

# *Course of Study*

## *Electrical Trades*

**Warren County Career Center**

**3525 North State Route 48  
Lebanon, Ohio 45036**

**Adopted July 17, 2008**

*This document is for the use of the staff at Warren County Career Center.  
Credit is given the designer of the template, Upper Valley JVS, Piqua, Ohio.*

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# *Acknowledgements*

## **Electrical Trades 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. Justin Perry  
Mr. Tim Ely  
Mr. Mark Holzmacher  
Mr. Rob Spurlock  
Mr. Kyle Hurtt  
Mr. Rick Centers

***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 Electrical Trades 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 Electrical Trades program; and

WHEREAS, the Electrical Trades 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 Electrical Trades Course of Study.

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District Superintendent

Date

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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 Electrical Trades 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 Electrical Trades Program at the Warren County Career Center is responsible for meeting the educational and occupational needs of the students and industries of the community by training young people and adults. Our vocational and related programs develop the knowledge and skills students need to enter the work force, to prepare them for further education or training, and to function effectively in today's society. Each student is given the opportunity in a vocational setting for his/her own talents and skills.

## ***Course Goals***

The course goals for Electrical Trades are to:

### **Related Classroom:**

- To solve problems applicable to electrical installations by the use of science, mathematics, physics, and trade technology.
- To measure accurately in the construction of electrical installations.
- To draw an isometric drawing, and to interpret trade blueprints, as well as plan the installation of the required wiring.
- To understand the field of electricity in order to receive further training and education desired to move up the job ladder.

### **Laboratory:**

- To identify, use, and care for tools and equipment used in electrical trades.
- To develop marketable skills in the installation service entrance, 3-way switching, grounding, fixture installation and enabling the trainee to handle these installations under minimum supervision.
- To know basic skills in the inspections and testing in the repair of electrical installation.
- To exhibit safety awareness which is reflected in good work habits including cleanliness, orderliness and habits of safe practice.
- To develop qualities of self-confidence, initiative, and appreciation for work, planning abilities and practices of the democratic process.

# ***Course Description***

## **Program Overview**

This course of study of the Electrical Trades program for junior and senior vocational students is arranged to meet a two-year program. Students have demonstrated the interest, aptitude, and the ability to succeed in the Electrical Trade and will be ready for gainful employment. Upon entering the Electrical Trades program, the student must meet certain requirements in having the necessary academic studies completed. These requirements meet the needs of beginners in the study of the electrical trade. With the successful completion of the Electrical Standardized Craft Curriculum level one, the student will be qualified to find apprenticeship entry-level positions in our labor market. Also the student, by some degree, has developed his or her potential in citizenship, leadership, and character.

## **Program Academic Requirements**

Preparatory courses for the Electrical Trades should include mathematics, Algebra I, Mechanical drawing and Industrial arts. Related classes during the school day for each program will include Math, English, Science and related class using the Electrical Standardized Craft Curriculum.

## **Early Placement**

Students that meet the requirements set by the early Placement Committee is eligible to work with local Contractors the second semester of their Senior year. This allows the student to work during designated lab time with the approval of the Trade Instructor. This requires the Trade Instructor to continually monitor academic eligibility along with the status of their field progress using contractor evaluation. This also requires parent's approval along with a written contract with the student for certain goals to be achieved.

## **Articulation Agreement**

The Electrical Standardized Craft Curriculum used by the Electrical Trades program is approved by the Ohio Department of Education under sponsorship with the Ohio Valley Chapter of the Associated necessary Builders and Contractors Inc. The program provides students with the lab and related class time to complete the requirements for level one of the Electrical Standardized Craft Curriculum apprenticeship program.

## **Technology**

The Electrical Trades Program promotes knowledge and skill development in mechanical engineering principles. The Electrical Standardized Craft Curriculum is continually updated through a Subject Matter Expert Committee to ensure the content reflects state-of-the-art

technologies and is correct. The Lab is continually updated to accommodate the requirements to complete each module of the Electrical Standardized Craft Curriculum.

### **Student Leadership**

Instructors encourage student participation in VICA competition. This is an integral part of the in-school instructional program. Students are also encouraged to participate in out-of-school leadership, citizenship, and cooperation activities. An annual competition is held locally for all Electrical Trade students' participation in VICA. This provides opportunities to compete at local, regional, stated and national VICA competitions.

## *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 21<sup>st</sup> 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
<b>CONSTRUCTION TECHNOLOGIES CORE BODY OF KNOWLEDGE</b>				
<b>Unit 1: Career Exploration and Development</b>				
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
<b>Unit 2: Materials</b>				
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
<b>Unit 3: Estimating</b>				
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
<b>Unit 4: Inter-relational Systems</b>				
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
<b>Unit 5: Communications</b>				
5.1 Apply active listening skills to obtain and clarify information provided in oral communications	P	R	R	E

<b>Competency</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>	<b>BIL</b>
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
<b>Unit 6: Leadership and Teamwork</b>				
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
<b>Unit 7: Safety</b>				
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
<b>Unit 8: Health and Environment</b>				
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
<b>Unit 9: Legal and Ethical Aspects</b>				
9.1 Differentiate between legal and ethical issues	P	R	R	E

<b>Competency</b>		<b>12</b>	<b>AD</b>	<b>ApT</b>	<b>BIL</b>
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
<b>Unit 10: Problem Solving and Critical Thinking</b>					
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
<b>Unit 11: Tools and Equipment</b>					
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
<b>Unit 12: Business Practices</b>					
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
<b>Unit 13: Basic Construction Skills</b>					
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
<b>Unit 14: Electrical</b>					
14.1	Explain electrical principles and theories	P	R	R	E
14.2	Analyze basic electrical theory	P	R	R	E
14.3	Analyze and evaluate alternating current (AC)	P	R	R	E
14.4	Solve mathematical problems related to electricity	P	R	R	E
14.5	Explain and apply National Electrical Code (NEC) and other applicable codes	I	R	P	E
14.6	Demonstrate test equipment	I	R	P	E
14.7	Read and interpret blueprints	I	R	P	E
14.8	Demonstrate various uses for fasteners and anchors	P	R	R	E
14.9	Install rough-in wiring	I	R	P	E
14.10	Install finish wiring	I	R	P	E

<b>Competency</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>	<b>BIL</b>
14.11 Complete commercial and industrial installations	I	R	P	E
14.12 Explain distribution systems	I	R	P	E
14.13 Install motors and power wiring in accordance with NEC	I	R	P	E
14.14 Differentiate between specialized systems	P	R	R	E
14.15 Demonstrate electrical safety practices	P	R	R	E
14.16 Construct housekeeping pads and light pole bases	I	R	P	E
14.17 Construct electrical drawings (i.e., as built)	P	R	R	E

## Unit 1: Career Exploration and Development

**BIL:** Essential

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

### 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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

### 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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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 journey person 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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>P</b>	<b>P</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**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: Electrical**

(Industry-Driven Authentic Assessment, See Appendix.)

**BIL:** Essential

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**Competency 14.1: Explain electrical principles and theories**

**Descriptors:**

- 14.1.1 Explain atoms, how they are constructed and their relationship to electricity
- 14.1.2 Describe the relationship between electrical and magneto electric effect
- 14.1.3 Describe the photoelectric effect
- 14.1.4 Describe the thermocouple effect
- 14.1.5 Describe the thermoelectric effect
- 14.1.6 Describe the piezoelectric effect
- 14.1.7 Describe the turboelectric effect
- 14.1.8 Describe the electro-chemical effect
- 14.1.9 Describe principles of harmonics
- 14.1.10 Describe the electrical effect of friction
- 14.1.11 Identify sources of electricity
- 14.1.12 Identify potential sources of electricity
- 14.1.13 Describe the differences between alternating current and direct current (AC and DC)
- 14.1.14 Define voltage and identify the ways in which it can be produced
- 14.1.15 Explain the difference between conductors and insulators
- 14.1.16 Define the units of measurement that are used to measure the properties of electricity
- 14.1.17 Explain how voltage, current and resistance are related to each other
- 14.1.18 Calculate an unknown value using the formula of Ohm's Law
- 14.1.19 Explain the different types of meters used to measure voltage, current and resistance.
- 14.1.20 Calculate the amount of power used by a circuit using the power formula

**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)
- *Solve and graph linear equations and inequalities.* (Algebra F, 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)*
- *Solve problem situations involving derived measurement; e.g., density, acceleration. (Measurement D, 11-12)*

**BIL: Essential**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**Competency 14.2: Analyze basic electrical theory**

**Descriptors:**

- 14.2.1 Explain the relationship of electron theory to circuit design using Ohm’s Law
- 14.2.2 Explain the uses of series, parallel and series-parallel circuits including trouble-shooting skills
- 14.2.3 Identify the types and uses of transformers and motors
- 14.2.4 Explain principles of magnetism and electromagnetism
- 14.2.5 Examine basic AC theory
- 14.2.6 Analyze alternating current

**BIL: Essential**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**Competency 14.3: Analyze and evaluate alternating current (AC)**

**Descriptors:**

- 14.3.1 Construct series AC resistive circuits for analysis
- 14.3.2 Construct parallel AC resistive circuits for analysis
- 14.3.3 Construct series-parallel AC resistive circuits for analysis
- 14.3.4 Evaluate voltage, current, frequency and phase relative to the sine wave
- 14.3.5 Explain principles of transformers
- 14.3.6 Identify the characteristics of inductors in series and parallel circuits
- 14.3.7 Identify the characteristics of capacitors in series and parallel circuits
- 14.3.8 Evaluate resistive-capacitive (RC) and resistive-inductive (RL) time constants (TC)
- 14.3.9 Evaluate true power, apparent power, reactive power and power factor
- 14.3.10 Evaluate impedance
- 14.3.11 Measure current, voltage and resistance in AC circuits
- 14.3.12 Explain simple AC generator action
- 14.3.13 Explain simple AC motor action

**Correlated Mathematics Academic Content Benchmarks**

- *Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations. (Algebra D, 8-10)*
- *Apply mathematical modeling to workplace and consumer situations, including problem formulation, identification of a mathematical model, interpretation of the solution with the model, and validation to the original problem situation (Mathematics. Process J, 11-12)*

**BIL:**            **Essential**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**Competency 14.4: Solve mathematical problems related to electricity**

**Descriptors:**

- 14.4.1 Solve word problems involving whole numbers, fractions and decimals
- 14.4.2 Convert metric prefixes to their numerical equivalents and vice-versa
- 14.4.3 Convert numbers to scientific notation
- 14.4.4 Solve algebraic and trigonometric formulas pertaining to electrical applications
- 14.4.5 Solve problems involving percentage, ratio and proportion
- 14.4.6 Solve problems using direct and inverse relationships
- 14.4.7 Measure distance using scales and measuring devices
- 14.4.8 Use a calculator to solve electrical problems
- 14.4.9 Interpret charts, graphs and schematics

**Correlated Mathematics Academic Content Benchmarks**

- *Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations. (Algebra D, 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, compute and solve problems involving scientific notation, square roots and numbers with integer exponents. (Number I, 8-10)*
- *Use right triangle trigonometric relationships to determine lengths and angle measurements. (Geometry I, 8-10)*
- *Solve and graph linear equations and inequalities. (Algebra F, 8-10)*
- *Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)*
- *Model and solve problem situations involving direct and inverse variation. (Algebra I, 8-10)*
- *Solve increasingly complex non-routine measurement problems and check for reasonableness of results. (Measurement A, 8-10)*

**BIL:**            **Essential**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>R</b>	<b>P</b>

**Competency 14.5: Explain and apply National Electrical Code (NEC) and other applicable codes**

**Descriptors:**

- 14.5.1 Describe the purpose of the National Fire Protection Association (NFPA)
- 14.5.2 Explain the purpose and history of the National Electrical Code (NEC)
- 14.5.3 Describe the scope of NEC and local codes
- 14.5.4 Describe how local codes may differ from NEC
- 14.5.5 Demonstrate use of code books (e.g., mandatory and fine print rules)
- 14.5.6 Apply commonly used articles of the NEC and other applicable codes (i.e., Building Officials and Code Administrators (BOCA), OBBC, Life Safety Codes)
- 14.5.7 Use NEC to calculate various general job requirements (e.g., service conductors; feeders; branch circuits; permissible loads on various circuits; allowable cable tray fills; ampacity of various

- conductors and fill situations; ampacity of various circuits and load types; overload protection for motors, equipment and phase converters; minimum ampacity for motor disconnecting means; horsepower ratings for motors and disconnecting means; and grounding requirements)
- 14.5.8 Use NEC for hazardous locations (e.g., hazardous locations by class, equipment and wiring methods necessary for particular hazardous locations)
- 14.5.9 Describe the purpose for the National Electrical Manufacturers' Association (NEMA)  
Explain the role of testing laboratories such as Universal Laboratory (UL), Canadian Standards Association (CSA) and ITS

**Correlated English Language Arts Academic Content Benchmarks**

- *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)*

**Correlated Mathematics Academic Content Benchmarks**

- *Translate information from one representation (word, table, graph or equation) to another representation of a relations or function. (Algebra C, 8-10)*

**BIL: Essential**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>R</b>	<b>P</b>

**Competency 14.6: Demonstrate test equipment**

**Descriptors:**

- 14.6.1 Identify safety procedures established for the use of test equipment specific to the type of test being done (e.g., high voltage testing, capacitance, National Fire Protection Association 70 E)
- 14.6.2 Measure voltage using a voltage tester (e.g., Wiggins)
- 14.6.3 Measure current using a clamp-on ammeter
- 14.6.4 Measure voltage, current and/or resistance using an analog multimeter
- 14.6.5 Measure voltage, current and/or resistance using a digital multimeter
- 14.6.6 Verify installation using a receptacle polarity tester
- 14.6.7 Verify the operation of a ground-fault circuit interrupter using a GFCI tester
- 14.6.8 Demonstrate the operation of an ammeter
- 14.6.9 Demonstrate the operation of a wattmeter
- 14.6.10 Demonstrate the operation of a continuity tester
- 14.6.11 Demonstrate the use of recording instruments
- 14.6.12 Demonstrate the use of cable-length meters
- 14.6.13 Demonstrate the use of a megohmmeter
- 14.6.14 Demonstrate the use of a potentiometer
- 14.6.15 Demonstrate the use of an oscilloscope
- 14.6.16 Demonstrate the use of a phase-rotation meter
- 14.6.17 Demonstrate the use of a circuit tracer
- 14.6.18 Demonstrate the use of a tic tester
- 14.6.19 Demonstrate the use of a light meter
- 14.6.20 Explain how to read and convert from one scale to another using the test equipment listed above
- 14.6.21 Explain the importance of proper meter polarity

**BIL: Essential**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>R</b>	<b>P</b>

**Competency 14.7: Read and interpret blueprints**

**Descriptors:**

- 14.7.1 Explain the basic layout of a blueprint
- 14.7.2 Describe the information included in the title block of a blueprint
- 14.7.3 Identify the types of lines used on blueprints
- 14.7.4 Interpret dimension, symbols, views and scales
- 14.7.5 Describe architect's and engineer's scales
- 14.7.6 Read equipment schedules found on electrical blueprints
- 14.7.7 Describe the type of information included in electrical specifications
- 14.7.8 Interpret electrical drawings, including site plans, floor plans and detail drawings
- 14.7.9 Locate sites for installation
- 14.7.10 Identify layout for wiring runs
- 14.7.11 Interpret other drawings as appropriate (e.g., mechanical, security, fire alarm, HVAC, architectural job specs)
- 14.7.12 Coordinate applicable job specifications with all the blueprints

**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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**Competency 14.8: Demonstrate various uses for fasteners and anchors****Descriptors:**

- 14.8.1 Identify different types of fasteners and anchors
- 14.8.2 Demonstrate the correct applications for fasteners and anchors
- 14.8.3 Install fasteners and anchors

**BIL: Essential**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>R</b>	<b>P</b>

**Competency 14.9: Install rough-in wiring****Descriptors:**

- 14.9.1 Follow specifications, drawings and code requirements for rough-in wiring
- 14.9.2 Select materials in compliance with specifications, drawings and code requirements
- 14.9.3 Lay out runs based on circuit requirements (i.e., three-ways, four-ways, home runs and ground fault circuit interrupter)
- 14.9.4 Locate and mount boxes
- 14.9.5 Install wiring between and in boxes
- 14.9.6 Identify and connect wiring in boxes
- 14.9.7 Install wiring underground
- 14.9.8 Arrange for rough-in inspections
- 14.9.8 Install service entrance systems in accordance with customer and power company agreements
- Verify that the location of service equipment is in compliance with NEC and utility requirements
- 14.9.9 Lay out service equipment
- 14.9.10 Install service panels and meter apparatus
- 14.9.11 Install grounding electrode systems, making all needed connections
- 14.9.12 Install sub panels, making all needed connections
- 14.9.13 Install and identify over current protective devices

### 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**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>R</b>	<b>P</b>

### Competency 14.10: Install finish wiring

#### Descriptors:

- 14.10.1 Install lighting fixtures
- 14.10.2 Install wiring devices and covers
- 14.10.3 Connect appliances
- 14.10.4 Check and test installation
- 14.10.5 Arrange for final inspections
- 14.10.6 Identify panel directory
- 14.10.7 Install residential low-voltage systems (e.g., communication and telephone systems, control systems and lighting systems)
- 14.10.8 Service low-voltage systems
- 14.10.9 Verify residential installations following established troubleshooting and repair procedures

#### **BIL: Essential**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>R</b>	<b>P</b>

### Competency 14.11: Complete commercial and industrial installations

#### Descriptors:

- 14.11.1 Install rough-in wiring
- 14.11.2 Schedule necessary inspections
- 14.11.3 Verify onsite dimensions
- 14.11.4 Select materials in compliance with specifications, drawings and code requirements
- 14.11.5 Follow specifications, drawings and code requirements for rough-in wiring
- 14.11.6 Locate electrical boxes and panels
- 14.11.7 Install electrical boxes and panels
- 14.11.8 Lay out conduit or cable runs
- 14.11.9 Install raceways and cable systems (e.g., EMT, GRC, IMC, PVC, ENT, AC, MC)
- 14.11.10 Identify needed conductors according to specifications, drawings and code requirements
- 14.11.11 Pull identified conductors using the method appropriate for the size and number of conductors
- 14.11.12 Install equipment grounding and bonding systems
- 14.11.13 Define cable tray
- 14.11.14 Make conductor terminations
- 14.11.15 Describe exothermic connections

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**BIL:**           **Essential**

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	<b>I</b>	<b>R</b>	<b>P</b>

**Competency 14.12: Explain distribution systems**

**Descriptors:**

- 14.12.1       Verify that the location of service equipment is in compliance with NEC and utility requirements
- 14.12.2       Lay out distribution systems
- 14.12.3       Identify service equipment
- 14.12.4       Identify meter apparatus
- 14.12.5       Identify grounding-electrode systems, making all needed connections
- 14.12.6       Identify feeders and all needed connections
- 14.12.7       Identify transformers and all needed connections
- 14.12.8       Identify metering equipment, panels and disconnects, and all needed connections

**BIL:**           **Essential**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>R</b>	<b>P</b>

**Competency 14.13: Install motors and power wiring in accordance with NEC**

**Descriptors:**

- 14.13.1.1     Interpret motor nameplate information and motor specifications on drawings
- 14.13.2       Wire single-phase and three-phase motors
- 14.13.3       Install motor controllers
- 14.13.4       Wire motors to motor controllers
- 14.13.5       Verify motor rotation
- 14.13.6       Install motor control wiring
- 14.13.7       Describe the operation of programmable controllers

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

**BIL:**           **Essential**

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	<b>P</b>	<b>R</b>	<b>R</b>

**Competency 14.14: Differentiate between specialized systems**

**Descriptors:**

- 14.14.1     Identify various types of data and communication systems
- 14.14.2     Identify local, state and NEC requirements for the installation of security and fire alarms
- 14.14.3     Identify energy management systems according to the manufacturer's specifications
- 14.14.4     Identify SMART HOUSE systems
- 14.14.5     Identify fiber-optic systems
- 14.14.6     Identify installation techniques for each system (e.g., security, fire alarm, energy- management)

**BIL: Essential**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**Competency 14.15: Demonstrate electrical safety practices**

**Descriptors:**

- 14.15.1 Identify, utilize and inspect proper safety equipment, such as PPE-safety shoes, hard hat, gloves, rubber gloves, rubber blankets, safety glasses, insulated tools, fire resistant clothing and training
- 14.15.2 Utilize safe OSHA procedures: OSHA-employer/employee responsibilities, confined spaces, worker safety programs, ladder safety, GFCI, fall protection, clearance and boundaries, excavation, written safety programs, lock-out-tag-out, hazard analysis, proper labeling, MSDS, welding safety, man lifts, training and scaffolding
- 14.15.3 Utilize safe NFPA procedures: NFPA 70E-arc flash boundaries, current limiting fuses, live work power permits, electrically safe work conditions, emergency worker safety programs, scheduling, energized circuits and training
- 14.15.4 Define drug free workplace: drug awareness program, just say “no”
- 14.15.5 Utilize proper training and implementation of testing procedures and equipment
- 14.15.6 Utilize a proper understanding of high-voltage safety

**BIL: Essential**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>I</b>	<b>R</b>	<b>P</b>

**Competency 14.16: Construct housekeeping pads and light pole bases**

**Descriptors:**

- 14.16.1 Identify, describe and assemble materials for forms
- 14.16.2 Lay out and install anchor bolts in concrete
- 14.16.3 Strip forms
- 14.16.4 Use formulas to find surface area and volume for specified three-dimensional objects accurate to a specified level of precision
- 14.16.5 Level base material
- 14.16.6 Lay out and erect forms and install reinforcing material

**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)*

**BIL: Essential**

<b>EDU:</b>	<b>12</b>	<b>AD</b>	<b>ApT</b>
	<b>P</b>	<b>R</b>	<b>R</b>

**Competency 14.17: Construct electrical drawings (i.e., as built)**

**Descriptors:**

- 14.16.7 14.17.1 Identify components and symbols
- 14.16.8 14.17.2 Identify connections
- 14.16.9 14.17.3 Draw an electrical plan locating receptacle, switch and lighting outlets
- 14.16.10 14.17.4 Draw a wiring schematic

14.16.11      Apply Auto CAD

**Correlated Mathematics Academic Content Benchmarks**

- *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)*

# *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**