

*Examples from
this document*

Construction Technologies
Career Field Technical Content Standards
with
Academic Content Standards in
English Language Arts and Mathematics

2005-2006



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FOREWORD

The Construction Technologies Career Field Technical Content Standards are the curricular framework for Ohio College Tech Prep and career-technical education programs in construction. This document reflects the career field framework outlined in Ohio Administrative Code 3301-61-03 (Criteria for Secondary Workforce Development Programs).

This document represents a collaborative effort of the following professional partners: the Ohio Department of Education's Office of Career-Technical and Adult Education, the Ohio Board of Regents, the College Tech Prep Curriculum Service Center at the University of Toledo and the Ohio Resource Center at The Ohio State University. Secondary and postsecondary educators, along with business and industry professionals, also participated in the development of the technical content standards.

The Construction Technologies Career Field Technical Content Standards combine business/industry standards (reflecting science, mathematics, English language arts and technology), academic content standards (English language arts, mathematics) and the business process framework to develop technical literacy in construction systems. The Construction Technologies Career Field includes occupations that focus on planning design, site development, building and maintenance of commercial and residential structures. The Construction Technologies Career Field is comprised of three pathways leading to technically-based careers in:

- Pre-Construction design
- Construction
- Construction management

This document delineates competencies that outline the knowledge and skills needed for career success in the above three pathways. It includes a) core competencies that span the construction career field addressing critical workplace skills, including technical skills; business processes; problem solving and critical thinking; leadership and teamwork skills; and b) pathway and specialization competencies that describe specific occupational knowledge and skills.

In addition, benchmarks from the Ohio *English Language Arts Academic Content Standards* and the *Mathematics Academic Content Standards* have been embedded, outlining the mathematics and language arts knowledge and skills associated with specific technical competencies.

The Construction Technologies document seeks to provide the basis for educational programming that will foster the development of what Doug Bush, vice president and chief information officer, Intel Corporation, refers to as the "T-shaped" employee. The T-shaped employee combines broad knowledge, insight and understanding of business processes, academic attainment, and workplace readiness (the crossbar of the "T") with depth of knowledge and expertise in a career specialty (the post of the "T"). The T-shaped employee is needed to ensure that Ohio's construction workforce of tomorrow is competitive in a global environment that requires specialized skills in a broader context aimed at the innovation of new products and services in an ever-changing economy.

This document forms the basis for the development of an integrated delivery system that provides opportunities for new and challenging programs and courses. It is hoped that the document will enhance and expand career-technical education, College Tech Prep and postsecondary degree programs in construction and related fields.

The document is available on the Internet at www.techprepohio.com and through the Ohio Department of Education career field initiative Web pages at www.ode.state.oh.us/ctae/cf/.

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Philosophy and Principles for Implementation

Ohio Career Field Initiative

The overarching framework for Ohio career-technical education is outlined in the Ohio Revised Code and subsequent administrative rules, which specify career-technical programming based on 16 career fields. To view the full text of Administrative Rule 3301-61-03 (Criteria for Secondary Workforce Development Programs), go to: www.ode.state.oh.u/ctae/regulations/admin_rules.asp. These fields provide the framework for an Ohio career field initiative that seeks to foster the educational shift needed to respond to the needs of a rapidly changing global environment.

A career field is a “grouping of occupations and broad industries based on commonalities” (see www.careercluster.org). Career fields are the basis for developing both broad and specialized technical content standards that serve as a framework for curriculum, instruction, assessment and program design, addressing the needs of an entire industry and business sector. Ohio’s 16 career fields align with national efforts to broaden career-technical education, integrate career-technical with academic study and reflect the workforce needs of today and tomorrow. For today’s students to be adequately prepared for tomorrow’s workforce, they must have an education that:

- **incorporates a broad, long-term conception of work in combination with the depth of specialization skills;**
Employees need a comprehensive understanding beyond a single occupational area. Occupationally focused programming needs to be provided in a larger context, so students can generalize learning, make connections between education and work, and adapt to changes in their careers. Workplace knowledge and skills are needed to prepare employees for collaborating and problem solving while contributing to the broader business process.
- **emphasizes the acquisition of strong academic knowledge and skills; and**
Academic skills provide the foundation for career success. The integration of academic content standards with career field technical content standards helps to contextualize learning for students, making mathematics and English language arts relevant to students as a means to an important end—success at work and in life.
- **facilitates high-school-to-postsecondary transitions.**
A lifetime of change means a lifetime of learning, including postsecondary education. Students need knowledge and skills for success in a variety of postsecondary options, including apprenticeships, industry credentialing through adult education, two- and four-year college degree programs, and graduate school.

Ohio Career Field Technical Content Standards

Career field technical content standards outline the knowledge and skills needed for success within a career field, multiple pathways and in some cases, areas of specialization. Validated by Ohio business and industry representatives in conjunction with Ohio educators, these standards form the basis for developing educational programming in Ohio secondary and postsecondary schools. The standards also serve as the framework for developing strong career pathways that connect secondary, adult and postsecondary education systems with the workplace.

While mirroring the diverse nature of each career field, all career field technical content standards documents will delineate competencies that outline the knowledge and skills that span the career field (core competencies), as well as those that relate to specific career field pathways (pathway competencies) and, in some cases, career field specialization (specialization competencies).

Additionally, academic benchmarks from Ohio's academic content standards for mathematics and English language arts are correlated with the career field technical content standards. The embedded benchmarks have been determined by business representatives and academic and technical educators from secondary and postsecondary institutions to be strongly related to specific knowledge and skills statements or competencies for the given career field.

Key features of Ohio Career Field Technical Content Standards include:

1. Broad as well as specialized technical competencies;
2. Embedded benchmarks for the Mathematics and English Language Arts Academic Content Standards; and
3. Workplace readiness competencies (communications; safety, health and environment; problem solving and critical thinking; leadership, management and teamwork; information technology applications; ethics and legal responsibility; business systems; and career development and employability).

Career Pathways

A key component of the Ohio Career Field Initiative is a career pathway, which is a series of academic and technical career-focused course work and other learning experiences leading to a career specialty and employment in a career field. Pathways facilitate a seamless transition from high school to postsecondary education (including apprenticeships, adult education, two- and four-year colleges, and graduate school) and from postsecondary education to the workplace.

To effectively facilitate the transition from secondary to postsecondary education and a career, high school career pathways should encompass:

1. Challenging technical course work in a chosen career field based on career field technical content standards;
2. Rigorous academics that meet Ohio's academic content standards and grade-level expectations;
3. Electives that relate to career objectives;
4. Instructional enhancements such as experiential and authentic learning opportunities (e.g. work-based learning, mentorships, internships) and career-technical student organization participation;
5. Opportunities (when appropriate) for program and student certification and licensure;
6. Preparation for transition to further study that includes college readiness and opportunities to earn college credit while in high school;
7. Preparation for transition to employment with advancement opportunities; and
8. Performance targets that include high school academic and technical testing/exit and postsecondary entry/placement requirements

For additional information on the Career Field Initiative, including Ohio Career Field Technical Content Standards and Career Pathways, go to www.ode.state.oh.us/ctae/cf.

The Ohio College Tech Prep Advisory Council approved the standards below in May 2002. Please note that new Ohio Career Field Technical Content Standards replace the Technical Competency Profiles (TCPs) referred to in the document. As these are developed, they will serve as the basis for College Tech Prep program development in those pathways approved as College Tech Prep.

College Tech Prep Program Standards

College Tech Prep programs are rigorous programs of study starting at the secondary school level and continuing through the associate degree and beyond. In accordance with the Carl D. Perkins Vocational Technical Education Enhancement Act of 1998, College Tech Prep programs are seamless, non-duplicative programs of study combining high-level academic and technical preparation in a variety of career fields.

The Carl D. Perkins Vocational and Technical Education Act of 1998 defines College Tech Prep as:

A program that provides technical preparation in a career field such as engineering; applied science; mechanical, industrial or practical arts or trade; agriculture; health occupations; business; or applied economics, and must do the following:

- *Combines at least two years of secondary and two years of post-secondary education in a sequential course of study without duplication of course work;*
- *Integrates academic, vocational and technical education, and if appropriate and available, work-based learning;*
- *Provides technical preparation for careers;*
- *Leads to an associate or a baccalaureate degree or postsecondary certificate in a specific career field;*
- *Leads to placement in appropriate employment or further education.*

The Ohio College Tech Prep Advisory Council recommended to the Ohio Board of Regents and the Ohio Department of Education the following standards for all College Tech Prep programs:

- Academics are taught at a college-preparatory level and are aligned with state models and academic content standards.

In addition to Ohio graduation requirements specified in SB 55, required academic components for College Tech Prep programs include:

- Mathematics taught at a minimum level of Algebra II by the completion of high school;
- An integrated or stand-alone senior year math component;
- Three units of science, including at least two lab-based science courses;
- College Tech Prep programs will use a state-developed Technical Competency Profile (TCP)* as the basis for pathway development. The pathway document should reflect secondary and postsecondary course work and should be made available for stakeholders. All secondary and postsecondary TCP competencies must be clearly identified and addressed. The TCP is the framework used to develop all associated curricular documents; however, components from other competency profiles, such as OCAPs (Occupational Competency Analysis Profiles), ITACs

Unit 14: Carpentry

(Industry-Driven Authentic Assessment, See Appendix.)

BIL: Essential

EDU:	12	AD	ApT
	P	R	R

Competency 14.1: Interpret construction drawings and demonstrate construction layout procedures

Descriptors:

- 14.1.1 Identify types of drawings, specifications and common scales used in construction drawings
- 14.1.2 Interpret site plans, symbols, dimensions and sections
- 14.1.3 Compute various attributes, including length, angle measurement, surface area and volume
- 14.1.4 Utilize layout instruments to lay out a building, driveway and sidewalk
- 14.1.5 Demonstrate fundamentals in squaring, plumbing and leveling techniques
- 14.1.6 Demonstrate manual and electronic layout equipment (e.g., transit, laser level)
- 14.1.7 Locate and square building corners

Correlated English Language Arts Academic Content Benchmarks

- *Analyze the features and structures of documents and critique them for their effectiveness.* (Reading: Informational Text A, 11-12)

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

Correlated Science Academic Content Benchmarks

- *Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate and communicate the results of these investigations.* (Scientific Inquiry A, 9-10)

BIL: Essential

EDU:	12	AD	ApT
	I	P	P

Competency 14.2: Select materials for various construction applications

Descriptors:

- 14.2.1 Describe criteria used for material selection
- 14.2.2 Identify and evaluate alternative materials
- 14.2.3 Prepare and communicate a summary of material options to the client
- 14.2.4 Explain the process necessary to select approved materials
- 14.2.5 Discuss comparative analysis cost versus quality

Correlated English Language Arts Academic Content Benchmarks

- 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)
- 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

- Use a variety of mathematical representations flexibly and appropriately to organize, record and communicate mathematical ideas. (Mathematics. Process E, 8-10)
- Construct convincing arguments based on analysis of data and interpretation of graphs. (Data F, 8-10)

Correlated Science Academic Content Benchmarks

- Describe the identifiable physical properties of substances (e.g., color, hardness, conductivity, density, concentration and ductility). Explain how changes in these properties can occur without changing the chemical nature of the substance. (Physical Sciences C, 9-10)

BIL: Essential

EDU:	12	AD	ApT
	I	P	P

Competency 14.3: Construct footings and foundations

Descriptors:

- 14.3.1 Identify, describe and assemble materials for footer forms
- 14.3.2 Use formulas to find surface area and volume for specified three-dimensional objects, accurate to a specified level of precision
- 14.3.3 Apply various measurement scales to layout length, width and angle measurements
- 14.3.4 Erect and brace forms and install bulkheads
- 14.3.5 Construct boxes for specified openings
- 14.3.6 Layout and install anchor bolts in concrete
- 14.3.7 Layout and install expansion and contraction joints in concrete walls
- 14.3.8 Install keyways for footings and foundations
- 14.3.9 Strip forms

Correlated Mathematics Academic Content Benchmarks

- Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision. (Measurement E, 8-10)
- Use formulas to find surface area and volume for specified three-dimensional objects accurate to a specified level of precision. (Measurement B, 8-10)