Architecture & Construction

Career Pathways for the Construction Trades

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Missouri Career Education
ESSENTIAL SKILLS FOR ALL STUDENTS

Career Pathways for the Construction Trades

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Section 1: Introduction

Introduction

Technological advances and the drive for sustainable solutions have transformed the nature of the building industry. Tomorrow's jobs will require more knowledge, better skills, and more flexibility than ever before to apply these solutions to existing facilities and structures while building for a growing population. Tomorrow's workers must be prepared to change jobs and careers several times, while continually updating their knowledge and skills.

Career Clusters provide a common framework for career preparation by linking what students learn in school with the knowledge, skills, and experiences needed for success in postsecondary education and careers. When used to develop a student's Personal Plan of Study, the Career Clusters Framework provides students with a strong foundation for postsecondary education and future employment.

Missouri's Seven Core Concepts for Career Clusters

1. Learning should be student-centered.
2. Instruction should integrate academic education, career development, and career education.
3. Connections should be enhanced among secondary education, postsecondary education, business, and economic development.
4. Rigorous and relevant academics are needed by all students, whatever their educational and career plans.
5. Secondary schools' instruction should prioritize foundational knowledge and skills for career preparation above job preparation.
6. Industry-verified standards should serve as a benchmark for career education.
7. School reform is needed to prepare students for success in the 21st century workforce.

[Source: Missouri Department of Elementary and Secondary Education (DESE)]

Career Pathways for the Construction Profession, within the Architecture and Construction career cluster, provides students opportunities to focus on future employment as carpenters, electricians, masonry workers, HVAC contractors, remodeling contractors, facility managers, and construction managers. This competency packet can be used to effectively plan a Career Pathways for the Building Trades program within a school district or to adapt or expand an existing program. Administrators, educators, students, and parents can use components of the packet to assist in career planning and to continue a focus on the Architecture and Construction career cluster.

Career Pathways for the Construction Trades Competency Packet Components*:

- Tools for the Administrator
- Tools for the Teacher
- Tools for the Student
- Appendix A: Core Competencies
- Appendix B: Instructional Frameworks
- Appendix C: Resources

* *Development of this competency packet was funded by the Missouri Department of Elementary and Secondary Education (DESE) and facilitated by the Missouri Center for Career Education (MCCE). Core Competencies were identified by the advisory committee and approved by DESE.*

About Career Pathways for the Construction Trades

In the construction pathway, people build cities, homes, and highways as well as remodel buildings used for commercial and residential purposes as well as build infrastructure (e.g., highways, bridges, tunnels, and airports). The following occupations are representative of this pathway:

- Boilermakers
- General Construction Workers
- Bricklayers and Stonemasons
- Glaziers
- Cabinetmakers
- Heating and Cooling System Mechanics
- Carpenters
- Insulation Installers
- Cement Masons
- Landscapers and Grounds Keepers
- Commercial Drivers
- Line Installers and Repairers
- Construction and Well Drillers
- Painters
- Construction Helpers
- Paving Equipment Operators
- Construction Managers
- Pipelayers
- Drywall Finishers
- Plasterers
- Drywall Installers
- Plumbers and Pipefitters
- Electrician Helpers
- Roof Bolters
- Electricians
- Roofers
- Elevator Installers and Repairers
- Sheet Metal Workers
- Explosives Workers
- Structural Metal Workers
- Fence Builders
- Tile Setters
- Floor Sanding Machine Operators
- Wallpaper Hangers

(Source: www.missouriconnections.org):

Initially, it is important to understand the core competencies required for success in the construction trades. Ensure that everyone involved in your program carefully reviews the competencies outlined in Appendix A (pages 37 through 48). Appendix B provides the Instructional Framework tied to these core competencies.

Assessing the Construction Program in Your Local Community

Conducting a survey will provide program administrators and instructors with a better understanding of a community's occupational needs in the construction trades. Table 1.1 (on the next page) provides guidance for structuring and conducting a survey as well as for evaluating survey results. In general, you will want to identify demographics, anticipated participation, and available resources. Additionally you can access this type of information through your local chamber of commerce, professional association [e.g., Associated General Contractors of America, Inc. (AGC), American Public Works Association (APWA), etc.] and local or regional Job Service centers.

It is important to clearly identify the benefits of the survey in terms of new teaching strategies, new industry information, new equipment/methodology being used, or local/state administrator guidance, and then seek feedback from a program advisory committee (see pages 7 through 9 about creating an advisory committee).

This packet is to be used only with a DESE-approved Career Pathways for the Construction Trades program.

For more information, contact:

Missouri Department of Elementary and Secondary Education

Skilled Technical Sciences

PO Box 480
Jefferson City, MO
65102-0480

http://dese.mo.gov/divcareered/skilled_tech_sciences_index.htm

Table 1.1. Tips for Conducting a Local Program Needs Assessment

Identifying demographic, participation, resource information needed	Conducting a Feasibility Assessment	Evaluating Assessment Results
To structure your survey, determine:	**To conduct your survey, determine:**	**To evaluate survey results, consider:**
• What group of people will you survey (e.g., construction firms within a 25-mile radius; electrical firms with 15 or fewer employees, remodeling contractors, facility managers of public institutions, etc.)?	• How will you collect survey data (e.g., by phone, mail, online survey program, job shadowing)?	• What the data means and how you are interpreting that data (e.g., if 13 of the 15 respondents answered the same way on a particular question, what does this indicate?)
• Why did you choose this population? How did you decide which members of the population you would survey (e.g., all available firms, a randomly selected percentage)?	• How long will you give respondents to respond (if not a job shadowing approach)? What will you do to enhance the return rate?	• How the results affect your individual program
• Is there an existing survey that can be modified for your purpose, or do you need to create an original one?	• How will you format data collected (e.g., table, narrative section describing data collected)?	• If curriculum changes or program administration changes are indicated from the survey results, how will you implement these changes?
• What is the most feasible time line for conducting, evaluating, and implementing survey results?	• How will you deal with unexpected data provided (e.g., additional comments), and will this data be beneficial?	• How transferable is this information to other Missouri Vocational/ Technical programs? What are the benefits of sharing this information, and how will you do so?

This packet contains a wealth of tools for program administrators, teachers, and students involved in a Construction Trades career program. Highlights from each section are:

Section 1: Introduction provides information on assessing your local community for need and possible participation.

Section 2: Tools for the Program Administrator guides you through setting up an advisory committee and suggested resources for funding and other assistance with securing facilities, equipment, and tools for your program.

Section 3: Tools for the Teacher provides information on technical skills training, OSHA training, and "soft skills" training.

Section 4: Tools for the Student features guidance on the employment outlook for the construction trades as well as on developing a personal plan of study.

Appendix A presents core competencies for the Architecture and Construction Core as well as for the Construction Pathway.

Appendix B presents the instruction framework (crosswalk).

Appendix C lists diverse resources related to construction industry, relevant careers, and construction trades programs.

Section 2: Tools for the Program Administrator

Tools for the Program Administrator

The resources available to you as a program administrator for a Construction Trades program are extensive. In this section, you will find information on tapping the resources available from the Division of Career Education at Missouri Department of Elementary and Secondary Education (DESE), creating and managing an advisory committee, and sourcing funding as well as facilities, equipment, and tools necessary for a successful program.

To begin to build your program, access the ***Common Standards for Career Education Programs*** with associated quality indicators (developed by DESE, Division of Career Education). These standards are organized in six areas:

- **Program Management and Planning** — A system of data collection and evaluation that supports continuous improvement resulting in high student achievement
- **Curriculum** — A written curriculum for each sequential course that balances classroom/lab instruction, leadership, and personal development
- **Instruction** — Classroom instruction congruent with the written curriculum
- **Professional Development** — Certified teachers participating in ongoing, high-quality professional development activities
- **Career and Technical Student Organizations (CTSOs)** — CTSOs affiliated with state and national organizations as an intra-curricular element of the program

- **Instructional Facilities and Equipment** — Safe, clean, and appropriate facilities and equipment

For a downloadable copy of these standards and quality indicators, access:
http://dese.mo.gov/divcareered/Common_Program_Standards.pdf

Key to initiating a successful program is the creation of an advisory committee. An advisory committee collectively advises decision making regarding career education and/or workforce development. Members predominantly hail from outside the education field, and are selected because of their expertise and experience in business, industry, and labor. The committee collectively serves schools, students, and educators, consulting on current job skills, employment trends, program delivery needs and resources available, and the relevancy of the program's curriculum.

Once an advisory committee has been formed, the members can assist with sourcing facilities, equipment, and tools; and help solidify and communicate program requirements.

TIP: Contact other advisory committees and consider attending one of their meetings as a visitor to get advice on conducting and evaluating a needs assessment as well as setting up your own advisory group.

Alternately, if there is an active advisory committee near you, talk to committee members about expanding their focus (and adding members from your community) to form a regional advisory committee serving your area.

Creating an Advisory Committee

Your construction career and technical program will benefit from having an advisory committee in a number of ways. This group can help enhance the program quality by:

- Tapping into community expertise to review local needs assessment planning and findings as well as short- and long-range plans for recruiting students to the program
- Helping prioritize CTE expenditures
- Reviewing existing local and state board of education policies on career and technical education for relevance to the industry
- Fostering public awareness
- Offering career awareness and guidance to the students in the program through internships, job shadowing, and full- or part-time employment
- Strengthening ongoing partnerships between education and business/industry in the community
- Evaluating facilities, program equipment, and resources and comparing these with current standards
- Reviewing the safety program for compatibility with industry standards
- Evaluating course content (including software packages, textbooks, and other resources) as well as instructional methods (e.g., field experiences, occupational training stations) to ensure essential areas are covered for students to successfully find employment
- Championing your program through promotional, multi-media programs that encourage other businesses to develop work experience programs and build interest and understanding between the school and community organizations

Setting up an Advisory Committee

Before you begin to create an advisory committee, be sure to conduct a needs assessment for the CTE program in your community. Next, you will need to develop a list of prospective members. Plan for a maximum of 15 members, with two or three being "ex-officio education members" (e.g., school administrators, CTE teachers, academic teachers) and the rest being managers, supervisors, technicians, and laborers from business and industry in the area (e.g., county/city leaders, chamber of commerce leaders, former students, or media and labor representatives). Ensure that those you invite understand what will be required of them (see table 2.1 below) and adequately represent the geographic area served in terms of race, gender, and ethnicity. Invite these prospective members to come to an initial meeting, assuring those you contact that their input will be utilized to make the program stronger.

TIP: Focus on the expertise of the members you invite. Think about who will be most committed to the students and their success: Have they contributed to education initiatives in the past? Do they know about emerging career opportunities in your area?

TIP: Make sure you understand local policies regarding advisory committees and inform proper school administrators of your plans.

Table 2.1. Typical Requirements for Advisory Committee Members

Advisory Committee Member Requirements
A specific term of service (one, two, or three years)
Member replacement (on a staggered basis so there is continuity from year to year, prevention of "burn out," and increased program awareness by regularly recruiting new members
Regular meeting attendance
Following parliamentary procedure
Recording and dissemination of minutes
Possible need to assign subcommittees to further explore issues arising during meetings
Decision-making by quorum vote

Preparing for the First Meeting

Develop a thoughtful, well-structured agenda to make the advisory committee a meaningful experience for everyone involved. Have the committee chair and a school representative identify and prepare the agenda and distribute it to members before the meeting. Meeting agenda items typically include:

- Roll call and agenda additions (if any)
- Introduction of guests
- Approval of previous minutes
- Special presentations
- Communication
- Committee reports
- Old business
- New business
- Adjournment

At the first advisory committee meeting, allow members to introduce themselves and give their backgrounds – the school representative will provide an explanation of the program background and may also lead a tour of the CTE facility. Elect a chairperson and other officers identified (as needed), establish a procedure for developing committee by-laws, and determine number and schedule of future and annual meetings to hold. Table 2.2 (below) summarizes typical officer responsibilities.

Elect officers at the first or last meeting of the school year. The first meeting of each new year can be reserved for orienting new members and for establishing the program of work.

Table 2.2. Typical Officer Responsibilities

Committee Chair	Vice Chair	Secretary
• Work with school and community representatives to plan and carry out the program of work. • Prepare agendas and assist the instructor in handling meeting details. • Preside at meetings. • Keep group efforts focused. • Delegate tasks and follow-up. • Represent the committee at official meetings and functions. • Submit recommendations to appropriate groups. • Follow-up on committee recommendations.	• Fill in for Chair whenever necessary. • Same responsibilities as the Chair.	• Take, prepare, and distribute minutes. • Mail agenda, announcements, minutes, and other information to members. • Help assemble and distribute necessary background information to members. • Correspond with the school and community, as needed.

Managing Your Advisory Committee

Four elements are key to the ongoing operation of an effective advisory committee:

1. Utilizing by-laws or policies and rules that specify purpose and scope of responsibility for the committee as well as member expectations. By-laws should reflect program requirements and the needs of the school district/school in which the program operates.
2. Maintaining a focus on helping programs and schools improve CTE instruction quality in CTE with serving the needs of business and industry as secondary goals.
3. Recognizing member participation and enthusiasm.
4. Reviewing progress in terms of whether or not annual priorities were met, program of work was realistic, and impact of the committee on the CTE program.

Determining and Sourcing Facilities and Tools

Implementing a successful construction trades program requires significant resources in terms of facilities, equipment, tools, and materials. Funding and in-kind sources for these are many, including:

- **Advisory Committee Members** — By establishing an advisory committee comprised of local business and industry leaders, your program will benefit from their fundraising expertise and connections within the industry and community.
- **Local Construction Companies/Suppliers** — Your students will be the skilled craftsmen of the future. As such, local builders and building supply companies (e.g., Lowes, Home Depot, Sutherlands) understand the importance of supporting construction education programs. Look to these sources for tools, supplies, facility use, and expertise.
- **Industry Organizations' Outreach Programs** — Many construction industry professional associations offer educational outreach programs and support for career education. For resources, access information on local chapters of building industry organizations (see information at right).
- **Government Funds/Grants** — A number of programs fund equipment and other resources through Missouri's Vocational-Technical Education Enhancement Grant Award program. These grants require that eligible programs have an existing advisory committee of at least 12 members and that funds be used for instructional equipment, information technology resources (i.e.., software, network/Internet connections, and installation), curriculum enhancement, and facility improvement. Awards can be as much as 75 percent of the cost of items with 25 percent local matching required. For complete information on applying for an enrichment grant, download the Administration Planning Guide (either as a .doc or .pdf file) at http://dese.mo.gov/divcareered/grants.htm.

  Also, talk with your career center administrator about using Carl Perkins funds for program resources.

Find information on building industry organizations and how to contact local chapters at::

— Associated Builders and Contractors (ABC), www.abc.org

— Associated General Contractors of America, Inc. (AGC), www.agc.org

— National Association of Home Builders, www.hbi.org

— National Association of the Remodeling Industry (NARI), www.nari.org/education

— International Facility Management Association, www.ifma.org

— Mason Contractors Association of America (MCAA), www.masoncontractors.org

— Air Conditioning Contractors of America, www.acca.org

— American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), www.ashrae.org

— Refrigeration Service Engineers Society (RSES), www.rses.org

— National Electrical Contractors Association (NECA), www.necanet.org

Establishing Program Requirements — Teacher Qualifications

When recruiting instructors for your Construction Trades program, you will need to focus on finding those individuals who have a genuine desire to teach, and ability to relate to teens, AND possess relevant experience in the construction field. Instructors can begin working with the program with a Temporary Authorization Certificate (TAC) until they acquire the credentials necessary for a Career Continuous Career Education (CCCE) classification. Additionally, many programs prefer relevant industry certifications and field experience.

Temporary Authorization Certificate (TAC)

To obtain a TAC, candidates will need to comply with the professional requirements indicated in table 2.3 below. The initial TAC is valid for one (1) year and renewable annually by the certificate holder and the employing Missouri school district submitting an application. The school must also verify the certificate holder has satisfied all of the following requirements:

- Continued contracted employment
- Successfully completed a yearly Performance-Based Teacher Evaluation
- Participated in a yearly mentoring program
- Submitted official transcript(s) documenting the completion of six (6) semester hours of coursework toward initial career education certificate

Career Education License-to-Teach Requirements – Career Continuous Career Education (CCCE)

To obtain the CCCE classification, applicants must complete and verify all of the following:

- Four (4) years of state-approved teaching experience
- Development, implementation, and completion of a professional development plan of at least ninety (90) contact hours [at least thirty (30) contact hours per school year] in the career education subject in which the applicant is seeking certification
- Participation in a two (2)-year mentoring program, reflecting the guidelines established by the local school district
- Verified participation in a Beginning Career Education Teacher's Assistance Program, which can include re-training, internship, counseling, and in-service training
- Annual participation in the district's Performance-Based Teacher Evaluation (PBTE) program

Table 2.3. Initial TAC

Education Attained	Experience*	Documentation
High School Diploma	6,000 hours	Professional License**
BA/BS or Higher***	4,000 hours	Transcript****
Associates Degree***	5,000 hours	Transcript****

Notes:

* *Minimum DESE-approved, Related Occupational Experience with most recent 10 years*

** *Valid, unencumbered, undisciplined copy of professional license for instructional area*

*** *From accredited college or university in the subject area to be taught*

**** *Includes verification of coursework in education not to exceed eighteen (18) credit hours, falling under the following competencies: curriculum, methods, assessment, psychology of the exceptional child, foundations/implementation, and coordination of cooperative education.*

Industry Certifications/Field Experience

Many programs require industry certifications or licenses as part of teacher qualifications. For example, an area career center might require a construction program teacher to have at least 6,000 hours of experience with five year's teaching experience. Many programs prefer teachers to have national credentials as well (e.g., from AGC).

Recruiting Students

Recruiting students to your construction program will require both a short- and long-term strategy. In the short term, attract high school students to the program by:

- Developing relationships with directors and teachers at sending high schools
- Sponsoring booths at high school career fairs and participating in Career Day activities
- Being involved in "career night" events along with counselors, superintendents, principals, and teachers
- Volunteering to help with high school extracurricular activities and field trips (e.g., coaching summer baseball, football)
- Offering to speak at 9th grade career exploratory classes that introduce students to various career opportunities
- Hosting tours for students and teachers of the career center and especially the construction trades program area
- Ensuring that all students and teachers who visit the construction trades area leave with a positive impression about the training and the opportunities students have in the field
- Advertising your program at high school sports events, dances, and other school-sponsored events
- Ensuring that your program's Web site and social media pages (e.g., FaceBook, MySpace, Twitter) are up to date and inviting with new content added regularly

For longer-term recruiting, you need to interest youth at the elementary and middle school/junior high levels. Recommended strategies include:

- Getting local chapters of industry professional organization (e.g., AGC, APWA) to put on demonstrations and events (e.g., construction rodeo) at younger grades to generate interest earlier
- Having high school students in the Construction Trades program (as part of their CTSO activities) visit elementary schools and talk to younger kids about what they're learning in the program and what they hope to be doing after high school in the field
- Advertising in local papers, school newsletters, and other venues that target the whole family and community; getting parents, siblings, grandparents, friends, and others interested in promoting the construction trades to youth they come in contact with

For all recruiting activities, it is vital that everyone associated with the program, including students, project a positive, work-oriented image for the program, including perhaps wearing the uniform or job-specific work clothes typical of that trade when addressing groups or giving tours. Also key to your recruiting efforts is to always show relevancy of education to the real world of working in the construction trades.

Section 3: Tools for the Teacher

Tools for the Teacher

The Career Pathways for the Construction Trades program focuses on carpentry, masonry, electrical, and HVAC competencies as well as occupational safety. This collaborative program helps prepare secondary students for future careers in the construction trades by:

- Recruiting quality secondary students for the profession
- Providing students with information about the challenges and opportunities offered by a career in the construction trades
- Provides students a seamless pathway to a career in the construction trades through academic coursework and experiential learning activities with the potential for advanced knowledge and skills

Core Competencies/Recommendations

Core competencies include foundation knowledge and skill statements that apply to all careers in the Architecture and Construction Cluster as well as those that apply to all careers in the Construction Pathway. The Architecture and Construction core competencies cover:

- Academic Foundations
- Communications
- Problem-Solving and Critical Thinking
- Information Technology Applications
- Systems
- Safety, Health and Environmental
- Leadership and Teamwork
- Ethical and Legal Responsibilities
- Employability and Career Development
- Technical Skills

More industry-specific competencies for the Construction Pathway are organized as follows:

- Systems
- Safety, Health and Environmental
- Leadership and Teamwork
- Ethical and Legal Responsibilities
- Technical skills

Technical Skills Attainment (TSA)

The Perkins Act of 2006 (Perkins IV) requires 2S1 Technical Skill Attainment (TSA) to measure the percentage of Career and Technical Education (CTE) concentrators who pass a skill assessment aligned with industry-recognized standards (if available and appropriate). Perkins IV outlines specific requirements and guidelines in the type of assessment used to measure CTE skill proficiency.

Students take the TSA after becoming a concentrator (one who is enrolled in three courses in the same field) and completing a program, rather than taking it after every course. Eventually, all concentrators who complete a program will be expected to take a technical skill assessment. This process will be phased-in by 2012.

The assessment tools (see table 3.1 at right) developed by these national organizations are currently accepted by the Division as meeting the criteria established by Perkins IV:

- American Association of Family and Consumer Sciences (AAFCS)
- Skills USA
- NOCTI

The state will continually monitor and incorporate new assessments as they become available and appropriate. Districts currently using an assessment they believe would qualify as an industry recognized assessment, but not administered by a national organization, should contact their Program Director at the Division for guidance.

For additional questions, contact Kristie Davis, supervisor, Administration and Accountability, (573) 526-4987.
Source: http://dese.mo.gov/divcareered/perkins_iv_tsa_guidelines.htm

Industry Certification Requirements for Program Completers

To be eligible for available positions in the construction trades, students who complete this program will need at least an OSHA 10-hour certification (see pages 17 through 19) and likely a National Center for construction Education and Research (NCCER) certification. For HVAC work, certain Environmental Protection Agency (EPA)certifications may be required. Many program utilize a math pretest for admission to the program.

Table 3.1. Current Available TSAs for Architecture and Construction:

Air Conditioning Certification	HVAC Excellence
Architectural Drafting	SkillsUSA
AutoCAD	Brainbench
Building Construction Occupations	NOCTI
Building Trades Maintenance	NOCTI
Cabinetmaking	NOCTI
Carpentry	NOCTI
Carpentry	SkillsUSA
Construction	PACT (pre-apprenticeship certificate training)
Construction	Ramsay Corporation
Construction Masonry - Blocklaying option	NOCTI
Construction Masonry - Bricklaying option	NOCTI
Construction Masonry - Stone option	NOCTI
Housing (IN PROGRESS)	AAFCS
HVAC	NOCTI
HVAC/R	NOCTI
HVAC/R (IN PROGRESS)	SkillsUSA
Masonry	SkillsUSA
NCCER	
Plumbing	NOCTI
Plumbing	SkillsUSA
Residential Construction	Home Builders Institute (HBI)
Residential Wiring	SkillsUSA

Student placement and follow-up (180-day follow-up)

The 180-day follow-up is a state-mandated measurement of post-graduation career outcomes.

Area career centers direct the 180-day follow-up of students who earn at least one unit of credit at the area career center and report the resulting data for each student to the appropriate sending high school. Each school then enters that student's information into the Missouri Student Information System (MOSIS) database.

If a student earns credit at both the sending high school and the area career center, the sending high school determines to which career education program the student's 180-day follow-up will be reported in MOSIS, considering the student's personal plan of study and the program area for which they received the most credit.

Teaching Content

Curriculum to use

Career education programs have written curriculum requirements for each sequential course, balancing classroom/laboratory instruction, leadership, and personal development.

Quality indicators of such programs include:

- Written curriculum guide and grading system/ achievement measurement policy
- Annual curriculum review/revision to reflect changes in industry, student needs, and instructional technology

- Development, implementation, and updates for written articulation agreements and dual credit arrangements with postsecondary institutions
- Embedded credit opportunities
- Balance of Career and Technical Student Organization (CTSO) activities and classroom/laboratory instruction to achieve curricular goals

The Missouri Department of Elementary and Secondary Education, Division of Career Education lists these quality indicators for career education classroom instruction congruent with written curriculum:*

- Lesson plans and teaching calendars derived from the curriculum guide are used to direct the instructional process.
- A variety of instructional methods are used to accommodate all learning styles.
- Effective classroom management techniques facilitate instruction.

- Program/course objectives, assessment methods, and performance expectations are shared with students and parents/guardians prior to instruction.
- An instructional management system exists for reporting student progress and classroom mastery of curriculum competencies.
- The teacher utilizes instructional strategies identified in the students' Individual Education Plan to facilitate student achievement.
- School and community resources are used to effectively achieve curricular and program goals.
- Appropriate equipment and instructional materials are utilized to support the curriculum and instructional process.
- Students can acquire industry-recognized credentials, if applicable that demonstrate skills to meet industry accepted standards.
- The instructor and the guidance staff work cooperatively to provide assistance to the transition to the workplace and/or continued education.
- Work-based learning is integral to the curriculum and program objectives.
- Cooperative education is guided by Department policies for credit and supervised employment for approved high school cooperative education programs.

**From: Missouri Department of Elementary and Secondary Education, Division of Career Education. 2006. Common Standards for Career Education Programs.*

The following covers both technical skills training curriculum and resources for soft skills training for construction programs.

Technical skills training

Technical skills taught should center on key competencies in carpentry, masonry, electrical., and HVAC trades. All programs are designed to prepare students for an apprenticeship or entry-level position in the field. Use the following as examples and work with your advisory committee to refine your technical skills training based on the core competencies and instruction framework information found in appendices A and B.

Carpentry:

- Teach entry-level skills for the major trades involved in residential construction such as carpentry, siding, interior trim, drywall hanging, roofing, and concrete work.
- Provide students with a working knowledge of relevant technology as well as necessary critical thinking and academic skills for pursuing apprenticeships or entry-level careers in residential and commercial construction.
- Include major units of instruction for safety, blueprint reading, foundation layout, framing, roofing, drywall, insulation, painting, finish carpentry, cabinetry, electrical, HVAC, masonry, plumbing, concrete, and siding.

Masonry

- Provide instruction on safety procedures; make-up properties, uses, and sizes of all masonry units; use of tools and equipment; use of anchors, ties, and reinforcement; types of courses and bonds
- Facilitate experiences in laying brick in various bond patterns used in commercial and residential construc-

tion; properties and technical details of foundations, floors, roofs, walls, and fireplaces; and blueprint reading.

- Teach construction techniques for building fireplaces, and chimneys, arches, special wall openings, double wythe and reinforced masonry, wall anchoring systems, flashing and prevention of water penetration, and masonry paving.
- Facilitate gaining knowledge of various types of stone contraction and tuckpointing.

Electrical

- Teach students to identify, install, and troubleshoot electrical wiring and associated devices commonly used in both residential and commercial environments and abide by strict safety rules.
- Direct students on how to construct, calculate, and install basic residential (e.g., switches, receptacles, lighting, low voltage communications wiring, service installation) and commercial (e.g., Start-Stop Stations, 3 phase motors, signal and three-phase transformers, relay logic, and programmable logic controllers) wiring.
- Provide students with knowledge of how to interpret designs, drawings, and specifications as well as to demonstrate the appropriate use of industry codes.

HVAC

- Impact an understanding of the basic mechanical refrigeration system and electrical circuits used to power and control air conditioning and refrigeration systems.
- Help students develop basic troubleshooting skills and perform these on domestic refrigeration systems, air conditioners, heating systems, and light commercial refrigeration systems.
- Teach a solid foundation in the principles of heating, ventilation, air conditioning, and refrigeration, combined with extensive laboratory experience
- Provide students with instruction on developing load calculations and testing, systematically trouble shooting, repairing, and maintaining electrical and mechanical HVAC-R systems and components.

Safety – OSHA Training

The Occupational Safety and Health Administration's (OSHA) Outreach Training Program is a voluntary program to train workers in the basics of safety and health hazard recognition and prevention. OSHA authorizes trainers who complete construction and general industry train-the-trainer courses to conduct occupational safety and health classes for workers.

The OSHA Outreach Training Program enjoys wide industry acceptance. Many employers in the building trades, general contractors, employer associations, insurance companies, and manufacturing firms endorse this training as a foundation for occupational safety and health training within their organization and make the program a requirement for employment. In addition, Missouri State law required completion of the 10-hour construction training for workers on various sized publicly funded construction projects as of August 2009.

The 10-hour Construction Industry Outreach Training Program provides an entry-level construction worker a general

awareness for recognizing and preventing hazards on a construction site. Covering a variety of construction safety and health hazards that a worker may encounter at a construction site; this training emphasizes hazard identification as well as avoidance, control, and prevention, rather than focusing solely on OSHA standards. Workers must receive additional training on hazards specific to their job. Topics covered in the 10-hour class include those that are:

- **Mandatory (4 hours)**: Four topics to be taught, ranging from one-half to two hours each
- **Elective (2 hours)**: Choose at least two of these topics to teach, for a minimum of one-half hour each. Must cover at least two hours.
- **Optional (4 hours)**: Teach any other construction industry hazards or policies and/or expand on the mandatory or elective topics, minimum of one-half hour each.

Table 3.2 (on the next page) details the topics to be covered in these three areas.

Finding an OSHA 10-Hour Outreach Class

You can find a 10- hour construction outreach training course by:

- Visiting OutreachTrainers.org — This free Web site lists authorized trainers for OSHA outreach training classes based on type of training and proximity. OSHA encourages authorized outreach trainers to add their trainer profile and training schedules to the site.
- Contacting one of four regional Outreach Training Institute Education Centers:
  - — Metropolitan Community College
    Business and Technology
    775 Universal Avenue
    Kansas City, MO 64120-1313
    Phone: (800) 841-7158, Fax: (816) 482-5454
  - — Midwest OSHA Education Centers:
    National Safety Council
    11620 M Circle
    Omaha, NE 68137-2231
    Phone: (800) 592-9004, Fax: (402) 896-6331

    Saint Louis University
    3545 Lafayette, Ste. 300
    St. Louis, MO 63104-8150
    Phone: (800) 332-8833, Fax: (314) 977-8150

    Kirkwood Community College
    6301 Kirkwood Blvd. SW
    Cedar Rapids, IA 52404-5260
    Phone: (800) 464-6874, Fax: (319) 398-1250

Table 3.2. 10 Hour Construction Industry Required Course Topics

*OSHA SUBPART REFERENCES ARE PROVIDED FOR INFORMATIONAL PURPOSES; TRAINING SHOULD EMPHASIZE HAZARD AWARENESS	
MANDATORY - 4 HOURS	ELECTIVE - 2 HOURS
One Hour - Introduction to OSHA including: • OSHA Act, General Duty Clause, Employer and Employee Rights and Responsibilities, Whistleblower Rights, Record-keeping basics • Inspections, Citations, and Penalties • General Safety and Health Provisions, Subpart C • Competent Person, Subpart C • Value of Safety and Health • OSHA Website and available resources • OSHA 800 number **Two Hours (minimum 15 minutes on each of 4 areas)** **OSHA Focus Four Hazards** • Fall Protection, Subpart M • Electrical, Subpart K • Struck by (e.g., falling objects, trucks, cranes) • Caught in/between (e.g., trench hazards, equipment) **30 Minutes** **Personal Protective and Lifesaving Equipment, Subpart E** **30 Minutes** **Health Hazards in Construction (e.g., noise, hazards communication and crystalline silica)**	Choose at least two of the following elective topics: These topics must add up to at least two hours: Minimum one-half hour each: • Materials Handling, Storage, Use and Disposal, Subpart H • Tools - Hand and Power, Subpart I • Scaffolds, Subpart L • Cranes, Derricks, Hoists, Elevators, and Conveyors, Subpart N • Excavations, Stbpart P • Stairways and Ladders, Subpart X **Optional - 4 hours** For the remaining four class hours: Teach any other construction industry hazards or policies and/or expand on the mandatory or elective topics.

From: U.S. Department of Labor, Occupational Safety and Health Administration,http://www.osha.gov/dte/outreach/construction_generalindustry/construction.html

Soft Skills Training

Soft skills training – the nuts and bolts of how to get and keep a job — involves an understanding of what employers expect from those they hire, using that understanding to craft effective resumes and cover letters, and successfully completing job applications and interviews. In addition, it is important for those seeking construction-related positions to understand the types of pre-employment testing they might encounter as well as their rights related to taking these tests.

What Employers Expect

You can learn a great deal about what a potential employer may be looking for in a job candidate by the words they use in their advertisements, job descriptions, and even during an interview. Knowing the kinds of things to emphasize about you that fit with these expectations can be a real boost for your job search.

Use the information in table 3.3 (at right) as a guide to matching your resume, cover letter, and rehearsed interview responses to key terms used in job listings.

Guidelines for Resumes and Cover Letters

A resume is one of the most fundamental tools of job seekers, so take the time and care to develop the best resume based on your previous work experience and job search aspirations. For some job seekers, it is wise to develop different types of resumes to use in different situations. Use table 3.4 on the next page to determine which types of resumes best fit your experience and job-seeking approach.

Table 3.3. Employer Expectations/Job Description Terms

Key Term	Meaning	Abilities to Emphasize
A Team Player	Those able to relate and work well with a diverse people, who show up to work with a "winning" attitude, who pull their own load without griping about having to pull someone else's at times	Working with others in complex and stressful situations Observing and respecting an organization's chain of command Accepting constructive criticism as helpful Handling conflict without antagonism Competing with others and being measured on performance in relation to others Encouraging others to be effective, enthusiastic members of the team
A Go-Getter	Those able to get the ball rolling alone, don't need to be babied or asked twice to do something, can generate new ideas that actually benefit the company	Identifying and working toward specific goals Looking for things that need to be done Confronting problems that may not have standard solutions Being energetic about making things move forward Sustaining work effort at an above-average rate
Multifaceted	Those who can perform a variety of duties with ease and enthusiasm and are willing to learn new skills	Possessing the intelligence, education, and skills required for the position Quickly learning how things are done in a company Following directions exactly
Flexible	Those who can "go with the flow," and handle assignments as needed	Accepting assignments not necessarily part of the job description Dealing positively and effectively with situations and people Changing and being receptive to new situations and ideas
A Good Communicator	Those with poise, tact, something worthwhile to say, and a good command of the English language; those who can converse with ease and write as compellingly as they speak	Organizing thoughts and ideas effectively Expressing ideas clearly when speaking and writing Presenting ideas persuasively Effectively asking for clarification Accepting and conveying constructive criticism without taking it personally or becoming angry
Dependable	Those who will be honest, show up on time, focus on work when at work, and show loyalty to the company	Being punctual and dressing appropriately Providing advanced notice of any personal commitments that cannot be scheduled before or after working hours Avoiding personal calls, emails, and Internet use during work hours Protecting company proprietary business information and practices

Table 3.4. Types of Resumes

Type	Description	Best for those who…	Not recommended for those who…
Chronological	Organized by employment history in reverse chronological order with job titles/names and locations of employers/dates of employment/ accomplishments, working backwards 10-15 years maximum	Apply to the widest variety of employers as well as recruiters and Internet job boards	Have gaps in employment or lack of employment history
Functional	Organized by skill and function clusters with company names, employment dates, and position titles intentionally omitted	Need to highlight transferable skills for a new industry; have limited or checkered job history, have been out of the workforce for awhile or have just entered the job market after graduation	Are applying to recruiters, head hunters, employers in conservative fields (e.g.,banking, accounting, law), international employers, or Internet job boards
Combination	Organized with both functional and chronological characteristics; however, the work history section only includes job title, name and location of employer, and dates of employment; highlights skills and achievements, clusters of transferable skills and experiences; deemphasizes job chronology	Have a diverse job history, work experience that is related but not an exact fit to desired position; need to downplay employment history, academic deficiencies, or limited experience	Are applying to recruiters, head hunters, employers in conservative fields (e.g., banking, accounting, law), international employers, or Internet job boards

Drafting Your Resume

Give your resume as sharp a focus as possible. Given that employers screen resumes for between 2.5 and 20 seconds, you need a way to show the employer at a glance your strengths and interests.

Resumes need not follow a traditional, chronological format (where experience and education are the primary focus); they can focus on your accomplishments and highlight your qualifications. Keep your resume short (one page is ideal), and try to focus on the impacts of what you've done in terms of solving problems, recognition (winning awards or special honors), and how you've advanced in your skills as a result of a particular experience.

General Content Recommendations:

1. Always tell the truth on your resume.
2. Include as much contact information as possible; any information that would enable an employer to reach you during business hours.
3. Don't use personal pronouns (e.g., I, my, me) in a resume.
4. Use strong, concrete action verbs consistently
5. Avoid including information about:
   - ❒ Height and weight
   - ❒ Age, date of birth, or place of birth
   - ❒ Marital status, sex, ethnicity/race
   - ❒ Health
   - ❒ Hobbies
   - ❒ Social security number
   - ❒ Reasons for leaving previous job(s)/names of former supervisors
   - ❒ Specific street addresses or phone numbers of former employers
   - ❒ Picture of yourself, salary information
   - ❒ Any information that could be perceived as controversial (e.g., religion, church affiliations, or political affiliations)

General Format Recommendations:

1. Keep the resume to a single page.
2. Use a bulleted list style to make your resume more reader-friendly.
3. Avoid justified text blocks; they insert odd spaces between words. Instead, make your type flush left.
4. Proofread carefully: misspellings, incorrect grammar, and typos in a resume can signal that you lack attention to detail.

Use the following to draft your resume:

Contact Information (name, address, daytime phone, e-mail):

_____
_____
_____
_____

Objective: What kind of position are you seeking? What is important to you in a job? Is it a chance to learn new skills or put those you already have to use in the real world; is it an opportunity to serve a cause you believe in, or learn more about a career you're thinking of pursuing? For example: "Objective: To contribute strong carpentry skills and experience to your historic renovation company."

_____
_____
_____
_____

Major Accomplishments: What have you done in school, sports, community service, or previous jobs that made a difference in terms of projects completed, money saved, people helped, etc.? Have you received any awards or honors? Have you been told that a project was completed ahead of schedule, on time, or for less money because of your involvement?

_____
_____
_____
_____
_____
_____

(Optional) Summary of Qualifications: It might be helpful to consider the possibility of a functional format for your resume — a format organized around functional skills clusters. After listing three to four skills clusters and showing how you've demonstrated those skills, you provide a bare bones work history. This format can be strategic for career changers, students and others who lack experience, and those with gaps in their employment as well as those re-entering the workforce. For example, you might group qualifications according to construction estimating, cabinetry, frame construction, or supervisory expertise.

_____
_____
_____
_____
_____
_____
_____
_____

Work History: In reverse chronological order, list jobs or community service projects/volunteer activities separately beginning with your current position/activity. Give title, name of employer organization, city/state, dates of employment, and a brief description of key duties. Quantify whenever possible. Use numbers to tell employers how many people you supervised, by what percentage you increased sales, how many products you represented, etc. Be sure that some of your accomplishments listed above relate to those items in your work history.

Education/Special Interest Activities: Order your educational information as follows:

Type of degree (e.g., Bachelor or Associates degree):

_____

In what area/major: _____

From name of college/university: _____

At (city/state of institution): _____

In (graduation year):_____

Peripheral information, such as minor and GPA:

_____

If you haven't yet graduated, list your graduation year anyway. Simply by virtue of the fact that the date's in the future, the employer will know you don't have the degree yet. Include any clubs or organizations you belong to that indicate skills attained, special learning opportunities, or character development (e.g., community service, scouts, 4H, FFA, honor societies, debate team, etc.) that might relate to the positions you're looking for.

References: Typically, you will want to include the following at the bottom of the resume, "References available upon request." Then prepare a separate list of references for use at an interview or for sending later to an interested, prospective employer. Be sure to only give out someone's name and contact information as a reference if you have first secured their permission to do so. **Note**: if you're cramped for space, you can omit this line since it is assumed that you will provide references if asked.

Drafting Your Cover Letter

Use a tailored cover letter to expand or amplify the information you listed in your resume, limiting what you say to only those specific qualifications relevant to the job you're applying for. Use the position description (or advertisement) for the job to identify key qualifications the employer is looking for: these tell you what the employer needs. Your cover letter should tell the employer how your experience and skills meet those needs.

Use the guidance below and on the next page to draft a tailored cover letter for each job for which you apply.

Your Address: _____

Date: _____

Name/Title of Contact Person and Address:

_____

_____

_____

_____

Salutation: Be sure to use the person's name and title in the salutation if the advertisement gives the name. If not, use "Hiring Manager" or "Human Resources Manager" or other title appropriate for the situation. You can always call a company and ask for the name or title of the person who will be accepting resumes for a specific, advertised position. The more you pay attention to these details, the better received your resume will be received.

_____

_____

Subject: Make your opening direct, and refer to the position and the source for your information (e.g., "Subject: Production Coordinator Position Advertised in the Sunday Times").

_____

_____

Beginning Statement: Focus on the need you can fill (e.g., "My qualifications closely match your requirements for a detail-oriented construction coordinator listed in today's Times advertisement.").

_____

_____

_____

_____

Body of Letter: Explain how your specific experience and accomplishments relate to two or three key requirements listed in the job advertisement. This might include explaining how the summer job you had at a local contractor's office helped you understand the various elements of safety and quality control at a construction site. Or, you might highlight that you have been recognized for two years by local Science Fair judges for exceptional project documentation, indicating your ability to keep good records and communicate effectively.

Closing Statement: Use a strong concluding sentence with positive language, such as: "As this letter and my resume indicate, I am a quick learner and able to efficiently complete tasks in a production environment." Be sure to indicate how you can be reached for an interview and your willingness to answer questions and provide references.

For More Information on Resumes and Cover Letters:

- "Employer Expectations." Cockrell School of Engineering, The University of Texas at Austin. 2005. (http://ecac.engr.utexas.edu/students/employerExpectations.cfm)
- Goldstein, M.S., Chun, M., & Winkler, M. (1994). "Job Seeking Skills for People with Disabilities A Guide to Success." The Career Center, California State University, Northridge. (http://www.csun.edu/~sp20558/dis/about.html)
- Kyser, C. (2008). The Black Collegian. (http://www.black-collegian.com/career/kyser/kyser_employer_expectations.htm)
- About.com. (2009). (http://jobsearch.about.com/od/resumes/a/actionverb.htm)
- Hansen, R.S. & Hansen, K "What Resume Format is Best for You?" (http://www.quintcareers.com/best_resume_format.html)
- Hansen, K. "Resume Preparation Do's and Don'ts." (http://www.quitcareers.com/resume-dos-donts.html)
- Office of Career Services Rollins College. (http://www.rollins.edu/careerservices/resumes/cover-letters.htm)
- About.com. (http://jobsearch.about.com/od/coerlettersamples/a/senior.htm)
- Transferable Job Skills (article and worksheet) include a link to pdf from Michelle's soft skills materials from Wisconsin

Job Applications

As part of the job application process, you will likely be asked to complete an employment application, even if you already have a resume and cover letter prepared. This allows the potential employer to verify your resume information, have a signed record of your personal and employment history, and determine your ability to communicate information accurately, completely, and legibly. Use these guidelines to write attention-getting applications:

- **Complete all requested information.** Don't leave anything blank. Come to the interview prepared with any information you might need to reference when filling out the application. One tip is to download a sample job application from the Internet, complete it at home, and take it with you as a reference to every job interview. If you don't know the details, consider bringing the application home and returning it when it's completed. You can also enter as much information as you know; for example, you could give a salary range for a past job if you don't know the exact amount. Avoid answering with "N/A" or "see resume" — responses that may be interpreted as lazy by the potential employer.
- **Be consistent with all information from your resume, cover letter, and application**. Double check all materials to ensure there are no discrepancies in the information you provided. For example: Do all the dates match up? Are the job titles and descriptions consistent? Consistency may very well be something an employer wants to ensure before agreeing to grant you an interview.
- **Write clearly and neatly**, using black or blue ink. Don't let your application be rejected because potential employers can't read your answers to application questions.
- **Check for spelling and grammatical errors**. Whether in print or online, take your time and proofread your job application form (either on your own or ask someone else) before turning it in. Don't risk losing out on a good job opportunity because the potential employer thought you were careless.
- **List your most recent job first** when completing employment information. Be sure to have information with you about each job (e.g., contact info, supervisor's name, dates employed, salary, reason for leaving, awards or accomplishments while at that position, etc.).
- **List your most recent education first**. Include vocational schools and training programs as well as college and high school. Know what degrees, diplomas, or certificates you earned and dates of graduation.
- **References don't necessarily have to be professional**. References can be teachers, people you've worked with as a volunteer or leaders of student organizations (e.g., scouting, 4H, FFA, etc.). Just make sure to ask for permission and verify contact information prior to listing each reference.
- **Ask for help** if you don't understand an item on the application or if you need more time than allotted to adequately complete the form. Many times, administrative assistants who give you the application to fill out have some input into the hiring decision. Treat

them with respect, and they will likely put in "a good word" for you.

- **When you need to apply for a job online, accuracy, consistency, and completeness are equally important as when filling out a print application.** Additionally, many employers and recruiters now use the online application process as a screening tool to "weed out" those applicants who aren't a good fit for the position. Consider filling out some online applications for companies you're NOT interested in working for to get practice for completing the applications that really count.

Don't forget to sign your application!

Interviews

A crucial part of any hiring process for a company is the job interview. During an interview, you will want to find out what you can about the company, make a great first impression, and effectively respond to the interviewers questions. Remember that the interview is a way for you to learn if the job is right for you as well. You may be asked to complete an application or describe what you would do in a hypothetical situation (also known as "behavioral interviewing").

The key is to be prepared. Don't rely on your application or resume to do the selling for you. Interviewers will want you to be convincing.

To maximize your chances of getting the position you want, use the tips below to plan your strategy for before, during, and after the interview.

Before the Interview

- Learn as much as you can about the company beforehand — know its products and services, its profit margin, its management, its culture, its dress code, and anything else you can think of. Good sources are your career services center, a college or public library, and the Internet. Research similar companies, the industry in general, and typical salary range for this field and position.
- Do practice interviews with a career counselor, friends, and family members — or with yourself, in front of a mirror. Many career services centers offer workshops, mock interviews, or one-on-one coaching. Some even make videotapes of mock interviews. Mock up answers to behavioral interviewing questions (see page 21 for an example).
- Think about how your experience in work, classes, and activities can relate to the job you're seeking.
- Allow plenty of time to get to the interview and, if possible, visit the site in advance and time how long it takes to get there. Arrive on time or a few minutes early.
- Plan your interview attire in advance and make sure your clothing is pressed, your shoes are shined, and your hair and nails are well groomed. If you aren't sure what to wear, visit the organization and watch employees coming in and out of the office to see what they are wearing.
- Bring extra copies of your resume and a list of references. Don't bring food, drink, or your cell phone (except if "off") to the interview.

During the Interview

- Greet the interviewer by last name and positively connect with him or her; smile, shake hands, make eye contact, exude confidence, and be engaging.
- Project energy and enthusiasm. Speak slowly and clearly and don't be afraid to pause for a moment to collect your thoughts. Keep your answers succinct, to-the-point and focused and don't ramble — simply answer the question. If you don't understand a question or need a moment to think about it, say so. Never pretend to know something or someone when you don't.
- Be honest. Don't try to cover up mistakes. Instead, focus on how you learned from them. Explain your "yes" or "no" answers whenever possible.
- Be assertive about your qualifications and interest in the opportunity for professional development. Avoid asking questions about salary and benefits, and respond to questions about your salary expectations with a range based on what you've researched about the industry.
- If presented with an application, fill it out neatly and completely. Don't attach your resume unless you're told to do so.
- Listen carefully and respond succinctly and articulately. Look the hiring manager in the eye while speaking.
- Early in the meeting, try to get the interviewer to describe the job and the duties to you so you can focus your responses on your background, skills, and accomplishments that relate to the position.

- Don't make negative remarks about present or former employers. When explaining your reasons for leaving, communicate your rationale professionally.
- Don't over-answer questions. If the interviewer steers the conversation into controversial, or even illegal, topics, try to do more listening than speaking. Keep your responses non-committal.

After the Interview

- Ask the interviewer for a business card and send a thank-you note or e-mail as soon as possible.
- Use all interview experiences (positive and negative) to learn. What did you do well? What could you improve next time?

Sources:

- *National Association of Colleges and Employers. JobWeb.com. http://www.jobweb.com/Interview/help.aspx?id=636.*
- *Robert Half Management Resources. (2009).http://www.robertyhalffinance.com/InterviewDosAndDonts#Dos*

Talk with your program administrator, teacher, or guidance counselor about what to expect once hired in terms of benefits and tax withholding.

Behavioral Interviewing Sample

What would you do if, during an interview, the company's hiring manager said to you, *"Tell me how you dealt with a situation where you were working with a team and one of the members wasn't contributing as expected."*

Try the STAR approach to dealing with these types of hypothetical situation questions. STAR stands for Situation or Task, Action you took, Results you achieved (See table 3.5. at right).

Using the STAR approach, here's how you might answer that original question about a coworker:

Situation or Task: *"I was assigned to a team in my marketing class to propose a method for increasing revenues for a particular business by 10 percent. One of the members of my team wasn't attending many meetings and didn't have his assignments prepared."*

Action You Took: *"I decided to talk with him; in private, about how the group needed every member to complete their assigned tasks, and asked what he needed to get back on track. He told me that he was having trouble with one of his other classes, and it took up most of his time. With his consent, we talked about this with the other members of the team. The team recommended that he ask the Student Tutorial Center for help on his other class, and we would help him get caught up with our team project. He agreed."*

Results You Achieved: *"It took a couple of weeks for him to catch up, but after he did, he completed his assignments on time, and our group got an "A" on the project. He also thanked the group during his part of the presentation for helping him do well in both of his classes."*

Table 3.5. STAR Approach to Behavioral Interviewing

Situation or Task	Describe the situation that you were in or the task that you needed to accomplish. You must describe a specific event or situation, not a generalized description of what you have done in the past. Be sure to give enough detail for the interviewer to understand. This situation can be from a previous job, from a volunteer experience, or any relevant event.
Action you took	Describe the action you took and be sure to keep the focus on you. Even if you are discussing a group project or effort, describe what you did — not the efforts of the team. Don't tell what you might do, tell what you did.
Results you achieved	What happened? How did the event end? What did you accomplish? What did you learn?

Sources:

- *"Acing the Behavioral Interview." Career Center California State University, Chico. (2007). http://www.csuchico.edu/plc/behav-interview.html.*
- *"STAR Interviewing Response Technique for Success in Behavioral Job Interviews." Quintessential Careers. (2009). http://www.quintcareers.com/STAR_interviewing.html.*

For More Information on Behavioral Interviewing:

1. Free Sample Behavioral Interview Questions
   Quintessential Careers. (2009). http://www.quintcareers.com/sample_behavioral.html.
2. The 150 Typical Job Interview Questions
   Quintessential Careers. (2009). http://www.quintcareers.com/interview_question_database/interview_questions.html.
3. It's Your Turn: What to Ask an Interviewer
   Hovanec, E. (2009). Yahoo! Hot Jobs. http://hotjobs.yahoo.com/interview/Its_Your_Turn_What_to_Ask_an_Interviewer__2003228-1221.html?subtopic=Interview+Preparation.
4. Doyle, A. About.com. http://jobsearch.about.com/od/thankyouletters/a/thankyouletters.htm.

Pre-Employment Testing

In addition to interviews, employers often use tests and other selection procedures to screen applicants. This practice is legal, so long as companies don't use the tests to discriminate based on race, color, sex, national origin, religion, disability, or age (40 or older). Additionally, employment tests must relate to the jobs they are being used to screen for and for the purposes for which they are being used. Depending on the type of test, employment testing can be conducted online or in the employer's office.

Typical Employment Tests

- **Personality Tests — Tests that:**
  - — Assess the degree to which a person has certain traits or dispositions
  - — Predict the likelihood that a person will engage in certain conduct
  - — Determine the "fit" between the job and the candidate
- **Pre-Employment Physical Exams** — A pre-employment physical examination sometimes required to determine an individual's suitability to consistently perform tasks inherent in a particular type of work
- **Drug Tests** — Laboratory tests of urine, hair, saliva, or sweat that show the presence of drugs or alcohol
- **Cognitive (or Intelligence) Tests** — Assessments of a candidate's reasoning, memory, perceptual speed and accuracy, and skills in arithmetic and reading comprehension as well as knowledge of a particular function or job
- **Physical Ability Tests** — Measurement of an applicant's physical ability to perform a particular task or the strength of specific muscle groups as well as strength and stamina in general
- **Sample Job Tasks** — Assessment of an applicants performance and aptitude on particular tasks (e.g., performance tests, simulations, work samples, and realistic job previews)
- **Background and Credit Checks** — Research on arrest and conviction history as well as credit and financial history
- **English Proficiency Tests** — Assessment of a candidate's fluency with the English language

Your Rights and Employment Testing

There is virtually no government regulation regarding who can design and administer employment tests; however, most large human resource consulting firms and some corporations will use organizational psychologists to develop and perform assessments. These psychologists abide by a codes of ethics and guidelines related to test reliability and validity, scrupulously follow laws forbidding discrimination, and promote respectful treatment for test takers. See the information on the American Psychological Association's Web site (www.apa.org), *The Rights and Responsibilities of Test Takers*. Of course, assessors who are not psychologists are not necessarily bound by a professional code of conduct.

At no time should you be asked any questions about disabilities you may or may not have; this is illegal under the Ameri-

cans with Disabilities Act. Questions about sexual orientation, sexual practices, with whom you live, your religious beliefs, or your ethnic background are also inappropriate although not necessarily illegal.

Of course, you can refuse to take a test or participate in any part of any test. This will probably result in being rejected for the job. If you believe that the testing was illegal in any respect, you can pursue legal remedies just as you can for any unfair and illegal employment practice. If you felt the assessor at any time treated you unfairly or with disrespect, you may want to bring that up with the employer and/or the assessment firm.

Professionalism

Your day-to-day performance on the job should reflect professionalism in terms of dressing appropriately for the work environment, limiting personal cell phone usage, avoiding texting, using appropriate language, and avoiding all types of harassment.

Accessing Core Competencies/Instructional Frameworks

Appendix A (pages 37 through 48) provides the core competencies required for success in the construction trades. Appendix B (pages 49 through xx) "crosswalks" the relevant instructional frameworks for these competencies. A "crosswalk" links tow or more classificaiton systems and can help career development program administraots and teachers to:

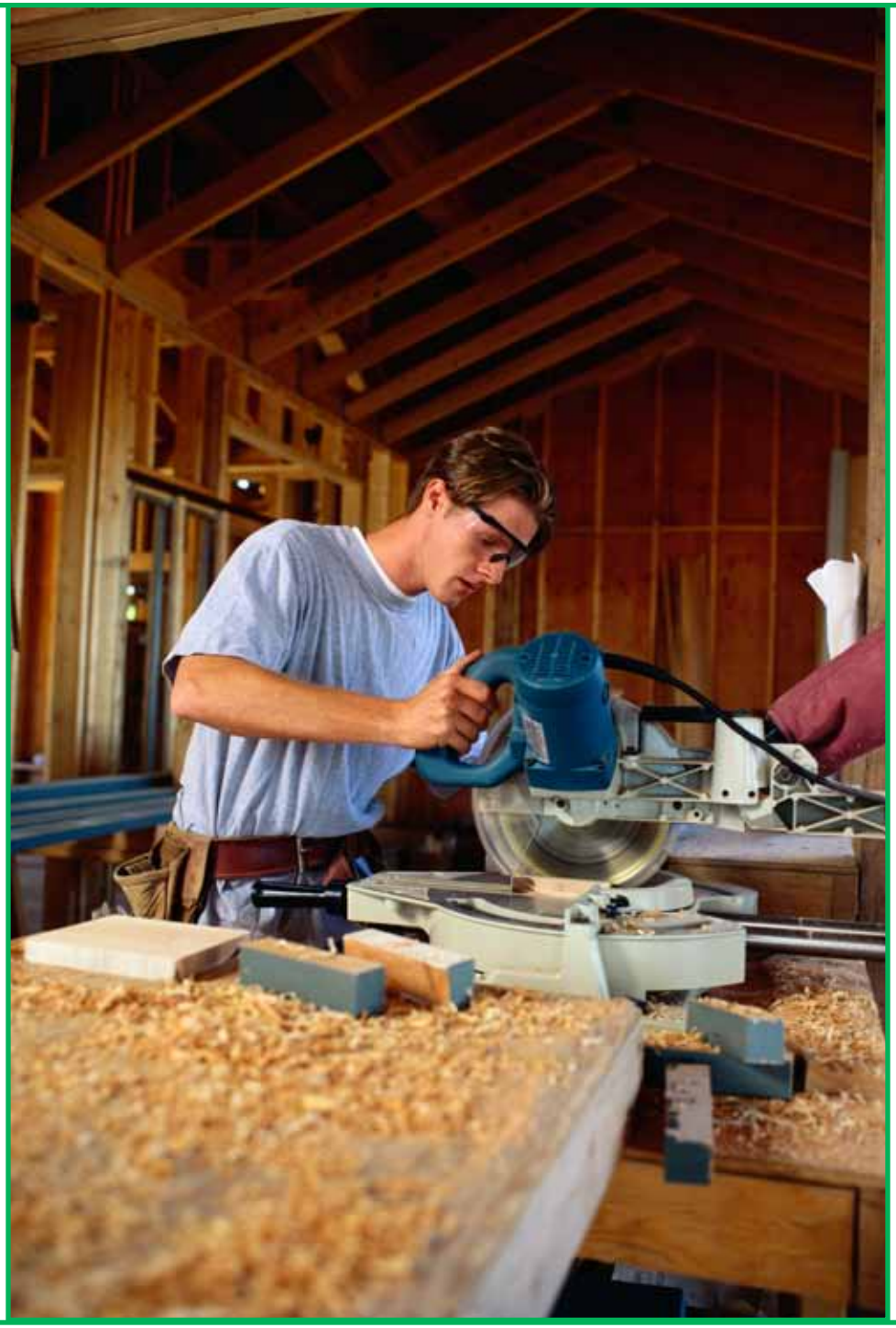
- Integrate academic and vocational coursework
- Correlate curricula with academic/vocational standards
- See how activities in vocational student organizations can align with academic or vocational standards
- Articulate Tech Prep high school and technical/community college courses
- Link student interests and potential careers

Crosswalks can be a useful tool to make connections between the various systems and standards in use for reporting and statistical analysis, curriculum and academic program development, and career counseling.

For More Information on Pre-employment Tests:

- Klein, E. (2009). North Bridge Group, Inc. http://www.askthe-headhunter.com/gv000802.htm.

Section 4: Tools for the Student



Tools for the Student

The Architecture and Construction Career Cluster encompasses career in the design, construction, and maintenance and operations industries, the last tow of which rely heavily on skilled crafts people in the construction trades: carpentry, plumbing, masonry, electrical, and HVAC work. These trades will account for the largest number of new jobs in the building industry by the year 2018, according to the U.S. Bureau of Labor Statistics (www.bls.gov). ***A sample Plan of Study for the Architecture and Construction Cluster appears on page 36.***

Employment Outlook

Population growth, deteriorating infrastructure, and aging buildings will generate employment growth in the construction industry. The number of wages and salary jobs in the construction industry is expected to grow by 19 percent through the year 2018, compared with the 11 percent projected for all industries combines. Specific areas of opportunity will be:

- Senior housing and healthcare residences
- Renovation and expansion of older homes
- Repair and remodel of existing homes
- Replacement of many industrial plants
- Medical treatment facilities
- Infrastructure maintenance and repairs (e.g., highway, bridge, and street construction)
- Power line and related construction

Job prospects are expected to be good, especially for experienced and skilled construction trades workers, because of the need to replace the large number of workers anticipated to retire from these occupations over the next decade.

Missouri's Hot Jobs — Construction

The information in table 4.1 (below) has been compiled from "Missouri's Hot Jobs," Missouri Economic Research and Information Center, 2010. These occupations (with the exception of First-line Supervisors) are all listed under Missouri's "Top 25 Green Jobs" as well (MERIC, 2010).

Table 4.1. Missouri Construction Jobs Outlook

Occupation	Openings* over 10 yrs	Annual Wages ** in Missouri		
		Entry	Average	Experienced
*On-the-job Training****				
Carpenters	3,449	$26,277	$45,746	$55,480
Construction Laborers	2,296	$23,244	$38,623	$46,313
Electricians	3,047	$32,405	$53,111	$63,434
Heating, Air Conditioning, and Refrigeration Mechanics and Installers	1,309	$26,115	$40,878	$48,259
Maintenance and Repair Workers	6,010	$21,682	$34,274	$40,570
Plumbers, Pipefitters, and Steamfitters	1,950	$32,639	$54,237	$65,037
*Bachelor's Degree (BA or BS)****				
Construction Managers	772	$46,054	$82,583	$100,847
*BA/BS or Work Experience in a Related Occupation****				
First-Line Supervisors/ Managers of Construction Trades and Extraction Workers	1,728	$40,618	$62,277	$73,106

Notes:

* *Occupational projections based on 2008 data and cover years 2008-2018. Occupations in this report are graded on a combination of average wage, percent growth, and total openings over the 10-year period of employment projections. The occupations shown represent a better-than-average outlook for the 10-year period.*

** *Wage data is from 2008.*

*** *Desired occupations may have specific education and/or licensing requirements.*

Developing a Personal Plan of Study

Use the sample Plan of Study shown on page 28 as a starting point for developing your own plan for preparing for a career in the construction trades. Work with your guidance counselor and program administrator to determine what academic as well as "real-world" experiences will best prepare you for the field. Consider the certification requirements as well as internship/job shadowing opportunities and involvement in Career and Technical Student Organizations (CTSOs).

Certification requirements

To be eligible for available positions in the construction trades, students who complete this program will need at least an OSHA 10-hour certification (see pages 17 through 19) and likely a National Center for construction Education and Research (NCCER) certification. For HVAC work, certain Environmental Protection Agency (EPA) certifications may be required. Many programs utilize a math pretest for admission to the program.

Internship/job shadowing opportunities

Internships and job shadowing opportunities allow students to further apply skills learned in a real-world setting. These opportunities are defined as:

- **Internships** — Supervised, hands-on activities for students outside of the school in a community business or other facility that enhance classroom learning and/or career planning; can be either paid or voluntary and typically last anywhere from a week to a semester.

- **Job Shadowing** — Seasoned experts allow students to observe everything that they do related to their job during the course of a day, providing a real-life opportunity for students to explore careers. Students, working with program teachers, should contact local contractors, remodelers, facilities managers, and maintenance/operations professionals about internship and job shadowing opportunities available. Ask these professionals to clarify if any of the following apply:
  - — Application and submission requirements, including background checks, pre-employment screening tests, residency requirements, etc.
  - — Uniforms or other specific dress/appearance requirements
  - — Normal working hours/days of the week

Once involved in a job shadowing or internship opportunity, be sure to ask your sponsors questions such as :

1. How did you get your job?
2. What is your typical workday like?
3. What level of education is needed for this position? What academic and vocational skills?
4. What is the salary range and work schedule for this position?
5. What do you like most and least about your job?
6. What should a student do who is interested in working in this occupation to prepare for such a career/

Career and Technical Student Organizations

Involvement in Career and Technical Student Organizations (CTSOs) allows you to gain workplace skills in the areas of effective communication, creative thinking, and problem solving. You will gain personal management skills (e.g., self esteem, goal setting) and increase group effectiveness skills (e.g., interpersonal relationships, leadership, negotiating, and team-building). All this and have fun competing in state and national events.

CTSOs related to the construction industry are:

- **Technical Student Association (TSA)** — Chartered in 1978, this national, non-profit organization serves middle and high school students with a strong interest in technology. TSA fosters personal growth, leadership, and opportunities in technology, innovation, design, and engineering. Members apply and integrate science, technology, engineering and mathematics (STEM) concepts through co-curricular activities, competitive events, and related programs. For more information, visit: http://www.tsaweb.org.
- **SkillsUSA** (for career and technical education students) — Missouri SkillsUSA is an applied method of instruction for preparing America's high-performance workers in public career and technical programs by involving students in leadership, teamwork, citizenship, and character development. SkillsUSA is a national nonprofit organization serving teachers and high school and college students preparing for careers in trade, technical, and skilled service occupations. More than 285,000 students and instructors join SkillsUSA each year. SkillsUSA Missouri (a state association of SkillsUSA, Inc.) is an applied method of learning where students practice skills and build self-confidence while helping their school and communities. For information on membership eligibility requirements, visit http://dese.mo.gove/divcareered/skillsusa_membership_eligibility.htm.

Becoming involved in CTSOs offers many ways to augment your personal plan of study, including getting local business community leaders to:

- Share information about job markets and qualities/skills employers most value
- Judge CTSO contests, giving you an opportunity to demonstrate your talents to key employers
- Provide professional development educational materials
- Promote leadership and build teamwork skills

Name _____

Learner ID _____

School/College/University _____

SAMPLE

Architecture and Construction

Career Cluster Plan of Study for ▶ Learners ▶ Parents ▶ Counselors ▶ Teachers/Faculty

This Career Cluster Plan of Study (based on the Architecture and Construction Career Cluster) can serve as a guide, along with other career planning materials, as learners continue on a career path. Courses listed within this plan are only recommended coursework and should be individualized to meet each learner's educational and career goals. *This Plan of Study, used for learners at an educational institution, should be customized with course titles and appropriate high school graduation requirements as well as college entrance requirements.

EDUCATION LEVELS	GRADE	English/ Language Arts	Math	Science	Social Studies/ Sciences	Other Required Courses Other Electives Recommended Electives Learner Activities	*Career and Technical Courses and/ or Degree Major Courses for Architecture and Construction	SAMPLE Occupations Relating to This Career Cluster
	Interest Inventory Administered and Plan of Study Initiated for all Learners							
SECONDARY	9	English/ Language Arts I	Algebra I	Earth or Life or Physical Science	State History Civics or World History	All plans of study should meet local and state high school graduation requirements and college entrance requirements. Certain local student organization activities such as SkillsUSA are also important including public speaking, record keeping and work-based experiences.	**Introduction to the Built Environment	▶ Architect ▶ Carpenter ▶ Civil Engineer ▶ Construction Foreman/Manager ▶ Contractor ▶ Demolition Engineer ▶ Drafter ▶ Drywall Installer ▶ Electrician ▶ Electronic Systems Technician ▶ Equipment/Material Manager ▶ General Contractor/Builder ▶ Heating, Ventilation, Air Conditioning and Refrigeration Mechanic ▶ Interior Designer ▶ Painter ▶ Paperhanger ▶ Plumber ▶ Project Estimator ▶ Project Inspector ▶ Roofer ▶ Safety Director ▶ Sheet Metal Worker ▶ Tile and Marble Setter
	10	English/ Language Arts II	Geometry	Biology	U.S. History		**The Language of Architecture and Construction **Information Technology Applications	
	11	English/ Language Arts III Technical Writing	Algebra II	Physics	Economics Psychology		**Safety, Health and the Workplace Environment	
	College Placement Assessments-Academic/Career Advisement Provided						Continue courses pertinent to the pathway selected.	
	12	English/ Language Arts IV	Dependent on chosen pathway	Chemistry				
	Articulation/Dual Credit: Transcripted Postsecondary courses may be taken/viewed to the secondary level for articulation/dual credit purposes.							
POSTSECONDARY	Year 13	English Composition English Literature	Dependent on chosen pathway	Physics	American Govt. or History, plus Psychology/ Interpersonal Skills	All plans of study need to meet learner's career goals with regard to required degrees, licenses, certifications or journey worker statuts. Certain local student organization activities may also be important to include.	Continue courses pertinent to the pathway selected.	
	Year 14	Speech/ Oral Communication	Dependent on chosen pathway	Environmental Science	Sociology Business Law			
	Year 15	Continue courses in the area of specialization.						
	Year 16							

**See course descriptions on page 2.

SAMPLE

Appendix A:
Core Competencies

Architecture and Construction Core

The following Cluster (Foundation) Knowledge and Skill statements apply to all careers in the Architecture and Construction Cluster.

ACADEMIC FOUNDATIONS

Perform math operations such as estimating and distributing materials and supplies to complete jobsite/workplace tasks.
Use basic math functions to complete jobsite/workplace tasks.
Identify whole numbers, decimals, fractions, complex numbers, and polynomials.
Apply basic arithmetic add, subtract, multiply, and divide operations.
Apply relational (equal, not equal, greater than, less then, etc.) and logical operators in a logical expression.
Use geometric formulas to determine areas and volumes of various structures.
Calculate areas and volumes of structures.
Estimate materials and supplies needed.
Use appropriate formulas to determine percentages /decimals.
Calculate percentages/decimals.
Use percentages/decimals to perform measurement tasks.
Use appropriate formulas to determine ratios, fractions, and proportion measures.
Calculate ratios, fractions, and proportion measures.
Use ratios, fractions, and proportion measures to perform measurement tasks.
Use appropriate formulas to determine measurements of dimensions, spaces, and structures.
Measure dimensions, spaces, and structures using U.S. Standard unit.
Measure dimensions, spaces, and structures using Metric units.
Use dimensions, spaces, and structures calculations to estimate materials and supplies needed.
Conceptualize a three-dimensional form from a two-dimensional drawing to visualize proposed work.
Build Create three-dimensional form models.
Apply principles of physics as they relate to worksite/jobsite situations to work with materials and load applications.
Apply basic concepts of statics and loads to planning.
Use the basic concepts of static and load calculations for rigging and moving loads.
Identify the physical properties present when using common construction materials in order to use the materials safely, effectively and efficiently.
Use the basic concepts of physics when working with common construction materials.

COMMUNICATIONS
Use vocabulary and visual cues commonly used in design and construction to be successful in workplace/jobsite communications.
Match vocabulary and visual cues to workplace/jobsite situations.
Use correct terminology to convey verbal and visual.
Utilize vocabulary and visual cues in context of design and construction situations.
Confirm understanding of verbal and visual instructions.
Ask questions concerning details of instructions.
Perform assignments as requested.
Perform assignments as requested.

PROBLEM-SOLVING AND CRITICAL THINKING
Create and implement project plans considering available resources and requirements of a project/problem to accomplish realistic planning in design and construction situations.
Plan, organize, schedule, and manage a project/job to optimize workflow and outcome.
Report results of the project/job.
Manage the schedule of a project/job.
Identify timeline required to complete a project/job..
Evaluate efficiency and effectiveness of a project/job.
Estimate resources/materials required for a specific project or problem.
Estimate correct amount of required resources/materials.
Create a budget.
Use available resources/materials effectively while completing a project or resolving a problem with a project plan.
Evaluate waste of resources/materials.
Evaluate necessity for additional resources/materials.
Determine alternative solutions for a specific project/problem.
Evaluate feasibility of alternative suggestions.
Implement appropriate alternatives.
Evaluate and adjust design and construction project plans and schedules to respond to unexpected events and conditions.
Incorporate potential job disruptions into planning time lines.
Identify potential events and conditions that disrupt the completion of a job.
Solve situational problems involved with unexpected events and conditions.
Adjust project plans and schedules when presented with unexpected information.
Modify existing plans to reflect an unexpected change.
Modify existing schedules to reflect an unexpected change.
Modify existing budget to reflect unexpected change.
Identify and assess critical situations as they arise to resolve issues.
Evaluate potential solutions and determine best solution.
Appraise critical situations and implement appropriate response.
Generate a project update that tracks changes necessitated by unexpected events and conditions.
Present an oral and/or written status report on the project.

INFORMATION TECHNOLOGY APPLICATIONS

No additional statements in this topic beyond those found in the Essential Knowledge and Skills Chart.

SYSTEMS

COMPLY WITH REGULATIONS AND APPLICABLE CODES TO ESTABLISH A LEGAL AND SAFE WORKPLACE/JOBSITE.

Identify governmental regulations and national, state, and/or local building codes that apply to a given workplace/jobsite.

- Follow governmental regulations and building codes.
- Follow jurisdictional regulations and building codes.
- Use information given in regulations and codes correctly.
- Pass job inspections and comply with regulations at all times.
- Pass required substance abuse screening.

Evaluate workplace/jobsite activities for compliance with governmental and other applicable safety regulations such as EPA and OSHA.

- Read and discuss information on OSHA, EPA, and other safety regulations.
- Pass safety inspections and comply with regulations at all times.

Use MSDS (Material Safety Data Sheets) information for the management, use, and disposal of materials.

- Obtain, understand, and follow MSDS (Material Safety Data Sheets) information
- Use materials safely.

Identify workplace/jobsite environmental hazards of a given situation.

- Follow safe practices relating to environmental hazards.

EXAMINE ALL FACTORS EFFECTING THE PROJECT AND THE PLANNING PROCESS.

Understand social, environmental, and political factors that affect the project.

- Label all systems on a set of construction documents.
- Discuss the interrelationship of the systems in the built environment.
- Use the concept of “Critical Path Method” (CPM) and/or similar, sequential methods so that work progresses efficiently.

Understand the context of the projects.

- Follow safe practices relating to environmental hazards.

UNDERSTAND AND MANAGE UNION-MANAGEMENT RELATIONSHIPS AND CONTRACTS TO CREATE A COOPERATIVE WORK ENVIRONMENT.

Analyze a proposed contract in terms of both the company’s and the union’s position in labor contract negotiations.

- Document how quality improves profitability.
- Discuss the interrelationship of the systems in the built environment.

Assess a situation for compliance with terms of a contract.

SAFETY, HEALTH, AND ENVIRONMENTAL
Assess and control the types and sources of workplace hazards to ensure a safe workplace and jobsite.
Follow governmental regulations and building codes.
Follow jurisdictional regulations and building codes.
Use information given in regulations and codes correctly.
Pass job inspections and comply with regulations at all times.
Pass required substance abuse screening.
LEADERSHIP AND TEAMWORK
ESTABLISH SPECIFIC GOALS TO MANAGE PROJECT ASSIGNMENTS IN A TIMELY MANNER.
Establish project goals that assist in meeting project specifications and deadlines.
Define and describe project goals.
Identify and list key project activities.
Identify and report activity deadlines.
Organize work teams that effectively manage assignments.
Determine and list assignments by activity and personnel.
Complete assignments.
Monitor and write a report on progress of the project.
Evaluate completed project according to customer requirements.

ETHICS AND LEGAL RESPONSIBILITIES
Recognize legal and ethical relationships between employees and employers to establish workplace/jobsite rules, regulations, and guidelines in a design and/or construction setting.
Access appropriate resources to identify the roles, rights, and responsibilities of an employee and an employer.
Practice workplace/jobsite conduct incorporating employee and employer roles, rights, and responsibilities.
Examine insurance documentation to determine liability issues associated with a job.
Describe liability issues as needed.
Comply with employer policies, procedures, and job-specific agreements, such as sexual harassment avoidance and substance abuse control, to prevent ethical and legal problems.
Comply with employer policies and procedures.
Comply with project labor agreements.
Read regulations and contracts to ensure ethical and safety elements are observed.
Study regulations and codes to identify those applicable to the local area.
Locate and implement regulations and codes applicable to tasks and projects.
Comply with local, state and Federal codes.
Explain the various aspects of service contracts to ensure compliance.
Evaluate and follow service contracts.
Recognize the relationships among and responsibilities of various parties to a contract.
Fulfill contractual roles and responsibilities.
Monitor relationships with other parties.
Recognize the definition of specialized words or phrases to fully understand documents and contracts.
Use industry jargon or terminology appropriately.
Use industry acronyms correctly.
Use words with multiple meanings correctly in context.
Use ethical and legal standards to avoid conflicts of interest in a design and/or construction setting.
Identify conflicts of interest relating to a job or project to prevent ethical or legal problems.
Resolve issues relating to any potential conflicts of interest.

EMPLOYABILITY AND CAREER DEVELOPMENT
EXPLAIN WRITTEN ORGANIZATIONAL POLICIES, RULES, AND PROCEDURES COMMON IN DESIGN AND CONSTRUCTION SETTINGS TO HELP EMPLOYEES PERFORM THEIR JOBS.
Locate appropriate information on organizational policies in handbooks and manuals.
Identify the contents of various organizational publications.
Select the appropriate document(s) as reference for the situation.
Discuss how specific organizational policies and rules influence a specific work situation..
Locate and identify specific organizational policy, rule or procedure to assist with a given situation.
Explain specific organizational policy, rule or procedure to improve a given situation.
RECOGNIZE THE RESPONSIBILITIES AND PERSONAL CHARACTERISTICS TO DEVELOP INDIVIDUAL GOALS FOR PROFESSIONALISM.
Identify appropriate responsibilities and personal characteristics by researching workplace/jobsite information.
Practice the responsibilities and characteristics of a professional craftsperson.
Identify all critical/important functions.
Document customer satisfaction.
Present a professional image in the workplace/jobsite.
Maintain appropriate professional memberships.
Follow rules, regulations, and guidelines.

TECHNICAL SKILLS
Read, interpret, and use technical drawings, documents, and specifications to plan a project.
Interpret drawings used in project planning.
Recognize elements and symbols of blueprints and drawings.
Describe written standards and specifications that apply.
Interpret and explain standards and specifications.
Recognize how specifications and standards are arranged for proper access.
Use specifications and standards.
Apply specifications and standards appropriately.
Use architect's plan, manufacturer's illustrations and other materials to communicate specific data and visualize proposed work.
Sketch/draw/illustrate concepts and ideas.
Draw or sketch plan/layout to be completed.
Use proper measurements to determine layout.
Use and maintain appropriate tools, machinery, equipment, and resources to accomplish project goals.
Select tools, machinery, equipment, and resources that match requirements of the job.
Operate tools, machinery, and equipment in a safe manner.
Properly maintain and care for tools, machines, and equipment.
Safely use tools, machines, and equipment productively and efficiently in alignment with industry standards.
Identify sources of information concerning state-of-the-art tools, equipment, materials, technologies and methodologies.
Read current periodicals, industry publications, and manufacturer's catalogs.
Use state-of-the-art tools, equipment, materials, technologies, and methodologies.
Demonstrate use of tools, machinery, equipment, and other resources commonly used in design and construction.

Construction Pathway

The following knowledge and skill statements apply to all careers in the Construction Pathway. The statements are organized within five topics.

SYSTEMS

Understand contractual relationships with all parties involved in the building process to ensure successful build of a project.
Create a sustainable and accountable partnership between stakeholders.
Establish/implement reporting relationships among stakeholders.
Determine priorities of all parties involved.
Design and implement submittal approval procedures to ensure effective flow of information in construction process.
Identify the components necessary for developing submittal approval procedures system.
Employ procedures that complete submittal approval process related to shop drawings.
Employ procedures that complete submittal approval process related to state and local permits.
Understand risk management and use a variety of strategies and tactics to maintain, increase or decrease risk.
Evaluate the tolerability of the inherent risk exposure in a given situation.
Provide solutions to unaddressed problems that pose great risk to a project.
Identify the most appropriate team member to manage risk in a given situation.
Understand construction subcontracts and manage working relationships on a project.
Identify the components of a subcontract.
Explain the function of each component of a subcontract.
Assess the relevance of subcontract terms in a given situation.
Understand and apply project turnover procedures to successfully manage construction projects.
Identify the components of project turnover procedures.
Explain the function of each component of project turnover procedures.
Explain the use of project turnover procedures for a given situation.
Build in accordance with contracts to meet budget and schedule.
Recognize and understand the contract documents and related activities in respect to a specific project.
Apply the components of the document as they relate to a given project.
Identify activities such as coordination meetings, project schedules, meeting deadlines, resolving disputes, change orders, etc. for use in a given project.
Understand and implement testing and inspection procedures to ensure successful completion of the project.
List testing and inspection procedures related to specific areas.
Interpret guides designed for testing and inspection purposes in specific areas.
Understand purpose for scheduling as it relates to successful completion of the project.
Develop a schedule for a specific project.
Explain rationale for a specific scheduling procedure.
Understand and apply closeout procedures to effectively complete a project.
Identify the components of closeout procedures.

SAFETY, HEALTH, AND ENVIRONMENTAL
Create and apply a jobsite safety program to ensure safe practices and procedures.
Determine procedures for a jobsite safety program.
Explain the importance of workers being OSHA certified.
Recognize and employ universal construction signs and symbols to function safely in the workplace.
Identify universal signs and symbols such as colors, flags, stakes, and hand signals that apply to construction workplace situations.
Explain functions of signs and symbols.
Work safely using signs and symbols.
Inspect all signs and symbols for safe and proper use.
Use proper signs and signals for the work area.
Respond appropriately to signs and signals.
Select the most appropriate sign or symbol for use in a workplace situation.
Understand and apply procedures for jobsite security to prevent liability.
Explain the need for jobsite security to prevent liability.
Design and implement jobsite security procedures.
Create and apply a jobsite environmental program.
Explain the need for an environmental program that include recycling, site clean-up, and safe disposal in accordance with MSDS.
List the steps to establish an environmental program.
LEADERSHIP AND TEAMWORK
Manage relationships with internal and external parties to successfully complete construction projects.
Describe strategies used to promote collaboration, trust, and clear communication among contractors, suppliers, clients, and others on a jobsite.
Plan and organize project meetings.
LEGAL RESPONSIBILITIES AND ETHICS
Establish specific goals to manage project assignments in a timely manner.
Understand proper changeover procedures for successful completion of the project.
Establish process for changeover procedures.
Explain the need for specific changeover procedures.

TECHNICAL SKILLS
EXAMINE BUILDING SYSTEMS AND COMPONENTS TO EVALUATE THEIR USEFULNESS TO A PROJECT.
Identify building systems needed to complete a construction project.
List all building systems involved in a project.
Describe the purpose of each system.
List all components of the involved building system.
Describe the function of each component.
Identify components of building systems needed to complete a construction project. Incorporate appropriate building systems into a construction project.
Incorporate appropriate building systems into a construction project.
UTILIZE CRAFT SKILLS TO MEET OR EXCEED CUSTOMER EXPECTATIONS.
Develop and utilize good craft skills.

Appendix B:
Instructional Framework

Standards Alignment: Common Core / Carpentry

Construction Standards	Common Core Standards	Explanation
Module 00101-09 – Basic Safety	RI 11-12.7, RST 11-12.2	Watch safety videos, read related information on safety, and demonstrate safety procedures.
1. Explain the idea of a safety culture and its importance in the construction crafts.	SL 11-12.1.a, SL 11-12.1.c	Read and understand information, discuss as a group, and ask questions to understand safety processes and procedures.
2. Identify causes of accidents and the impact of accident costs.	SL 11-12.1.a, SL 11-12.1.c	
3. Explain the role of OSHA in job-site safety.	SL 11-12.1.a, SL 11-12.1.c	
4. Explain OSHA's General Duty Clause and 1926 CFR Subpart C.	SL 11-12.1.a, SL 11-12.1.c	
5. Recognize hazard recognition and risk assessment techniques.	SL 11-12.1.a, SL 11-12.1.c	
6. Explain fall protection, ladder, stair, and scaffold procedures and requirements.	SL 11-12.1.a, SL 11-12.1.c F-IF 2, F-IF 4, F-BF 1, F-LE 1, F-LE 5	Demonstration. Extension ladder ratio.
7. Identify struck-by hazards and demonstrate safe working procedures and requirements.		
8. Identify caught-in-between hazards and demonstrate safe working procedures and requirements.		
9. Define safe work procedures to use around electrical hazards.	SL 11-12.1.a, SL 11-12.1.c	
10. Demonstrate the use and care of appropriate personal protective equipment (PPE).		
11. Explain the importance of hazard communications (HazCom) and Material Safety Data Sheets (MSDSs).	SL 11-12.1.a, SL 11-12.1.c	

Construction Standards	Common Core Standards	Explanation
12. Identify other construction hazards on your job site, including hazardous material exposures, environmental elements, welding and cutting hazards, confined spaces, and fires.	SL 11-12.1.a, SL 11-12.1.c	
13. Demonstrate an understanding of safety through the OSHA 10-hour safety course and assessment.	SL 11-12.1.a, SL 11-12.1.c	
Module 00102-09 – Introduction to Construction Math This module introduces mathematical operations commonly used in construction and explains how the metric system and geometry are used in the trade. Trainees will learn how to add, subtract, multiple, and divide whole numbers, fractions, and decimals, as well as how to convert decimals, fractions, and percentages.		
1. Add, subtract, multiply, and divide whole numbers, with and without a calculator.	N-Q 1, N-Q 2, N-Q 3	"Reason quantitatively and use units to solve problems"—put in a construction context with units.
2. Use a standard ruler, a metric ruler, and a measuring tape to measure.	N-RN 3, N-Q 1, N-Q 2, N-Q 3, F-IF 4, F-BF 1, F-BF 2, F-LE 1, F-LE 5	
3. Add, subtract, multiply, and divide fractions.	N-RN 3	
4. Add, subtract, multiply, and divide decimals, with and without a calculator.	N-RN 3, N-Q 1, N-Q 2, N-Q 3	
5. Convert decimals to percentages and percentages to decimals.	N-RN 3, N-Q 1, N-Q 2, N-Q 3, F-IF 4, F-BF 1, F-BF 2, F-LE 1	
6. Convert fractions to decimals and decimals to fractions.	N-RN 3, N-Q 1, N-Q 2, N-Q 3, F-IF 4, F-BF 1, F-BF 2, F-LE 1	
7. Explain what the metric system is and how it is important in the construction trade.	N-RN 3, N-Q 1, N-Q 2, N-Q 3, F-IF 4, F-BF 1, F-BF 2, F-LE 1	
8. Recognize and use metric units of length, weight, volume, and temperature.	N-RN 3, N-Q 1, N-Q 2, N-Q 3, F-IF 4, F-BF 1, F-BF 2, F-LE 1	
9. Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.	G-CO 5, G-SRT 2, G-SRT 3, G-SRT 5, G-SRT 8, G-GMD 1, G-GMD 3, G-GMD 4, G-MG 1	

Construction Standards	Common Core Standards	Explanation
Module 00103-09 – Introduction to Hand Tools This module explains how to inspect and properly use hand tools. Trainees will learn how to identify and take care of basic hand tools.		Some math concepts from above can be reinforced and expanded in teaching the use of some tools.
1. Recognize and identify some of the basic hand tools and their proper uses in the construction trade.	SL 11-12.5, SL 11-12.1.a, RI 11-12.7, RST 11-12.2	Pull evidence from the text. Reading and research.
2. Visually inspect hand tools to determine if they are safe to use.		
3. Safely use hand tools.	RI 11-12.7, RST 11-12.2	
Module 00104-09 – Introduction to Power Tools This module introduces power tools commonly used in the construction trade. Trainees will learn how to safely use and properly maintain a variety of power tools.		
1. Identify power tools commonly used in the construction trades.	SL 11-12.5, SL 11-12.1.a, RI 11-12.7, RST 11-12.2	
2. Use power tools safely.		
3. Explain how to maintain power tools properly.	SL 11-12.1.a	
Module 00105-09 – Introduction to Construction Drawings This module discusses blueprint terms, components, and symbols. Trainees will learn how to interpret blueprints, recognize classifications of drawings, and use drawing dimensions.		
1. Recognize and identify basic construction drawing terms, components, and symbols.	RST 11-12.4, L 11-12.6, G-MG 1-3	
2. Relate information on construction drawings to actual locations on the print.	SL 11-12.5, G-CO 2, G-CO 3, G-CO 5, G-CO 6, G-SRT 2, G-SRT 5, G-SRT 8, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
3. Recognize different classifications of construction drawings.	RST 11-12.2, L 11-12.6, N-Q 1, N-Q 2, N-Q 3, G-CO 5, G-SRT 2	
4. Interpret and use drawing dimensions.	SL 11-12.1.a, G-CO 5, G-CO 12, G-GMD 4, G-MG 1, G-MG 2, G-MG3	

Construction Standards	Common Core Standards	Explanation
Module 00106-09 – Basic Rigging This module introduces the uses of slings and common rigging hardware. Trainees will learn basic inspection techniques, hitch configurations, and load-handling safety practices, as well as how to use American National Standards Institute hand signals.		Read about the information and describe/discuss in class each competencies.
1. Identify and describe the use of slings and common rigging hardware.	RST 11-12.2	
2. Describe basic inspection techniques and rejection criteria used for slings and hardware.	SL 11-12.1.a, S-ID 9, S-IC 6, S-MD 7	
3. Describe basic hitch configurations and their proper connections.	SL 11-12.1.a	
4. Describe basic load-handling safety practices.	SL 11-12.1.a, S-ID 9, S-IC 6, S-MD 7	
5. Demonstrate proper use of American National Standards Institute (ANSI) hand signals.	SL 11-12.1.a	
Module 00107-09 – Basic Communication Skills This module reviews basic communication skills. Trainees will learn how to interpret information in written and verbal form and how to communicate effectively using written and verbal skills.		
1. Interpret information and instructions presented in both verbal and written form.	SL 11-12.4, WHST 11-12.8, W 11-12.8, S-ID 9, S-IC 6, S-MD 7	Conduct research on steps and procedures in order to plan project sheets for the week.
2. Communicate effectively in on-the-job situations using verbal and written skills.	SL 11-12.4, WHST 11-12.8, L 11-12.6, W 11-12.8	Use proper construction terminology for the task at hand.

Construction Standards	Common Core Standards	Explanation
Module 00108-09 – Basic Employability Skills This module discusses basic employability skills. Trainees will learn how to effectively use critical thinking, computer, and relationship skills in the construction industry. This module will also increase trainee awareness of such workplace issues as sexual harassment, stress, and substance abuse.		
1. Explain the role of an employee in the construction industry.	SL 11-12.4, W 11-12.9, S 11-12.9	
2. Demonstrate critical thinking skills and the ability to solve problems using those skills.	SL 11-12.1.c, S-ID 9, S-IC 6, S-MD 7	
3. Demonstrate knowledge of computer systems and explain common uses for computers in the construction industry.		
4. Define effective relationship skills.	SL 11-12.1.b	
5. Recognize workplace issues such as sexual harassment, stress, and substance abuse.	RST 11-12.2	
Module 00109-09 – Introduction to Materials Handling		
1. Define a load.	SL 11-12.4	
2. Establish a pre-task plan prior to moving a load.	SL 11-12.4, N-Q 1, N-Q 2, N-Q 3, A-REI 1	
3. Use proper materials-handling techniques.		
4. Choose appropriate materials-handling equipment for the task.	S-MD 7	
5. Recognize hazards and follow safety procedures required for materials handling.	RST 11-12.3, S-IC 6	

Construction Standards	Common Core Standards	Explanation
Module 27101-06 – Orientation to the Trade This module introduces the carpentry trainee to the carpentry trade, including the apprenticeship process and the opportunities within the trade.		
2. Identify the aptitudes, behaviors, and skills needed to be a successful carpenter.	RST 11-12.2	
3. Identify the training opportunities within the carpentry trade.	W 11-12.9, RST 11-12.2, S-ID 9, S-IC 6, S-MD 7	Research and write a paper on the career in construction the individual is interested in.
4. Identify the career and entrepreneurial opportunities within the carpentry trade.	RST 11-12.2	
5. Identify the responsibilities of a person working in the construction industry.	W 11-12.9, RST 11-12.2	
6. State the personal characteristics of a professional.	RST 11-12.2	
7. Explain the importance of safety in the construction industry.	SL 11-12.1.a, SL 11-12.1.c	
Module 27102-06 – Building Materials, Fasteners, and Adhesives This module introduces the carpentry trainee to wood building materials, fasteners, and adhesives.		
1. Identify various types of building materials and their uses.	RST 11-12.3, L 11-12.6, S-ID 9, S-IC 6	Read about how to do it in text, use a job sheet to identify the procedures and samples.
2. State the uses of various types of hardwoods and softwoods.	SL 11-12.5, RST 11-12.3, S-ID 9, S-IC 6	
3. Identify the different grades and markings of wood building materials.	RST 11-12.2	
4. Identify the safety precautions associated with building materials.	RST 11-12.2	
5. Describe the proper method of storing and handling building materials.	RST 11-12.3	

Construction Standards	Common Core Standards	Explanation
6. State the uses of various types of engineered lumber.	RST 11-12.3	
7. Calculate the quantities of lumber and wood products using industry-standard methods.	WHST 11-12.6, N-Q 1, N-Q 2, N-Q 3, N-VM 7, A-REI 1, F-IF 4	Research products and produce material list.
8. Describe the fasteners, anchors, and adhesives used in construction work and explain their uses.	RST 11-12.3, L 11-12.6	
Module 27103-06 – Hand and Power Tools This module expands upon the hand and power tool information provided in the Core Curriculum and introduces the carpentry trainee to additional tools used in the carpentry trade.		
1. Identify the hand tools commonly used by carpenters and describe their uses.	RST 11-12.3, L 11-12.6	
2. Use hand tools in a safe and appropriate manner.	S-ID 9, S-IC 6	
3. State the general safety rules for operating all power tools, regardless of type.	RST 11-12.2, SL 11-12.1.a, S-ID 9, S-IC 6	
4. State the general rules for properly maintaining all power tools, regardless of type.	RST 11-12.2, SL 11-12.1.a, S-ID 9, S-IC 6	
5. Identify the portable power tools commonly used by carpenters and describe their uses.	RST 11-12.3	
6. Use portable power tools in a safe and appropriate manner.	S-ID 9, S-IC 6	

Construction Standards	Common Core Standards	Explanation
Module 27104-06 – Reading Plans and Elevations This module reviews and builds on the construction drawing (blueprint) material introduced in the Core Curriculum. It also introduces new information and techniques relevant to the carpentry trade for reading construction drawings and specifications.		
1. Describe the types of drawings usually included in a set of plans and list the information found on each type.	RST 11-12.3	
2. Identify the different types of lines used on construction drawings.	SL 11-12.1.c, RST 11-12.2, L 11-12.6, N-Q 1, N-Q 2, N-Q 3	
3. Identify selected architectural symbols commonly used to represent materials on plans.	SL 11-12.1.c, RST 11-12.2, G-CO 6, G-SRT 2, G-GMD 4	
4. Identify selected electrical, mechanical, and plumbing symbols commonly used on plans.	RST 11-12.3	
5. Identify selected abbreviations commonly used on plans.	RST 11-12.3, L 11-12.6	
6. Read and interpret plans, elevations, schedules, sections, and details contained in basic construction drawings.	RST 11-12.3, G-CO 5, G-SRT 2	
7. State the purpose of written specifications.	S-IC 6	
8. Identify and describe the parts of a specification.	RST 11-12.3, L 11-12.6	
9. Demonstrate or describe how to perform a quantity takeoff for materials.	N-Q 1, N-Q 2, N-Q 3, N-VM 7, A-SSE 1, A-SSE 2, A-SSE 3, A-CED 1, A-CED 4, A-REI 1, A-REI 2, A-REI 3, F-BF 1, F-LE 1b	

Construction Standards	Common Core Standards	Explanation
Module 27105-06 – Floor Systems This module introduces the carpentry trainee to residential floor systems. It covers the materials and general methods used to construct floor systems, with emphasis placed on the platform method of floor framing.		
1. Identify the different types of framing systems.	RST 11-12.2, L 11-12.6	
2. Read and interpret drawings and specifications to determine floor system requirements.	RST 11-12.2	
3. Identify floor and sill framing and support members.	RST 11-12.2, L 11-12.6	
4. Name the methods used to fasten sills to the foundation.	RST 11-12.2	
5. Given specific floor load and span data, select the proper girder/beam size from a list of available girders/beams.	RST 11-12.2, F-IF 4	
6. List and recognize different types of floor joists.	RST 11-12.3	
7. Given specific floor load and span data, select the proper joist size from a list of available joists.	RST 11-12.3, F-IF 4	
8. List and recognize different types of bridging.	RST 11-12.3	
9. List and recognize different types of flooring materials.	RST 11-12.3	
10. Explain the purposes of subflooring and underlayment.	RST 11-12.3	
11. Match selected fasteners used in floor framing to their correct uses.	RST 11-12.3	
12. Estimate the amount of material needed to frame a floor assembly.	RST 11-12.3, A-CED 4, A-REI 1, S-ID 6c, S-ID 7	
13. Demonstrate the ability to: • Lay out and construct a floor assembly • Install bridging • Install joists for a cantilever floor • Install a subfloor using butt-joint plywood/OSB panels • Install a single floor system using tongue-and-groove plywood/OSB panels	G-C0 2, 4, 12, G-SRT 2, G-GMD 4, G-MG 3	

Construction Standards	Common Core Standards	Explanation
Module 27106-06 – Wall and Ceiling Framing This module introduces the carpentry trainee to the materials and general procedures used in wall and ceiling framing.		
1. Identify the components of a wall and ceiling layout.	RST 11-12.2, N-Q 1, N-Q 2, N-Q 3, G-CO 12	
2. Describe the procedure for laying out a wood frame wall, including plates, corner posts, door and window openings, partition Ts, bracing, and firestops.	G-C0 2, G-CO 4, G-CO12, G-SRT 2, G-GMD 4, G-MG 3	
3. Describe the correct procedure for assembling and erecting an exterior wall.	RST 11-12.3	
4. Identify the common materials and methods used for installing sheathing on walls.	RST 11-12.3	
5. Lay out, assemble, erect, and brace exterior walls for a frame building.	RST 11-12.3, G-C0 2, G-CO 4, G-CO 12, G-SRT 2, G-GMD 4, G-MG 3	
6. Describe wall framing techniques used in masonry construction.	RST 11-12.3, RST 11-12.3	
7. Explain the use of metal studs in wall framing.	RST 11-12.3	
8. Describe the correct procedure for laying out ceiling joists.	RST 11-12.3, G-C0 2, G-CO 4, G-CO 12, G-SRT 2, G-GMD 4, G-MG 3	
9. Cut and install ceiling joists on a wood frame building.		
10. Estimate the materials required to frame walls and ceilings.	WHST 11-12.6, A-CED 4, A-REI 1, S-ID 6c, S-ID 7	
Module 27107-06 – Roof Framing This module introduces the carpentry trainee to the methods and procedures used in roof framing.		
1. Understand the terms associated with roof framing.	RST 11-12.2	
2. Identify the roof framing members used in gable and hip roofs.	RST 11-12.2, G-CO.12, G-CO 5, G-CO 6, G-SRT 2, G-SRT 3, G-SRT 8, G-GPE 5, G-GPE 7, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	

Construction Standards	Common Core Standards	Explanation
3. Identify the methods used to calculate the length of a rafter.	RST 11-12.3, F-IF 4, F-BF 1, F-BF 2, F-BF 3, F-LE 1, F-LE 5, F-TF 7, G-CO 3, G-CO 4, G-CO 5, G-CO 6, G-CO 7, G-CO 8, G-CO 3-8.12, G-SRT 1, G-SRT 2, G-SRT 3, G-SRT 4, G-SRT 5, G-SRT 6, G-SRT 7, G-SRT 8, G-SRT 9, G-SRT 10, G-SRT 11, G-GPE 5, G-GPE 6, G-GPE 7, G-GMD 4, G-MG 1, G-MG 2, G-ME 3	
4. Identify the various types of trusses used in roof framing.	RST 11-12.3	
5. Use a rafter framing square, speed square, and calculator in laying out a roof.	F-IF 4, F-BF 1, F-BF 3, F-LE 1, F-LE 5, F-TF 7, G-CO 3-8, G-CO 3-8.12, G-SRT 1, G-SRT 2, G-SRT 3, G-SRT 4, G-SRT 5, G-SRT 6, G-SRT 7, G-SRT 8, G-SRT 9, G-SRT 10, G-SRT 11, G-GPE 5, G-GPE 6, G-GPE 7, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
6. Identify various types of sheathing used in roof construction.	RST 11-12.3	
7. Frame a gable roof with vent openings.	RST 11-12.3, N-Q 1, N-Q 2, N-Q 3, G-CO 3-8, G-CO 3-8.12, G-SRT 8, G-GPE 6, G-MG 3, F-IF 3, F-BF 1a, F-LE 1	
8. Frame a roof opening.	RST 11-12.3, N-Q 1, N-Q 2, N-Q 3, G-CO 12, G-SRT 8, G-GPE 6, G-MG 3	
9. Erect a gable roof using trusses.	RST 11-12.3	
10. Estimate the materials used in framing and sheathing a roof.	WHST 11-12.6, A-CED 4, A-REI 1, S-ID 6c, S-ID 7	

Construction Standards	Common Core Standards	Explanation
Module 27108-06 – Introduction To Concrete, Reinforcing Materials, And Forms This module introduces the carpentry trainee to various cements and other materials that, when mixed together, form various types of concrete. Concrete volume estimates and concrete forms are also covered. In addition, reinforcement materials such as reinforcement bars, bar supports, and welded-wire fabric are discussed.		
1. Identify the properties of cement.	RST 11-12.2	
2. Describe the composition of concrete.	RST 11-12.2, S-IC 6	
3. Perform volume estimates for concrete quantity requirements.	G-GMD 3, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
4. Identify types of concrete reinforcement materials and describe their uses.	RST 11-12.2, L 11-12.6	
5. Identify various types of footings and explain their uses.	RST 11-12.2	
6. Identify the parts of various types of forms.	RST 11-12.2, L 11-12.6	
7. Explain the safety procedures associated with the construction and use of concrete forms.	S-IC 6	Show industry collected data helps in the development of safety procedures.
8. Erect, plumb, and brace a simple concrete form with reinforcement.	N-Q 1, N-Q 3, G-CO 12, G-GMD 4, G-MG 1, G-MG 3	

Construction Standards	Common Core Standards	Explanation
Module 27109-06 – Windows and Exterior Doors This module introduces the carpentry trainee to methods and procedures used in the selection and installation of residential windows and exterior doors.		
1. Identify various types of fixed, sliding, and swinging windows.	RST 11-12.3	
2. Identify the parts of a window installation.	RST 11-12.3	
3. State the requirements for a proper window installation.	RST 11-12.3, N-Q 1, N-Q 2, N-Q 3	
4. Install a pre-hung window.	RST 11-12.3, N-Q 1, N-Q 2, N-Q 3	
5. Identify the common types of exterior doors and explain how they are constructed.	RST 11-12.3	
6. Identify the parts of a door installation.	RST 11-12.3	
7. Identify the types of thresholds used with exterior doors.	RST 11-12.3	
8. Install a pre-hung exterior door.	RST 11-12.3 ,N-Q 1, N-Q 2, N-Q 3	
9. Identify the various types of locksets used on exterior doors and explain how they are installed.	RST 11-12.3	
10. Install a lockset.	RST 11-12.3, N-Q 3	

Construction Standards	Common Core Standards	Explanation
Module 27110-06 – Basic Stair Layout This module introduces the Carpentry trainee to the materials and methods used to construct interior and exterior wooden stairs.	RST 11-12.3	
1. Identify the various types of stairs.	RST 11-12.3, L 11-12.6	
2. Identify the various parts of stairs.	RST 11-12.3	
3. Identify the materials used in the construction of stairs.	RST 11-12.3, L 11-12.6, N-Q 1, N-Q 2	
4. Interpret construction drawings of stairs.	RST 11-12.3, G-GMD 4	
5. Calculate the total rise, number and size of risers, and number and size of treads required for a stairway.	WHST 11-12.6, N-Q 1, N-Q 2, N-Q 3, F-IF 1, F-IF 4, F-BF 1, F-BF 3, F-LE 1, F-LE 5, G-CO 4, G-CO 5, G-CO 6, G-CO 7, G-CO 12, G-SRT 2, G-SRT 8, G-GPE 6, G-GPE 7, G-GMD 4, G-MG 1, G-MG 2, G-MG 3, A-CED 1, A-REI 1	
6. Lay out and cut stringers, risers, and treads.	RST 11-12.3, N-Q 1, N-Q 2, N-Q 3, G-CO 12, G-GMD 4, G-MG 1, G-MG 3	
7. Build a small stair unit with a temporary handrail.	RST 11-12.3, N-Q 1-3	

Construction Standards	Common Core Standards	Explanation
Module 27201-07 – Commercial Drawings This module describes the types and uses of drawings prepared for commercial structures. It provides information about the format and content of commercial drawings and their use in conveying specific construction requirements. It describes the standard format for specifications.		
1. Recognize the difference between commercial and residential construction drawings.	RST 11-12.3, N-Q 1	
2. Identify the basic keys, abbreviations, and other references contained in a set of commercial drawings.	RST 11-12.3, N-Q 1	
3. Accurately read a set of commercial drawings.	RST 11-12.3, N-Q 1, G-GMD 4, G-MG 1, G-MG 3	
4. Identify and document specific items from a door and window schedule.	RST 11-12.3	
5. Explain basic construction details and concepts employed in commercial construction.	RST 11-12.3, G-GMD 4, G-MG 1, G-MG 3	
6. Calculate the floor area of each room in a floor plan.	WHST 11-12.6, N-Q 1, N-Q 2, N-Q 3, G-GPE 7, G-GMD 4, G-MG 1, G-MG 3	

Construction Standards	Common Core Standards	Explanation
Module 27202-07 – Roofing Applications This module covers the common materials used in residential and light commercial roofing, along with the safety practices and application methods for these materials. It includes shingles, roll roofing, shakes, tiles, and metal and membrane roofs. As well as the selection and installation of roof vents.	RST 11-12.3	
1. Identify the materials and methods used in roofing.		
2. Explain the safety requirements for roof jobs.		
3. Install fiberglass shingles on gable and hip roofs.		
4. Close up a valley using fiberglass shingles.		
5. Explain how to make various roof projections watertight when using fiberglass shingles.		
6. Complete the proper cuts and install the main and hip ridge caps using fiberglass shingles.	N-Q 1, N-Q 2, N-Q 3, G-CO 12	
7. Lay out, cut, and install a cricket or saddle.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, F-BF 1, F-BF 3, F-LE 1, F-LE 5, F-TF 7, G-CO 3, G-CO 4, G-CO 5, G-CO 6, G-CO 7, G-CO 8, G-CO 12, G-SRT 1, G-SRT 2, G-SRT 3, G-SRT 4, G-SRT 5, G-SRT 6, G-SRT 7, G-SRT 8, G-SRT 9, G-SRT 10, G-SRT 11, G-GPE 5-7, G-GMD 4, G-MG 1, G-MG 3	
8. Install wood shingles and shakes on roofs.		
9. Describe how to close up a valley using wood shingles and shakes.		
10. Explain how to make roof projections watertight when using wood shakes and shingles.		
11. Complete the cuts and install the main and hip ridge caps using wood shakes/shingles.	N-Q 1, N-Q 2, N-Q 3, G-CO 12	
12. Demonstrate the techniques for installing other selected types of roofing materials.	N-Q 1, N-Q 2, N-Q 3, G-CO 12	

Construction Standards	Common Core Standards	Explanation
Module 27203-07 – Thermal and Moisture Protection This module covers the selection and installation of various types of insulating materials in walls, floors, and attics. It also covers the uses and installation practices for vapor barriers and weather-proofing materials.		
1. Describe the requirements for insulation.	RST 11-12.3	
2. Describe the characteristics of various types of insulation material.	RST 11-12.3	
3. Calculate the required amounts of insulation for a structure.	WHST 11-12.6,N-Q 1, N-Q 2, N-Q 3, G-GMD 3, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
4. Install selected insulation materials.	RST 11-12.3	
5. Describe the requirements for moisture control and ventilation.	RST 11-12.3	
6. Install selected vapor barriers.	RST 11-12.3	
7. Describe various methods of waterproofing.	RST 11-12.3	
8. Describe air infiltration control requirements.	RST 11-12.3	
9. Install selected building wraps.	RST 11-12.3	

Construction Standards	Common Core Standards	Explanation
Module 27204-07 – Exterior Finishing This module covers the various types of exterior siding used in residential construction and their installation procedures, including wood, metal, vinyl, and cement board siding.	RST 11-12.3	
1. Describe the purpose of wall insulation and flashing.		
2. Install selected common cornices.		
3. Demonstrate lap and panel siding estimating methods.	N-Q 1, N-Q 2, N-Q 3, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
4. Describe the types and applications of common wood siding.		
5. Describe fiber-cement siding and its uses.		
6. Describe the types and styles of vinyl and metal siding.		
7. Describe the types and applications of stucco and masonry veneer finishes.		
8. Describe the types and applications of special exterior finish systems.		
9. Install three types of siding commonly used in your area.		

Construction Standards	Common Core Standards	Explanation
Module 27206-07 – Drywall Installation This module describes the various types of gypsum drywall, their uses, and the fastening devices and methods used to install them. It also contains detailed instructions for installing drywall on walls and ceilings, using nails, drywall screws, and adhesives. It also covers fire- and sound-rated walls.		
1. Identify the different types of drywall and their uses.	RST 11-12.3, F-IF 4	
2. Select the type and thickness of drywall required for specific installations.	RST 11-12.3, F-IF 4	
3. Select fasteners for drywall installation.	RST 11-12.3, F-IF 4	
4. Explain the fastener schedules for different types of drywall installations.	RST 11-12.3, F-IF 4	
5. Perform single-layer and multi-layer drywall installations using different types of fastening systems, including: • Nails • Drywall screws • Adhesives		
6. Install gypsum drywall on steel studs.	RST 11-12.3	
7. Explain how soundproofing is achieved in drywall installations.	RST 11-12.3	
8. Estimate material quantities for a drywall installation.	RST 11-12.3, N-Q 1, N-Q 2, N-Q 3, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	

Construction Standards	Common Core Standards	Explanation
Module 27207-07 – Drywall Finishing This module covers the materials, tools, and methods used to finish and patch gypsum drywall. It includes coverage of both automatic and manual taping and finishing methods.	RST 11-12.3	
1. State the differences between the six levels of finish established by industry standards and distinguish a finish level by observation.	S-IC 6, S-MD 7	
2. Identify the hand tools used in drywall finishing and demonstrate the ability to use these tools.		
3. Identify the automatic tools used in drywall finishing.		
4. Identify the materials used in drywall finishing and state the purpose and use of each type of material, including: • Compounds • Joint reinforcing tapes • Trim material • Textures and coatings	L 11-12.6	
5. Properly finish drywall using hand tools.		
6. Recognize various types of problems that occur in drywall finishes; identify the causes and correct methods for solving each type of problem.	S-ID 9, S-IC 6	
7. Patch damaged drywall.		Will it crack later?

Construction Standards	Common Core Standards	Explanation
Module 27208-07 – Doors and Door Hardware This module covers the installation of metal doors and related hardware in steel-framed, wood-framed, and masonry walls, along with their related hardware, such as locksets and door closers. It also covers the installation of wooden doors, folding doors, and pocket doors.	RST 11-12.3	
1. Identify various types of door jambs and frames and demonstrate the installation procedures for placing selected door jambs and frames in different types of interior partitions.	N-Q 1, N-Q 3	
2. Identify different types of interior doors.	L 11-12.6	
3. Identify different types of interior door hardware and demonstrate the installation procedures for selected types.		
4. Demonstrate the correct and safe use of the hand and power tools described in this module.		
5. List and identify specific items included on a typical door schedule.		
6. Demonstrate the procedure for placing and hanging a selected door.	N-Q 1, N-Q 3	

Construction Standards	Common Core Standards	Explanation
Module 27210-07 – Window, Door, Floor, and Ceiling Trim This module covers the different types of trim used in finish work. It focuses on the proper methods for selecting, cutting, and fastening trim to provide a professional finished appearance.		
1. Identify the different types of standard moldings and describe their uses.	RST 11-12.3	
2. Make square and miter cuts using a miter box or power miter saw.	RST 11-12.3	
3. Make coped joint cuts using a coping saw.	RST 11-12.3	
4. Select and properly use fasteners to install trim.	RST 11-12.3, F-IF 4	
5. Install interior trim, including: • Door trim • Window trim • Base trim • Ceiling trim	RST 11-12.3	
6. Estimate the quantities of different trim materials required for selected rooms.	WHST 11-12.6, N-Q 1, N-Q 2, N-Q 3, G-GPE 7, G-GMD 4, G-MG 1-3	
Module 27211-07 – Cabinet Installation This module provides detailed instructions for the selection and installation of base and wall cabinets and countertops.	RST 11-12.3	
1. State the classes and sizes of typical base and wall kitchen cabinets.		
2. Identify the cabinet components and hardware and describe their purposes.		
3. Lay out factory-made cabinets, countertops, and backsplashes.	N-Q 1, N-Q 2, N-Q 3, G-CO 12, G-GMD 4, G-MG 1, 3	
4. Explain the installation of an island base.	S-MD 7	Will the anchorage hold up over time as people lean on the island?

Codes for Common Core English Language Arts and Literacy are:

L = Language

RI = Reading for Informational Text

RST = Reading for Literacy in Science and Technical Subjects

SL = Speaking and Listening

W = Writing

WHST = Writing for Literacy in History/Social Studies, Science, and Technical Subjects

Codes for Common Core Mathematics are:

A-SSE = Algebra: Seeing Structure in Expressions

A-CED = Algebra: Creating Equations

A-REI = Algebra: Reasoning with Equations and Inequalities

F-IF = Functions: Interpreting Functions

F-BF = Functions: Building Functions

F-LE = Functions: Linear, Quadratic, and Exponential Models

G-CO = Geometry: Congruence

G-SRT = Similarity, right Triangles, and Trigonometry

G-GMD = Geometry: Geometric Measurement and Dimension

G-MG = Geometry: Modeling with Geometry

N-RN = Number and Quantity: The Real Number System

N-Q = Number and Quantity: Quantities

N-VM = Number and Quantity: Vector and Matrix Quantities

S-ID = Statistics and Probability: Interpreting Categorical and Quantitative Data

S-IC = Statistics and Probability: Making Inferences and Justifying Conclusions

S-MD = Statistics and Probability: Using Probability to Make Decisions

Standards Alignment: Common Core / Masonry

Construction Standards	Common Core Standards	Explanation
Module 28101-04 - Introduction To Masonry		
1. Discuss the history of masonry.		
2. Describe modern masonry materials and methods.		
3. Explain career ladders and advancement possibilities in masonry work.		
4. Describe the skills, attitudes, and abilities needed to work as a mason.		
5. State the safety precautions that must be practiced at a work site, including the following: • Safety practices • Fall-protection procedures • Forklift-safety operations	WHST 11-12.2, L 11-12.1, L 11-12.2	Write safety procedures for operating a mortar mixer.
6. Perform the following basic bricklaying procedures: • Mixing of mortar* • Laying a mortar bed • Laying bricks	*N-Q 1, N-Q 2, N-Q 3, A-SSE 1, A-CED 1, A-CED 2, A-CED 4, A-REI 1, A-REI 2, A-REI 3, F-IF 4, F-BF 1, F-LE 1b, F-LE 5	Stress all the relationships between rates, ratios, percents, unit conversions in adding water, admixtures, and other components to mortar mix. (Many students have a great deal of trouble with these concepts in math and science classes, but grasp it more easily in a context such as this.)
7. Put on eye protection, respiratory protection, and a safety harness.		
8. Use the correct procedures for fueling and starting a gasoline-powered tool.		
Performance Tasks		
1. Put on eye protection, respiratory protection, and a safety harness.		
2. Demonstrate the ability to properly use a trowel to spread and furrow bed joints and butter head joints.		

Construction Standards	Common Core Standards	Explanation
Module 28102-04 - Masonry Tools and Equipment	**RST 11-12.4**	
1. Identify and name the tools used in performing masonry work.	L 11-12.6	
2. Identify and name the equipment used in performing masonry work.	L 11-12.6	
3. Describe how each tool is used.		
4. Describe how the equipment is used.	S-ID 9	
5. Associate trade terms with the appropriate tools and equipment.		
6. Demonstrate the correct procedures for assembling and disassembling scaffolding according to federal safety regulations, under the supervision of a competent person.	S-MD 7	
Performance Tasks		
1. Identify masonry hand and power tools.	L 11-12.6	
2. Assemble and disassemble scaffolding under the supervision of a competent person, according to federal safety regulations.	S-IC 6	
Module 28103-04 - Measurements, Drawings, and Specifications	**RST 11-12.4**	Read a blueprint for an outdoor restroom; room addition.
1. Work with denominate numbers.	N-Q 1, N-Q 2, N-Q 3	
2. Read a mason's measure.	N-Q 1, N-Q 2, N-Q 3	
3. Convert measurements in the U.S. Customary (English) system into their metric equivalents.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, F-IF 8, F-BF 1, F-BF 3, F-LE 1b, A-SSE 3, A-CED 2, A-CED 4, A-REI 1, A-REI 2, A-REI 3	
4. Recognize, identify, and calculate areas, circumferences, and volumes of basic geometric shapes.	G-GMD 3, G-MG 1, G-MG 2, G-MG 3	Estimate material to construct chimney.
5. Identify the basic parts of a set of drawings.	G-GMD 4	
6. Discuss the different types of specifications used in the building industry and the sections that pertain to masonry.	S-IC 6	

Construction Standards	Common Core Standards	Explanation
Performance Tasks		
1. Use a mason's rule to measure a space and calculate its volume.	G-MG 3	Estimate material to construct a concrete footing.
2. Use a mason's rule to measure a space and estimate the number of bricks to build a wall across it.	G-MG 1, G-MG 2, G-MG 3	Estimate material to construct a brick wall.
3. Interpret information on blueprints.	G-GMD 4	
Module 28104-04 – Mortar	RST 11-12.3, SL 11-12.1	**Troubleshoot mortar problems.**
1. Name and describe the primary ingredients in mortar and their properties.		
2. Identify the various types of mortar used in masonry work.		
3. Describe the common admixtures and their uses.		
4. Identify the common problems found in mortar application and their solutions.	S-ID 9, S-IC 6, S-MD 7	
5. Properly set up the mortar mixing area.		
6. Properly mix mortar by hand.	N-Q 1, N-Q 2, N-Q 3, A-SSE 1, A-CED 1, A-CED 2, A-CED 4, A-REI 1, A-REI 2, A-REI 3, F-IF 4, F-BF 1, F-LE 1b, F-LE 5	Mix mortar for inside of a fireplace requires adding fireclay; use different categories (strength) of mortar for different applications.
7. Properly mix mortar with a mechanical mixer.		
Performance Tasks		
1. Properly set up the mortar mixing area.		
2. Properly mix mortar by hand		
3. Properly mix mortar with a mechanical mixer.		

Construction Standards	Common Core Standards	Explanation
Module 28105-04 - Masonry Units and Installation Techniques	RST 11-12.3, SL 11-12.1	**Build an outdoor restroom; build a sign.**
1. Describe the most common types of masonry units.		
2. Describe and demonstrate how to set up a wall.	G-CO 12	
3. Lay a dry bond.	G-CO 12	
4. Spread and furrow a bed joint, and butter masonry units.		
5. Describe the different types of masonry bonds.	N-Q 1, N-Q 2, N-Q 3, A-SSE 1, G-MG 1, G-MG 2, G-MG 3	
6. Cut brick and block accurately.	N-Q 1, N-Q 2, N-Q 3	
7. Lay masonry units in a true course.	N-Q 1, N-Q 2 , N-Q 3, G-CO 12	
Performance Tasks		
1. Lay a dry bond.		
2. Accurately cut masonry units with a brick set and masonry hammer, a block set and mash, and a masonry hammer, power saw, and splitter.	N-Q 1, N-Q 2, N-Q 3	
3. Spread, edge, and furrow bed joints.		
4. Butter bricks and blocks and place them on a bed joint.		
5. Lay masonry units in courses that are true for height, level, plumb, and straightness.	N-Q 1, N-Q 2, N-Q 3, G-CO 12	
6. Build a rackback corner lead.	G-CO 12	
7. Lay masonry units to the line.		
Module 28201-05 – Residential Plans and Drawing Interpretation		
1. Explain the organization of residential plans and drawings.		
2. Interpret dimensions and scales on drawings.	F-LE 1b, N-Q 1	
3. Interpret information on residential plans.	N-Q 1, G-GMD 4, G-MG 1, G-MG 3	
4. Estimate material quantities from plans and drawings.	N-Q 1, N-Q 2, N-Q 3, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	

Construction Standards	Common Core Standards	Explanation
Performance Tasks		
1. From a plan, calculate the square footage of one elevation, including openings.	N-Q 1, N-Q 3, G-GPE 7, G-GMD 4, G-MG 1, G-MG 3	
2. Estimate the amount of brick and mortar from that same elevation.	N-Q 1, N-Q 2, N-Q 3, G-GMD 4, G-MG 1, G-MG 2, G-MG 3, F-IF 4, F-IF 5	
3. Estimate the size and number of lintel block for that same elevation.	N-Q 1, N-Q 2, N-Q 3, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
Module 28202-05 – Residential Masonry		
2. Identify and explain the characteristics, uses, and installation techniques for brick pavers.		
3. Lay out and build steps, patios, and decks made from masonry units.	N-Q 1, N-Q 2, N-Q 3, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
4. Lay out and build chimneys and fireplaces.	N-Q 1, N-Q 2, N-Q 3, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
Module 28203-05 – Grout and Other Reinforcement		
1. Name and describe the primary ingredients in grout and their properties.	S-ID 9, S-IC 6	Give some information about how standards developed (materials testing, etc.).
2. Identify the different types of grout used in masonry work.	S-ID 9, S-IC 6	
3. Describe the common admixtures and their uses.	S-ID 9, S-IC 6	
4. Describe the use of steel bar reinforcement in masonry construction.	S-ID 9, S-IC 6	
5. Apply grout in low and high lifts using the proper techniques.	S-ID 9, S-IC 6, S-MD 7	
6. Place grout in a hollow block wall and rod it into place.		
Performance Tasks		
1. Place grout in a hollow block wall and rod in place.		
Module 28204-05 – Metal Work in Masonry		
1. Describe the uses and installation of vertical reinforcement.	S-ID 9, S-IC 6, S-MD 7	
2. Describe the uses and installation of different types of horizontal joint reinforcements and ties.	S-ID 9, S-IC 6, S-MD 7	

Construction Standards	Common Core Standards	Explanation
3. Describe the uses and installation of different anchors, fasteners, and embedded items.	S-ID 9, S-IC 6, S-MD 7	
4. Install hollow metal frames.		
5. Describe the functions of sills and lintels.	S-ID 9, S-IC 6, S-MD 7	
6. Install sills and lintels.		
7. Install metal hardware.		
Performance Tasks		
3. Lay one wythe of brick against one side of the frame.		
4. Install hardware cloth unit ties in every other course.		
Module 28205-05 – Advanced Laying Techniques	RST 11-12.3, SL 11-12.1	Build an arch entrance way.
1. Recognize the structural principles and fundamental uses of basic types of walls.	S-ID 9, S-IC 6, S-MD 7	
2. Recognize the requirement for, and function of, control joints and expansion joints.	S-ID 9, S-IC 6, S-MD 7	
3. Build various types of walls using proper reinforcement, jointing, and bonding techniques.		
5. Identify and explain the different types of masonry arches used today.		
6. Lay out a semicircular arch and a jack arch.	G-CO 12, G-C 2, G-C 4, G-C 5, G-GMD 1, G-GMD 4, G-MG 1, G-MG 3	
Performance Tasks		
1. Lay a wythe of brick against a block wythe or wood frame to make a composite wall. Use ties and a collar joint.	N-Q 1, N-Q 2, N-Q 3, G-CO 6, G-CO 12, G-GMD 4, G-MG 1-3	
2. Lay out specialty structures and arches.	N-Q 1, N-Q 2, N-Q 3, G-CO 6, 12, G-C 2, G-C 4, G-C 5, G-GMD 1, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	

Construction Standards	Common Core Standards	Explanation
Module 28206-05 – Construction Techniques and Moisture Control		Evaluate a project under construction against specifications.
1. Explain and demonstrate techniques for constructing masonry around windows, doors, and other openings.		Give some information about how standards developed (materials testing, etc.).
2. Explain the requirements for wall bracing, and demonstrate the techniques used to construct pilasters and other types of bracing.		
3. Identify the various types of insulation used in conjunction with masonry construction, and explain installation techniques.		
4. Identify the need for moisture control in various types of masonry construction, and demonstrate the techniques used to eliminate moisture problems.		
5. Construct corbeling in a double-wythe wall.		
6. Join intersecting walls.		
7. Install flashing.		
Performance Tasks		
1. Construct a four-course corbel starting at the fifth course of a double-wythe wall.		
2. Construct an intersecting block wall joined with wire mesh or metal lath.		
3. Install a row of flashing in an anchored veneered wall.		
Module 28207-05 – Construction Inspection and Quality Control	SL 11-12.1	
1. Describe industry standards for quality control.	S-ID 9, S-IC 6, S-MD 7	
2. Describe how to build masonry sample panels and prisms.		

Construction Standards	Common Core Standards	Explanation
Module 28301-05 – Masonry in High-Rise Construction		
1. Recognize and explain the use of high-rise construction equipment.		
2. Identify construction sequence in high-rise construction.		
3. State the safety procedures in high-rise construction.		
5. Properly put on a safety harness, lanyard, and lifeline.		
6. Demonstrate hand signals used for lifting materials.		
Module 28302-05 – Specialized Materials and Techniques		
1. Explain the various techniques used to provide adequate protection during hot- and cold-weather masonry construction.	S-ID 9, S-IC 6, S-MD 7	Give some information about how standards developed (materials testing, etc.).
2. Describe all-weather construction techniques.	S-ID 9, S-IC 6, S-MD 7	Give some information about how standards developed (materials testing, etc.).
3. Describe techniques for surface-bonding mortar.	S-ID 9, S-IC 6, S-MD 7	Give some information about how standards developed (materials testing, etc.).
4. Demonstrate techniques for construction of stone walls and other stone building surfaces.	N-Q 1, N-Q 3	
5. Demonstrate basic knowledge of various building materials such as glass block and refractory brick.		

Construction Standards	Common Core Standards	Explanation
Module 28303-05 – Repair and Restoration	RST 11-12.3	Repair a chimney.
1. Recognize signs of deterioration in masonry structures.	S-ID 9, S-IC 6, S-MD 7	Give some information about how standards developed (materials testing, etc.).
2. Describe the causes of efflorescence, cracking, and faulty mortar joints.	S-ID 9, S-IC 6, S-MD 7	Give some information about how standards developed (materials testing, etc.).
3. Describe the procedures for preventing and correcting efflorescence, cracking, and faulty mortar joints.	S-ID 9, S-IC 6, S-MD 7	Give some information about how standards developed (materials testing, etc.).
4. Describe the procedures for preventing and correcting water damage in basements.	S-ID 9, S-IC 6, S-MD 7	Give some information about how standards developed (materials testing, etc.).
5. Describe the procedures for rebuilding fireplaces.	S-ID 9, S-IC 6, S-MD 7	Give some information about how standards developed (materials testing, etc.).
6. Replace a damaged brick in a wall.		
7. Repair mortar joints.		
Performance Tasks		
1. Replace a damaged brick in a wall.		
2. Repair mortar joints in a brick wall by tuckpointing.		
Module 28304-05 – Commercial Drawings	RST 11-12.4	Build a commercial sign from a drawing.
1. Recognize the difference between commercial and residential construction drawings.	N-Q 1	
2. Identify the basic keys, abbreviations, and other references contained in a set of commercial drawings.	N-Q 1	
3. Accurately read a set of commercial drawings.	N-Q 1, G-GMD 4, G-MG 1, G-MG 3	
4. Explain basic construction details and concepts employed in commercial construction.	G-GMD 4, G-MG 1, G-MG 3	
Performance Tasks		
2. Calculate the floor area of each room in a floor plan.	N-Q 1, N-Q 3, G-GPE 7, G-GMD 4, G-MG 1, G-MG 3	

Construction Standards	Common Core Standards	Explanation
Module 28305-05 – Estimating		Build an outdoor restroom.
1. Explain and apply basic materials estimating procedures for concrete block and brick construction.	N-Q 1, N-Q 2, N-Q 3, G-GMD 4, G-MG 1, G-MG 2, G-MG 3, F-IF 3, F-IF 4, F-IF 5, F-IF 8, F-BF 1, F-LE 1, F-LE 5	
2. Explain and apply basic estimating procedures for reinforcements, ties, and other materials.	N-Q 1, N-Q 2, N-Q 3, G-GMD 4, G-MG 1, G-MG 2, G-MG 3, F-IF 3, F-IF 4, F-IF 5, F-IF 8, F-BF 1, F-LE 1, F-LE 5	
3. Explain and apply procedures for estimating quantities of mortar and mortar materials.	N-Q 1, N-Q 2, N-Q 3, G-GMD 4, G-MG 1, G-MG 2, G-MG 3, F-IF 3, F-IF 4, F-IF 5, F-IF 8, F-BF 1, F-LE 1, F-LE 5	
Performance Tasks		
2. Complete a set of estimating worksheets.		
Module 28306-05 – Site Layout—Distance Measurement and Leveling		
2. Convert measurements stated in feet and inches to equivalent measurements stated in decimal feet, and vice versa.	N-Q 1, N-Q 2, N-Q 3	
6. Recognize, use, and properly care for tools and equipment associated with differential leveling.		
7. Use a builder's level or transit and differential leveling procedures to determine site and building elevations.	N-Q 1, N-Q 2, N-Q 3, G-CO 6, G-CO 12, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
9. Check and/or establish 90-degree angles using the 3–4–5 rule.	N-Q 1, N-Q 2, N-Q 3, G-CO 5, G-CO 6, G-CO 12, G-SRT 5, G-SRT 8, G-GMD 4, G-MG 1, G-MG 3	Build an outdoor restroom (or any building with a square corner).
Performance Tasks		
6. Use a builder's level, leveling rods, and differential leveling procedures to determine site and building elevations.	N-Q 1, N-Q 2, N-Q 3, G-CO 6, G-CO 12, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
9. Check and/or establish 90-degree angles using the 3–4–5 rule.	N-Q 1, N-Q 2, N-Q 3, G-CO 5, G-CO 6, G-CO 12, G-SRT 5, G-SRT 8, G-GMD 4, G-MG 1, G-MG 3	Build an outdoor restroom (or any building with a square corner).

Construction Standards	Common Core Standards	Explanation
Module 28307-05 – Introductory Skills for the Crew Leader		
1. Discuss current issues and organizational structure in the construction industry today.		
2. Understand and incorporate leadership skills into work habits, including communication, motivation, team building, problem solving, and decision-making skills.	SL 11-12.1	
3. Demonstrate an awareness of safety issues, including the cost of accidents and safety regulations.	W 11-12.3, W 11-12.4	Write an accident report.
5. Show a basic understanding of the planning process, scheduling, and cost and resource control.	A-CED 1, A-CED 2, A-CED 3, N-Q 1, N-Q 2, N-Q 3, F-IF 4, F-IF 5, F-IF 6, F-LE 1, S-IC 6	
Performance Tasks		
1. Lay a wythe of brick against a block wythe or wood frame to make a composite wall. Use ties and a collar joint.	N-Q 1, N-Q 2, N-Q 3, G-CO 6, G-CO 12, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
2. Lay out specialty structures and arches.	N-Q 1, N-Q 2, N-Q 3, G-CO 6, G-CO 12, G-C 2, G-C 4, G-C 5, G-GMD 1, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	

Codes for Common Core English Language Arts and Literacy are:

L = Language

RST = Reading for Literacy in Science and Technical Subjects

SL = Speaking and Listening

WHST = Writing for Literacy in History/Social Studies, Science, and Technical Subjects

Codes for Common Core Mathematics are:

A-SSE = Algebra: Seeing Structure in Expressions

A-CED = Algebra: Creating Equations

A-REI = Algebra: Reasoning with Equations and Inequalities

F-IF = Functions: Interpreting Functions

F-BF = Functions: Building Functions

F-LE = Functions: Linear, Quadratic, and Exponential Models

G-CO = Geometry: Congruence

G-SRT = Similarity, right Triangles, and Trigonometry

G-C = Geometry: Circles

G-GMD = Geometry: Geometric Measurement and Dimension

G-MG = Geometry: Modeling with Geometry

N-Q = Number and Quantity: Quantities

S-ID = Statistics and Probability: Interpreting Categorical and Quantitative Data

S-IC = Statistics and Probability: Making Inferences and Justifying Conclusions

S-MD = Statistics and Probability: Using Probability to Make Decisions

Standards Alignment: Common Core / Electrical Trades

Construction Standards	Common Core Standards	Explanation
Module 26101-08 – Orientation To The Electrical Trade		
1. Describe the apprenticeship/training process for electricians.	RST 11-12.2	
2. Describe various career paths/opportunities one might follow in the electrical trade.	RST 11-12.2	
3. Define the various sectors of the electrical industry.		
4. State the tasks typically performed by an electrician.		
5. Explain the responsibilities and aptitudes of an electrician.	RST 11-12.2	
Module 26102-08 – Electrical Safety		
1. Recognize safe working practices in the construction environment.		
2. Explain the purpose of OSHA and how it promotes safety on the job.	RST 11-12.2	
3. Identify electrical hazards and how to avoid or minimize them in the workplace.	RST 11-12.8	Set up various hazards in the lab and have the students identify the hazard and hypothesize the outcome.
4. Explain safety issues concerning lockout/tagout procedures, confined space entry, respiratory protection, and fall protection systems.	RST 11-12.7	The students must explain LO/TO procedures from an initiator point of view.
5. Develop a task plan and a hazard assessment for a given task and select the appropriate PPE and work methods to safely perform the task.	S-ID 9, S-IC 6, S-MD 7, RST 11-12.9	Show industry collected data helps in the development of safety procedures.

Construction Standards	Common Core Standards	Explanation
Performance Tasks		
1. Perform a visual inspection on various types of ladders.		
2. Set up a ladder properly to perform a task.	F-IF 2, F-IF4, F-BF 1, F-LE 1, F-LE 5	Extension ladder ratio.
4. Perform a hazard assessment of a job such as replacing the lights in your classroom. • Discuss the work to be performed and the hazards involved. • Locate the closest phone to the work site and ensure that the local emergency telephone numbers are either posted at the phone or known by you and your partner(s). • Plan an escape route from the location in the event of an accident.	RST 11-12.3	
Module 26103-08 – Introduction To Electrical Circuits		
1. Define voltage and identify the ways in which it can be produced.		
2. Explain the difference between conductors and insulators.		
3. Define the units of measurement that are used to measure the properties of electricity.	N-Q 1, N-Q 2, N-Q 3, A-CED 4	
4. Identify the meters used to measure voltage, current, and resistance.	N-Q 1, N-Q 2, N-Q 3	
5. Explain the basic characteristics of series and parallel circuits.	G-GMD 4, G-MG 1	
Module 26104-08 – Electrical Theory		
1. Explain the basic characteristics of combination circuits.		
4. Using Ohm's law, find the unknown parameters in series, parallel, and series-parallel circuits.	N-Q 1, N-Q 2, N-Q 3, A-SSE 1, A-CED 4, A-REI 1	

Construction Standards	Common Core Standards	Explanation
Module 26105-08 – Introduction To The National Electrical Code®		
1. Explain the purpose and history of the NEC®.	RI 11-12.1	
2. Describe the layout of the NEC®.	RI 11-12.4	Draw or write a diagram that lays out the Chapter, article, Parts, and sub-parts of a given code rule. Each student will randomly draw a code rule.
3. Demonstrate how to navigate the NEC®.	RI 11-12.5	
4. Describe the purpose of the National Electrical Manufacturers Association and the NFPA.	RI 11-12.6	In your own words describe the function of these organizations NEMA, NFPA, NECA, IBEW, and IEC.
5. Explain the role of nationally recognized testing laboratories.	RI 11-12.8	What is UL?
Performance Tasks		
1. Use NEC Article 90 to determine the scope of the NEC®. State what is covered by the NEC® and what is not.	RI 11-12.1	
2. Find the definition of the term feeder in the NEC®.	RI 11-12.3	
3. Look up the NEC® specifications that you would need to follow if you were installing an outlet near a swimming pool.	RI 11-12.4	
4. Find the minimum wire bending space for two 1/0 AWG conductors installed in a junction box or cabinet and entering opposite the terminal.	G-MG 1, G-MG 2, G-MG 3, N-Q 1, N-Q 2, N-Q 3, RI 11-12.5	

Construction Standards	Common Core Standards	Explanation
Module 26106-08 – Device Boxes		
1. Describe the different types of nonmetallic and metallic boxes.		
2. Calculate the NEC® fill requirements for boxes under 100 cubic inches.	N-Q 1, N-Q 2, N-Q 3, A-CED 1, A-CED 2, A-CED 3, A-CED 4, F-IF 1, F-IF 4, F-IF 5, F-IF 6	
3. Identify the appropriate box type and size for a given application.	N-Q 1, N-Q 2, N-Q 3, F-IF 1, F-IF 2, F-IF 4, F-IF 5, F-IF 6	
4. Select and demonstrate the appropriate method for mounting a given box.	RST 11-12.3	
Performance Tasks		
1. Identify the appropriate box type and size for a given application.		
2. Select the minimum size pull or junction box for the following applications: • Conduit entering and exiting for a straight pull • Conduit entering and exiting at an angle	N-Q 1, N-Q 2, N-Q 3, A-CED 1, A-CED 2, A-CED 3, A-CED 4, F-IF 1, F-IF 4, F-IF 5, F-IF 6	
Module 26107-08 – Hand Bending®		
1. Identify the methods for hand bending and installing conduit.	RST 11-12.4	Identify the marks/symbols and their uses on a hand bender.
2. Determine conduit bends.	N-Q 1, N-Q 2, N-Q 3, G-C 2, G-C 5, G-GMD 4, G-GM 1, G-GM 3	
3. Make 90-degree bends, back-to-back bends, offsets, kicks, and saddle bends using a hand bender.	N-Q 1, N-Q 2, N-Q 3, G-C 2, G-C 5, G-GMD 4, G-GM 1, 3RST 11-12.3	
4. Cut, ream, and thread conduit.	N-Q 1, N-Q 2, N-Q 3	
Performance Tasks		
1. Make 90-degree bends, back-to-back bends, offsets, kicks, and saddle bends using a hand bender.	RST 11-12.3	
2. Cut, ream, and thread conduit.		

Construction Standards	Common Core Standards	Explanation
Module 26108-08 – Raceways and Fittings		
1. Identify and select various types and sizes of raceways and fittings for a given application.	N-Q 1, N-Q 2, N-Q 3, G-GMD 4, G-GM 1, G-GM 3	
2. Identify various methods used to fabricate (join) and install raceway systems.	G-GMD 4, G-GM 1, G-GM 3	
3. Identify uses permitted for selected raceways.		
4. Demonstrate how to install a flexible raceway system.		
5. Terminate a selected raceway system.		
6. Identify the appropriate conduit body for a given application.		
Performance Tasks		
1. Identify and select various types and sizes of raceways, fittings, and fasteners for a given application.		
2. Demonstrate how to install a flexible raceway system.		
3. Terminate a selected raceway system.		
4. Identify the appropriate conduit body for a given application.		
Module 26109-08 – Conductors and Cables		
1. From the cable markings, describe the insulation and jacket material, conductor size and type, number of conductors, temperature rating, voltage rating, and permitted uses.	S-IC 6	
2. Determine the allowable ampacity of a conductor for a given application.	N-Q 1, N-Q 2, N-Q 3, S-IC 6	
3. Identify the NEC® requirements for color coding of conductors.	F-IF 1, RST 11-12.9	Identify the use of a conductor based only on its color Could reinforce a function concept here about mapping relationships.
4. Install conductors in a raceway system.	RST 11-12.3	

Construction Standards	Common Core Standards	Explanation
Performance Tasks		
1. Install conductors in a raceway system.		
Module 26110-08 – Basic Electrical Construction Drawings		
1. Explain the basic layout of a set of construction drawings.	N-Q 1, N-Q 2, N-Q 3, G-CO 2, G-CO 3, G-CO 5, G-CO 6, G-SRT 2, G-SRT 5, G-SRT 8, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
2. Describe the information included in the title block of a construction drawing.	N-Q 1, N-Q 2, N-Q 3, RST 11-12.4	Interpret the information on the title block.
3. Identify the types of lines used on construction drawings.	G-GMD 4, G-MG 1	
4. Using an architect's scale, state the actual dimensions of a given drawing component.	N-Q 1, N-Q 2, N-Q 3	
5. Interpret electrical drawings, including site plans, floor plans, and detail drawings.	N-Q 1, N-Q 2, N-Q 3, G-CO 2, G-CO 3, G-CO 5, G-CO 6, G-SRT 2, G-SRT 5, G-SRT 8, G-GMD 4, G-MG 1, G-MG 2, G-MG 3, RST 11-12.4	Decipher the meanings of the various symbols.
6. Interpret equipment schedules found on electrical drawings.	G-GMD 4	
7. Describe the type of information included in electrical specifications.	RST 11-12.4	Locate the spec sheet in a commercial blueprint.
Performance Tasks		
1. Using an architect's scale, state the actual dimensions of a given drawing component.	N-Q 1, N-Q 2, N-Q 3	
2. Make a material takeoff of the lighting fixtures specified in Performance Profile Sheet 2 using the drawing provided on Performance Profile Sheet 3. The takeoff requires that all lighting fixtures be counted, and where applicable, the total number of lamps for each fixture type must be calculated.	A-CED 1, A-REI 1, F-IF 1, F-IF 2, F-IF 3, F-IF 4, F-IF 5, F-IF 6, F-BF 1, F-BF 2, F-LE 1b, F-LE 2, F-LE 5, RST 11-12.9	

Construction Standards	Common Core Standards	Explanation
Module 26111-08 – Residential Electrical Services		
1. Explain the role of the National Electrical Code® in residential wiring and describe how to determine electric service requirements for dwellings.	S-ID 9, S-IC 6, S-MD 7, RST 11-12.3	Locate the section in the NEC that carries the rules for residential electrical services.
2. Explain the grounding requirements of a residential electric service.	RST 11-12.2	
3. Calculate and select service-entrance equipment.	N-Q 1, N-Q 2, N-Q 3, G-GMD 4, G-MG 1, G-MG 2, G-MG 3, A-CED 1, A-REI 1, F-IF 1, F-IF 2, F-IF 3, F-IF 4, F-IF 5, F-IF 6, F-BF 1, F-BF 2, F-LE 1b, F-LE 2, F-LE 5	
4. Select the proper wiring methods for various types of residences.		
5. Compute branch circuit loads and explain their installation requirements.	N-Q 1, N-Q 2, N-Q 3, G-GMD 4, G-MG 1, G-MG 2, G-MG 3, A-CED 1, A-REI 1, F-IF 1, F-IF 2, F-IF 3, F-IF 4, F-IF 5, F-IF 6, F-BF 1, F-BF 2, F-LE 1b, F-LE 2, F-LE 5	
6. Explain the types and purposes of equipment grounding conductors.		
7. Explain the purpose of ground fault circuit interrupters and tell where they must be installed.	RST 11-12.2	
8. Size outlet boxes and select the proper type for different wiring methods.	N-Q 1, N-Q 2, N-Q 3, A-CED 1, A-CED 2, A-CED 3, A-CED 4, F-IF 1, F-IF 4, F-IF 5, F-IF 6, RST 11-12.4	
9. Describe rules for installing electric space heating and HVAC equipment.	RST 11-12.2	
10. Describe the installation rules for electrical systems around swimming pools, spas, and hot tubs.	RST 11-12.2	
11. Explain how wiring devices are selected and installed.	RST 11-12.2	
12. Describe the installation and control of lighting fixtures.	RST 11-12.2	

Construction Standards	Common Core Standards	Explanation
Performance Tasks		
1. For a residential dwelling of a given size, and equipped with a given list of major appliances, demonstrate or explain how to: • Compute the lighting, small appliance, and laundry loads. • Compute the loads for large appliances. • Determine the number of branch circuits required. • Size and select the service-entrance equipment (conductors, panelboard, and protective devices).	N-Q 1, N-Q 2, N-Q 3, G-GMD 4, G-MG 1, G-MG 2, G-MG 3, A-CED 1, A-REI 1, F-IF 1, F-IF 2, F-IF 3, F-IF 4, F-IF 5, F-IF 6, F-BF 1, F-BF 2, F-LE 1b, F-LE 2, F-LE 5	Calculate the load for your individual house.
2. Using an unlabeled diagram of a panelboard (Performance Profile Sheet 3), label the lettered components.	RST 11-12.4	
3. Select the proper type and size outlet box needed for a given set of wiring conditions.	N-Q 1, N-Q 2, N-Q 3, A-CED 1, A-CED 2, A-CED 3, A-CED 4, F-IF 1, F-IF 4, F-IF 5, F-IF 6	
Module 26112-08 – Electrical Test Equipment		
1. Explain the operation of and describe the following pieces of test equipment: • Voltmeter • Ohmmeter • Clamp-on ammeter • Multimeter • Motor and phase rotation testers	RST 11-12.2 N-Q 1, N-Q 2, N-Q 3	
2. Select the appropriate meter for a given work environment based on category ratings.	N-Q 1, N-Q 2, N-Q 3, RST 11-12.9	From a randomly drawn scenario choose the correct meter for the job.
3. Identify the safety hazards associated with various types of test equipment.		
Performance Tasks		
1. Under instructor supervision, measure the voltage in your classroom from line to neutral and neutral to ground.	N-Q 1, N-Q 2, N-Q 3, RST 11-12.3	

Construction Standards	Common Core Standards	Explanation
2. Under instructor supervision, use an ohmmeter to measure the value of various resistors.	N-Q 1, N-Q 2, N-Q 3, RST 11-12.3	
Module 26202-08 – Motors: Theory and Application		
5. Explain how the direction of a three-phase motor is changed.	S-ID 9, S-IC 6, RST 11-12.2	
9. Describe the methods for determining various motor connections.	S-ID 9, S-IC 6, RST 11-12.2	
Performance Tasks		
1. Collect data from a motor nameplate.	S-ID 9, S-IC 6, RST 11-12.4	
2. Identify various types of motors and their application(s).		
Module 26203-08 – Electric Lighting		
1. Describe the characteristics of light.		
2. Recognize the different kinds of lamps and explain the advantages and disadvantages of each type: • Incandescent • Halogen • Fluorescent • High-intensity discharge (HID)	RST 11-12.9	
3. Properly select and install various lamps in lighting fixtures.		Could reinforce a function concept here about mapping relationships.
4. Recognize and describe the installation requirements for various types of lighting fixtures: • Surface-mounted • Recessed • Suspended • Track-mounted	RST 11-12.9	
5. Recognize ballasts and describe their use in fluorescent and HID lighting fixtures.		

Construction Standards	Common Core Standards	Explanation
6. Explain the relationship of Kelvin temperature to the color of light produced by a lamp.	F-IF 1, F-IF 4, F-IF 5, F-IF 6, F-LE 1, F-LE 2, F-LE 5, RST 11-12.2	
7. Recognize basic occupancy sensors, photoelectric sensors, and timers used to control lighting circuits and describe how each device operates.		
Performance Tasks		
1. Read and interpret information given in lamp manufacturers'catalogs for one or more selected lamps.		
2. Properly select and install lamps into lighting fixtures.		
3. Install one or more of the following lighting fixtures and their associated lamps: • Surface-mounted • Recessed • Suspended • Track-mounted	RST 11-12.3	
Module 26204-08 – Conduit Bending		
1. Describe the process of conduit bending using power tools.	RST 11-12.2	
2. Identify all parts of electric and hydraulic benders.		
3. Bend offsets, kicks, saddles, segmented, and parallel bends.	N-Q 1, N-Q 2, N-Q 3, G-CO 1, G-CO 2, G-CO 4, G-CO 5, G-CO 6, G-CO 12, G-C 2, G-C 4, G-C 5, G-GPE 6, G-GMD 4, G-GM 1, G-GM 3	
4. Explain the requirements of the National Electrical Code® (NEC®) for bending conduit.	RST 11-12.2	
5. Compute the radius, degrees in bend, developed length, and gain for conduit up to six inches.	N-Q 1, N-Q 2, N-Q 3, G-CO 1, G-CO 2, G-CO 4, G-CO 5, G-CO 6, 12, G-C 2, G-C 4, G-C 5, G-GPE 6, G-GMD 4, G-GM 1, G-GM 3	

Construction Standards	Common Core Standards	Explanation
Performance Tasks		
1. Use an electric or hydraulic bender to bend a conduit stub-up to an exact distance of 151⁄4" above the deck.	N-Q 1, N-Q 2, N-Q 3, G-CO 1, G-CO 2, G-CO 4, G-CO 5, G-CO 6, G-CO 12, G-C 2, G-C 4, G-C 5, G-GPE 6, G-GMD 4, G-GM 1, G-GM 3, RST 11-12.3	
2. Make an offset in a length of conduit to miss a 10" high obstruction with a clearance between the obstruction and the conduit of not less than 1" nor more than 11⁄2".	N-Q 1, N-Q 2, N-Q 3, G-CO 1, G-CO 2, G-CO 4, G-CO 5, G-CO 6, G-CO 12, G-C 2, G-C 4, G-C 5, G-GPE 6, G-GMD 4, G-GM 1, G-GM 3, RST 11-12.3	
3. Make a saddle in a length of conduit to cross an 8" pipe with 1" clearance between the pipe and the conduit.	N-Q 1, N-Q 2, N-Q 3, G-CO 1, G-CO 2, G-CO 4, G-CO 5, G-CO 6, G-CO 12, G-C 2, G-C 4, G-C 5, G-GPE 6, G-GMD 4, G-GM 1, G-GM 3, RST 11-12.3	
Module 26205-08 – Pull and Junction Boxes		
1. Describe the different types of nonmetallic and metallic pull and junction boxes.		
2. Properly select, install, and support pull and junction boxes and their associated fittings.	N-Q 1, N-Q 2, N-Q 3, A-CED 1, A-CED 4, F-IF 1, F-IF 2, F-IF 4, F-IF 5, F-IF 6, RST 11-12.9	
3. Describe the National Electrical Code® (NEC®) regulations governing pull and junction boxes.	S-IC 6, SL 11-12.4	
4. Size pull and junction boxes for various applications.	N-Q 1, N-Q 2, N-Q 3, A-CED 1, A-CED 2, A-CED 3, A-CED 4, F-IF 1, F-IF 2, F-IF 4, F-IF 5, F-IF 6	
5. Understand the NEMA and IP classifications for pull and junction boxes.		
6. Describe the purpose of conduit bodies and Type FS boxes.	SL 11-12.4	

Construction Standards	Common Core Standards	Explanation
Performance Tasks		
1. Identify various NEMA boxes.		
2. Properly select, install, and support pull and junction boxes over 100 cubic inches in size.	N-Q 1, N-Q 2, N-Q 3, A-CED 1, A-CED 2, A-CED 3, A-CED 4, F-IF 1, F-IF 2, F-IF 4, F-IF 5, F-IF 6	
3. Identify various conduit bodies and fittings.		
Module 26206-08 – Conductor Installations		
1. Explain the importance of communication during a cable-pulling operation.	RST 11-12.2	
2. Plan and set up for a cable pull.		
3. Set up reel stands and spindles for a wire-pulling installation.		
4. Explain how mandrels, swabs, and brushes are used to prepare conduit for conductors.	SL 11-12.4	
5. Properly install a pull line for a cable-pulling operation.		
6. Explain how and when to support conductors in vertical conduit runs.	RST 11-12.2	
7. Describe the installation of cables in cable trays.		
8. Calculate the probable stress or tension in cable pulls.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, S-ID 9, S-IC 6, S-MD 7, A-CED 1, A-CED 4, A-REI 1, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
Performance Tasks		
1. Prepare multiple conductors for pulling in a raceway system.		
2. Prepare multiple conductors for pulling using a wire-pulling basket.		

Construction Standards	Common Core Standards	Explanation
Module 26208-08 – Conductor Terminations and Splices		
1. Describe how to make a good conductor termination.	S-ID 9, S-MD 7, RST 11-12.2	
2. Prepare cable ends for terminations and splices and connect using lugs or connectors.	RST 11-12.4	
3. Train cable at termination points.		
4. Understand the National Electrical Code® (NEC®) requirements for making cable terminations and splices.		
5. Demonstrate crimping techniques.		
6. Select the proper lug or connector for the job.		
Module 26209-08 – Grounding and Bonding		
1. Explain the purpose of grounding and bonding and the scope of NEC Article 250.	RST 11-12.2	
2. Distinguish between a short circuit and a ground fault.		
3. Define the National Electrical Code® requirements related to bonding and grounding.		
4. Distinguish between grounded systems and equipment grounding.		
6. Explain the function of the grounding electrode system and determine the grounding electrodes to be used.	RST 11-12.2	
8. Use NEC Table 250.122 to size the equipment grounding conductor for raceways and equipment.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, S-IC 6	
9. Explain the function of the main and system bonding jumpers in the grounding system and size the main and system bonding jumpers for various applications.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, S-IC 6, S-MD 7, RST 11-12.2	
10. Size the main bonding jumper for a service utilizing multiple service disconnecting means.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, S-IC 6, S-MD 7, A-CED 1, A-REI 1	
11. Explain the importance of bonding equipment in clearing ground faults in a system.	RST 11-12.2	

Construction Standards	Common Core Standards	Explanation
12. Explain the purposes of the grounded conductor (neutral) in the operation of overcurrent devices.	RST 11-12.2	
Performance Tasks		
1. Using the proper fittings, connect one end of a No. 4 AWG bare copper grounding wire to a length of 3⁄4" galvanized water pipe and the other end to the correct terminal in a main panelboard.	N-Q 1, N-Q 2, N-Q 3	
2. Install two lengths of Type NM cable in a switch box using Type NM cable clamps: • Strip the ends of the cable to conform with NEC® requirements. • Secure the cable in the switch box and tighten the cable clamps. • Connect and secure the equipment grounding conductors according to NEC® requirements, and secure to the switch box with either a ground clip or a grounding screw.	N-Q 1, N-Q 2, N-Q 3, RST 11-12.3	
3. Size the minimum required grounding electrode conductor for a 200A service fed by 3/0 copper.	N-Q 1, N-Q 2, N-Q 3, F-IF 4	
4. Size the minimum required equipment grounding conductor in each conduit for a 400A feeder gap using two parallel runs of 3/0 copper.	N-Q 1, N-Q 2, N-Q 3, F-IF 4	
5. Size the minimum required bonding jumper for a copper water pipe near a separately derived system (transformer) where the secondary conductors are 500 kcmil copper.	N-Q 1, N-Q 2, N-Q 3, F-IF 4	

Construction Standards	Common Core Standards	Explanation
Module 26210-08 – Circuit Breakers and Fuses		
1. Explain the necessity of overcurrent protection devices in electrical circuits.	RST 11-12.2	
2. Define the terms associated with fuses and circuit breakers.		
3. Describe the operation of a circuit breaker.	RST 11-12.2	
4. Apply the National Electrical Code® (NEC®) requirements for overcurrent devices.	N-Q 1, N-Q 2, N-Q 3, F-IF 4	
5. Describe the operation of single-element and time-delay fuses.		
Performance Tasks		
1. Identify the following on one or more circuit breaker(s) and fuse(s): • Number of poles • Load rating • Voltage rating • Amperage interrupting rating	RST 11-12.4 N-Q 1-3	

Construction Standards	Common Core Standards	Explanation
Module 26211-08 – Control Systems and Fundamental Concepts		
1. Describe the operating principles of contactors and relays.		
2. Select contactors and relays for use in specific electrical systems.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, S-ID 9, S-IC 6, S-MD 7, A-CED 1, A-REI 1, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
3. Explain how mechanical contactors operate.		
4. Explain how solid-state contactors operate.		
5. Install contactors and relays according to the NEC® requirements.		
6. Select and install contactors and relays for lighting control.		
7. Read wiring diagrams involving contactors and relays.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, S-ID 9, S-IC 6, S-MD 7, A-CED 1, A-REI 1, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
8. Describe how overload relays operate.		
9. Connect a simple control circuit.		
10. Test control circuits.		

Construction Standards	Common Core Standards	Explanation
Module 26301-08 – Load Calculations– Branch and Feeder Circuits		
1. Calculate loads for single-phase and three-phase branch circuits.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, S-IC 6, S-MD 7, A-CED 1, A-REI 1, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
2. Size branch circuit overcurrent protection devices (circuit breakers and fuses) for noncontinuous duty and continuous duty circuits.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, S-IC 6, S-MD 7, A-CED 1, A-REI 1, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
3. Apply derating factors to size branch circuits.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, S-IC 6, S-MD 7, A-CED 1, A-REI 1	
4. Calculate ampacity for single-phase and three-phase loads.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, S-IC 6, S-MD 7, A-CED 1, A-CED 2, A-CED 3, A-CED 4, A-REI 1	
5. Use load calculations to determine branch circuit conductor sizes.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, S-IC 6, S-MD 7, A-CED 1, A-REI 1	
6. Use NEC Table 220.55 to calculate residential cooking equipment loads.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, S-IC 6, S-MD 7, A-CED 1, A-REI 1	
7. Select branch circuit conductors and overcurrent protection devices for electric heat, air conditioning equipment, motors, and welders.		

Construction Standards	Common Core Standards	Explanation
Module 26302-08 – Conductor Selection and Calculations		
1. Select electrical conductors for specific applications.		
2. Calculate voltage drop in both single-phase and three-phase applications.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, S-ID 9, S-IC 6, S-MD 7, A-CED 1, A-REI 1, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
3. Apply National Electrical Code® (NEC®) regulations governing conductors to a specific application.	N-Q 1-3, F-IF 4, , S-ID 9, S-IC 6, S-MD 7, A-CED 1, A-REI 1, G-GMD 4, G-MG 1-3	
4. Calculate and apply NEC® tap rules to a specific application.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, S-ID 9, S-IC 6, S-MD 7, A-CED 1, A-REI 1, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
5. Size conductors for the load.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, S-ID 9, S-IC 6, S-MD 7, A-CED 1, A-REI 1, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
6. Derate conductors for fill, temperature, and voltage drop.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, S-ID 9, S-IC 6, S-MD 7, A-CED 1, A-REI 1, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
7. Select conductors for various temperature ranges and atmospheres.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, S-ID 9, S-IC 6, S-MD 7, A-CED 1, A-REI 1, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	

Construction Standards	Common Core Standards	Explanation
Module 26303-08 – Practical Applications of Lighting		
1. Explain how the lighting terms lumen, candlepower, and footcandle relate to one another.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, F-LE 5, S-IC 6, A-CED 1-4, A-REI 1, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
2. Classify lighting fixtures by type and application.		
3. Identify the general lighting pattern produced by each type of fixture.	G-CO 2, G-SRT 1, G-SRT 2, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
4. Identify the lighting requirements associated with lighting systems used in selected applications such as office buildings, schools, theaters, hazardous areas, etc.		
5. Identify various dimming systems and their components.		
6. Use manufacturers' lighting fixture catalogs to select the appropriate lighting fixtures for specific lighting applications.		Could reinforce a function concept here about mapping relationships.
Performance Tasks		
1. Using manufacturers' catalogs, select the appropriate lighting fixtures for specific lighting situations.		
2. While touring selected structures to observe their lighting systems: • Identify the various types of lighting fixtures used. • Explain the specific purpose(s) served by the different fixtures. • Identify the lighting system class of service.		
Module 26304-08 – Hazardous Locations		
1. Define the various classifications of hazardous locations.		
2. Describe the wiring methods permitted for branch circuits and feeders in specific hazardous locations.	RST 11-12.2	

Construction Standards	Common Core Standards	Explanation
Performance Tasks		
1. Using two rigid metal conduit nipples, a sealing fitting, three pieces of No. 12 THHN conductors, and a packing fiber/sealing kit, perform the following operations: • Secure one conduit nipple in each end of the seal. • Make sure the required number of threads are engaged. • Pull the three THHN conductors through the nipples and seal so that about 6" is protruding from each nipple. • Pack the fiber following the instructions furnished with the sealing kit. • Mix the sealing compound. • Position the unit in the required location and pour in the sealing compound.	RST 11-12.3	
Module 26305-08 – Overcurrent Protection		
1. Apply the key National Electrical Code® (NEC®) requirements regarding overcurrent protection.		
2. Check specific applications for conformance to NEC® sections that cover short circuit current, fault currents, interrupting ratings, and other sections relating to overcurrent protection.		
4. Select and size overcurrent protection for specific applications.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, S-ID 9, S-IC 6, S-MD 7, A-CED 1, A-REI 1, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	

Construction Standards	Common Core Standards	Explanation
Module 26309-08 – Motor Calculations		
1. Size branch circuits and feeders for electric motors.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, S-ID 9, S-IC 6, S-MD 7, A-CED 1, A-REI 1, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
2. Size and select overcurrent protective devices for motors.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, S-ID 9, S-IC 6, S-MD 7, A-CED 1, A-REI 1, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
Module 26401-08 – Load Calculations – Feeders and Services		
1. Size feeders and services in accordance with National Electrical Code® (NEC®) requirements.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, S-ID 9, S-IC 6, S-MD 7, A-CED 1, A-REI 1, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
2. Calculate loads and ampacities for single-phase and three-phase feeders.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, S-ID 9, S-IC 6, S-MD 7, A-CED 1, A-REI 1, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
Module 26413-08 – Introductory Skills for the Crewleader		
Chapter One		
1. Discuss the growth and economic conditions of the construction industry.	SL 11-12.4	Research and present findings on emerging markets in the electrical field
2. Describe how workers' values have changed over the years.	SL 11-12.4	
3. Explain the importance of training for construction industry personnel.	RST 11-12.2	
4. List the new technologies available, and discuss how they are helpful to the construction industry.		
5. Identify the gender and minority issues associated with a changing workforce.	SL 11-12.4	
6. Describe what employers can do to prevent workplace discrimination.	RST 11-12.2	
7. Differentiate between formal and informal organizations.	RST 11-12.9	

Construction Standards	Common Core Standards	Explanation
8. Describe the difference between authority and responsibility.		
9. Explain the purpose of job descriptions and what they should include.	RST 11-12.2	
10. Distinguish between company policies and procedures.		
Chapter Two		
1. Explain the role of a crew leader.	RST 11-12.2	
2. List the characteristics of effective leaders.		
3. Be able to discuss the importance of ethics in a supervisor's role.	SL 11-12.4	
4. Identify the three styles of leadership.		
5. Describe the forms of communication.	SL 11-12.4	
6. Explain the four parts of verbal communication.	RST 11-12.2	
7. Demonstrate the importance of active listening.		
8. Illustrate how to overcome the barriers to communication.		
9. List some ways that supervisors can motivate their employees.		
10. Explain the importance of delegating and implementing policies and procedures.	RST 11-12.2	
11. Differentiate between problem solving and decision making.	RST 11-12.9	

Construction Standards	Common Core Standards	Explanation
Chapter Three		
1. Demonstrate an understanding of the importance of safety.		
2. Give examples of direct and indirect costs of workplace accidents.	SL 11-12.4	
3. Identify safety hazards of the construction industry.	RST 11-12.8	
4. Explain the purpose of the Occupational Safety and Health Act (OSHA).		
5. Discuss OSHA inspection programs.		
6. Identify the key points of a safety program.		
9. Explain the importance of having employees trained in first aid and Cardio-Pulmonary Resuscitation (CPR) on the job site.	SL 11-12.4	
Module 26501-09 – Managing Electrical Hazards		
1. Identify types of electrical hazards and locations, and explain related safety guidelines and terms.		
2. Recognize and explain hazard boundaries.		
3. Explain employer and employee responsibilities in recognizing and managing electrical hazards.	RST 11-12.8	
4. List common factors that lead to electrical incidents and explain the importance of using appropriate procedures and safe work practices.	RST 11-12.8	
5. Analyze the electrical hazards of a given task, plan the job, and complete an electrical work permit request.	RST 11-12.8	
6. Select, inspect, and maintain personal protective equipment (PPE) and test equipment used for electrical work.		
7. Explain how to create an electrically safe work condition.	SL 11-12.4	

Construction Standards	Common Core Standards	Explanation
Module 26303-08 – Practical Applications of Lighting		
1. Explain how the lighting terms lumen, candlepower, and footcandle relate to one another.	N-Q 1, N-Q 2, N-Q 3, F-IF 4, F-LE 5, S-IC 6, A-CED 1-4, A-REI 1, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
3. Identify the general lighting pattern produced by each type of fixture.	G-CO 2, G-SRT 1, G-SRT 2, G-GMD 4, G-MG 1, G-MG 2, G-MG 3	
4. Identify the lighting requirements associated with lighting systems used in selected applications such as office buildings, schools, theaters, hazardous areas, etc.		

Codes for Common Core English Language Arts and Literacy are:

L = Language

RI = Reading for Informational Text

RST = Reading for Literacy in Science and Technical Subjects

SL = Speaking and Listening

W = Writing

WHST = Writing for Literacy in History/Social Studies, Science, and Technical Subjects

Codes for Common Core Mathematics are:

A-SSE = Algebra: Seeing Structure in Expressions

A-CED = Algebra: Creating Equations

A-REI = Algebra: Reasoning with Equations and Inequalities

F-IF = Functions: Interpreting Functions

F-BF = Functions: Building Functions

F-LE = Functions: Linear, Quadratic, and Exponential Models

G-CO = Geometry: Congruence

G-SRT = Similarity, right Triangles, and Trigonometry

G-GMD = Geometry: Geometric Measurement and Dimension

G-MG = Geometry: Modeling with Geometry

N-RN = Number and Quantity: The Real Number System

N-Q = Number and Quantity: Quantities

N-VM = Number and Quantity: Vector and Matrix Quantities

S-ID = Statistics and Probability: Interpreting Categorical and Quantitative Data

S-IC = Statistics and Probability: Making Inferences and Justifying Conclusions

S-CP = Statistics and Probability: Conditional Probability and the Rules of Probability

S-MD = Statistics and Probability: Using Probability to Make Decisions

Standards Alignment: Common Core / HVAC

Construction Standards	Common Core Standards	Explanation
Module 03102-07 – Trade Mathematics This module explains how to solve problems involving the measurement of lines, area, volume, weights, angles, pressure, vacuum, and temperature. It also introduces scientific notation, powers, roots, and basic algebra and geometry.		
1. Identify similar units of measurement in both the inch-pound (English) and metric systems and state which units are larger.	A-CED 1, N-Q 1, N-Q 2, N-Q 3	
2. Convert measured values in the inch-pound system to equivalent metric values and vice versa.	A-CED 2, A-CED 4, N-Q 1, N-Q 2, N-Q 3, F-LE 1b	
3. Express numbers as powers of ten.	A-REI 1, N-Q 1, N-Q 2, N-Q 3	
4. Determine the powers and roots of numbers.	A-REI 1, A-REI 2, A-REI 4, N-RN 2	
5. Solve basic algebraic equations.	A-CED 1, A-REI 1, A-REI 2, A-REI 3	
6. Identify various geometric figures.	G-CO 1, G-GMD 4	
7. Use the Pythagorean theorem to make calculations involving right triangles.	G-SRT 8, G-SRT 9, A-CED 4, A-REI 2, A-REI 4	
8. Convert decimal feet to feet and inches and vice versa.	N-Q 1	
9. Calculate perimeter, area, and volume.	N-Q 1, N-Q 2, N-Q 3, G-C 2, G-GPE 7, G-GMD 3	
10. Convert temperature values between Celsius and Fahrenheit.	N-Q 1, N-Q 3, A-CED 4	

Construction Standards	Common Core Standards	Explanation
Module 03103-07 – Copper and Plastic Piping Practices This module covers the selection, preparation, joining, and support of plastic and copper piping and fittings.		
1. State the precautions that must be taken when installing refrigerant piping.	S-IC 6	
2. Select the right tubing for a job.		
3. Cut and bend copper tubing.		
4. Safely join tubing by using flare and compression fittings.		
5. Determine the kinds of hangers and supports needed for refrigerant piping.		
6. State the basic safety requirements for pressure-testing a system once it has been installed.	RST 11-12.3	
7. Identify types of plastic pipe and state their uses.		
8. Cut and join lengths of plastic pipe.		

Construction Standards	Common Core Standards	Explanation
Performance Tasks		
1. Correctly measure the diameter of copper tubing.	N-Q 3	
2. Cut and ream copper tubing using a tubing cutter.		
3. Correctly bend copper tubing using bending tools.		
4. Make a swage joint in a section of copper tubing.		
5. Make and join flare connections.		
6. Join two sections of tubing using a compression fitting.		
7. Cut and join two sections of plastic pipe using appropriate fittings.		
8. Identify correct types of copper pipe for given applications.	S-IC 6	
9. Identify copper pipe sizes and wall thicknesses.		
Module 03104-07 – Soldering and Brazing This module covers the tools, materials, and safety precautions and depicts step-by-step procedures for soldering and brazing piping.		
1. Assemble and operate the tools used for soldering.		
2. Prepare tubing and fittings for soldering.		
3. Identify the purposes and uses of solder and solder fluxes.	S-ID 9, S-IC 6	
4. Solder copper tubing and fittings.		
5. Assemble and operate the tools used for brazing.		
6. Preparing tubing and fittings for brazing.		
7. Identify the purposes and uses of filler metals and fluxes used for brazing.	S-ID 9, S-IC 6	
8. Braze copper tubing and fittings.		
9. Identify the inert gases that can be used safely to purge tubing when brazing.	S-ID 9, S-IC 6, S-MD 7	

Construction Standards	Common Core Standards	Explanation
Performance Tasks		
1. For both soldering and brazing: • Cut tubing to correct length. • Clean tubing and fittings. • Select and apply flux to tubing and fittings. • Assemble tubing and fittings.		
2. For soldering: • Assemble a propane torch. • Light and adjust a propane torch flame. • Select correct solder for the intended soldering job. • Heat joint to the right temperature and apply solder to fill a joint. • Clean and cool a soldered joint. —Solder a joint using butane. —Solder a joint using acetylene.		
3. For brazing: • Assemble an oxyacetylene torch, including selection of the proper size tip for the job. • Light and adjust an oxyacetylene torch flame. • Select correct filler metal rod for the intended brazing application. • After heating and brazing, clean and cool the brazed joint.		
4. Assemble and operate a pressure regulator system used with an inert gas to purge tubing for brazing.		
5. Assemble a brass-to-copper joint.		

Construction Standards	Common Core Standards	Explanation
Module 03106-07 – Basic Electricity This module covers basic power generation and distribution, electrical components, DC circuits, and electrical safety.		
1. State how electrical power is distributed.	SL 11-12.1a	
2. Describe how voltage, current, resistance, and power are related.	S 11-12.1a, N-Q 1, N-Q 2, N-Q 3, A-CED 4	
3. Use Ohm's law to calculate the current, voltage, and resistance in a circuit.	A-CED 4	
4. Use the power formula to calculate how much power is consumed by a circuit.	A-CED 4	
5. Describe the difference between series and parallel circuits and calculate loads in each.	SL 11-12.1a, A-CED 1, A-CED 2, A-CED 3, A-CED 4	
6. Describe the purpose and operation of the various electrical components used in HVAC equipment.	SL 11-12.1a	
7. State and demonstrate the safety precautions that must be followed when working on electrical equipment.	SL 11-12.1a, S-ID 9, S-IC 6	
8. Make voltage, current, and resistance measurements using electrical test equipment.	N-Q 1, N-Q 2, N-Q 3	
9. Read and interpret common electrical symbols.	RST 11-12.1, G-GMD 4	
Performance Tasks		
1. Use a multimeter to measure voltage.	N-Q 1, N-Q 2, N-Q 3	
2. Use a multimeter to measure current.	N-Q 1, N-Q 2, N-Q 3	
3. Use a multimeter to measure resistance.	N-Q 1, N-Q 2, N-Q 3	
4. Use a multimeter to check circuit continuity.	N-Q 1, N-Q 2, N-Q 3	
5. Assemble and test series and parallel circuits using a battery, wires, and selected load devices.	G-GPE 6, G-GMD 4, G-MG 2, G-MG 3	

Construction Standards	Common Core Standards	Explanation
Module 03107-07 – Introduction To Cooling This module covers the basic principles of heat transfer, refrigeration, and pressure-temperature relationships and describes the components and accessories used in air conditioned systems.		
1. Explain how heat transfer occurs in a cooling system, demonstrating an understanding of the terms and concepts used in the refrigeration cycle.	A-CED 1, A-CED 2, SL 11-12.1a	
2. Calculate the temperature and pressure relationships at key points in the refrigeration cycle.	A-CED 1, A-CED 2, F-IF 4, F-IF 5, F-IF 6, N-Q 1	Use charts, temperatures, and pressures to determine proper operating pressures.
3. Under supervision, use temperature- and pressure-measuring instruments to make readings at key points in the refrigeration cycle.	A-CED 1, A-CED 2, N-Q 1, N-Q 2, N-Q 3	
4. Identify commonly used refrigerants and demonstrate the proper procedures for handling these refrigerants.	S-ID 9, S-IC 6	
5. Identify the major components of a cooling system and explain how each type works.	S-ID 9, S-IC 6	
6. Identify the major accessories available for cooling systems and explain how each works.	S-ID 9, S-IC 6	
7. Identify the control devices used in cooling systems and explain how each works.	S-ID 9, S-IC 6	
8. State the correct methods to be used when piping a refrigeration system.	SL 11-12.1b	
Performance Tasks		
1. Measure temperatures in an operating air conditioning system.	N-Q 3	
2. Use cylinder color codes to identify refrigerants.		
3. Identify compressors, condensers, evaporators, metering devices, controls, and accessories.		
4. Use service valves to gain access to an air conditioning system in order to measure pressures using a gauge manifold set.	N-Q 3	

Construction Standards	Common Core Standards	Explanation
Module 03108-07 – Introduction To Heating This module covers heating fundamentals, types and designs of furnaces and their components, and basic procedures for installing and servicing furnaces.		
1. Explain the three methods by which heat is transferred and give an example of each.	SL 11-12.1c	
2. Describe how combustion occurs and identify the byproducts of combustion.	SL 11-12.1c	
3. Identify various types of fuels used in heating.		
4. Identify the major components and accessories of an induced draft and condensing gas furnace and explain the function of each component.	S-ID 9, S-IC 6	
5. State the factors that must be considered when installing a furnace.	SL 11-12.1c, S-ID 9, S-IC 6	
6. Identify the major components of a gas furnace and describe how each works.	SL 11-12.1c	
7. With supervision, use a manometer to measure and adjust manifold pressure on a gas furnace.	N-Q 1, N-Q 2, N-Q 3	
8. Describe how an electric furnace works.	RST 11-12.3	
9. With supervision, perform basic furnace preventive maintenance procedures such as cleaning and filter replacement.		
Performance Tasks		
1. Identify the components of an induced draft and condensing gas furnace and state their purpose.	S-ID 9, S-IC 6	
2. With supervision, turn on and check a gas furnace.	S-MD 7	
3. Identify symptoms of combustion problems in a gas furnace and adjust the manifold pressure.	S-ID 9, S-IC 6, S-MD 7	
4. With supervision, perform preventive maintenance procedures on a gas furnace, including filter replacement, cleaning of components, and temperature measurements.	N-Q 2, N-Q 3, S-ID 9, S-IC 6, S-MD 7	

Construction Standards	Common Core Standards	Explanation
Module 03202-07 – Chimneys, Vents, and Flues This module covers proper venting of fossil-fuel furnaces and the procedures for selecting and installing vents in all types of gas furnaces.		
1. Describe the principles of combustion and explain complete and incomplete combustion.	RST 11-12.1, S-ID 9, S-IC 6, S-MD 7	
2. Describe the content of flue gas and explain how it is vented.	RST 11-12.1	
3. Identify the components of a furnace vent system.		
4. Describe how to select and install a vent system.	RST 11-12.7, S-ID 9, S-IC 6, S-MD 7	
5. Perform the adjustments necessary to achieve proper combustion in a gas furnace.	S-ID 9, S-IC 6, S-MD 7, N-Q 1, N-Q 2, N-Q 3	
6. Describe the techniques for venting different types of furnaces.	RST 11-12.7	
7. Explain the various draft control devices used with natural-draft furnaces.	RST 11-12.7	
8. Calculate the size of a vent required for a given application.	S-ID 9, S-IC 6, S-MD 7, G-GPE 7, G-GMD 3, G-GMD 4, G-MG 1, G-MG 2, G-MG 3, A-CED 3, A-CED 4, A-REI 1	
9. Adjust a thermostat heat anticipator.		
Performance Tasks		
1. Measure supply and return temperature and determine the temperature rise of a furnace.	A-CED 1, N-Q 1, N-Q 2, N-Q 3	
2. Adjust a thermostat heat anticipator.		
3. Calculate the correct size and type of PVC pipe using manufacturer's instructions or *National Fuel Gas Code* or American Gas Association specifications.	S-ID 9, S-IC 6, S-MD 7, G-GPE 7, G-GMD 3, G-GMD 4, G-MG 1, G-MG 2, G-MG 3, A-CED 3, A-CED 4, A-REI 1	
4. Calculate the correct size and type of furnace vent connector and metal vent using manufacturer's instructions or *National Fuel Gas Code* or American Gas Association specifications.	S-ID 9, S-IC 6, S-MD 7, G-GPE 7, G-GMD 3, G-GMD 4, G-MG 1, G-MG 2, G-MG 3, A-CED 3, A-CED 4, A-REI 1	

Construction Standards	Common Core Standards	Explanation
Module 03205-07 – Leak Detection, Evacuation, Recovery, and Charging This module introduces the trainee to the leak detection, evacuation, recovery, and charging service procedures used to troubleshoot, repair, and/or maintain proper operation of the mechanical refrigeration systems.		
1. Identify the common types of leak detectors and explain how each is used.	S-ID 9, S-IC 6, S-MD 7	
2. Perform leak detection tests using selected methods.	S-ID 9, S-IC 6, S-MD 7	
3. Identify the service equipment used for evacuating a system and explain why each item of equipment is used.	S-ID 9, S-IC 6, S-MD 7	
4. Perform system evacuation and dehydration.		
5. Identify the service equipment used for recovering refrigerant from a system and for recycling the recovered refrigerant, and explain why each item of equipment is used.		
6. Perform a refrigerant recovery.		
7. Evacuate a system to a deep vacuum.		
8. Identify the service equipment used for charging refrigerant into a system, and explain why each item of equipment is used.	RST 11-12.7	
9. Use nitrogen to purge a system.		
10. Charge refrigerant into a system by the following methods: • Weight • Subcooling • Superheat • Charging pressure chart	F-LE 1b N-Q 1, N-Q 2, N-Q 3 F-IF 4, F-IF 5, F-IF 6	

Construction Standards	Common Core Standards	Explanation
Performance Tasks		
1. Identify the common types of leak detectors and explain the advantages and disadvantages associated with each type.	RST 11-12.3	
2. Use selected electronic, ultrasonic, liquid (bubble), and ultraviolet/fluorescent leak detectors to leak test a pressurized operational system.		
3. Under supervision, use a recovery and/or recovery/recycle unit to recover the refrigerant from a system.		
4. Under supervision, use a mixture of nitrogen and a trace amount of HCFC-22 refrigerant to pressurize a refrigerant system in preparation for leak testing.		
5. Under supervision, demonstrate and/or describe how to evacuate a system using the deep vacuum method.	RI 11-12.7	
6. Perform a vacuum leak test on an evacuated system.		
7. Under supervision, demonstrate how to evacuate a system using the triple evacuation method.		
8. Under supervision, demonstrate how to use dry nitrogen as the moisture-absorbing gas when triple evacuating a system.		
9. Under supervision, demonstrate how to charge a system by weight.		
10. Under supervision, demonstrate how to charge a system using the superheat method.		
11. Under supervision, demonstrate how to charge a system using the subcooling method.		
12. Under supervision, demonstrate how to charge a system using the charging pressure charts method.		

Construction Standards	Common Core Standards	Explanation
Module 03206-07 – Alternating Current This module introduces the trainee to the production, transmission, and uses of alternating current in the HVAC field.		
1. Describe the operation of various types of transformers.	RST 11-12.3	
2. Explain how alternating current is developed and draw a sine wave.	RST 11-12.3, F-TF 5	
3. Identify single-phase and three-phase wiring arrangements.	G-MG 1	
4. Explain how phase shift occurs in inductors and capacitors.	RST 11-12.3	
5. Describe the types of capacitors and their applications.	RST 11-12.3	
6. Explain the operation of single-phase and three-phase induction motors.	RST 11-12.3	
7. Identify the various types of single-phase motors and their applications.		
8. State and demonstrate the safety precautions that must be followed when working with electrical equipment.	RST 11-12.3, S-ID 9, S-IC 6, S-MD 7	
9. Test AC components, including capacitors, transformers, and motors.		
Performance Tasks		
1. Identify the components used in a given AC circuit and explain their functions.	RST 11-12.3	
2. Identify types of single-phase and three-phase power distribution systems from electrical circuit diagrams.	G-GMD 4, G-MG 1	
3. Following applicable safety practices, test AC components, including transformers, capacitors, and motor windings.	S-ID 9, S-IC 6, S-MD 7	
4. Identify various types of AC motors from schematic diagrams.	G-GMD 4, G-MG 1	

Construction Standards	Common Core Standards	Explanation
Module 03208-07 – Introduction To Control Circuit Troubleshooting This module covers the various types of thermostats used in HVAC systems. It also covers hydronic, pneumatic, and digital controls and introduces the trainee to control circuit analysis and troubleshooting.		
1. Explain the function of a thermostat in an HVAC system.	SL 11-12.1c	
2. Describe different types of thermostats and explain how they are used.	SL 11-12.1c	
3. Demonstrate the correct installation and adjustment of a thermostat.		
4. Explain the basic principles applicable to all control systems.	SL 11-12.1c	
5. Identify the various types of electromechanical, electronic, and pneumatic HVAC controls, and explain their function and operation.		
6. Describe a systematic approach for electrical troubleshooting of HVAC equipment and components.	RST11-12.3, S-ID 9, S-IC 6, S-MD 7	
7. Recognize and use equipment manufacturer's troubleshooting aids to troubleshoot HVAC equipment.	S-ID 9, S-IC 6, S-MD 7	
8. Demonstrate how to isolate electrical problems to faulty power distribution, load, or control circuits.	S-ID 9, S-IC 6, S-MD 7	
9. Identify the service instruments needed to troubleshoot HVAC electrical equipment.		
10. Make electrical troubleshooting checks and measurements on circuits and components common to all HVAC equipment.	N-Q 1, N-Q2, N-Q 3	
11. Isolate and correct malfunctions in a cooling system control circuit.	S-ID 9, S-IC 6, S-MD 7	

Construction Standards	Common Core Standards	Explanation
Performance Tasks		
1. Identify various types of thermostats and explain their operation and uses.	SL 11-12.1c	
2. Install a conventional 24V bimetal thermostat and hook it up using the standard coding system for thermostat wiring.		
3. Check and adjust a thermostat, including heat anticipator setting and indicator adjustment.		
4. Program an electronic programmable thermostat.		
5. Identify electrical, electronic, and pneumatic components and circuits, recognize their diagram symbols, and explain their functions.	G-GMD 4, G-MG 1	
6. Interpret control circuit diagrams.	G-GMD 4, G-MG 1	
7. Perform electrical tests and troubleshooting as follows: • Single- and three-phase input voltage measurements • Fuse and circuit breaker checks • Resistive and inductive load checks • Switch and contactor/relay checks • Control transformer checks	N-Q 1, N-Q 2, N-Q 3, S-ID 9, S-IC 6, S-MD 7	
8. Perform electrical tests and troubleshooting of compressor and fan motors as follows: • Start and run capacitor checks • Start relay and start thermistor checks • Open, shorted, and grounded winding check	S-ID 9, S-IC 6, S-MD 7	

Construction Standards	Common Core Standards	Explanation
Module 03209-07 – Troubleshooting Gas Heating This module introduces the trainee to the procedures for recognizing, analyzing, and repairing malfunctions in gas heating equipment.		
1. Describe the basic operating sequence for gas heating equipment.	RST 11-12.3	
2. Interpret control circuit diagrams for gas heating systems.	G-GMD 4, G-MG 1	
3. Describe the operation of various types of burner ignition methods.	RST 11-12.3	
4. Identify the tools and instruments used when troubleshooting gas heating systems.		
5. Demonstrate using the tools and instruments required for troubleshooting gas heating systems.		
6. Isolate and correct malfunctions in gas heating systems.	S-ID 9, S-IC 6, S-MD 7	
Performance Tasks		
1. Develop a checklist for troubleshooting a gas heating appliance.	F-IF 1, F-IF 3, F-IF 4	
2. Select the tools and instruments needed to troubleshoot a gas heating appliance in a given situation.	S-ID 9, S-IC 6, S-MD 7	
3. Analyze control circuit diagram(s) for a selected gas heating appliance.	G-GMD 4, G-MG 1	
4. Isolate and correct malfunctions in a gas heating appliance. • Control circuits • Combustion system • Safety controls • Air system	S-ID 9, S-IC 6, S-MD 7	

Construction Standards	Common Core Standards	Explanation
Module 03210-07 – Troubleshooting Cooling This module covers the troubleshooting methods used with cooling systems.		
1. Describe a systematic approach for troubleshooting cooling systems and components.	RST 11-12.3	
2. Isolate problems to electrical and/or mechanical functions in cooling systems.	S-ID 9, S-IC 6, S-MD 7	
3. Recognize and use equipment manufacturer's troubleshooting aids to troubleshoot cooling systems.	S-ID 9, S-IC 6, S-MD 7	
4. Identify and use the service instruments needed to troubleshoot cooling systems.		
5. Successfully troubleshoot selected problems in cooling equipment.	S-ID 9, S-IC 6, S-MD 7	
6. State the safety precautions associated with cooling troubleshooting.	RST 11-12.8	
Performance Tasks		
1. Develop a checklist for troubleshooting cooling systems.	F-IF 1, F-IF 3, F-IF 4	
2. Select the tools and instruments needed to troubleshoot a cooling system in a given situation.		
3. Analyze control circuit diagram(s) for a selected cooling system.	G-GMD 4, G-MG 1	
4. Isolate and correct malfunctions in a cooling appliance: • Electrical problems • Compressor electrical failures • System-related compressor problems • Refrigerant overcharge and undercharge • Evaporator and condenser problems • Metering device problems • Refrigerant lines and accessories • Noncondensibles and contamination	S-ID 9, S-IC 6, S-MD 7, N-Q 1, N-Q 2, N-Q 3	

Construction Standards	Common Core Standards	Explanation
Module 03211-07 – Heat Pumps This module introduces covers operation, installation, and control circuit analysis for heat pumps.		
1. Describe the principles of reverse-cycle heating.	RST 11-12.3	
2. Identify heat pumps by type and general classification.		
3. Describe various types of geothermal water loops and their application.	RST 11-12.3	
4. List the components of heat pump systems.		
5. Describe the role and basic operation of electric heat in common heat pump systems.	RST 11-12.3	
6. Describe common heat pump ratings, such as Coefficient of Performance (COP), Heating Season Performance Factor (HSPF), and Seasonal Energy Efficiency Ratio (SEER).	RST 11-12.3, A-SSE 1, F-IF 5, F-BF 1c, F-LE 5	
7. Demonstrate heat pump installation and service procedures.		
8. Identify and install refrigerant circuit accessories commonly associated with heat pumps.		
9. Analyze a heat pump control circuit.	G-GMD 4, G-MG 1	
10. Isolate and correct malfunctions in a heat pump.	S-ID 9, S-IC 6, S-MD 7	
Performance Tasks		
1. Identify components that are unique to heat pumps and explain the function of each.		
2. Calculate the balance point of a heat pump.	A-CED 1, A-CED 2, A-CED 3, A-CED 4, A-REI 1, A-REI 2, A-REI 3	
3. Simulate the installation procedures for a heat pump.		
4. Perform heat pump servicing procedures.		
5. Analyze a heat pump circuit diagram and perform simulated troubleshooting exercises.	G-GMD 4, G-MG 1, S-ID 9, S-IC 6, S-MD 7	

Construction Standards	Common Core Standards	Explanation
Module 03212-07 – Basic Installation And Maintenance Practices This module introduces the trainee to the basic mechanical procedures commonly performed in HVAC servicing work. Basic maintenance procedures, documentation, and customer relations are also covered.		
1. Identify, explain, and install threaded and non-threaded fasteners.		
2. Identify, explain, remove, and install types of gaskets, packings, and seals.		
3. Identify types of lubricants, and explain their uses.		
4. Use lubrication equipment to lubricate motor bearings.		
5. Identify the types of belt drives, explain their uses, and demonstrate procedures used to install or adjust them.		
6. Identify and explain types of couplings.		
7. Demonstrate procedures used to remove, install, and align couplings.		
8. Identify types of bearings, and explain their uses.		
9. Explain causes of bearing failures.	S-ID 9, S-IC 6, S-MD 7	
10. Demonstrate procedures used to remove and install bearings.		
11. Perform basic preventive maintenance inspection and cleaning procedures.		
12. List ways to develop and maintain good customer relations.		

Construction Standards	Common Core Standards	Explanation
Performance Tasks		
1. Identify different types of threaded fasteners.		
2. Identify non-threaded fasteners.		
3. Identify different types of gaskets.		
4. Identify mechanical seal parts.		
5. Install an oil seal.		
6. Align and properly adjust V-belts.	G-MG 3	
7. Identify different types of drive couplings.		
8. Tighten a four-bolt flange.		
9. Install an expandable anchor bolt.		
10. Identify different types of bearings.		
11. Recognize and use a manual bearing puller to remove a bearing.		
12. Recognize and use a feeler gauge to measure bearing clearances.		
13. Lubricate a bearing using a lever-type grease gun.		
14. Fill out typical forms used for installation and service calls.		

Construction Standards	Common Core Standards	Explanation
Module 03213-07 – Sheet Metal Duct Systems This module introduces sheet metal duct systems and explains how to lay out and install sheet metal and flexible ducts.		
1. Identify and describe the basic types of sheet metal.		
2. Define properties of steel and aluminum alloys.		
3. Describe a basic layout method and perform proper cutting.	G-CO 12, G-GMD 4, RST 11-12.3	
4. Join sheet metal duct sections using proper seams and connectors.	G-MG 3, G-GMD 4	Transitioning from square to round duct.
5. Describe proper hanging and support methods for sheet metal duct.	RST 11-12.3	
6. Describe thermal and acoustic insulation principles.	RST 11-12.3	
7. Select, apply, and seal the proper insulation for sheet metal ductwork.		
8. Describe guidelines for installing components such as registers, diffusers, grilles, dampers, access doors, and zoning accessories.	RST 11-12.3	
9. Install takeoffs and attach flexible duct to a sheet metal duct.		
Performance Tasks		
1. Join duct sections and fittings.		
2. Install takeoffs and attach flexible duct.		

Construction Standards	Common Core Standards	Explanation
Module 03301-08 – Refrigerants and Oils This module covers the refrigerants and oils commonly used in HVAC/R systems. It includes identification and classification of refrigerants, differences between pure and blended refrigerants, types and properties of oils, use and testing of oils, and refrigerant retrofits.		
1. Identify the refrigerants in common use and state the types of applications in which each is used.		
2. Explain the effects of releasing refrigerants into the atmosphere.	S-ID 9, S-IC 6	
3. Explain how refrigerants are classified by their chemical composition.		
4. Describe the color-coding scheme used to identify refrigerant cylinders.	RI 11-12.7, F-IF 1	
5. Describe how azeotropes and near-azeotropes differ from each other and from so-called pure refrigerants.	RST 11-12.3	
6. Interpret a P-T chart for an azeotrope refrigerant.	F-IF 4	
7. Calculate superheat and subcooling.	A-REI 1	
8. Demonstrate refrigerant leak detecting methods.		
9. Identify the different types of oils used in refrigeration systems and explain their relationships to the various refrigerants.		Could reinforce a function concept here about mapping relationships.
10. Explain how to add and remove oil from a system.		
11. Describe how to test oil for contamination.	RST 11-12.3	
12. Perform a refrigerant retrofit.		
Performance Tasks		
1. Interpret a P-T chart for an azeotrope refrigerant.		
2. Calculate superheat and subcooling.		
3. Perform a refrigerant leak detection procedure.		
4. Perform a refrigerant retrofit.		

Construction Standards	Common Core Standards	Explanation
Module 03302-08 – Compressors This module explains the operating principles of the different types of compressors used in comfort air conditioning systems and the basic installation service and repair procedures for these compressors.		
1. Identify the different types of compressors.		
2. Demonstrate or describe the mechanical operation for each type of compressor.		
3. Demonstrate or explain compressor lubrication methods.		
4. Demonstrate or explain methods used to control compressor capacity.		
5. Demonstrate or describe how compressor protection devices operate.		
6. Perform the common procedures used when field servicing open and semi-hermetic compressors, including: • Shaft seal removal and installation • Valve plate removal and installation • Unloader adjustment		
7. Demonstrate the procedures used to identify system problems that cause compressor failures.	S-ID 9, S-IC 6, S-MD 7	
8. Demonstrate the system checkout procedure performed following a compressor failure.		
9. Demonstrate or describe the procedures used to remove and install a compressor.		
10. Demonstrate or describe the procedures used to clean up a system after a compressor burnout.		

Construction Standards	Common Core Standards	Explanation
Performance Tasks		
1. Identify different types of compressor capacity controls.		
2. Identify protection devices commonly used with compressors.		
3. Under supervision, make electrical troubleshooting checks on single-phase and three-phase compressor motors.	S-ID 9, S-IC 6, S-MD 7	
4. Under supervision, use a sealed tube acid/moisture test kit to test a system for the presence of acid and/or moisture.	S-ID 9, S-IC 6, S-MD 7	
5. Under supervision, remove and install a hermetic compressor.		
6. Remove and install a valve plate assembly and head on a semi-hermetic compressor.		
7. Adjust the cylinder unloader on a semi-hermetic compressor.		
Module 03303-08 – Metering Devices This module covers operation and servicing of the various types of fixed-orifice and expansion valve metering devices used in refrigerant systems.		
1. Explain the function of metering devices.	RST 11-12.3	
2. Describe the operation of selected fixed-orifice and expansion valves.	RST 11-12.3	
3. Identify types of expansion valves.		
4. Describe problems associated with replacement of expansion valves.	RST 11-12.3, S-ID 9, S-IC 6, S-MD 7	
5. Describe the procedure for installing and adjusting selected expansion valves.	RST 11-12.3, S-ID 9, S-IC 6, S-MD 7	

Construction Standards	Common Core Standards	Explanation
Performance Tasks		
1. Identify various types of metering devices.		
2. Replace the orifice piston in a piston-type metering device.		
3. Use catalog data to select a replacement metering device.		
4. Install an externally equalized expansion valve, correctly placing the sensing bulb and equalizer tube.		
5. Calculate superheat and adjust an expansion valve to obtain the correct superheat.	A-REI 1	
Module 03311-08 – Troubleshooting Heat Pumps This module introduces the trainee to the procedures for recognizing, analyzing, and repairing malfunctions in heat pumps.		
1. Describe the basic operating sequence for an air-to-air heat pump.	RST 11-12.3	
2. Interpret control circuit diagrams for heat pumps.	RH 11-12.7, G-GMD 4, G-MG 1	
3. Develop a checklist for troubleshooting a heat pump.	F-IF 1, F-IF 3, F-IF 4	
4. Identify the tools and instruments used in troubleshooting heat pumps.		
5. Correctly use the tools and instruments required for troubleshooting heat pumps.		
6. Isolate and correct malfunctions in heat pumps.	S-ID 9, S-IC 6, S-MD 7	
7. Describe the safety precautions associated with servicing heat pumps.	RST 11-12.3	
Performance Tasks		
1. Develop a checklist for troubleshooting a heat pump.	F-IF 1, F-IF 3, F-IF 4	
2. Analyze control circuit diagram(s) for a selected heat pump.	G-GMD 4, G-MG 1	
3. Isolate and correct malfunctions in a heat pump using the correct tools and instruments: • Cooling function • Reverse cycle heating function • Defrost cycle • Auxiliary electric heat	S-ID 9, S-IC 6, S-MD 7	

Construction Standards	Common Core Standards	Explanation
Module 03407-09 – Heating And Cooling System Design This module identifies the factors that affect the heating and cooling loads of a building. It describes the process by which heating and cooling loads are calculated, and shows how load information is used to select heating and cooling equipment, including duct systems.		
1. Identify and describe the steps in the system design process.	G-MG 2, RST 11-12.3	
2. From construction drawings or an actual job site, obtain information needed to complete heating and cooling load estimates.	G-MG 2, S-IC 1, S-IC 4, S-MD 1, S-MD 2, S-MD 4, S-MD 5b, S-MD 7, G-GPE 7, G-GMD 3, G-GMD 4, G-MG 1, G-MG 2, G-MG 3, N-Q 1, N-Q 2, N-Q 3	
3. Identify the factors that affect heat gains and losses to a building and describe how these factors influence the design process.	G-MG 2, RST 11-12.3, S-ID 9	
4. With instructor supervision, complete a load estimate to determine the heating and/or cooling load of a building.	G-MG 2, G-GPE 7, G-GMD 3, G-GMD 4, G-MG 1, G-MG 2, G-MG 3, A-CED 1, A-CED 2, A-CED 3, A-CED 4, A-REI 1, A-REI 2, A-REI 3, F-IF 1, F-IF 4, F-IF 5, F-IF 6, N-Q 1, N-Q 2, N-Q 3	
5. State the principles that affect the selection of equipment to satisfy the calculated heating and/or cooling load.	G-MG.2, RST 11-12.8, S-IC 6	
6. With instructor supervision, select heating and/or cooling equipment using manufacturers' product data.	G-MG 2, S-IC 6	
7. Identify the various types of duct systems and explain why and where each type is used.	G-MG 2, RST 11-12.7	
8. Demonstrate the effect of fittings and transitions on duct system design.	G-MG 2	
9. Use a friction loss chart and duct sizing table to size duct.	G-MG 2, F-IF 4, G-GMD 4, G-MG 1, G-MG 2, G-MG 3, N-Q 1, N-Q 2, N-Q 3	
10. Install insulation and vapor barriers used in duct systems.		
11. Following proper design principles, select and install refrigerant and condensate piping.	G-MG 2	

Construction Standards	Common Core Standards	Explanation
12. Estimate the electrical load for a building and calculate the effect of the comfort system on the electrical load.	G.MG.2, G-GPE 7, G-GMD 3, G-GMD 4, G-MG 1, G-MG 3, A-CED 1, A-CED 2, A-CED 3, A-CED 4, A-REI 1, A-REI 2, A-REI 3, F-IF 1, F-IF 4, F-IF 5, F-IF 6, N-Q 1, N-Q 2, N-Q 3	
Performance Tasks		
1. Develop a list of factors that affect heating and cooling loads.	F-IF 1, F-IF 3	Could reinforce a function concept here about mapping relationships.
2. Develop a floor plan that contains all the information needed to perform a load estimate.		
3. Perform a load estimate using a standardized method.		
4. Use manufacturer's product data to select the appropriate heating and cooling equipment based on a load estimate and airflow requirements.		
5. Determine the number, location, and sizes of supply outlets and return inlets needed in a building.		
6. Use a friction chart and/or standard duct sizing tables to size the trunk and branch ducts for a selected low-volume air distribution system.		
7. Use a duct design calculator to size the trunk and branch ducts for a selected low-volume air distribution system.		
8. Calculate the total system friction loss (external static pressure) for a selected air distribution system.		

Construction Standards	Common Core Standards	Explanation
Module 03105-07 – Ferrous Metal Piping Practices This module covers various types of iron and steel pipe and fittings, and provides step-by-step instructions for cutting, threading, and joining ferrous piping.		
1. Identify the types of ferrous metal pipes.		
2. Measure the sizes of ferrous metal pipes.	N-Q 1, N-Q 2, N-Q 3	
3. Identify the common malleable iron fittings.		
4. Cut, ream, and thread ferrous metal pipe.		
5. Join lengths of threaded pipe together and install fittings.		
6. Describe the main points to consider when installing pipe runs.	RST 11-12.7	
7. Describe the methods used to join grooved piping.	RST 11-12.7	
Performance Tasks		
1. Identify types of carbon steel pipe.		
2. Identify pipe sizes and weights.	F-IF 4, F-IF 5, F-IF 6, F-BF 1, F-LE 1.b, F-LE 2, F-LE 5	
3. Identify various pipe fittings.		
4. Use five methods for measuring pipe.	N-Q 1, N-Q 2, N-Q 3	
5. Cut, ream, thread, and assemble steel pipe.		

Construction Standards	Common Core Standards	Explanation
Module 03109-07 – Air Distribution Systems This module describes air distribution systems and their components, air flow measurement, duct work installation principles, and the use of instruments for measuring temperature, humidity, pressure, and velocity.		
1. Describe the airflow and pressures in a basic forced-air distribution system.	RST 11-12.3	
2. Explain the differences between propeller and centrifugal fans and blowers.	WHST 11-12.2e	
3. Identify the various types of duct systems and explain why and where each type is used.	RST 11-12.3	
4. Demonstrate or explain the installation of metal, fiberboard, and flexible duct.	RST 11-12.3	
5. Demonstrate or explain the installation of fittings and transitions used in duct systems.	RST 11-12.3	
6. Demonstrate or explain the use and installation of diffusers, registers, and grilles used in duct systems.	RST 11-12.3	
7. Demonstrate or explain the use and installation of dampers used in duct systems.	RST 11-12.3	
8. Demonstrate or explain the use and installation of insulation and vapor barriers used in duct systems.	RST 11-12.3	
9. Identify instruments used to make measurements in air systems and explain the use of each instrument.		
10. Make basic temperature, air pressure, and velocity measurements in an air distribution system.	N-Q 1, N-Q 2, N-Q 3	

Construction Standards	Common Core Standards	Explanation
Performance Tasks		
1. Use a tachometer to measure blower motor rpm.	N-Q 1, N-Q 2, N-Q 3	
2. Read and interpret equivalent length charts and required air volume/duct size charts.	N-Q 1, N-Q 2, N-Q 3, F-IF 4	
3. Assemble duct and fittings.		
4. Assemble flexible duct.		
5. Install insulation and vapor barriers on metal ducts.		
6. Use a manometer to measure static pressure in a duct system.	N-Q 1, N-Q 2, N-Q 3	
7. Use a velometer to measure the velocity of airflow at the output of air system supply diffusers and registers.	N-Q 1, N-Q 2, N-Q 3	
Module 03204-07 – Air Quality Equipment This module covers common accessories used to control air quality, including dehumidifiers, humidifiers, and filters. It also covers energy conservation equipment.		
1. Explain why it is important to control humidity in a building.	RST 11-12.7, S-ID 9, S-IC 6	
2. Recognize the various kinds of humidifiers used with HVAC systems and explain why each is used.	RST 11-12.7, S-ID 9, S-IC 6, S-MD 7	
3. Demonstrate how to install and service the humidifiers used in HVAC systems.		
4. Recognize the kinds of air filters used with HVAC systems and explain why each is used.	RST11-12.7, S-ID 9, S-IC 6, S-MD 7	
5. Demonstrate how to install and service the filters used in HVAC systems.		
6. Use a manometer or differential pressure gauge to measure the friction loss of an air filter.	N-Q 1, N-Q 2, N-Q 3	
7. Identify accessories commonly used with air conditioning systems to improve indoor air quality and reduce energy cost, and explain the function of each, including: • Humidity control devices • Air filtration devices • Energy conservation devices		

Construction Standards	Common Core Standards	Explanation
8. Demonstrate or describe how to clean an electronic air cleaner.	RST 11-12.3	
Performance Tasks		
1. Demonstrate how to inspect, clean, and replace humidifiers.		
2. Inspect disposable/permanent air filters for mechanical damage and cleanliness.		
3. Clean permanent-type air filters.		
4. Measure the differential pressure drop across an air filter with a manometer.		
Module 03214-07 – Fiberglass And Flexible Duct Systems This module introduces fiberglass and flexible duct systems and explains how to lay out and install them.		
1. Identify types of fiberglass duct, including flexible duct.		
2. Describe fiberglass duct layout and some basic fabrication methods.	N-Q 1, N-Q 2, N-Q 3, G-CO 5, G-CO 12, G-GMD 4, G-MG 2, G-MG 3, RST 11-12.3	
3. Describe the various closure methods for sealing fiberglass duct.	RST 11-12.3	
4. Fabricate selected duct modules and fittings using the appropriate tools.	N-Q 1, N-Q 2, N-Q 3, G-CO 5, G-CO 12, G-GMD 4, G-MG 3	
5. Describe hanging and support methods for fiberglass duct.	RST 11-12.7	
6. Describe how to repair major and minor damage to fiberglass duct.	RST 11-12.3	
7. Install takeoffs and attach flexible duct to a fiberglass duct.		
Performance Tasks		
1. Fabricate and assemble fiberglass duct fittings and sections.		
2. Install takeoffs and attach flexible duct.		

Construction Standards	Common Core Standards	Explanation
Module 03304-08 – Retail Refrigeration Systems This module covers the mechanical refrigeration systems normally found in retail establishments. This equipment includes reach-in and walk-in coolers and freezers, ice machines, and other appliances used in stores, restaurants, and hotels. This module includes a discussion of the refrigeration process and defrost techniques, as well as troubleshooting and maintenance procedures.		
1. Describe the mechanical refrigeration cycle as it applies to retail refrigeration systems.	RST 11-12.3	
2. Explain the differences in refrigerants and applications in low-, medium-, and high-temperature refrigeration systems.	WHST 11-12.2e	
3. Identify and describe the primary refrigeration cycle components used in retail refrigeration systems.	L 11-12.6	
4. Identify and describe the supporting components and accessories used in retail refrigeration systems.	L 11-12.6	
5. Describe the various methods of defrost used in retail refrigeration systems.	L 11-12.6	
6. Identify and describe the applications for the various types of retail refrigeration systems.	L 11-12.6	
7. Describe the control system components used in retail refrigeration systems.	L 11-12.6	
8. Explain the operating sequence of a retail refrigeration system.	RST 11-12.3	
9. Interpret wiring diagrams and troubleshooting charts to isolate malfunctions in retail refrigeration systems.	RH 11-12.7, G-GMD 4, G-MG 1, S-ID 9, S-IC 6, S-MD 7, N-Q 1, N-Q 2, N-Q 3	
Performance Tasks		
1. Clean an ice machine.		
2. Isolate faults in refrigeration and ice machines.		
3. Set up an electric defrost schedule for a refrigeration appliance.		

Construction Standards	Common Core Standards	Explanation
Module 03401-09 – Construction Drawings and Specifications This module covers the techniques for reading and understanding various types of construction drawings, specifications, and other related documents. Emphasis is placed on the types of drawings and specifications that are commonly used by those in the HVAC trade and other closely-related trades. The procedures and documents involved in an HVAC equipment and material takeoff are also covered.		
1. Read HVAC drawings and architect's plans and explain their relationships.	RH 11-12.7, G-GMD 4, G-MG1, G-MG 2, G-MG 3, N-Q 1, N-Q 2, N-Q 3	
2. Compare mechanical plans with the actual installation of duct and pipe runs, fittings, and sections.	G-GMD 4, G-MG1, G-MG 2, G-MG 3	
3. Interpret specification documents and apply them to the plans.	RH 11-12.7, N-Q 1, N-Q 2, N-Q 3, S-IC 6	
4. Interpret shop drawings and apply them to the plans and specifications.	RH 11-12.7, G-GMD 4, G-MG 1, G-MG 2, G-MG 3, N-Q 1, N-Q 2, N-Q 3	
5. Describe a submittal, its derivation, routing, and makeup.	RST 11-12.8	
6. Develop a field set of as-built drawings.	G-CO 5, G-CO 12, G-SRT 3, G-GMD 4, G-MG1, G-MG 2, G-MG 3, N-Q 1, N-Q 2, N-Q 3	
7. Identify the steps required for transferring design information to component production.	RST 11-12.3, G-CO 5, G-CO 12, G-SRT 3, G-GMD 4, G-MG1, G-MG 2, G-MG 3, N-Q 1, N-Q 2, N-Q 3	
8. Identify, develop, and complete takeoff sheets.	A-CED 1, A-CED 2, A-CED 3, A-CED 4, F-LE 5	
9. List and classify materials most commonly used in HVAC systems.		
10. Complete takeoff procedures for HVAC systems.		

Construction Standards	Common Core Standards	Explanation
Performance Tasks		
1. Identify and interpret a site plan drawing.	RH 11-12.7	
2. Identify and interpret the following on an architectural drawing: • Floor plans and details • Elevations • Foundation plan • Reflected ceiling plan	RH 11-12.7, G-GMD 4	
3. Identify and interpret the following on a plumbing plan drawing: • Sanitary plumbing plans • Domestic water plumbing plans • Isometric views • Riser diagrams • Schedules • Specification references • Legends	RH 11-12.7, G-GMD 4	
4. Identify and interpret the following on a mechanical plan drawing: • Hot- and chilled-water coil piping • HVAC piping • Chiller piping/installation • Refrigeration piping schematics • Air handling unit installation/connecting ductwork • Hot- and chilled-water flow diagrams • Schedules • Specification references • Legends	RH 11-12.7, G-GMD 4	
5. Identify and interpret the following on an electrical plan drawing: • Riser diagrams • Schedules • Specification references • Legends	RH 11-12.7, G-GMD 4	
6. Prepare a request for information (RFI) form.		
7. Identify and interpret the information given in the specifications pertaining to a construction project.	RH 11-12.7	

Construction Standards	Common Core Standards	Explanation
8. Interpret all types of HVAC-related shop drawings.	RH 11-12.7, G-GMD 4	
9. Mark up HVAC mechanical plans to show as-built modifications.	G-GMD 4, G-MG 1	
10. Perform an HVAC equipment and material takeoff and prepare the takeoff forms.	N-Q 1, N-Q 2, N-Q 3, N-VM 7, A-REI 1, A-REI 3, F-IF 4, A-SSE 1, A-SSE 3, F-BF 1, F-LE 1b	
11. Prepare building coordination drawings that show the composite installation of HVAC equipment relative to the equipment installed by other trades, such as the electrical and plumbing trades.	G-GMD 4, G-MG 1	
Module 03403-09 – Indoor Air Quality This module covers indoor air quality and its effect on the health and comfort of building occupants. It provides guidelines for performing a building IAQ survey and identifies the equipment and methods used to test and control indoor air quality.		
1. Explain the need for good indoor air quality.	RST 11-12.7	
2. List the symptoms of poor indoor air quality.		
3. Perform an inspection/evaluation of a building's structure and equipment for potential causes of poor indoor air quality.		
4. Identify the causes and corrective actions used to remedy common indoor air problems.	S-ID 9, S-IC 6, S-MD 7	
5. Identify the HVAC equipment and accessories that are used to sense, control, and/or enhance indoor air quality.		
6. Use selected test instruments to measure or monitor the quality of indoor air.	N-Q 1, N-Q 2, N-Q 3	
7. Clean HVAC air system ductwork and components.		

Construction Standards	Common Core Standards	Explanation
Performance Tasks		
1. Use selected radon monitors and/or test kits.	N-Q 2, N-Q 3	
2. Perform a building indoor air quality (IAQ) inspection/evaluation.		
3. Make air measurements using each of the following: • Carbon dioxide (CO2) detector/sensor • Carbon monoxide (CO) detector/sensor • Volatile organic compound (VOC) detector/sensor • Combustion analyzer	N-Q 2, N-Q 3	
4. Use a manufacturer's humidifier capacity chart to find the humidifier capacity needed for various building types and sizes.	F-IF 4	
5. Use a manufacturer's portable dehumidifier capacity chart to find the dehumidifier capacity needed for various building types and sizes.	F-IF 4	
6. Clean and inspect ductwork using one or more approved methods: • Contact vacuum • Air washing • Power brushing		

Construction Standards	Common Core Standards	Explanation
Module 03404-09 – Energy Conservation Equipment This module covers various heat recovery/reclaim devices and other energy conservation equipment. It includes information on their operation as well as maintenance procedures.		
1. Identify selected air-to-air heat exchangers and describe how they operate.		
2. Identify selected condenser heat recovery systems and explain how they operate.		
3. Identify a coil energy recovery loop and explain how it operates.		
4. Identify a heat pipe heat exchanger and explain how it operates.		
5. Identify a thermosiphon heat exchanger and explain how it operates.		
6. Identify a twin tower enthalpy recovery loop system and explain how it operates.		
7. Identify air-side and water-side economizers and explain how each type operates.		
8. Identify selected steam system heat recovery systems and explain how they operate.		
9. Identify an ice bank-type off-peak hours energy reduction system.		
10. Operate selected energy conversion equipment.		
Performance Tasks		
1. Adjust an economizer for the proper setting in a local area.		

Construction Standards	Common Core Standards	Explanation
Module 03408-09 – Commercial And Industrial Refrigeration Systems This module expands on the refrigeration system coverage provided in the *HVAC Level Three* module *Retail Refrigeration Systems*. It covers large-scale refrigeration systems such as those found in supermarkets, cold storage facilities, packing houses, and food processing plants.		
1. Identify different types of refrigerated coolers and display cases and describe each one's common application.		
2. Compare the basic components used in commercial/industrial refrigeration systems with those used in retail refrigeration systems.		
3. Identify single, multiple, and satellite compressor systems. Describe the applications, installation considerations, and advantages and disadvantages of each type.		
4. Identify packaged condensing units and unit coolers. Describe their applications, operation, and installation considerations.		
5. Identify two-stage compressors and explain their operation and applications.		
6. Identify the various accessories used in commercial refrigeration systems. Explain why each is used and where it should be installed in the system.		
7. Identify the various refrigeration control devices. Explain the purpose of each type and how it works.		
8. Compare the components used in ammonia systems with those used in halocarbon-based refrigerant systems.		

Construction Standards	Common Core Standards	Explanation
Performance Tasks		
1. Install a packaged condensing unit and/or individual air-cooled condenser in a refrigeration system.		
2. Install a packaged unit cooler and/or individual evaporator in a refrigeration system.		
3. Install two to three selected refrigeration system accessories.		
4. From a selection provided by the instructor, identify the following control devices commonly used in refrigeration systems: • Crankcase pressure regulator • Evaporator pressure regulator • Condenser head pressure regulator • Hot gas bypass regulator • Compressor cylinder unloader • Solenoid-controlled unloader		

Codes for Common Core English Language Arts and Literacy are:

L = Language

RH = Reading for Literacy in History/Social Studies

RI = Reading for Informational Text

RST = Reading for Literacy in Science and Technical Subjects

SL = Speaking and Listening

W = Writing

WHST = Writing for Literacy in History/Social Studies, Science, and Technical Subjects

Codes for Common Core Mathematics are:

A-CED = Algebra: Creating Equations

A-REI = Algebra: Reasoning with Equations and Inequalities

F-IF = Functions: Interpreting Functions

F-BF = Functions: Building Functions

F-LE = Functions: Linear, Quadratic, and Exponential Models

G-CO = Geometry: Congruence

G-SRT = Similarity, right Triangles, and Trigonometry

G-C = Geometry: Circles

G-GMD = Geometry: Geometric Measurement and Dimension

G-MG = Geometry: Modeling with Geometry

N-RN = Number and Quantity: The Real Number System

N-Q = Number and Quantity: Quantities

S-ID = Statistics and Probability: Interpreting Categorical and Quantitative Data

S-IC = Statistics and Probability: Making Inferences and Justifying Conclusions

S-MD = Statistics and Probability: Using Probability to Make Decisions

Appendix C:
Resources

Appendix C: Resources

Career and Educational Resources

The following Internet resources provide diverse, career-related information that can be used by teachers, students, and program administrators to identify current trends in career planning efforts.

- **America's Career InfoNet** — This site offers a one-stop resource for learning about careers, including information organized by occupation, industry, and state. In addition, the site provides a number of interactive tools for career, education, and business decision-making. www.acinet.org
- **Bureau of Labor Statistics** — Provides a number of resources for teachers and students, including an "Occupational Outlook Handbook," a section on "Occupations by Education Level and Projected Growth," and "Occupational Profiles," which highlight where occupations are prevalent and expected pay rates. www.bls.gov
- **Explore Career Options** — This site offers resources for pursuing a variety of careers, including careers in construction and transportation. Features include information on which occupations are in demand and matching programs available in a specific area with the skills and education required to fill those in-demand positions. www.careervoyages.gov
- **Registered Apprenticeships** — The U.S. Department of Labor's site for the Registered Apprenticeship Program, which offers access to 1,000 career areas and provides information on the program (and career information as well) for students, parents, and employers. www.doleta.gov/atels_bat
- **Achieve** — Created by the nation's governors and business leaders, this site provides resources to help states raise academic standards and achievement so that all students graduate ready for college, careers, and citizenship. www.achieve.org
- **Career Clusters** — The Web site for the States' Career Clusters Initiative (SCCI), which features research, products, and services related to implementing career clusters based programs of study in schools. www.careerclusters.org
- **Edutopia** — Sponsored by the George Lucas Foundation, this site offers inspiring articles about and resources for innovative teaching in K-12 schools. www.edutopia.org
- **High Schools that Work** — This site, sponsored by the largest and oldest of the Southern Regional Education Board's (SREB) school improvement initiatives for high school and middle grades leaders and teachers, features information about exemplary school and classroom practices. www.sreb.org/Programs/hstw/hstwindex.asp
- **Project Lead the Way** — The Web site for a not-for-profit organization that promotes pre-engineering courses for middle and high school students by forming partnerships with public schools, higher education institutions, and the private sector. www.pltw.org

General Service Learning and Career Exploration Information

- Center for Community Engagement
  www.csulb.edu.cce
- CSU Service Learning
  www.calstate.edu/csl
- Campus Compact
  www.compact.org
- California Campus Compact
  www.cacampuscompact.org
- American Association of Colleges & Universities
  www.aacu-edu.org
- California Service Corps
  http://www.csc.ca.gov/index.asp
- HUD Office of University Partnerships
  http://www.oup.org
- Journal of Higher Education Outreach and Engagement
  www.uga.edu/~jpso
- Learn, Serve, & Surf
  www.edb.utexas.edu/servicelearning/index.html
- Michigan Journal of Community Service Learning
  www.umich.edu/~ocsl/MJCSL
- National Service-Learning Clearinghouse
  http://www.servicelearning.org/index.php
- Students in Service
  http://www.studentsinservice.org
- National Society for Experiential Education
  www.nsee.org
- DiplomaGuide.com
  http://diplomaguide.com

Construction Curriculum Development Resources

Resources available from Missouri Center for Career Education (free loan library)
www.mcce.org

Architecture & Construction Resources @ MCCE

T&I DVD ROM 10
Building Construction: Fundamentals
CEV Multimedia
LUBBOCK, TX, CEV MULTIMEDIA, 2003.DVD ROM
This presentation includes how to layout plates, make corners and tees, construct wall units, partitions, window and door units and headers. Step-by-step instructions are provided for cutting ceiling joists and rafters with demonstrations on proper techniques for some of the more exacting procedures ("lipping" a joist, cutting a "birdsmouth," marking a ridgeboard and assembling the rafters) necessary for beginning builders. During completion of the 16' X 10' portable building, you will learn proper techniques for laying a roof with discussions and demonstrations of the following roof construction steps: laying the roof deck, attaching metal flashing along the edges, rolling out and laying the roofing felt, marking the felt to prepare it for the asbestos shingles, and cutting a nailing composition shingles in an effective method and pattern. 160 min, 4 sections, 1 printable resource and 17 Web resources.

T&I DVD ROM 11
Building Construction: Site Surveying & Development
CEV Multimedia
LUBBOCK, TX, CEV MULTIMEDIA, 2003.
DVD ROM
Computer-generated visual effects help illustrate surveying concepts often difficult to teach in a classroom setting, such as differential leveling and profile leveling. As the featured expert illustrates route surveying and the setting of property boundaries, he also discusses equipment, field notes, other data collection and data analysis techniques. 101 minutes, 3 sections.

T&I DVD ROM 12
Building Construction: Concrete & Masonry
CEV Multimedia
LUBBOCK, TX, CEV MULTIMEDIA, 2003.
DVD ROM
Join an educational instructor in a lesson in safety and masonry techniques as students follow in selecting building materials and setting up guidelines. He stresses the consequences of poor workmanship and provides tips to create professional quality projects. This DVD also demonstrates the uses of concrete finishing tools to help in construction. A concrete expert shows how to use building techniques to form simple constructions, like a concrete slab. The course also includes informational steps for working with concrete. 144 min, 4 sections, 4 printable resources and 17 Web resources.

T&I DVD ROM 8
Building Construction: Basic Masonry
CEV Multimedia
LUBBOCK, TX, CEV MULTIMEDIA.
DVD ROM
An experienced agricultural education instructor teaches equipment identification, safety and masonry techniques as he demonstrates how to build a brick wall and a block wall. Follow along as he selects the building material, sets up guide lines, mixes mortar, "butters" the bricks and blocks, lays rows and explains clean-up procedures for building these standard construction structures. He points out the consequences of poor workmanship and gives tips on how to create professional-looking masonry structures. A supplement is included. 46 minutes.

TE DVD ROM 4
Measurement: The Long and the Short of It
Shopware
LAWRENCEVILLE, NJ, SHOPWARE, 2007.
DVD ROM
Emphasizing hands-on practice, this program is an excellent tool for introducing the basics of linear measurement: its history, terminology, systems, and practical applications. Using both customary and metric rulers, Measurement: The Long and the Short of It will guide your students through the process of taking measurements, performing related calculations using whole numbers and fractions, and arriving at answers they can feel confident with. Middle school, high school, and vocational/technical school. 16-minutes.

AG DVD ROM 100
Basic Methods of Measuring and Cutting Shopware
HAMILTON, NJ, FILMS MEDIA GROUP, 2004.
DVD ROM
This program reviews the English and metric measurement systems, and demonstrates how to measure and mark lumber and then cut with handsaws and portable power saws. Includes background on the careful and appropriate use of hand and power tools. 13 minutes.

AG DVD ROM 101
Ripping and Crosscutting
Shopware
HAMILTON, NJ, FILMS MEDIA GROUP, 2004.
DVD ROM
This program shows students the professional way to rip and crosscut with smooth precision. Includes background on the careful and appropriate use of hand and power tools involved. 14 minutes.

AG DVD ROM 102
Working With Nails and Screws
Shopware
HAMILTON, NJ, FILMS MEDIA GROUP, 2004.
DVD ROM
This program demonstrates how to drive and remove nails and explains how to work with wood screws--from pre-drilling, to countersinking and plugging, to increasing their holding power. Includes background on the careful and appropriate use of the hand and power tools involved. 17 minutes.

TE DVD ROM 10
Deconstruction: The Science of Building a House-Foundation to Roof
Discovery Channel University
LAWRENCEVILLE, NJ, SHOPWARE, 2004.
DVD ROM
This video highlights scientific aspects of concrete, steel, wood, and nails?and the forces that impact them. Experiments done on the building site and at materials testing labs investigate the strengths of concrete, rebar, and engineered lumber; the chemical properties of Portland cement and galvanized nails; and the effects of dead load and live load, torque and shear induced by wind and earthquakes, and Bernoulli's Principle as it relates to the effects of tornadoes on roofs. Microscope and infrared imaging plus animations give extra angles of insight. So do field trips to a concrete batch plant, a tree farm to study sylviculture, and a saw mill to see how computerized cutting and sorting are done. 50 minutes.

TE DVD ROM 11
Deconstruction: The Science of Building a House-Plumbing to Paint
Discovery Channel University
LAWRENCEVILLE, NJ, SHOPWARE, 2004.
DVD ROM
A home is more than a house; technologically speaking, it's an engineered habitat. This video explains how electrical, plumbing, and HVAC systems work with selected parts of the building envelope — building wrap, windows, fiberglass insulation, gypsum wallboard, and paint — to keep the weather out and comfort in. Animated diagrams, microscopic and thermal imaging, on-site demonstrations, and off-site tests are used to show how things like circuit breakers and P-traps work; to define U-factor, R-value, permeance, and other

technical terms and concepts; to demonstrate color-matching and paint-making; and to isolate envelope failures leading to moisture infiltration and mold. A visit to a USG wallboard plant is also included. 50 minutes.

T&I DVD ROM 11.1
Plumbing: Material & Tool ID
CEV Multimedia
LUBBOCK, TX, CEV MULTIMEDIA.
DVD ROM
More than 40 types of pipe, fittings and tools used in basic plumbing practices are identified and explained in the program. The featured speaker discusses the advantages and disadvantages, common lengths and gauges and uses for galvanized steel, copper (rigid and flexible) and plastic (PVC, CPVC, and ABS) pipe. His discussion of fittings includes couplings, 90 and 45 degree elbows, 90 degree street ell, reducer bushing, female and male adapters, gate and globe valves, union and tee connections. Twenty-two plumbing tools are identified and their usage explained. 47 minutes.

T&I DVD ROM 10.3
Building Trades II Construction Estimating: Industry Standards
Shopware
LAWRENCEVILLE, NJ, FILMS MEDIA, 2004.
DVD ROM
In this program, students will learn a number of industry-standard techniques used to calculate the amounts of building materials for many common construction projects. 19 minutes.

T&I 14.0100 D246
Estimating Building Costs For the Residential & Light Commercial Contractor
Wayne J. DelPico
KINGSTON, MA, REED CONSTRUCTION DATA, INC., 2004.
BOOK
This book provides a step-by-step process for organizing the information needed to assemble an estimate. Includes a detailed look at construction specialties explaining the components, takeoff units, and labor-hours--for site work, concrete and masonry, framing, roofing, siding, finish work, HVAC, plumbing and electrical, and special construction.

T&I DVD ROM 9.1
Inside the Electrician's Toolbox
Shopware
HAMILTON, NJ, FILMS MEDIA GROUP, 2008.
DVD ROM
This program includes a general introduction of electricity-electrons, current, kilowatts, and the journey of electrical power from utility company to home-and examines the work materials and tools commonly used by an electrician. Wires, cables, conduits, boxes, receptacles, and switches are illustrated, and the tools required to cut and run cable or conduit, detect and test voltage, and wire or connect fixtures are shown in action. Wiring diagrams and blueprints are also considered, and safety is stressed throughout. Recommended for high school, vocational/technical school, and adult education. 26 minutes.

T&I DVD ROM 9.2
Electric Current-Electricity: A 3-D Animated Demonstration
Shopware
LAWRENCEVILLE, NJ, FILMS MEDIA GROUP, 2008.
DVD ROM
This program explores how electric energy became an essential tool with the advent of electricity storage, allowing the flow of current to do useful work. Conductors and insulators, voltage, and current are defined and examined, using a water flow model to help ensure understanding. The difference between electron flow and current flow models is explained, and the nature of direct and alternating current (both one- and two-phase) is developed. Specific modules include Tapping a Source, Conductors and Insulators, Direction of Flow, Potential Difference, Measuring Voltage, Measuring Current, Alternating Current, and AC Voltage. 26 minutes.

T&I DVD ROM 9.5
Electrical Components Part 1: Resistors, Batteries, and Switches
Shopware Production
LAWRENCEVILLE, NJ, FILMS MEDIA GROUP, 2006.
DVD ROM
Fixed resistors, variable resistors, ballast resistors, batteries, and various types of switches are explained in this program. Computer animation, component cut-aways, and lab experiments are used to demonstrate how these basic components function. Designed for classes in electricity-electronics, technology, auto mechanics, and other technical areas. A Shopware Production. 22 minutes.

T&I DVD ROM 9.6
Electrical Tools, Safety & Wiring
CEV Multimedia
LUBBOCK, TX, CEV MULTIMEDIA, 2003.
DVD ROM
This program focuses on basic electrical safety procedures, and discusses a wide variety of topics, such as: Over-current protective devices; Care of insulation on electric power cords; Correct use of tools and following safe and approved working procedures; Proper electrical material identification. In order to provide practical application, electrical demonstration boards provide students with visual demonstration on how to wire three circuits commonly found in most residences— duplex receptacle, lighting fixture controlled by a dimmer and a three-way lighting circuit. 4 sections, 250 minutes.

T&I DVD ROM 11.2
HVAC Basics: Residential Heating and Ventilation
Shopware
LAWRENCEVILLE, NJ, FILMS MEDIA, 2008.
DVD ROM
This program illustrates several different types of heating systems, including forced-air gas furnaces, high-efficiency furnaces, and hot air systems. Different types of ignition and fuels are covered, along with the major elements of gas furnaces, including solenoids, burners, manifolds, heat exchangers, and more. Air flow components such as supply and return plenums, air filters, and split capacitor motors are also explained, in addition to thermostats, pilot safety switches, and gas valves. Viewers will get a look at the automated service centers at the heart of many modern large office buildings, which maintain climate control using high-tech sensors and adjustment systems. 24 minutes.

T&I DVD ROM 11.3
HVAC Basics: Residential Air Conditioning
Shopware
LAWRENCEVILLE, NJ, FILMS MEDIA, 2008.
DVD ROM
This program, summarizes air conditioning operation and service. Typical systems for cooling or dehumidifying residential environments are covered. Details on condensing units and their components—including the condenser coil, compressor, motor, fan, and accumulator—are illustrated along with typical outside housings and insulation materials. The three methods of heat transfer—conduction, convection, and radiation—are outlined, along with the difference between high side and low side pressure systems. The refrigeration cycle is demonstrated, as are different types of compressors, such as scroll, reciprocating, and piston. Heat pumps, electrical controls, evaporators, and sight glasses are explained. 21 minutes.

T&I DVD ROM 1.2
Safety Doesn't Happen By Chance
Meridian Education Corporation
PRINCETON, NJ, MERIDIAN EDUCATION CORPORATION, 2001.
DVD ROM
This program provides a guide to basic construction safety concerns and practices. Topics include: Personal protective equipment, including hardhats, protective glasses and goggles, clothing, and boots; Tool safety rules and tips; Electrical safety practices, including use of ground-fault circuit interruptors (GFCIs); Hazard communication, such as material safety data sheets (MSDS); Ladder and scaffold safety. A summary of the main points concludes the program. 12 minutes.

T&I DVD ROM 1.3
Jobsite Safety
Shopware
LAWRENCEVILLE, NJ, FILMS MEDIA, 2008.
DVD ROM
This program illustrates the key issues residential builders and workers need to focus on in order to reduce accidents and injuries. Based on the NAHB-OSHA Jobsite Safety Handbook, the program conveys a wide range of safety information in easy-to-understand demonstrations. Topics include the use of personal protective gear, such as hard hats, gloves, and steel-toed shoes, as well as scaffolding, ladders, stairways, vehicles, mobile machinery, and other equipment. Site organization, lifting safety, electrical safety, trenching, excavation, fire prevention, basic fall protection, and hazard signage and communication are also covered. 21 minutes.

TE DVD ROM 13
The Future of Home Construction: New Techniques, New Technologies
Meridian Education Corporation
MONMOUTH JCT., NJ, MERIDIAN EDUCATION CORPORATION, 2001.
VIDEO
This program travels to the National Association of Home Builders' Research Center to study four townhouses constructed using some of today's most innovative building materials and energy-saving technologies. Filmed at each stage of construction, these houses showcase foundations made of precast, pre-insulated, high-strength reinforced concrete or insulating concrete forms; walls made of ICFs, Hebel blocks, or steel framing; exterior finishes that incorporate thermally elastic stucco; and standing seam steel roofs. Photovoltaic roofing panels, a natural gas heat pump that uses a non-CFC

refrigerant, an electronic home energy management system, gas fireplaces, doors made from sawmill residue and wood scraps, a geothermal heat pump, a pellet stove, and a combined space heating and water heating system are also featured. 11 minutes.

T&I DVD ROM 12.1
Green Architecture: Environmentally Friendly Housing
Films for the Humanities & Sciences
HAMILTON, NJ, FILMS FOR THE HUMANITIES & SCIENCES, 2008.
DVD ROM
This program tracks the teams from the University of Maryland, MIT, The University of Texas at Austin, and Lawrence Technological University as they seek out corporate sponsors, research available materials, and hone their construction skills to create appealing living spaces that require zero energy. 31 minutes.

FCS DVD ROM 63.2
Home Performance: The First Step to Green
Shopware
HAMILTON, NJ, FILMS MEDIA, 2010.
DVD ROM
This program takes viewers through a home performance audit and shows how insights into the thermal envelope, energy footprint, and structural soundness can guide the remodeler and homeowner through the first steps toward creating a greener home. An overview of high-efficiency HVAC and geothermal technologies and the role they play in a house's energy efficiency is also explored. 40 minutes.

TE VIDEO 80
Discovering Math: Concepts in Geometry
Discovery School
SILVER SPRING, MD, DISCOVERY EDUCATION, 2005.
VIDEO
This program shows the role that math plays in the design, technology, and construction of buildings, from ancient Greek architecture to modern skyscrapers. Grades 9-12. 56 minutes.

AE 02.0102 H773
Practical Problems in Mathematics for Carpenters, 8th Edition
Mark Huth and Harry Huth
CLIFTON PARK, NY, DELMAR, 2006.
BOOK
Text presents basic mathematical problems relevant to the construction trade, accompanied by illustrations that together give readers the opportunity to apply and practice math principles common to carpentry.

E 10.0401 R553
Problem-Based Learning for Math & Science: Integrating Inquiry and the Internet, Second Edition
Diane L. Ronis
THOUSAND OAKS, CA, CORWIN PRESS, 2008.
BOOK
Resource for educators who want to expand their teaching repertoire and shift instruction from a teacher-centered to a learner-centered perspective. The author demonstrates how the problem-based learning (PBL) method gives students the opportunity to actively explore and resolve authentic problem simulations and student-identified problems in the community while strengthening their problem-solving skills. Provides: Problem-based learning activities relating to math and science

in each chapter; Projects that correlate to national science, mathematics, and technology standards.

C&E DVD ROM 25
Landing a Job in the Trades
Shopware
LAWRENCEVILLE, NJ, SHOPWARE, 2006.
DVD ROM
This DVD explores essential self-marketing practices that transform job-seekers into wage-earners, focusing on the best ways to display valuable skills and personality characteristics. The program illustrates how to structure a resume based on skills and background, how to compose a cover letter, how to behave and communicate during an interview, and how to follow up with a winning thank-you letter. Special emphasis is placed on building an upwardly-mobile approach, encouraging applicants to display enthusiasm, leadership potential, and a willingness to learn. 16 minutes.

C&E DVD ROM 48
Soft Skills in the Workplace
JIST Publishing
ST. PAUL, MN, JIST PUBLISHING, 2008.
DVD ROM
Soft skills include everything from getting to work on time to getting along with others to being enthusiastic on the job. This program focuses on the role these skills play in the workplace and offers insight into which skills viewers will need to develop to effectively handle a variety of work situations. This program is divided into several sections that demonstrate how certain soft skills influence one's performance on the job.

C&E DVD ROM 24.3
Introduction to Career Clusters
Career Kids, LLC
AUBURN, CA, CAREER KIDS, LLC, 2009.
DVD ROM
Introduces students to the 16 career clusters developed by the U.S. Department of Education. Each cluster shows a variety of people in their jobs, as well as the skills, interests and school subjects helpful for success. Provides students with information to begin their career exploration activities. Approximately 28 minutes.

C&E DVD ROM 24.2
Exploring Career Clusters and Paths
JIST Publishing
ST. PAUL, MN, JIST PUBLISHING, 2008.
DVD ROM
This program features real students describing their interests, what they like to do, and what they are good at as the basis for exploring career options. Next, the program demonstrates how this insight is fundamental to a young person's career exploration. Career experts describe basic strategies young people can do to find their career interests and career direction. Emphasizes the relationship between school subjects and careers. Students learn how to explore their career clues and how to consider opportunities in the 16 U.S. Department of Education career clusters. Career information sources, such as reference books and Web sites, are also discussed. Information about networking, volunteering, and internships connect students to ideas for gaining work experience and learning more about careers. 20 minutes.

TE DVD ROM 13.1
Building Green: Green Careers
Phoenix Learning Group, Inc.
ST. LOUIS, MO, PHOENIX LEARNING GROUP, INC., 2008.
DVD ROM
Program explores this industry where there is a high demand for trained professionals, designers, and workers to help improve the efficiency of commercial and residential buildings through better design of new buildings and smart improvements to existing structures. Jobs profiled include: Solar Installer, Lighting Technician, Energy Auditor. Grades 7 - College. 19 minutes.

C&E 13.0001 R228
Career Ideas For Teens in Architecture and Construction
Diane Lindsey Reeves, Gail Karlitz, Don Rauf
NEW YORK, NY, FERGUSON, 2005.
BOOK
Construction and architecture form one of the largest industries in the United States. From planning, drafting, and building to maintenance and operations, this field offers a broad range of exciting, hands-on careers. Careers profiled include: Architect; Brick mason; Carpenter; Civil engineer; Demolition engineer; Electrician; Estimator; General contractor Interior designer; Landscape architect Preservationist; Urban planner.

TE VIDEO 72
Collapse: Failure by Design
Discovery Channel School
BETHESDA, MD, DISCOVERY COMMUNICATIONS, INC., 2001.
VIDEO
When builders use innovative materials or implement creative design, sometimes the result is disastrous. Explore the flaws of four structures that failed the test of integrity and collapsed. Grades 6 - 12. 25:50 minutes.

TE DVD ROM 41
The Lost City of New Orleans: A Case Study
Films for the Humanities & Sciences
PRINCETON, NJ, FILMS MEDIA GROUP, 2006.
DVD ROM
Throughout the world, sea levels are rising, coastlines are crumbling, and the intensity of hurricanes is increasing. Is the situation in New Orleans a glimpse into the future of all cities that exist near major bodies of water? Filmed six months after Katrina, this program analyzes why New Orleans flooded so catastrophically and asks whether the city — constructed on a steadily subsiding floodplain and losing coastal barrier land at the highest rate in the U.S. — should be rebuilt at all. Louisiana State Climatologist Barry Keim; Harry Roberts, director of LSU's Coastal Studies Institute; hurricane expert Ivor Van Heerden; Colonel Richard Wagenaar, of the Army Corps of Engineers; and Hassan Mashriqui, who is developing coastal hydrologic/hydraulic modeling capabilities for the LSU Hurricane Center, are among the experts featured. Original BBCW broadcast title: The Lost City of New Orleans. 50 minutes

Construction Industry Information

General Construction Industry Information

- Occupational Outlook Handbook, 2010-11 Edition
  http://www.bls.gov/oco/oco1009.htm
  Associated Builders and Contractors
- Workforce Development Department, 9th Floor
  4250 North Fairfax Dr., Arlington, VA 22203
  http://www.trytools.org
- Associated General Contractors of America, Inc.
  2300 Wilson Blvd, Suite 400
  Arlington, VA 22201
  http://www.agc.org
- National Association of Home Builders
  Home Builders Institute
  1201 15th St NW
  Washington, DC 20005-2800
  http://www.hbi.org
- National Center for Construction Education and Research
  PO Box 141104
  Gainesville, FL 32614
  http://www.nccer.org

Specific Trades Resources

- Vocational Information Center, Masonry Career Guide
  http://www.khake.com/page24.html
- Mason Contractors Association of America (MCAA)
  http://www.masoncontractors.org
- HVAC Careers
  http://www.hvaccareers.com/
- US Environmental Protection Agency
  http://www.epa.gov/iaq/schooldesign/hvac.html
- Air Conditioning Contractors of America
  www.acca.org
- American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
  http://www.ashrae.org/
- Refrigeration Service Engineers Society (RSES)
  http://www.rses.org/
- Vocational Information Center, Masonry Career Guide
  http://www.khake.com/page18.html
- National Electrical Contractors Association (NECA)
  http://www.necanet.org/

Remodel/Repair/Facilities Management Industry Resources

- National Association of the Remodeling Industry (NARI)
  780 Lee Street, Suite 200
  Des Plaines, IL 60016
  http://www.nari.org/education
- International Facility Management Association
  1 E Greenway Plaza, Suite 1100
  Houston, TX 77046
  http://www.ifma.org

Public Works Industry Resources

The following organizations are involved in the public works industry and are a resource for outreach ideas as well as possible partnering for local programs.

- American Concrete Institute (ACI)
  http://www.concrete.org/general/home.asp
- American Concrete Pipe Association (ACPA)
  http://www.concrete-pipe.org/
- American Concrete Pressure Pipe Association (ACPPA)
  http://www.acppa.org/
- American National Standards Institute (ANSI)
  http://www.ansi.org
- American Public Works Association (APWA)
  www.apwa.net
- American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
  http://www.ashrae.org/
- American Society for Quality (ASQ)
  http://www.asq.org
- American Society for Testing and Materials (ASTM)
  http://www.astm.org/
- American Segmental Bridge Institute (ASBI)
  http://www.asbi-assoc.org
- Association of State Dam Safety Officials (ASDSO)
  http://www.damsafety.org
- American Statistical Association (ASA)
  http://www.amstat.org/
- ASM — The Materials Information Society
  http://asmcommunity.asminternational.org/portal/site/www/
- American Traffic Safety Services Association (ATSSA)
  http://www.atssa.com/
- American Water Works Association (AWWA)
  http://www.awwa.org/
- Associated General Contractors of America (AGC)
  http://www.agc.org/
- Association for Facilities Engineering - AFE (formerly AIPE)
  http://www.afe.org/
- Intelligent Transportation Society of America
  http://www.itsa.org/
- International Desalination Association
  http://www.idadesal.org/
- International Right of Way Association
  https://www.irwaonline.org/eweb/startpage.aspx
- International Road Federation
  http://www.irfnet.org/
- International Organization for Standardization (ISO)
  http://www.iso.org
- Masonry Institute of Washington
  http://www.masonryinstitute.com

- Materials Research Society (MRS)
  http://www.mrs.org/
- National Association of Clean Water Agencies
  http://www.nacwa.org/
- National Association of Counties
  http://www.naco.org/
- National Association of Manufacturers (NAM)
  http://www.nam.org/
- National Association of Pipe Fabricators, Inc.
  http://www.napf.com/
- National Association of Towns and Townships
  http://www.natat.org/
- National Association of Water Companies (NAWC)
  http://www.nawc.org/
- National Association of Women in Construction
  www.nawic.org
- National Fire Protection Association
  http://www.nfpa.org
- National Institute of Standards and Technology (NIST)
  http://www.nist.gov
- National Onsite Wastewater Recycling Association
  http://www.nowra.org/
- National Recycling Coalition, Inc.
  http://www.nrc-recycle.org/
- National Research Council
  http://www.nationalacademies.org/nrc/
- National Rural Water Association (NRWA)
  http://www.nrwa.org
- National Solid Wastes Management Association (NSWMA)
  http://www.environmentalistseveryday.org/
- National Utility Contractors Association (NUCA)
  http://www.nuca.com/
- North American Society for Trenchless Technology (NASTT)
  http://www.nastt.org/
- Public Utilities Risk Management Association
  http://www.purma.org/
- Steel Structures Painting Council (SSPC)
  http://www.sspc.org/
- U.S. Environmental Protection Agency
  http://www.epa.gov/
- UNI-BELL PVC Pipe Association
  http://www.uni-bell.org/
- Urban and Regional Information Systems Association
  http://www.urisa.org/
- Valve Manufacturers Association of America (VMA)
  http://vma.yourmembership.com/
- Water and Wastewater Equipment Mfr. Assoc. (WWEMA)
  http://www.wwema.org/
- Water Environment Federation (WEF)
  http://www.wef.org/Home

- Water Quality Association (WQA)
  http://www.wqa.org/

Program Administration Resources — Establishing Advisory Programs

- http://www.ode.state.or.us/teachlearn/pte/leadership-guide.pdf
- http://www.doe.mass.edu/cte/resources/acguide.pdf
- http://www.cccs.edu/Docs/CTE/AdvisoryCommittee-Guide_10-03.doc
- http://www.michigan.gov/documents/Advisory_Committee_Handbook_125499_7.doc
- http://www.ade.state.az.us/cte/info/MembersGuide.pdf
- http://www.state.tn.us/education/cte/directors/doc/developadv07sum.ppt