate using electronic equipment (e.g., computer, fax, pagers, copier, internet, phone, print, PDA, e-mail)

5.5.2 Access information using electronic equipment

5.5.3 Identify typical acceptable use and documentation policies regarding the use telecommunications tools

Correlated English Language Arts Academic Content Benchmarks

- *Demonstrate an understanding of effective speaking strategies by selecting appropriate language and adjusting presentation techniques.* (Communication D, 8-10)

BIL: **Recommended**

EDU:	12	AD	ApT
	I	P	P

Competency 5.6: Employ computer technology in construction operations

Descriptors:

5.6.1 Use writing and publications applications

5.6.2 Use spreadsheet applications

5.6.3 Use database applications

5.6.4 Describe computer terminology related to the construction profession (i.e., global positioning systems, geographic information systems, electronic surveying equipment, planning and scheduling)

Correlated English Language Arts Academic Content Benchmarks

- *Prepare writing for publication that is legible, follows an appropriate format and uses techniques such as electronic resources and graphics.* (Writing Process F, 8-10; Writing Process F, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Create, interpret and use graphical displays and statistical measures to describe data; e.g., box-and-whisker plots, histograms, scatter plots, measures of center and variability.* (Data A, 8-10)
- *Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators.* (Data A, 11-12)
- *Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlation and variability.* (Data B, 11-12)

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 5.7: Explain the impact of emerging electronic technology in construction

Descriptors:

5.7.1 Identify various uses of technology in construction process (e.g., scheduling, bar coding, material management, equipment, hardware, GPS, RIS and robotics)

5.7.2 Analyze the impact of technology use (e.g., distance learning, CD ROM use) for the construction industry

5.7.3 Implement individualized technology in construction operations

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 5.8: Utilize written contract documents to direct the work

Descriptors:

5.8.1 Generate work orders, including change order requests

5.8.2 Calculate job cost and prepare billing documents

5.8.3 Prepare and process building permit requests

5.8.4 Describe the components of an avoid verbal order, request for information, addendums and bulletins

5.8.5 Apply concepts of tolerances and equivalency to specifications

5.8.6 Identify the components of the contract documents

Correlated English Language Arts Academic Content Benchmarks

- *Produce functional documents that report, organize and convey information and ideas accurately, foresee readers' problems or misunderstandings and include formatting techniques that are user friendly.* (Writing Applications C, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Formulate a problem or mathematical model in response to a specific need or situation, determine the information required to solve the problem, choose a method for obtaining this information, and set limits for an acceptable solution.* (Mathematics. Process A, 8-10)
- *Apply mathematical modeling to workplace and consumer situations, including problem formulation, identification of a mathematical model, interpretation of a solution with the model, and validation to the original problem situation.* (Mathematics. Process J, 11-12)
- *Apply various measurement scales to describe phenomena and solve problems.* (Measurement B, 11-12)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 5.9: Explain the fundamentals of schematics, specifications, and construction drawings

Descriptors:

5.9.1 Recognize, identify and interpret specifications
5.9.2 Identify established procedures for interpreting construction documents and diagrams
5.9.3 Interpret dimensions, symbols, types of lines, views and scales
5.9.4 Make spatial interpretation of various three-dimensional forms for two-dimensional drawings
5.9.5 Apply algebraic procedures and geometric concepts to reading construction documents
5.9.6 Work within established industry tolerance parameters as defined by construction documents
5.9.7 Describe zoning, property lines, utilities, building line, setback, building corners and elevation
5.9.8 Discuss the need for coordinating all trade documents

Correlated Mathematics Academic Content Benchmarks

- *Translate information from one representation (words, table, graph or equation) to another representation of a relation or function.* (Algebra C, 8-10)
- *Apply indirect measurement techniques, tools and formulas, as appropriate, to find perimeter, circumference and area of circles, triangles, quadrilaterals and composite shapes, and to find volume of prisms, cylinders and pyramids.* (Measurement C, 8-10)
- *Draw and construct representations of two- and three-dimensional geometric objects using a variety of tools, such as straightedge, compass and technology.* (Geometry E, 8-10)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 5.10: Read and interpret construction drawings, specifications and other contractual documents

Descriptors:

5.10.1 Organize drawings, specifications and contractual documents
5.10.2 Read and interpret documents
5.10.3 Locate information in documents
5.10.4 Coordinate information between trades and professions

Correlated English Language Arts Academic Content Benchmarks

- *Apply reading comprehension strategies to understand grade-appropriate texts.* (Reading Process A, 8-10; Reading Process A, 11-12)
- *Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing).* (Reading Process B, 8-10; Reading Process B, 11-12)

- *Evaluate how features and characteristics make information accessible and usable and how structures help authors achieve their purposes.* (Reading: Informational Text A, 8-10)
- *Analyze the features and structures of documents and critique them for their effectiveness.* (Reading: Informational Text A, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Use formulas to find surface area and volume for specified three-dimensional objects accurate to a specified level of precision.* (Measurement B, 8-10)
- *Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations.* (Measurement A, 11-12)
- *Apply various measurement scales to describe phenomena and solve problems.* (Measurement B, 11-12)

Unit 6: Leadership and Teamwork

(Industry-Driven Authentic Assessment, See Appendix.)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 6.1: Demonstrate the ability to work on a team in a construction environment

Descriptors:

6.1.1 Define teamwork and team goals and objectives
6.1.2 Identify types of teams (e.g., cross-functional, cross trained)
6.1.3 Describe the role of teams in high-performance workplaces
6.1.4 Examine unique issues associated with working on teams
6.1.5 Apply team problem solving and conflict resolution practices
6.1.6 Explain the roles and responsibilities of the individual as part of the team
6.1.7 Identify attitudes and behaviors that promote positive interaction among members of the work team (e.g., punctuality, attendance, preparedness)

Correlated English Language Arts Academic Content Benchmarks

- *Use multiple resources to enhance comprehension of vocabulary.* (Vocabulary F, 8-10; Vocabulary E, 11-12)
- *Select and use effective speaking strategies for a variety of audiences, situations and purposes.* (Communication C, 11-12)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 6.2: Perform responsibly as a team member

Descriptors:

6.2.1 Organize and schedule dependent team assignments
6.2.2 Complete assignments in a timely and effective manner
6.2.3 Assist other members of the work team

6.2.4 Monitor and write a report on progress
6.2.5 Discuss typical safety situations encountered where teamwork is essential

Correlated English Language Arts Academic Content Benchmarks

- *Produce functional documents that report, organize and convey information and ideas accurately, foresee readers' problems or misunderstandings and include formatting techniques that are user friendly.* (Writing Applications C, 11-12)

BIL: **Essential**

EDU:	**12**	**AD**	**ApT**
	I	**P**	**P**

Competency 6.3: Use mentoring skills to inspire others to achieve

Descriptors:

6.3.1 Describe the induction process new employees experience when they enter a new work group.
6.3.2 Discuss communication barriers new employees may encounter
6.3.3 Use motivational techniques to enhance performance in others
6.3.4 Develop and use reward and incentive systems

Correlated English Language Arts Academic Content Benchmarks

- *Select and use effective speaking strategies for a variety of audiences, situations and purposes.* (Communication C, 11-12)

BIL: **Essential**

EDU:	**12**	**AD**	**ApT**
	I	**P**	**P**

Competency 6.4: Describe the basic origins of conflict and the needs that motivate behavior

Descriptors:

6.4.1 Identify the basic psychological needs that motivate behavior (e.g., belonging, power, freedom)
6.4.2 Discuss the roles that different values play in generating conflict
6.4.3 Identify how the effects of substance abuse, mental health and disabilities impact conflict

BIL: **Essential**

EDU:	**12**	**AD**	**ApT**
	I	**P**	**P**

Competency 6.5: Examine the different responses to conflict as they relate to results

Descriptors:

6.5.1 Describe the soft response approach (e.g., avoidance, compromise and accommodation) and the typical reasons for using that approach
6.5.2 Describe the hard response approach (e.g., force, threats, aggression and anger) and the typical reasons for using that approach

6.5.3 Describe the principled response approach (e.g. good communication skills, problem solving skills and the ability to see the problem from more than one perspective) and the typical reasons for using that approach

Correlated English Language Arts Academic Content Benchmarks

- *Select and use effective speaking strategies for a variety of audiences, situations and purposes.* (Communication C, 11-12)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 6.6: Resolve conflicts to maintain a smooth workflow

Descriptors:

6.6.1 Use conflict resolution skills
6.6.2 Work collaboratively and cooperatively
6.6.3 Give and receive criticism in a diplomatic and constructive manner
6.6.4 Use diplomatic and constructive statements and responses

Correlated English Language Arts Academic Content Benchmarks

- *Select and use effective speaking strategies for a variety of audiences, situations and purposes. (Communication C, 11-12)*
- *Use a variety of strategies to enhance listening comprehension. (Communication A, 8-10; Communication A, 11-12)*

Unit 7: Safety

(Industry-Driven Authentic Assessment, See Appendix.)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 7.1: Maintain general safety in accordance with government regulations and health standards

Descriptors:

7.1.1 Wear protective clothing appropriate for the job (e.g., eye protection, hard hat, hard-toed shoes, buttoned-sleeve shirt, gloves)
7.1.2 Wear protective devices appropriate for the job (e.g., dust mask, hearing protection, respirators)
7.1.3 Check for potential hazards (e.g., hair, jewelry)
7.1.4 Maintain personal protective equipment (e.g., inspect, clean, repair)
7.1.5 Follow established procedures for using safety apparatus and equipment including fall protection
7.1.6 Conduct routine building safety inspections
7.1.7 Check power sources for potential hazards and confirm proper grounding
7.1.8 Shut down power equipment in dangerous situations using disconnect switches and established lock-out/tag-out procedures
7.1.9 Identify the locations of emergency flush showers, eye wash fountains, fire alarms and exits
7.1.10 Maintain work areas in accordance with standards for cleanliness and safety

7.1.11 Interpret personal safety rights according to the shop's "right-to-know" plan
7.1.12 Describe how to operate fire extinguishers and identify classes of fires
7.1.13 Inspect air and exhaust systems, including intake filters, fans and other mechanical components

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 7.2: Evaluate the ergonomic factors associated with the construction industry

Descriptors:
7.2.1 Identify work associated with lifting, moving, and placing heavy objects and materials
7.2.2 Demonstrate appropriate body mechanics in lifting and moving heavy objects
7.2.3 Describe the ergonomic importance of properly operating various types of equipment and using various tools
7.2.4 Describe the ergonomics of the workplace

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 7.3: Survey state, federal and local worker safety, health and environmental regulations

Descriptors:
7.3.1 Examine the Occupational Safety and Health Administration (OSHA) regulations
7.3.2 Examine the Bureau of Workers' Compensation (BWC) regulations

Correlated English Language Arts Academic Content Benchmarks

- *Apply reading comprehension strategies to understand grade-appropriate texts.* (Reading Process A, 8-10; Reading Process A, 11-12)
- *Use appropriate self-monitoring strategies for comprehension.* (Reading Process C, 8-10; Reading Process C, 11-12)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 7.4: Demonstrate practices that contribute to an accident free environment

Descriptors:
7.4.1 Identify potential hazards on the construction site

7.4.2 Follow established procedures to prevent accidents
7.4.3 Establish required weekly job safety meetings with relevant topics
7.4.4 Explain the concept of "engineering out" as a personal protection strategy
7.4.5 Describe "work zone" safety (lane closure) procedures

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 7.5: Explain emergency response plans in a variety of industry settings

Descriptors:

7.5.1 Describe different types of emergency response plans
7.5.2 Explain the procedures to be followed in the event of an emergency response
7.5.3 Describe the personal protective equipment and response equipment and materials needed for emergency response
7.5.4 Explain the importance of Material Safety Data Sheets (MSDS) in an emergency response
7.5.5 Practice universal precautions to protect against infection

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 7.6: Complete the requirements for First Aid and CPR certification

Descriptors:

7.6.1 Complete first aid training and certification
7.6.2 Complete cardiopulmonary resuscitation (CPR) training and certification

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 7.7: Examine access and egress procedures

Descriptors:

7.7.1 Examine various activities and tasks and the appropriate access and egress devices, fire safety, and structural safety components
7.7.2 Discuss various accident conditions associated with egress and access on a typical construction site
7.7.3 Describe various federal, state and local safety regulations associated with access and egress
7.7.4 Discuss potential work surface problems found on many construction sites and identify appropriate remediation measures

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 7.8: Analyze structural issues related to worker safety and health

Descriptors:

7.8.1 Explain loads and contributing factors impacting construction job safety
7.8.2 Explain excavation, trenching and shoring designs
7.8.3 Explain temporary bracing and planking
7.8.4 Explain tripping (e.g., single riser ¼, less 2 steps)
7.8.5 Explain scaffolding and temporary structures
7.8.6 Explain temporary utilities
7.8.7 Describe the affects of hazardous utilities (e.g., welding)

Correlated Mathematics Academic Content Benchmarks

- *Solve problem situations involving derived measurements; e.g. density, acceleration.* (Measurement D, 11-12)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 7.9: Process safety documentation

Descriptors:

7.9.1 Identify the forms required to document accidents
7.9.2 Complete and file accident reports in accordance with required standards
7.9.3 Describe the impact of construction accidents on workers' compensation and insurance bonding
7.9.4 Describe managed care organizations

Correlated English Language Arts Academic Content Benchmarks

- *Produce functional documents that report, organize and convey information and ideas accurately, foresee readers' problems or misunderstandings and include formatting techniques that are user friendly.* (Writing Applications C, 11-12)

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 7.10: Demonstrate the American National Standards Institute (ANSI) hand signals to communicate with other workers

Descriptors:

7.10.1 Identify and employ the correct signal to direct a load
7.10.2 Discuss and confirm signal use with the equipment operator
7.10.3 Identify vantage points (locations) to see and be seen as the signaler
7.10.4 Discuss rules for designating signalers and how to deal with infractions

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 7.11: Utilize universal signs and symbols that apply to given workplace situations

Descriptors:

7.11.1 Discuss the functions of signs and symbols
7.11.2 Inspect all signs and symbols for safe and proper use
7.11.3 Use proper signs and symbols for the work area
7.11.4 Respond appropriately to signs and symbols

Unit 8: Health and Environment

(Industry-Driven Authentic Assessment, See Appendix.)

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 8.1: Survey state, federal and local worker health and environmental regulations

Descriptors:

8.1.1 Discuss the Environmental Protection Agency (EPA) regulations
8.1.2 Describe the Nuclear Regulatory Commission (NRC) regulations
8.1.3 Interpret personal safety rights according to the employee's right-to-know plan

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 8.2: Demonstrate practices that contribute to a healthy environment

Descriptors:

8.2.1 Recognize symptoms of exposure to health-threatening environments (e.g., temperature, chemicals)
8.2.2 Describe the effects of hazardous activities (e.g., welding)
8.2.3 Inspect air and exhaust systems, including intake filters, fans and other mechanical components
8.2.4 Describe the interactions of incompatible substances
8.2.5 Explore sustainable design strategies, such as Leadership in Energy and Environmental Design (LEED)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 8.3: Explain the environmental aspects of worksites with contaminated soil and water

Descriptors:

8.3.1 Identify the appropriate permits needed for a contaminated site
8.3.2 Describe procedures for disposal of personal protective equipment
8.3.3 Explain disposal procedures for contaminated and construction waste
8.3.4 Describe procedures to control water runoff

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 8.4: Analyze design and construction elements to control mold

Descriptors:

8.4.1 Summarize the effects insulation, vapor barriers and ventilation can have on controlling molds
8.4.2 Discuss protection and storage procedures that shield materials from the environment (e.g., water) before and after installation

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 8.5: Handle hazardous materials in accordance with government regulations and health standards

Descriptors:

8.5.1 Identify types of hazardous materials
8.5.2 Interpret container label precautions
8.5.3 Interpret material safety data sheets (MSDS) and use materials accordingly
8.5.4 Store hazardous materials in accordance with government regulations
8.5.5 Dispose of hazardous materials in accordance with government regulations
8.5.6 Examine a hazardous materials safety plan

Unit 9: Legal and Ethical Aspects

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 9.1: Differentiate between legal and ethical issues

Descriptors:

9.1.1 Define "legal" and "ethical" issues
9.1.2 Translate legal and ethical issues to the construction industry

Correlated English Language Arts Academic Content Benchmarks

- *Use multiple resources to enhance comprehension of vocabulary.* (Vocabulary F, 8-10; Vocabulary E, 11-12)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 9.2: Complete work related duties within an ethical framework

Descriptors:

9.2.1 Identify codes of ethics within the professions
9.2.2 Develop an individual ethical framework
9.2.3 Demonstrate ethical behavior when interacting with colleagues both internal and external to the professions
9.2.4 Identify the consequences of unethical conduct

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 9.3: Assess the implications of ethical and unethical behavior

Descriptors:

9.3.1 Compare and contrast personal, professional and organizational ethics
9.3.2 Demonstrate respect for the property of customers, other professions and coworkers
9.3.3 Resolve issues relating to any potential conflicts of interest between personal and organizational ethics
9.3.4 Identify strategies for responding to the unethical actions of individuals and organizations
9.3.5 Identify the ramifications of unethical actions

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 9.4: Survey mandated standards

Descriptors:

9.4.1 Describe mandated standards for workplace safety, harassment, labor and employment laws
9.4.2 Identify the consequences of non-compliance for both employee and employer
9.4.3 Describe the interrelationship between local and national codes
9.4.4 Identify legal responsibilities specified by state practice act(s) and other pertinent legislation as it relates to mandated reporting of substance abuses
9.4.5 Identify legal responsibilities specified by state practice act(s), other pertinent legislation and regulatory agencies as it relates to union and/or non-union practices

Correlated English Language Arts Academic Content Benchmarks

- *Use multiple resources to enhance comprehension of vocabulary.* (Vocabulary F, 8-10)

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 9.5: Comply with governmental regulations and applicable codes

Descriptors:
9.5.1 Identify governmental regulations and building codes
9.5.2 Apply regulations and codes according to guidelines
9.5.3 Complete job inspections and adhere to all regulations and codes

Correlated English Language Arts Academic Content Benchmarks

- *Use multiple resources to enhance comprehension of vocabulary.* (Vocabulary F, 8-10)

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 9.6: Explain employee and employer liability

Descriptors:
9.6.1 Define liability and negligence
9.6.2 Discuss protections against liability
9.6.3 Explain the Bureau of Workers' Compensation's role in workplace injuries
9.6.4 Discuss the concept of transferring risk
9.6.5 Describe the "multi-employer" responsibility under OSHA and identify the types of citations

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 9.7: Perform duties according to regulations, policies, laws, legislated rights and contract provisions

Descriptors:

9.7.1 Describe the legal responsibilities, limitations and implications of actions
9.7.2 Comply with the legal responsibilities specified by state practice act(s) and other pertinent legislation
9.7.3 Compare and contrast the roles of various regulatory agencies (e.g., content of laws and regulation of jurisdictions)
9.7.4 Identify the types of contracts and describe their roles in the construction industry
9.7.5 Illustrate how work activities relate to health and safety issues
9.7.6 Describe design use issues (e.g., AIA specification divisions)

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 9.8: Explain accessibility issues

Descriptors:

9.8.1 Identify federal, state and local accessibility regulations
9.8.2 Specify reasonable accommodations for employee and contractor

Unit 10: Problem Solving and Critical Thinking

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 10.1: Employ critical thinking and problem solving skills to formulate solutions to problems

Descriptors:

10.1.1 Identify steps to effective problem solving
10.1.2 State the problem completely and precisely as it relates to budgets, scope or schedules
10.1.3 Assemble and examine pertinent information
10.1.4 Brainstorm potential solutions
10.1.5 Interpret consequences to each possible solution
10.1.6 Compare and contrast consequences and discuss underlying assumptions
10.1.7 Identify the best solution based on risks, costs, ethics, laws and benefits
10.1.8 Apply the best solution to the problem

Correlated English Language Arts Academic Content Benchmarks

- *Organize information from various resources and select appropriate sources to support central ideas, concepts and themes.* (Research C, 8-10)
- *Compile, organize and evaluate information, take notes and summarize findings.* (Research B, 11-12)
- *Evaluate the usefulness and credibility of data and sources, and synthesize information from multiple sources.* (Research C, 11-12)
- *Evaluate the clarity, quality, effectiveness and overall coherence of a speaker's key points, arguments, evidence, organization of ideas, delivery, diction and syntax.* (Communication B, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Present complete and convincing arguments and justifications, using inductive and deductive reasoning, adapted to be effective for various audiences.* (Mathematics. Process F, 11-12)

- *Apply mathematical modeling to workplace and consumer situations, including problem formulations, identification of a mathematical model, interpretation of a solution with the model, and validation to the original problem situation.* (Mathematics. Process J, 11-12)

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 10.2: Apply problem solving and critical thinking techniques to the conflict between available resources, requirements of the project and construction time lines

Descriptors:

10.2.1	Identify alternative solutions for a specific resources or materials problem
10.2.2	Calculate the potential waste of resources and materials
10.2.3	Examine the feasibility of each alternative suggestion
10.2.4	Implement an appropriate alternative
10.2.5	Use available resources and materials efficiently to complete the project
10.2.6	Discuss strategies to avoid the problem in the future

Correlated Mathematics Academic Content Benchmarks

- *Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions.* (Number G, 8-10)
- *Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision.* (Measurement E, 8-10)
- *Present complete and convincing arguments and justifications, using inductive and deductive reasoning, adapted to be effective for various audiences.* (Mathematics. Process F, 11-12)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 10.3: Combine critical thinking and team building skills to solve problems

Descriptors:

10.3.1	Work with others to define problems
10.3.2	Share ideas, facts, information and/or data with others
10.3.3	State personal positions clearly and respect conflicting positions
10.3.4	Accept and support group decisions even when different from a personal solution

Correlated English Language Arts Academic Content Benchmarks

- *Communicate findings, reporting on the substance and processes orally, visually and in writing, or through multimedia.* (Research E, 8-10; Research E, 11)
- *Select and use effective speaking strategies for a variety of audiences, situations and purposes*. (Communication C, 11-12)

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 10.4: Evaluate and adjust plans and schedules to respond to unexpected events and conditions

Descriptors:

10.4.1	Identify potential events and conditions that disrupt the completion of a job
10.4.2	Incorporate potential job disruptions into planning time lines
10.4.3	Solve situational problems involved with unexpected events and conditions
10.4.4	Identify and assess critical situations and implement appropriate responses
10.4.5	Adjust plans and schedules to reflect an unexpected change
10.4.6	Provide a project update to track changes

Correlated Mathematics Academic Content Benchmarks

- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data F, 8-10)
- *Apply mathematical modeling to workplace and consumer situations, including problem formulation, identification of a mathematical model, interpretation of a solution with the model, and validation to the original problem situation (Mathematics. Process J, 11-12*
  (Industry-Driven Authentic Assessment, See Appendix.)

Unit 11: Tools and Equipment

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 11.1: Identify the hand and power tools and equipment appropriate to the task

Descriptors:

11.1.1	Identify by name and illustration the various types of tools and equipment applicable to the specified construction profession (e.g., CADD, engineering programs)
11.1.2	Demonstrate the optimal use and safety considerations involved with various types of hand and power tools

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 11.2: Demonstrate the appropriate uses of tools to complete work functions

Descriptors:

11.2.1	Identify potential hazards and limitations related to the use of tools
11.2.2	Operate tools and equipment in accordance with established operating procedures and safety standards
11.2.3	Follow established procedures for setup, operation and maintenance of various types of tools specific to the identified construction profession
11.2.4	Demonstrate proper power attachment procedures

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 11.3: Maintain hand and power tools appropriate to the work site

Descriptors:

11.3.1 Conduct routine inspections of hand tools and power equipment
11.3.2 Troubleshoot maintenance problems in accordance with established procedures
11.3.3 Perform preventive maintenance in accordance with guidelines specified by the manufacturer and/or outside authorities with jurisdiction (e.g., OSHA)
11.3.4 Describe the certifications required for operating specific tools

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 11.4: Use appropriate personal protective equipment (PPE)

Descriptors:

11.4.1 Identify the appropriate personal protective equipment (PPE) to wear with specific construction tasks and specific to the identified construction trade
11.4.2 Discuss various conditions that workers encounter and match appropriate personal protective equipment (PPE) to each situation
11.4.3 Demonstrate and practice correct fit, use of each type and care of personal protective equipment (PPE)

Unit 12: Business Practices

(Industry-Driven Authentic Assessment, See Appendix.)

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 12.1: Develop a management plan for business

Descriptors:

12.1.1 Describe strategies to achieve company goals and objectives
12.1.2 Analyze financial issues
12.1.3 Design an organizational chart with job descriptions
12.1.4 Identify market segments and perspective clients
12.1.5 Prepare a business development plan

Correlated English Language Arts Academic Content Benchmarks

- *Select and use effective speaking strategies for a variety of audiences, situations and purposes.* (Communication C, 11-12)

- *Produce functional documents that report, organize and convey information and ideas, accurately foresee readers' problems or misunderstandings and that include formatting techniques that are user friendly.* (Writing Applications C, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonableness of solutions.* (Measurement F, 8-10)
- *Apply mathematical modeling to workplace and consumer situations, including problem formulation, identification of a mathematical model, interpretation of a solution with the model, and validation to the original problem situation.* (Mathematics. Process J, 11-12)
- *Solve systems of linear equations involving two variables graphically and symbolically.* (Algebra H, 8-10)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 12.2: Identify basic procedures in the accounting cycle

Descriptors:

12.2.1 Review internal accounting controls
12.2.2 Review accounts payable and accrued liability procedures
12.2.3 Review payroll records
12.2.4 Review financial statements (e.g., personal bank statements)
12.2.5 Describe the essentials of profitability
12.2.6 Explain cash flows and accounting principles
12.2.7 Describe job costing with direct and indirect costs
12.2.8 Describe "progress payments" (i.e., payment a percentage of project completion)

Correlated Mathematics Academic Content Benchmarks

- *Communicate mathematical ideas orally and in writing with a clear purpose and appropriate for a specific audience*. (Mathematics. Process I, 11-12)

BIL: **Recommended**

EDU:	12	AD	ApT
	I	R	R

Competency 12.3: Compare and contrast business side versus practice side licenses, insurance, bonds and certifications

Descriptors:

12.3.1 Identify licensing, certification, insurance and bonding requirements for the business side of design and construction
12.3.2 Identify licensing, certification, insurance and bonding requirements for the practice side of design and construction
12.3.3 Document sources and agencies for licensing, certification, insurance and bonding requirements

Unit 13: Basic Construction Skills

(Industry-Driven Authentic Assessment, See Appendix.)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 13.1: Explore performance skills in carpentry

Descriptors:

13.1.1 Trace the sequence of carpentry functions in construction
13.1.2 Identify the basic processes required to complete carpentry functions

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 13.2: Explore performance skills of electricians

Descriptors:

13.2.1 Trace the sequence of an electrician's functions in construction
13.2.2 Identify the basic processes required to complete electrician functions

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 13.3: Explore performance skills in environmental controls technology

Descriptors:

13.3.1 Trace the sequence of environmental controls technology functions in construction
13.3.2 Identify the basic processes required to complete environmental controls technology functions

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 13.4: Explore performance skills in brick, block and cement masonry

Descriptors:

13.4.1 Trace the sequence of brick, block and cement masons' functions in construction
13.4.2 Identify the basic processes required to complete brick, block and cement masons' functions

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 13.5: Explore performance skills in plumbing and pipefitting

Descriptors:

13.5.1 Trace the sequence of plumbing and pipefitting functions in construction

13.5.2 Identify the basic processes required to complete plumbing and pipefitting functions

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 13.6: Explore performance skills in heavy equipment operations

Descriptors:

13.6.1 Trace the sequence of heavy equipment operations in construction

13.6.2 Identify the basic processes required to complete heavy equipment operations functions

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 13.7: Explore performance skills in interior construction

Descriptors:

13.7.1 Trace the sequence of interior construction in construction

13.7.2 Identify the basic processes required to complete interior construction functions

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 13.8: Explore performance skills in wood technology products and cabinetry

Descriptors:

13.8.1 Trace the sequence of wood technology products and cabinetry in construction

13.8.2 Identify the basic processes required to complete wood technology products and cabinetry functions

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 13.9: Explore performance skills in architecture

Descriptors:

13.9.1 Trace the sequence of architecture functions in construction

13.9.2 Identify the basic processes required to complete architecture functions

BIL: **Essential**

EDU:	12	AD	ApT
	P	**R**	**R**

Competency 13.10: Explore performance skills in construction management

Descriptors:

13.10.1 Trace the sequence of construction management activities in structure development

13.10.2 Identify the basic areas of construction management (e.g., residential, commercial, institutional, heavy construction)

Unit 14: Environmental Controls Technology

(Industry-Driven Authentic Assessment, See Appendix.)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 14.1 Appraise the fundamental concepts of human comfort

Descriptors:

14.1.1 Analyze the effects of comfort factors

14.1.2 Evaluate air samples using psychrometrics

Correlated Mathematics Academic Content Standards Benchmarks

- *Create, interpret and use graphical displays and statistical measures to describe data; e.g., box-and-whisker plots, histograms, scatterplots, measures of center and variability.* (Data A, 8-10)
- *Evaluate different graphical representations of the same data to determine which is the most appropriate representation for an identified purpose.* (Data B, 8-10)
- *Compare the characteristics of the mean, median and mode for a given set of data, and explain which measure of center best represents the data.* (Data C, 8-10)
- *Find, use and interpret measures of center and spread, such as mean and quartiles, and use those measures to compare and draw conclusions about sets of data.* (Data D, 8-10)
- *Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collection and analysis.* (Data E, 8-10)
- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data F, 8-10)
- *Describe sampling methods and analyze the effects of the method chosen on how well the resulting sample represents the population.* (Data G, 8-10)
- *Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlation and variability.* (Data B, 11-12)

BIL: **Essential**

EDU:	12	AD	ApT
	P	R	R

Competency 14.2: Analyze and measure electrical values

Descriptors:

14.2.1 Explain the basics of magnetism.

14.2.2 Apply magnetic principles to electrical theory.

14.2.3 Identify conducting and insulating materials.
14.2.4 Measure resistance values
14.2.5 Apply Ohm's Law
14.2.6 Construct and analyze basic alternating current (AC) circuits.
14.2.7 Identify and troubleshoot basic electrical, electromechanical and solid state controls.
14.2.8 Measure current, voltage and resistance in AC circuits
14.2.9 Use electrical test equipment (e.g., ammeter, ohmmeter, voltmeter)
14.2.10 Compare peak (PK), root mean square (RMS) and average values

Correlated Mathematics Academic Content Benchmarks

- *Solve problem situations involving derived measurement; e.g., density, acceleration. (Measurement D, 11-12)*
- *Apply mathematical knowledge and skills routinely in other content areas and practical situations.* (Mathematics. Process B, 8-10)

BIL: **Essential**

EDU:	**12**	**AD**	**ApT**
	I	P	P

Competency 14.3 Troubleshoot single phase, split phase and three phase circuits and devices
Descriptors:
14.3.1 Identify various types of single phase and split phase motors
14.3.2 Explain motor starting components and sequencing
14.3.3 Analyze motor protection
14.3.4 Troubleshoot single phase and split phase motors and starting systems
14.3.5 Interpret motor nameplate information and motor specifications (i.e., National Electrical Manufacturers Association [NEMA])
14.3.6 Identify various types of three phase motors
14.3.7 Troubleshoot three phase motors
14.3.8 Discuss phase protection
14.3.9 Identify various types of motor assisting devices
14.3.10 Apply the use of motor assisting devices (i.e., contactors, starters, variable frequency and motor speed controls)
14.3.11 Wire single phase and three phase motors and motor control devices
14.3.12 Verify motor rotation and operation
14.3.13 Interpret schematics and control diagrams
14.3.14 Identify motor loads

BIL: **Recommended**

EDU:	**12**	**AD**	**ApT**
	P	R	R

Competency 14.4 Explain the physical laws as applied to refrigeration
Descriptors:
14.4.1 Record and compare temperature and pressure measurements
14.4.2 Analyze and interpolate temperature and pressure relationships
14.4.3 Explain heat and heat transfer
14.4.4 Explain energy and energy conversion
14.4.5 Differentiate sensible, latent and total heat

Correlated Mathematics Academic Content Benchmarks

- *Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problems situations.* (Algebra D, 8-10)
- *Model and solve problem situations involving direct and inverse variation.* (Algebra I, 8-10)

BIL: **Essential**

EDU:	**12**	**AD**	**ApT**
	I	P	P

Competency 14.5 **Analyze the mechanical refrigeration cycle and components**
Descriptors:
14.5.1 Discuss the principles of thermodynamics
14.5.2 Compare and contrast the functions of evaporators, condensers, compressors and metering devices
14.5.3 Compare various refrigerants and their characteristics

BIL: **Essential**

EDU:	**12**	**AD**	**ApT**
	P	R	R

Competency 14.6: **Explain the refrigeration cycle and its components**
Descriptors:
14.6.1 Define superheating and subcooling
14.6.2 Interpret and compare temperature pressure chart relationships
14.6.3 Calculate and record the saturation temperature of a refrigerant
14.6.4 Calculate and record superheating and subcooling

Correlated Mathematics Academic Content Benchmarks

- *Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonableness of solutions.* (Measurement F, 8-10)

BIL: **Essential**

EDU:	**12**	**AD**	**ApT**
	I	P	P

Competency 14.7: **Identify and perform soldering and brazing procedures**
Descriptors:
14.7.1 Review state codes related to pressure piping
14.7.2 Identify different soldering and brazing materials
14.7.3 Join materials with low-temperature solder
14.7.4 Join materials with high-temperature brazing
14.7.5 Join ferrous and non-ferrous metals

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 14.8: **Demonstrate the proper use of piping materials, fabrication and application**

Descriptors:

14.8.1 Identify different types of piping and tubing
14.8.2 Demonstrate proper techniques for bending and connecting tubing and piping
14.8.3 Demonstrate proper fabrication of tubing and piping
14.8.4 Identify and use proper tubing and piping fittings

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 14.9: **Perform leak detection procedures**

Descriptors:

14.9.1 Apply the soap bubble technique
14.9.2 Apply the inert gas technique
14.9.3 Apply the electronic test
14.9.4 Apply the fluorescent dye technique

BIL: **Essential**

EDU:	12	AD	ApT
	I	R	P

Competency 14.10: **Demonstrate specialized environmental controls technology test equipment and tools**

Descriptors:

14.10.1 Use refrigerant recovery equipment
14.10.2 Use a digital charging scale
14.10.3 Use a vacuum pump and micron gauge and scale
14.10.4 Use a thermometer and thermocouple
14.10.5 Use a fin comb
14.10.6 Use a heat gun
14.10.7 Use piercing valves
14.10.8 Use a sling digital
14.10.9 Use a manometer
14.10.10 Use air analyzing measuring instruments
14.10.11 Use a combustion analyzer and carbon monoxide meter

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 14.11: **Install refrigeration and air conditioning equipment**

Descriptors:

14.11.1 Install a window air conditioner
14.11.2 Install a central air conditioner and heat pump
14.11.3 Install a refrigeration condensing unit with a remote evaporator

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 14.12: Perform service maintenance (SM) on related environmental controls technology equipment

Descriptors:

14.12.1 Perform SM on electric heating equipment
14.12.2 Perform SM on an air handler
14.12.3 Perform SM on air filtration equipment
14.12.4 Perform SM on a humidifier/dehumidifier
14.12.5 Perform SM on the indoor and outdoor sections of an air conditioner or heat pump and refrigeration systems

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 14.13: Troubleshoot refrigeration and air conditioning equipment

Descriptors:

14.13.1 Connect a hermetic/semi-hermetic compressor to a power supply
14.13.2 Check the circuitry of a compressor, protector, relay, capacitor and hard start kit
14.13.3 Connect manifold and gauges to service valves and access fittings and check pressures
14.13.4 Examine unit operation, oil level, and sight glass moisture indicator
14.13.5 Analyze the circuitry of refrigeration defrost
14.13.6 Check and adjust refrigeration control thermostat
14.13.7 Check the condensate pump and drain
14.13.8 Check system for burnout and identify proper procedures for cleanup
14.13.9 Check and adjust water valve
14.13.10 Check and adjust pressure and safety controls
14.13.11 Verify proper operation of thermostatic expansion valve
14.13.12 Verify CFM and check temperature drips across indoor and outdoor coils

Correlated Mathematics Academic Content Benchmarks

- *Solve increasingly complex non-routine measurement problems and check for reasonableness of results.* (Measurement A, 8-10)
- *Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision.* (Measurement E, 8-10)
- *Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations.* (Measurement A, 11-12)
- *Apply various measurement scales to describe phenomena and solve problems.* (Measurement B, 11-12)

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 14.14: Service and repair refrigeration and air conditioning equipment (secure EPA refrigerant certification)

Descriptors:

14.14.1 Recover refrigerant from a system
14.14.2 Recharge a system utilizing different methods
14.14.3 Pump down a system
14.14.4 Repair all leaks in a system
14.14.5 Isolate system components
14.14.6 Match oil to refrigerants in a system
14.14.7 Remove and replace applicable components and accessories

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 14.15: Identify and install forced air heating systems

Descriptors:

14.15.1 Fabricate and install a distribution system
14.15.2 Install a gas (natural or propane), electric and oil heating unit
14.15.3 Utilize proper combustion, venting and ventilation tables to assure proper operations
14.15.4 Install an air-to-air heat pump
14.15.5 Identify the components of a geothermal system

Correlated Mathematics Academic Content Benchmarks

- *Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision.* (Measurement E, 8-10)

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 14.16: Troubleshoot and service heating systems

Descriptors:

14.16.1 Check the power supply
14.16.2 Check the fuel (gas or oil) supply
14.16.3 Check the ignition assembly
14.16.4 Check the wall thermostat (heat anticipator)
14.16.5 Check the gas train assembly
14.16.6 Check and adjust incoming and gas manifold pressure
14.16.7 Check the electronic ignition system on gas unit
14.16.8 Check and adjust the blower systems using different methods
14.16.9 Check and adjust fan control
14.16.10 Check limit control
14.16.11 Check the heat exchanger
14.16.12 Check the oil ignition system and pump pressure

14.16.13 Perform combustion analysis
14.16.14 Perform ventilation air test
14.16.15 Verify the operation of safety circuits
14.16.16 Remove and replace all applicable components

Correlated Mathematics Academic Content Benchmarks

- *Solve increasingly complex non-routine measurement problems and check for reasonableness of results.* (Measurement A, 8-10)
- *Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision.* (Measurement E, 8-10)
- *Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations.* (Measurement A, 11-12)
- *Apply various measurement scales to describe phenomena and solve problems.* (Measurement B, 11-12)

BIL: **Recommended**

EDU:	**12**	**AD**	**ApT**
	P	R	R

Competency 14.17: Explain the fundamentals of hot water and chilled water systems (hydronics)
Descriptors:
14.17.1 Identify basic system components
14.17.2 Identify basic system designs
14.17.3 Review state codes related to boilers and piping

BIL: **Essential**

EDU:	**12**	**AD**	**ApT**
	P	R	R

Competency 14.18: Explain the application, selection and installation of hydronic system components
Descriptors:
14.18.1 Observe and test the operation of a hydronics system
14.18.2 Identify components of a hydronics system
14.18.3 Select major components of a hydronics system
14.18.4 Review and test safety controls

Correlated Mathematics Academic Content Benchmarks

- *Apply mathematical knowledge and skills routinely in other content areas and practical situations.* (Mathematics. Process B, 8-10)

BIL: **Essential**

EDU:	**12**	**AD**	**ApT**
		I	P

Competency 14.19: Explain the application, selection and installation of low pressure steam systems
Descriptors:
14.19.1 Identify basic system components and designs
14.19.2 Review state codes related to boilers and piping
14.19.3 Observe and test the operation of a steam system
14.19.4 Review and test safety controls

Correlated Mathematics Academic Content Benchmarks

- *Apply mathematical knowledge and skills routinely in other content areas and practical situations.* (Mathematics. Process B, 8-10)

BIL: **Recommended**

EDU:	12	AD	ApT
	I	P	P

Competency 14.20: Assess sheet metal standards and materials
Descriptors:

14.20.1 Identify the basic components of duct systems
14.20.2 Classify sheet metal standards
14.20.3 Interpret a blueprint
14.20.4 Select duct systems and fittings (per application)
14.20.5 Examine different types of materials used in ductwork
14.20.6 Apply basic drawing procedures
14.20.7 Calculate mathematical equations used in layout and design
14.20.8 Demonstrate layout of sheet metal ducts and fittings

Correlated Mathematics Academic Content Benchmarks

- *Apply various measurement scales to describe phenomena and solve problems. (Measurement B, 11-12)*
- *Draw and construct representations of two- and three-dimensional geometric objects using a variety of tools, such as straightedge, compass and technology. (Geometry E, 8-10)*
- *Use right triangle trigonometric relationships to determine lengths and angle measurements. (Geometry I, 8-10)*

BIL: **Essential**

EDU:	12	AD	ApT
	I	P	P

Competency 14.21: Demonstrate different sheet metal fabrication procedures
Descriptors:

14.21.1 Demonstrate cutting and shearing
14.21.2 Demonstrate bending and folding
14.21.3 Demonstrate forming and assembly
14.21.4 Demonstrate sealing and insulating procedures
14.21.5 Identify various methods of fastening sheet metal
14.21.6 Demonstrate different methods of fastening and hanging
14.21.7 Assemble duct work with slops and drives

Correlated Mathematics Academic Content Benchmarks

- *Use proportional reasoning and apply indirect measurement techniques, including right triangle trigonometry and properties of similar triangles, to solve problems involving measurements and rates*. (Measurement D, 8-10)
- *Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision.* (Measurement E, 8-10)

BIL: **Essential**

EDU:	12	AD	ApT
	I	R	P

Competency 14.22: Create work sequences for tasks and units of work
Descriptors:

14.22.1 Discuss the sequence of activities on a typical environmental controls technology project
14.22.2 Discuss logical sequences for different types of projects with different space limitations
14.22.3 Discuss the impact of adequate and inadequate project planning
14.22.4 Develop a timeline for sequencing the activities for an entire project
14.22.5 Explain adjustments to special issues related to project startup and close

Correlated Mathematics Academic Content Benchmarks

- *Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonableness of solutions.* (Measurement F, 8-10)

BIL: **Essential**

EDU:	12	AD	ApT
	I	R	P

Competency 14.23: Create work assignments for crew and individuals
Descriptors:

14.23.1 Determine what constitutes a "unit of work" and its role in construction economics
14.23.2 Discuss typical tasks, needed skills and task assignments
14.23.3 Examine apprenticeship roles and rotations and how they relate to work and crew assignments
14.23.4 Coordinate and negotiate the work of tradespersons
14.23.5 Determine personnel needs
14.23.6 Develop a plan to monitor progress and quality on a periodic basis (e.g., critical milestone dates)
14.23.7 Adjust to special issues or needs of architects, owners, engineers and the public
14.23.8 Describe and clarify the contractual scope of work for individual contractors

Correlated English Language Arts Academic Content Benchmarks

- *Produce functional documents that report, organize and convey information and ideas, accurately foresee readers' problems or misunderstandings, and that include formatting techniques that are user friendly.* (Writing Applications C, 11-12)

BIL: **Essential**

EDU:	12	AD	ApT
	I	R	P

Competency 14.24: Clarify client expectations
Descriptors:

14.24.1	Communicate the mutual goals of the client(s) and construction team
14.24.2	Maintain communication with client(s) on a regular basis
14.24.3	Implement conflict resolution procedures
14.24.4	Employ the proper use of change orders

Correlated English Language Arts Academic Content Benchmarks

- *Use a variety of strategies to enhance listening comprehension.* (Communication A, 8-10; Communication A, 11-12)
- *Demonstrate an understanding of effective speaking strategies by selecting appropriate language and adjusting presentation techniques.* (Communication D, 8-10)

Correlated Mathematics Academic Content Benchmarks

- *Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonableness of solutions.* (Measurement F, 8-10)

BIL: **Essential**

EDU:	**12**	**AD**	**ApT**
	I	R	P

Competency 14.25: Employ positive client relationships
Descriptors:

14.25.1	Maintain ethical relationships
14.25.2	Demonstrate a proactive approach to clients' needs
14.25.3	Confirm client satisfaction
14.25.4	Perform post-warranty followup with a client

Correlated English Language Arts Academic Content Benchmarks

- *Use a variety of strategies to enhance listening comprehension.* (Communication A, 8-10; Communication A, 11-12*)*
- *Demonstrate an understanding of effective speaking strategies by selecting appropriate language and adjusting presentation techniques.* (Communication D, 8-10)

Technology Standards

Standard 1: Nature of Technology

Students develop an understanding of technology, its characteristics, scope, core concepts* and relationships between technologies and other fields.

Benchmark A: Synthesize information, evaluate and make decisions about technologies.

Benchmark B: Apply technological knowledge in decision-making.

Benchmark C: Examine the synergy between and among technologies and other fields of study when solving technological problems.

Standard 2: Technology and Society Interaction

Students recognize interactions among society, the environment and technology, and understand technology's relationship with history. Consideration of these concepts forms a foundation for engaging in responsible and ethical use of technology.

Benchmark A: Interpret and practice responsible citizenship relative to technology.

Benchmark B: Demonstrate the relationship among people, technology and the environment.

Benchmark C: Interpret and evaluate the influence of technology throughout history, and predict its impact on the future.

Benchmark D: Analyze ethical and legal technology issues and formulate solutions and strategies that foster responsible technology usage.

Benchmark E: Forecast the impact of technological products and systems.

Standard 3: Technology for Productivity Applications

Students learn the operations of technology through the usage of technology and productivity tools.

Benchmark A: Integrate conceptual knowledge of technology systems in determining practical applications for learning and technical problem-solving.

Benchmark B: Identify, select and apply appropriate technology tools and resources to produce creative works and to construct technology-enhanced models.

Standard 4: Technology and Communication Applications

Students use an array of technologies and apply design concepts to communicate with multiple audiences, acquire and disseminate information and enhance learning.

Benchmark A: Apply appropriate communication design principles in published and presented projects.

Benchmark B: Create, publish and present information, utilizing formats appropriate to the content and audience.

Benchmark C: Identify communication needs, select appropriate communication tools and design collaborative interactive projects and activities to communicate with others, incorporating emerging technologies.

Standard 5: Technology and Information Literacy

Students engage in information literacy strategies, use the Internet, technology tools and resources, and apply information-management skills to answer questions and expand knowledge.

Benchmark A: Determine and apply an evaluative process to all information sources chosen for a project.

Benchmark B: Apply a research process model to conduct research and meet information needs.

Benchmark C: Formulate advanced search strategies, demonstrating an understanding of the strengths and limitations of the Internet, and evaluate the quality and appropriate use of Internet resources.

Benchmark D: Evaluate choices of electronic resources and determine their strengths and limitations.

Standard 6: Design

Students apply a number of problem-solving strategies demonstrating the nature of design, the role of engineering and the role of assessment.

Benchmark A: Identify and produce a product or system using a design process, evaluate the final solution and communicate the findings.

Benchmark B: Recognize the role of teamwork in engineering design and of prototyping in the design process.

Benchmark C: Understand and apply research, development and experimentation to problem-solving.

Standard 7: Designed World

Students understand how the physical, informational and bio-related technological systems of the designed world are brought about by the design process. Critical to this will be students' understanding of their role in the designed world: its processes, products, standards, services, history, future, issues and career connections.

Benchmark A: Classify, demonstrate, examine, and appraise energy and power technologies.

Benchmark B: Classify, demonstrate, examine and appraise transportation technologies.

Benchmark C: Classify, demonstrate, examine and appraise manufacturing technologies.

Benchmark D: Classify, demonstrate, examine and appraise construction technologies.

Benchmark E: Classify, demonstrate, examine and appraise information and communication technologies

Benchmark F: Classify, demonstrate, examine and appraise medical technologies.

Benchmark G: Classify, demonstrate, examine and appraise agricultural and related biotechnologies.

Performance Measures/Student Assessment/Instructional Strategies

Assessments/Evaluations

- Observations
- Demonstrations
- Portfolios
- Standardized Tests
- Class Assignment
- Quizzes/Tests/Exams
- Web Exam/Certification

Instructional Strategies

- Teacher-Directed & Student-Centered Activities
- Case Study Problem Solving
- Cooperative Learning
- Project-Based Learning
- Career-Based Learning (Internships/Shadowing/Placement)
- Community-Based Learning (CTSOs and Other)
- Exploratory Learning
- Independent Research
- Team Teaching

Content Specific Strategies