Integrating Occupational Safety and Health Training into Career Technical Education in Construction

Formative Research Findings

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EXECUTIVE SUMMARY

The US Bureau of Labor Statistics estimates a 30% increase in construction employment from 2010 to 2020. This means that there will be many new and young workers entering the construction industry. It is well established that these new and young workers are at greater risk of injury, as they enter this high hazard industry. Although some will enter through apprenticeship programs, the vast majority will not.

One important way to better protect and prepare new and young workers is to strengthen the occupational safety and health (OSH) training they get through construction classes offered in Career Technical Education (CTE) programs at the high school, community and technical college level. Approximately 200,000 secondary and postsecondary graduates in a given year have taken one or more construction-related classes. In addition, CTE instructors are often well connected in their local construction communities and may prove to be effective transmitters of evidence-based health and safety practices.

While researchers have studied the effects of OSH training in the construction industry generally, there is little in the literature describing the quality and extent of OSH training in school-based CTE in construction, especially at the community and technical college level. To the extent that OSH training in the education system has received attention, the focus has been primarily on high school programs. In many states the CTE education standards are specifically for K-12 programs and do not impact community or technical colleges.

Purpose: The purpose of this study is to help address this information gap by conducting a preliminary scan of OSH training in CTE programs at both the high school and community and technical college levels. We sought to understand the extent of OSH integration in CTE systems, the barriers and gaps in integration, and how best to share new information with this community of instructors. This report describes our key findings and provides recommendations for further research or new initiatives to expand and improve OSH training in construction CTE programs.

Methodology: The scan included a review of the scientific literature as well as programmatic websites and resources. In addition, 22 key-informant interview sessions with 27 individuals were conducted, with instructors, administrators and leadership in CTE programs and organizations, as well as health and safety professionals with experience working with CTE programs in construction.

Key Findings:

State of the Literature: There continues to be almost nothing in the literature focused on OSH training in CTE programs. We did not identify any articles that focused on OSH training in career technical education generally, or in construction. A handful of articles addressed OSH training for construction students, but none of them focused on training in a CTE setting. Quality research is needed in this area.

Integrating Occupational Safety Health Training: Instructors in construction CTE programs are keenly aware of the need for OSH training. Primary drivers are concerns about liability and injury prevention in the CTE program itself, industry demands, and meeting education system standards. All described the OSH training provided as a combination of classroom and hands-on training. But because CTE program structure varies enormously from state to state, there is extensive variability in how and what training is delivered among states and even among individual programs. In many states, instructors create their own programs, relying on local industry advisory councils, participation in industry associations, other instructors, and word of mouth for their tools and resources. The one OSH resource referred to consistently was the OSHA 10-hour Construction Outreach Training Program. The OSHA 10 is a course

approved by federal OSHA and covers the major health and safety regulations that affect the construction industry. It does not provide training in OSH leadership, problem-solving, or communication skills. The OSHA 10 course appears to be widely used at the community college level, and its use is growing at the high school level.

Barriers and Gaps in OSH Integration: Instructors themselves did not immediately perceive barriers to teaching OSH in their programs, but along with other key informants identified several resource needs. Instructors need high quality training and related instructional tools to help them conduct more effective, participatory classroom training on OSH (especially OSHA-approved material to teach OSHA 10 content). Instructors need teaching activities to build students' problem-solving and communication skills. They also need time as well as systems to stay up-to-date and to share information and teaching activities. Postsecondary (community and technical college) level teachers in many states are the most challenging to reach, as they often work fairly autonomously.

Reaching Instructors in Career Technical Education Programs: There are both national and state level professional organizations for CTE instructors and administrators. Despite the limited participation of postsecondary instructors in these organizations, they remain the most likely way to reach and/or influence CTE programs and instructors. Reaching instructors through state professional organizations is likely to be most effective, but obviously more resource-intensive. Key national organizations include the American Association of Community Colleges (AACC), the Association for Career and Technical Education (ACTE), the Association for Skilled and Technical Sciences (ASTS), the National Association of State Directors of Career Technical Education Consortium (NASDCTEc), and SkillsUSA.

Recommendations:

1. Conduct further research with instructors to better define what kinds of resources are most needed by the greatest number of instructors.
2. Create a system for instructors to share best practices and resources, working with key national CTE and community college organizations, and with the OSHA Training Institute (OTI), which oversees the delivery of OSHA 10 training.
3. Strengthen and extend educational and industry standards for OSH skill development. All federal programs that provide funding for construction training should explicitly require the full range of OSH skills needed, including communication and jobsite problem-solving skills.
4. Promote the "critical thinking/problem-solving" OSH skills that should be included in quality OSH training. Clear articulation of what this entails needs to be developed and tailored to construction settings using some of the resources described in this document.
5. Develop, evaluate, and disseminate a model "OSHA 10-plus" training curriculum, based on evidence-based best training practices, and including leadership and communication skills, targeting new and young workers.
6. Conduct outreach to local industry advisory committees to increase industry's "pull" for safety. Local industry representatives and employers influence what is taught in local CTE programs, and need to understand and be able to articulate their need for employees with critical thinking skills in OSH.

KEY TO ACRONYMS USED IN THIS REPORT

Acronym	Definition
AACC	American Association of Community Colleges
ACTE	Association for Career and Technical Education
AFT	American Federation of Teachers
ARRA	American Recovery and Reinvestment Act of 2009
ASTS	Association for Skilled and Technical Sciences
BPI	Building Performance Institute
CCTC	Common Career Technical Core Standards
CTE	Career Technical Education
CYWSH	Center for Young Worker Safety and Health
FACE	Fatality Assessment and Control Evaluation
JATC	Joint Apprenticeship Training Council
LOHP	Labor Occupational Health Program
NARI	National Association of the Remodeling Industry
NASDCTEC	National Association of State Directors of Career Technical Education Consortium
NCCER	National Center for Construction Education Research
NCES	National Center for Education Statistics
NIOSH	National Institute for Occupational Safety and Health
NRCCTE	National Research Center for Career Technical Education
OPHS	The Office for the Protection of Human Subjects
OSH	Occupational Safety & Health
OSHA	Occupational Safety & Health Administration
OSHA 10	OSHA 10-Hour Construction Training Program
OTI	Occupational Safety and Health Administration Training Institute
OVAE	U. S. Department of Education's Office of Vocational and Adult Education
STEM	Science, Technology, Engineering, Math
WIA	Workforce Investment Act

I. Introduction and purpose

The US Bureau of Labor Statistics estimates a 30% increase in construction employment from 2010 to 2020 (1). This means that there will be many new and young workers entering the industry. Although some will enter through apprenticeship programs, the vast majority will not. Less than 3% of current construction workers are apprentices (2). Even in states with high union density, the availability of apprenticeships has shrunk enormously (3). Furthermore, it is well established that these new and young workers are at greater risk of injury (4), as they enter this high hazard industry.

One important way to better protect and prepare new and young workers is to strengthen the occupational safety and health (OSH) training they get through construction classes offered in Career Technical Education (CTE) programs—formerly known as vocational education—at the high school, community and technical college level. The latest data available (2009) show that approximately 200,000 secondary and postsecondary graduates in a given year have taken one or more construction-related classes (see Figure 6 on page 15).

The extent to which these programs provide instruction in OSH has not been previously assessed (5). It is clear, however, that providing such training and information could make a substantial difference in reducing the burden of occupational injuries, fatalities and illnesses in the U. S. The U.S. construction industry employs just 7% of the workforce, yet it accounts for almost a quarter of all work-related traumatic fatalities, more than any other industry(3, 6). OSH training provided as part of CTE programs—both OSH-specific classroom-based teaching, as well as integrating OSH content into hands-on skills training—at community colleges and elsewhere might be the only substantive point of contact with OSH information for thousands of workers who enter the job market following graduation, particularly workers who enter the largely non-unionized, residential construction industry.

With funding from CPWR - The Center for Construction Research and Training, the Labor Occupational Health Program at UC Berkeley (LOHP) conducted a small, qualitative research project to further our understanding of the following:

1) To what extent has OSH been integrated into CTE curricula and national CTE initiatives, particularly in construction-related programs?
2) What barriers exist to integrating OSH information and education into these programs?
3) What kinds of OSH curricula and resources would be of greatest use to instructors involved in construction CTE programs?
4) What channels and methods of communication will be most effective in reaching these instructors?

We used two methods to answer these questions: a literature review, and interviews with key informants, including CTE instructors, leaders in professional CTE organizations, and OSH trainers with experience in construction CTE programs.

The project addresses **NORA2 Strategic Developmental Goal 11. 0. –** (Increase the recognition and awareness of construction hazards and controls through broad dissemination of quality training), as well as many of the **intermediate goals** listed under Goal 11. These include compiling training resources (11.1.1), identifying training effectiveness gaps (11.1.4), partnering with construction groups (focusing

on CTE instructors) to inventory existing programs (11.2.1), identifying other existing quality training materials (11.2.2), and developing new approaches for addressing training delivery gaps (11.3.2). The project addresses **Strategic Impact Goal 12.0**—(Increase the use of effective interventions to reduce injuries and illnesses among vulnerable worker groups—in this case, new and young workers.)

This report describes our key findings and provides recommendations for further research or new initiatives to expand and improve OSH training in construction CTE programs.

II. Methodology

A. Literature Review

The objectives of our literature review were to: 1) determine what work has been done in the past 10 years to advance the integration of OSH into construction CTE programs; 2) identify models or best practices described in the literature; 3) identify key organizations in CTE; and 4) gain a better understanding of the training landscape for new workers entering the field of construction, including existing educational standards or other drivers of OSH instruction in CTE programs.

We began our search for peer-reviewed literature utilizing a variety of data bases, including PubMed, Web of Knowledge, Dissertations & Theses @ University of California, EconLit, ERIC, ProQuest Dissertations & Theses (PQDT), ProQuest Dissertations & Theses A&I, PsycARTICLES, PsycINFO, Social Services Abstracts, and Sociological Abstracts to help us describe the landscape of construction CTE training. We used the following search phrase for career and technical education: (CTE OR "career technical education" OR "career and technical education" OR "vocational technical education" OR "vocational education" OR "voc-ed" OR "technical education" OR vo-tech OR "industrial technology education"). We searched for the following known programs as: "Skills USA" OR "SkillsUSA" OR "SKILLS USA" OR NCCER OR "National Center for Construction Education and Research" OR "OSHA 10" OR OSHA 10-hour" OR CareerSafe or careersafe, as well as specific levels of education: "high school" OR "postsecondary" OR college OR "pre-apprenticeship". We also used the search strings: ("construction industry" OR "building trades") and ("occupational safety" OR "workplace safety" OR "injury prevention" OR "job safety' OR "occupational health") with our CTE search string to search for literature specifically devoted to our topic of interest. We also searched for "training" AND "safety" AND "construction workers."

We also searched for articles that cited the two seminal articles in this area: *Integrating occupational safety and health information into vocational and technical education and other workforce preparation programs* (5) and *Enhancing occupational safety and health through use of the national skill standards* (7).

We used professional contacts and internet searches to complement the peer-reviewed literature with "gray literature"—reports and project summaries that do not appear in published articles. This summary report presents what we learned about the state of occupational safety and health education

within career technical education construction classes in high schools and community colleges in the United States, model programs identified, and information on key CTE organizations and resources.

B. Key Informant Interviews

We identified career technical professional associations, OSH training experts with experience in construction training, and construction technology instructors, seeking experts with direct experience in integrating OSH into construction CTE programs. We used a snowball method to generate a list of over 90 suggested contacts throughout the course of the project, and conducted 22 interview sessions with a total of 27 people (some sessions included multiple participants). The majority of interviews were conducted during a 3-month period, January-March 2013. (See Figure 1 for a list of organizations and agencies represented.) Four of the eight instructors were also organizational representatives. We developed an interview instrument focused primarily on instructors and selected or adjusted questions to make them relevant to other types of interviewees (see Appendix 1). All interviews were conducted by phone, lasted for 15 to 53 minutes (averaging 35 minutes) and all but four were audiotaped. Detailed notes (but not transcripts) were prepared using the audiotapes, and later coded for themes and categories relevant to the questions we were seeking to answer, a standard coding approach used to analyze qualitative data (8, 9).

The Office for the Protection of Human Subjects (OPHS) of the University of California approved this study as exempt from the requirements of the Federal Policy for the Protection of Human Subjects.

Figure 1: Key Informants

Instructors

Cosumnes River College, CA
Los Angeles Trade-Technical College, CA
Bluegrass Community and Technical College, KY
Mineral Area College, MO
(4 others noted below had been or were instructors)

Labor Representatives

American Federation of Teachers
Carpenters Apprenticeship Program (instructor)

OSH Professionals

CareerSafe Online
California Department of Public Health/Occupational Health Branch
Center for Construction Research and Training (CPWR)
Georgia Technical Research Institute/Center for Young Worker Health and Safety
Massachusetts Department of Public Health/Occupational Health Surveillance Program/Teens at Work: Injury Surveillance and Prevention Project
National Institute for Occupational Safety and Health (NIOSH)
University of Washington/School of Public Health/Environmental and Occupational Health Sciences

Educational Organization Leadership

American Association of Community Colleges (AACC)
Association for Career and Technical Education (ACTE) (instructor)
Association for Skilled and Technical Sciences (ASTS)
National Association of State Directors of Career Technical Education Consortium (NASDCTEc) (instructor)
National Center for Construction Education and Research (NCCER) (instructor)
National Research Center for Career Technical Education (NRCCTE)
Skills USA (instructor)
Workforce Strategies, Aspen Institute

III. Results

A. State of the Literature

We identified only 12 peer-reviewed articles that addressed health and safety training for students in school settings that were published since 2005 (after the Schulte and Palassis articles were published). None of the articles focused on OSH training in career technical education generally, or in construction CTE. Only five of these articles addressed training for construction students, but none of them focused on training in a CTE setting—three explored training effectiveness in apprenticeship programs (10-12), and two were pilot studies of 3D game-based construction safety training, conducted with students in Canada (13) and the University of Washington's Department of Construction Management (14). Of the remaining seven articles only two focused on CTE training programs, and both articles reported on a single OSH training program used in a culinary arts program (15, 16). The other five articles addressed various types of school-based work experience programs, or issues other than training (17-21).

Our search of websites and leads provided by interviewees lead to additional reports describing various aspects of the career technical education landscape, links to key organizations and core competencies and standards, but no additional written reports specifically describing OSH training models in construction CTE programs. These results are integrated into the information below. None of the numerous reports assessing various program outcomes for a variety of CTE programs mentioned OSH training or program components.

B. The Landscape: Career Technical Education Programs in Construction

There are currently approximately 9.1 million construction workers in the U. S. The BLS estimates a 30% increase in construction employment from 2010 to 2020. But this comes on the heels of a 23% loss of jobs from 2007 to 2010 (3). This fact was a dominant issue in most conversations we had with key informants. The construction workforce is an aging workforce (2), as recent job losses predominantly impacted newer, less-experienced workers. These facts together mean that as the industry begins growing again, and older workers "age out" of the workforce, there will be many young and inexperienced workers entering the industry.

> ***"We see a lot of interesting data on fatalities going down and injury rates going down, but we also see that new and young workers, their proportionate numbers have gone down, and Hispanic workers as well, during the recession, because they seem to be the first ones to lose their jobs. So we have more experienced workers on the job right now, and as the economy grows, we'll see another influx of young, inexperienced, perhaps recent immigrants, coming into the industry. So we're setting ourselves up for concerns. It's timely to think about training –even though training is not the answer to everything!"***
>
> – OSH Professional

Several key informants suggested that residential construction is an entry point for many workers in the construction industry. Private sector, small residential contractors, however, are the least likely to have union contracts and/or regulated apprenticeship programs. Most apprenticeship programs are conducted as part of large public sector and private sector construction projects. Approximately 70% are joint labor-management programs (3). Large scale public sector construction projects are also the most likely to be covered by union contracts—35.1% of public sector construction workers are covered by union contracts, compared to 16.2% among all construction workers (3). Yet about two thirds of the construction workforce works for companies with less than 100 employees (2). This means that the vast majority of new and young construction workers are likely to start their work in construction outside an apprenticeship program, likely on a non-union project, working for a small firm.

Key informants described an enormous difference between the safety culture—both management and workforce—on large construction projects, versus residential projects. One participant, reflecting on his work over the years on large scale construction projects, stated:

> ***"That's really an important part of what I call the transition of our industry…Before, the craft professional had never had permission to…stand up for their safety rights, to make those statements. But what we're seeing now, with the new management, the newer craft professionals, and the younger generation, that culture is changing."***
>
> — Educational Organization Representative

The fact that a much greater percentage of workers on larger jobs are likely to have received their training through an apprenticeship program (and most likely a union-based program) is probably a contributing factor. According to key informants, the large contractors on these projects are more likely to be involved in developing industry and educational standards compared to smaller contractors, such that standards tend to reflect the experiences of larger employers, who assume that safety culture is strong and OSH resources are easily available and are provided as an accepted cost of business. As a consequence, existing standards may not provide students with all the skills they need to work in a world—such as residential construction—where assumptions about a strong safety culture may not be accurate.

Comprehensive statistics on the ways in which construction workers receive training before walking on to the job site are not available. Key informants and other reports (2, 22) suggest that the majority of construction workers initially learn their trade on the job. Some—when the opportunity arises—may then go on to enter an apprenticeship program to move into higher quality construction work. Key informants reported that construction apprentices average 28 years of age.

In addition to apprenticeship programs, there are two other types of programs where formal construction training is provided:

- Career Technical Education programs at high schools, postsecondary institutions and adult education programs
- Community-based pre-apprenticeship programs funded by a variety of funding streams

Pre-apprenticeship and apprenticeship programs are also sometimes partnered with public secondary and postsecondary schools. While our project focused on understanding the formal CTE training landscape, we have provided a brief description of pre-apprenticeship and apprenticeship programs to help fill out the landscape. (See Figure 6 at the end of this section for a summary chart.) For more information on apprenticeship and pre-apprenticeship programs, see Helmer et al and Lerman et al (2, 23), as well as the Department of Labor's website (24).

Career Technical Education

Career Technical Education (CTE), formerly known as vocational education, "generally refers to programs offered at the secondary or postsecondary level that combine academic instruction and occupational skill training to prepare individuals for transition to higher education or the workplace" (25). These include programs provided at comprehensive high schools, at technical high schools or 2-year technical colleges that may serve both high school students and adults, and at community colleges or 4-year colleges. The Carl D. Perkins Career and Technical Education Improvement Act (P. L. 109-270), first signed into law in 1984, is the primary dedicated source of funding for CTE programs – over $1. 2 billion in FY2013 (26). According to the U. S. Department of Education's Office of Vocational and Adult Education (OVAE), 12 million students participated in secondary and postsecondary CTE programs supported by the Perkins Act (27). While there is no specific mention in the Act of the need to teach OSH skills, the requirement to teach students "all aspects of the industry" is defined as "strong experience in, and comprehensive understanding of, the industry that the individual is preparing to enter" which is understood by the CTE community to include OSH skills (28).

The Act was last authorized in 2006, and is due for reauthorization in 2013. The Obama Administration's current proposal for reauthorization (29) emphasizes the following four principles:

1) Accountability, based upon common definitions and clear metrics for performance
2) Collaboration among secondary institutions, postsecondary institutions, and industry partners
3) Alignment between CTE programs and local labor market needs
4) Innovation supported by systemic reform of state policies and practices

The CTE community has commented on the proposal, and action is expected in late 2013.

Figure 2: CTE Delivery in California

Secondary: Department of Education

- 1413 comprehensive high schools
- 75 ROP/Cs (Regional Occupational Centers/Programs –primarily CTE)
- CTE Enrollment: 996,305
- 40% of Perkins Funds in CA

Postsecondary: California Community College Chancellor's Office

- 112 Public Community Colleges
- CTE Enrollment: 1,070,175
- 60% of Perkins Funds in CA

Leaders in the CTE field have been working toward a common organization of local programs of study, and the OVAE and the National Association of State Directors of Career Technical Education Consortium (NASDCTEc) recognize 16 "Career Clusters," of which "Architecture and Construction" is one, with multiple career pathways identified for each cluster. In the Architecture and Construction Cluster, they have identified three pathways: 1) Design/Pre-Construction, 2) Construction, and 3) Maintenance/Operations—the second two pathways

being those associated with the building trades (30, 31). Most state programs, especially those at the secondary level, have begun to align their programs with this structure.

At the same time, all of the key informants – as well as websites for CTE professional organizations such as the Association for Career and Technical Education (ACTE) and NASDCTEc—noted that "each state's system is unique" (32). (See p. 23 and Appendix 5 for descriptions of key professional CTE organizations.) Some states house both secondary and postsecondary CTE programs in a single state agency, outside of the Department of Education. Others house their secondary level programs (which may include technical schools that serve high school students as well as adults) in their Department of Education, but their postsecondary programs are under the jurisdiction of the community college administration—separate from the Department of Education. See Figures 2 and 3 for examples. Profiles of the CTE delivery system for each state can be found on the websites of both ACTE (32) and NASDCTEc (33).

Figure 3: CTE Delivery in Oklahoma

Oklahoma Department of Career and Technology Education

Secondary:

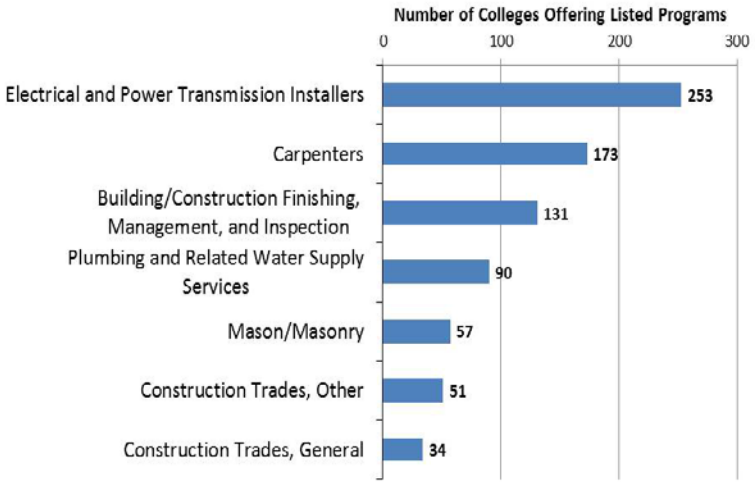
- 463 public high schools
- 57 Technology Centers (adults also)
- CTE Enrollment: 17,621
- 86% of Perkins Funds in OK

Postsecondary:

- 57 Technology Centers (high school students also)
- CTE Enrollment: 37,937
- 14% of Perkins Funds in OK

Secondary level programs: Classes at secondary schools (high schools) range from basic carpentry classes, to a program of coursework that is articulated with 2-year programs at local community colleges. According to the National Center for Education Statistics (NCES), in 2009, almost 130,000 public high school graduates (4. 3%) had taken one or more construction related classes. (See Figure 6 on p. 15.) We were unable to find statistics on the total number of secondary-level construction-related programs. Our search confirmed key informants' description regarding the lack of data on job placement rates; NCES, which conducts some longitudinal analyses, reported that among 2004 public high school graduates who were not enrolled in postsecondary education but were working for pay in 2006, 42.8% of those who were "occupational concentrators" in construction and architecture were working in their field – higher than any other occupational areas (34). One instructor estimated that in a good year, approximately 25% of graduates from a high school program might go directly into construction, whereas 60% of

Figure 4: Programs for Construction Trades in 2-year Colleges



American Association of Community Colleges, www.aacc.nche.edu/AboutCC/Trends/Pages/programsoffered.aspx (Accessed July 11, 2013). Data Source: Integrated Postsecondary Data System 2003

community college program might do so—but that these figures would fluctuate in response to the economy.

Postsecondary technical schools/community colleges: According to the American Association of Community Colleges (AACC), there are 431 construction programs offered at public community college campuses across the country (see Figure 4). These include public 2-year technical colleges as well. According to the NCES, 70,000 postsecondary students were in a construction-related program when last enrolled (see Figure 6 on page 15). According to the AACC representative, community college students are often working at the same time they are going to school, and are often older than students at 4-year colleges. She also noted that community colleges are often one of the few "brick and mortar" entities in a community, and as a result, they frequently serve as the recipient and coordinator of a variety of federally funded workforce development programs—a key source of resources noted by instructors we interviewed. While there is tremendous variability among programs, most have some kind of curriculum coordinator, and offer multiple programs within the pathways listed above. See Figure 5 for a description of typical offerings at a community college.

Figure 5: Course required for a Certificate of Achievement in Construction Cosumnes River College, Sacramento, CA

- 25 units (2 FT semesters)
- Prepares students for entry into the building and construction industry as a general tradesperson; prepares students currently working within the industry for advancement
- Courses
  - Construction Estimating
  - Construction Pre-Apprenticeship I
  - Construction Pre-Apprenticeship II
  - Construction Safety
  - Intro to Construction Plans and Specs
  - Materials of Construction
- Includes over 200 hours of off-campus house building (Habitat for Humanity)

A 13-unit Pre-apprenticeship certificate includes the 2 Pre-Apprenticeship classes and a 1-unit OSHA 10 course.

Community-Based Pre-Apprenticeship Programs

Community-based pre-apprenticeship programs are designed to provide basic skills, often including other employability skills, or academic preparation for a GED, and are usually targeted toward low-income youth and other at-risk populations, including formerly incarcerated individuals. The goal is to prepare participants to be eligible for an apprenticeship program, although this is not the most common outcome for participants (22). Programs include:

- Minority worker training programs, brownfields programs
- Employment programs funded by the federal Workforce Investment Act (WIA), including some targeted for youth
- Youth Build
- Job Corps

Most programs use a combination of funding streams to provide workforce development services. Several informants commented on the growth in community-based workforce development programs over the last 10-15 years. Informants noted that these programs typically have more time available to teach health and safety, but also pointed out that many of the participants face significant learning challenges. The Workforce Strategies Initiative of the Aspen Institute has conducted surveys and developed case studies describing best practices in these programs (2, 22). They found that programs with strong industry links do the best job placing participants.

Apprenticeship Programs

There are an estimated 215,000 construction apprentices. While the U. S. Department of Labor currently reports 111,982 apprentices active in 5,936 apprenticeship programs in construction (35), these numbers do not include many state-approved programs. In a recent policy brief, however, the U. S. Department of Labor estimated that approximately 430,000 apprentices were active in both state and federally-approved apprenticeship programs across all industries in 2010, about half of whom were construction apprentices (36). Each year, there are approximately 35,000 new registrants in construction apprenticeship programs. Approximately 70 per cent of these programs are joint labor-management programs; the rest are sponsored by employers or trade associations (3). These structured programs involve both classroom and on-the-job learning, where apprentices work under the supervision of a journey-level craft person. Apprentices earn wages throughout the 3-5 year program. In some cases, the classroom learning may take place in partnership with a community college. We were not able to find statistics on how often this is the case. One key informant described a program where apprentices also receive an associate degree (Empire State College in NY) while completing their apprenticeship. Another reported that Seattle Community College is involved in both union and non-union apprenticeship programs. Key informants reported that apprentices typically enter an apprenticeship program having already worked in construction.

While apprenticeship and pre-apprenticeship programs may be important sources of OSH training for some construction workers, in this report, we focus on programs in the public career technical education system.

Figure 6: Construction Training Programs

Program	# of Programs	# of graduates or new participants per year	Age/ Demographics	Duration	Persevere into Construction	Description
Construction CTE- Secondary	unknown	129,800 graduates with construction CTE credits[1] (37, 38)	16-18	5-24 months	42% of construction concentrators who work right out of high school (34)	Construction classes in comprehensive and technical high schools.
Construction CTE- Postsecondary	431 programs (39)	70,260[2] (40, 41) (30,000 certificates) (42)	adult	5-24 months	42% of those with certificates (43)	Construction classes in community colleges and technical colleges
Youth Build	273 in 46 states	10,000	16-24; low income	6-24 months	unknown	Federal programs. Earn GED, job skills while building affordable housing
Job Corps	125 centers	58,900 (not primarily construction)	16-24; low income	1-2 years	unknown	Federal program; industry credentials, CTE credential, other. Construction is 1 of 100 occupational areas.
Minority worker training programs	5 programs	300	Young, underserved minorities	unknown	unknown	Federal program. Life skills, OSH training for environmental clean-up and construction work
Other community-based pre-apprenticeship programs	unknown	unknown	varies	varies	No data	Workforce development programs providing services to connect trainees to construction industry
Apprenticeship	5,936 in federal data base	35,551 new registrants (3)	adult	3-5 years	40%	Structured program with classroom and on-the-job training; 70% run by joint-labor management

[1] Calculated using the number of high school graduates in 2009 (Table 103, NCES, http://nces.ed.gov/programs/digest/d09/tables/dt09_103.asp) and the percent of high school graduates who earned any credits in CTE construction courses in 2009 (Table H123, NCES, http://nces.ed.gov/surveys/ctes/tables/h123.asp)

[2] Calculated using the number of post-secondary students in 2009 (Table A-10-2, NCES, http://nces.ed.gov/programs/coe/tables/table-hep-2.asp) and the per cent with a construction-related major (Construction-related major when last enrolled, NCES, http://nces.ed.gov/datalab/powerstats/pdf/bps2009_subject.pdf)

C. OSH Integration into Construction CTE Programs

Key Findings

- Instructors in construction CTE programs are keenly aware of the need for OSH training, and are all doing some amount of classroom and hands-on training on OSH.
- Because CTE program structure varies enormously from state to state, OSH integration varies enormously as well.

> ***"It should be a no brainer… First thing you do is learn to be safe, then you go learn how to do the work."***
> —Educational Organization Representative

- Teaching the OSHA 10 (usually providing students with OSHA 10 cards) is almost universal at the community college level, and growing at the high school level.
- Key informants identified additional OSH teaching resources and best practices.
- Key informants identified the need for high quality training for teachers and related instructional tools to help teachers conduct more participatory classroom training on OSH, and in particular activities to build students' problem-solving and communication skills.
- Learning standards set by education agencies and organizations have a greater influence at the high school level than at the postsecondary level, but do impact many instructors.
- Learning standards set by industry (e.g. industry certifications) tend to have a greater influence on community college instruction, especially through local industry advisory councils.

Instructors in construction CTE programs are keenly aware of the need for OSH training, and are all doing some amount of classroom and hands-on training on OSH.

All of the instructors spoke about the importance of keeping their students safe while in their programs—first and foremost for the students' sake, but they also talked about concerns regarding liability and the repercussions instructors face if a student is injured. Several OSH researchers have examined injuries that occur in CTE programs (12, 44), and the Massachusetts Department of Public Health/Occupational Health Surveillance Program publishes cases identified through their NIOSH-funded Fatality Assessment and Control Evaluation (FACE) Project, where they have

> ***"The biggest motivators are the light of the fire and the heat of the fire. The heat of the fire, of course is that it's required, it's mandated, it must be taught. The light of the fire is that focus on ensuring [instructors'] welfare and the welfare of the students."***
> —Educational Organization Representative

Figure 7: Injury Report, Fatality Assessment and Control Evaluation (FACE) Project

A Cooperative Placement 11th Grade Student was Injured While Operating a Jointer in a Millwork Shop – Massachusetts

A student in an approved vocational technical education mill/carpentry program was injured while participating in a Cooperative Work Experience project (Co-op). The student was operating a jointer and was injured when the student's gloved left hand came in contact with the machine's cutting head. The student's left hand ring finger had to be amputated at the middle knuckle.

Report includes a detailed description of the incident and recommendations to prevent similar occurrences in the future.

http://www.cdc.gov/niosh/face/stateface/ma/08ma1NF.html

targeted injury surveillance for young workers. They share these cases with CTE instructors in Massachusetts through the state Department of Education—see Figure 7(45, 46).

All of the key informants with classroom experience described OSH training as consisting of a combination of introductory safety training (in the classroom), reinforced by hands-on training in the shop or in the field—"task and tool specific training." Reported classroom time spent on OSH training ranged from 4-6 hours in a high school setting to 140 hours in a multi-year apprenticeship training program. At the postsecondary level, classroom time in a semester-long introductory course was typically 20-40 hours (OSHA 10, plus an additional 10-30 hours of specific shop and tool safety).

Because CTE program structure varies enormously from state to state, OSH integration varies enormously as well.

Key informants, especially those who worked at the national level, or had contact with multiple states, strongly underlined the uniqueness of each state's structure. For example, in Tennessee, 2-year postsecondary institutions follow state CTE instructional standards, because they are in the same system as the secondary programs. But in Virginia, the 2-year postsecondary programs are in a separate system, and are more driven by industry standards.

Figure 8: OSHA 10-Hour Construction Training

Objective: To provide entry level construction workers information about their rights, employer responsibilities, and how to file a complaint as well as how to identify, abate, avoid and prevent job related hazards on a construction site.

- Intro to OSHA (2 hours)
- Focus Four (falls, electrocution, struck-by, caught-in) (4 hours)
- Personal Protective Equip. (30 min)
- Health Hazards (30 min)
- Instructors choice (limited) (3 hours)

Integration noted by key informants:

- Must have OSHA-10 care to compete in Skills USA student competitions
- Written into Youth Build RFP
- Taught by industry volunteers, OSHA consultation staff, teachers themselves

Figure 9: OSHA-10 Training for CT Students

The American Federation of Teachers (AFT) and its affiliate the State Vocational Federation of Teachers have a joint labor management program with the State of Connecticut to provide OSHA 10 cards for graduating **high school** seniors. The AFT provides OSHA authorized training (510/511 and 500/501) in the summers to career technical teachers.

The system has allowed the educators who complete the training to provide OSHA 10 and 30 training as part of the CTE program and to pay any administrative costs for students to receive an OSHA 10 card. The goal of the program is that every high school student in CT will graduate with an OSHA 10 card.

Teaching the OSHA 10 (usually providing cards) is almost universal at the community college level, and growing at the high school level.

Nearly all instructors mentioned the classroom-based OSHA 10-Hour Construction Training Program (OSHA 10—see Figure 8). In some cases, instructors themselves were authorized to teach it; others brought in industry partners to teach it. This is driven to some extent by the fact that more and more states have laws that require construction workers to complete the OSHA 10-hour construction safety training course before they can work on certain construction projects. The seven states that currently have such laws are:

Massachusetts, Connecticut, New Hampshire, Rhode Island, New York, Missouri and Nevada (47). In Massachusetts, for example, it has been institutionalized at the high school level that OSHA Consultation staff train CTE instructors to be able to provide OSHA 10 cards. (See Figure 9 for a similar effort taking place in Connecticut.)

Some informants mentioned use of online programs. The online program, CareerSafe, was mentioned by many interviewees, though primarily with regard to programs taught at the secondary level. (See Figure 10.) Several key informants expressed concern about using an online program to teach the OSHA 10 content. CareerSafe also provides supplemental teaching materials for participating teachers, and is working on a checklist to help teachers assess hazards in their own programs.

Figure 10: www.CareerSafeonline.com

- Largest provider of online OSHA 10 Hour courses by volume (includes both construction and general industry)
- Partnered with Skills USA
- Lowes provides$1.5 million in grant funding to fund 4000 students to get OSHA cards
- Housed at K2Share LLC (an online training company), affiliated with University of Texas at Arlington OSHA Training Center

The other program mentioned by several instructors was the Basic Safety unit of the *Core Curriculum—Introductory Crafts Skills* of the National Center for Construction Education Research (NCCER). (See Figure 11.) This unit, intended to be taught over a 12. 5 hour period, is designed to meet OSHA 10 requirements and is approved for that purpose by the OSHA Training Institute (OTI), if the instructor is OSHA-approved to teach the OSHA 10. Some instructors also use the NCCER materials, without offering an OSHA 10 card. Two interviews (neither of them with community college instructors) included mention of the Building Trades' Multi-Craft Core Curriculum, which was described as being used in union-affiliated apprenticeship programs. It was noted that development of this curriculum is a fairly recent effort. (See Appendix 2 for links to more information about these materials.)

Figure 11: National Center for Construction Education Research (NCCER)

- Offers teaching curricula and certificates for more than 60 craft areas.
- Core Curriculum—Introductory Crafts Skills includes a Basic Safety unit that meets current OSHA-10 requirements
- Students who pass the assessment for the Core Curriculum(if taught by an NCCER-certified instructor) receive a "Core Certificate of Completion"

Comments from Key Informants:

- The curriculum is essentially a textbook, although there are teaching tips in the instructor's manual.
- Content driven by input from big contractors.

Key informants identified additional OSH teaching resources and best practices.

Teaching Resources: In addition to the OSHA 10 PowerPoint materials, the NCCER core curriculum and related materials, and the supplemental CareerSafe teaching materials available to participating teachers, individuals mentioned other OSH curriculum resources:

- *NIOSH Youth @ Work—Talking Safety* curriculum: 3-5 hour curriculum designed to provide foundational OSH skills to high school students

- *OSHA's 11* curriculum: 11-hour curriculum designed to teach the OSHA 10 hour general industry content to high school students using participatory activities
- *Young Worker Safety and Health Training for the Construction Industry*: 1-hour lesson to accompany foundational OSH training activities from the *NIOSH Youth @ Work* curriculum
- *Basics of Occupational Safety*: an OSH text book
- WISC online: online teaching resources for CTE instructors

All of these are described in Appendix 2, with links. In Massachusetts, where the Occupational Health Surveillance Program at the Massachusetts Deptartment of Public Health has tailored the *Youth@Work* curriculum for health care and culinary programs, they have cross-walked the curriculum with MA curriculum frameworks, and with OSHA 10 requirements.

Teachers also used videos (including online AV), PowerPoint presentations, outside speakers (especially from industry), hands-on "trainers" (pieces of equipment designed for training purposes), and visits to job sites. They also relied heavily on their personal experience and "scare stories".

Best practices: When we asked about best practices, the following were identified:

- **Provide hands-on experience.** All instructors we interviewed described the critical importance of hands-on experience. One instructor said that they try to ensure that at least 50% of students' time is spent on hands-on training. Several mentioned partnering with Habitat for Humanity (200 hours in one program), and how important this was for students to get health and safety messages and hands-on guidance from a variety of different supervisors—not just lecture in the classroom. But at least one OSH trainer noted that this concept of "hands-on" is not necessarily applied to OSH activities in the classroom, such as skill-building around communication. Another instructor noted the importance of "just in time learning"—when something happens, such as a near-miss, and the instructor talks about it in the moment.

- **Model safe practices/follow procedures.** One instructor noted the importance of instructors and other on-site supervisors following all safety procedures to the letter.

- **Conduct demonstrations.** Several instructors described conducting demonstrations as being much more effective than simply lecturing, describing safe practices, or even showing pictures of safe practices.

- **Provide adequate structure for all student learning.** Several instructors noted that students need lots of structure, both in the classroom and in the shop. They emphasized the importance of communicating clear instructions and expectations, and careful observation and follow-up when instructions are not followed.

- **Conduct safety inspections.** In some states (e. g. OK and MA), periodic shop inspections are required by statute. One instructor invited an OSHA consultation inspector to come in as part of their competition process in the Skills USA competition (see below). The school ended up having to make some repairs. Initially, the school administration was unhappy with the instructor, but once the repairs were made, they recognized the value of having done this. Another instructor has one student serve as the "Safety Officer" of the week.

- **Provide other tools to support health and safety in CTE programs.** For example, in Massachusetts, the Occupational Health Surveillance Program (Massachusetts Department of Public Health) has developed a guide for co-operative work experience coordinators in CTE programs to help them safely place students in work experience settings. The guide includes information on requirements under the law, as well as assessment checklists for non-safety experts (48). Many noted that states with strong health and safety requirements at the state level, where teachers attend regular training, inspections are required, etc. , also have strong educational programs for their students. Model states mentioned by more than one key informant were Oklahoma, Ohio, Georgia and Florida (especially regarding their data systems). Other states mentioned by only one key informant were Minnesota, Texas, New York, Iowa, Connecticut, and Wisconsin.

- **Teach the OSHA -10 as effectively as possible.** Our key informants had many suggestions about ways they have taught the OSHA 10 more effectively. Further discussion of the barriers trainers face in teaching the OSHA 10 effectively can be found on p. 24.

    - **Make it as hands-on and experiential as possible.** Two OSH trainers mentioned the *OSHA's 11* curriculum, a curriculum put together by a consortium of programs to help instructors teach the general industry OSHA 10 in a more participatory way, using many activities from the NIOSH *Youth@Work--Talking Safety* curriculum, including hazard mapping, games, and role plays. This curriculum is not formally approved by the OSHA Training Institute (OTI) as an OSHA 10 curriculum. Another OSH trainer said he uses a role play to get at many of the critical rights and responsibilities issues—enabling him to skip 20 slides from the relevant OSHA PowerPoint presentation!

    - **Provide some initial training and background** before launching in to the OSHA 10. The Center for Young Worker Safety and Health at Georgia Tech Research Institute has developed a construction primer (*Young Worker Safety and Health Training for the Construction Industry*) to be combined with some of these core *Youth@Work* activities, which they use in high school construction programs to teach 6-10 hours of health and safety, instead of the OSHA 10. They have found that teachers are now requesting this more participatory, foundational training, even though their students will not receive an OSHA 10 card.

    - **Bring in industry representatives**, who can share their up-to-date experience.

Key informants identified the need for high quality training for teachers and related instructional tools to help teachers conduct more participatory classroom training on OSH, and in particular activities to build students' problem-solving and communication skills.

Research has shown that OSH training—including classroom training—that is participatory and practice-based is generally more effective than passive methods, such as lecture/slides (49, 50), but this was not typical in the classroom training described. Several key informants noted that many CTE instructors come from industry, and have limited training on pedagogy, as well as limited curricula that provide skill-based, participatory activities for students to learn the basic foundational skills they need to be safe on the job.

> ***"There are lots of things people are asked to do that would make you cringe."***
> —Instructor

The other training gap identified was the lack of training on communication and problem solving skills for the jobsite. Several instructors commented on the fact that the safe practices that students learn in their coursework may not be followed out in the field. This has been confirmed in the literature, where at least one study found that inexperienced construction workers are exposed to many fall hazards, but that they are not trained or prepared to negotiate safer conditions (51). Instructors might tell their students they need to speak up, or teach them about the need for communication —the NCCER Core Curriculum does include a 7. 5 hour unit on communication —but no one could describe any teaching activities (other than the *Youth @ Work* curriculum described above and used by some of the OSH trainers with high school students) that would help students develop those skills. The NCCER unit focuses on listening, speaking, reading and writing, but there are no teaching activities and little information on problem-solving or speaking up about hazards at the jobsite.

> ***"In my experience, when you make [students] go through safety [training] and then the employer doesn't hold them to that safety standard …they'll start to be lax in their practices. …. One of my students took a job with a local contractor, and, before he would put new nails in the nail gun, he would disconnect the air and then reload the nail gun and reconnect the air to the nail gun. That's what I taught him. He got kind of chastised a little bit "Hey, come on, you don't have to that here" and therefore he's like "oh, ok, then I won't."***
> —Instructor

> ***"You have to develop in that student a sense of self-esteem, that you matter more than that job that day. And if you ask in an appropriate way, in a respectful way, you can usually get what you need. And you can usually educate somebody who maybe is not even aware that they're putting you in a dangerous situation."***
> —Instructor

> ***"You have to tell them, 'you have to shut that off, that machismo—that you're a chicken if you don't get on the scaffolding. '…I think if you empower students, and you get them to have a sense of self-esteem, then they feel ok saying to [the employer] 'I don't know, but I think I'm supposed to have a fall harness, you know, I'm on a residential roof, but I'm 10 feet above in the air, you know, if I fall I could break my neck. If you don't have one, I've got one in the truck, I'm happy to go put it on. '…If you teach them how to ask or say that, then usually they're ok, because then they don't have to come up with it, they already have a script, a dialogue."***
> —Instructor

Learning standards set by education agencies and organizations have a greater influence at the high school level than at the postsecondary level, but do impact many instructors.

In their articles, Schulte and Palassis reported on the efforts taking place in the early 2000s to integrate OSH into various skill and competency standards, such as efforts by the National Skill Standards and the Career Clusters Initiative spearheaded by NASDCTEc (5, 7). While these efforts have resulted in a set of competencies, the Common Career Technical Core (CCTE-see Figure 12 (52)) promoted by NASDCTEc, key informants reported that the primary drivers in terms of educational standards are the CTE standards that exist at the state level. For example, health and safety advocates in Massachusetts worked to get a "core competency" added to their cooperative learning programs, requiring "understanding health and safety culture in the workplace." In Georgia, a certain number of hours of safety training is required for both secondary and postsecondary CTE students. In Oklahoma, every CTE student must take a safety course and score 100% on the assessment. See Appendix 3 for one example of comprehensive OSH standards at the state level (California.)

Figure 12: Common Career Technical Core (CCTC) Standards

Construction Career Pathway, Standard #5: Apply practices and procedures required to maintain jobsite safety.

Career Ready Practices #1,4,5,6,8:
1. Act as a responsible and contributing citizen and employee.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
8. Utilize critical thinking to make sense of problems and persevere in solving them.

> ***"We wouldn't get into the classrooms if there weren't standards requiring it."***
> —OSH Professional

National standards, such as the CCTC, as well as industry standards, can influence state-level standards. In many cases, however, these standards only apply to K-12 programs. Many key informants also noted that the standards are only effective if instructors are actually held accountable to them. So again, the strength of the standards, and the extent to which they influence what happens in the classroom, varies enormously state by state. CTE programs also can be influenced by academic standards, most notably at this time, by the national Common Core standards. The Common Core State Standards Initiative is a state-led effort that established a single set of clear educational standards for kindergarten through 12th grade in English language arts and mathematics that states voluntarily adopt, but which are also promoted through federal funding initiatives. All but five states in the country have adopted the Common Core standards for K-12 education. Many states have worked to "crosswalk" their CTE standards with Common Core standards, to help demonstrate the academic learning that takes place in CTE programs.

> ***"The primary drivers are whatever the reward or punishment systems are. So for example… when states have specific requirements, such that the high school CTE programs have to lead to an industry recognized credential, then that will drive the curriculum…Absence or presence of state standards, and the extent to which teachers are held accountable to them, really will drive behavior. Safety units are part of that."***
> —Educational Organization Representative

The other two sets of competencies that key informants mentioned that may influence some programs were: 1) the emerging STEM (Science, Technology, Engineering, Math) education framework, currently being promoted through the federal Race to the Top funding initiative, which focuses on preparing students at all levels to use technically sophisticated skills including the application of mathematics and science skills and concepts, as well as to become competent, capable citizens in a technology-dependent, democratic society (53); and 2) the competencies that students must meet to participate in Skills USA competitions (see Appendix 4). Students must pass a safety test with a 100% score to participate.

While key informants consistently talked about the importance of focusing primarily on meeting industry standards, they also talked about the need for a "push from the top" to keep OSH on the front burner for all programs. NIOSH recently announced its "Safe, Skilled, Ready Workforce Initiative"—an effort to add more detail to the foundational OSH skills that all workers need (as opposed to occupation-specific skills). The initiative's goal is to work in partnership with educational programs and institutions (including CTE), employers, labor, and health agencies and providers, to promote and integrate training on eight core competencies (54).

Learning standards set by industry (e. g. industry certifications) tend to have a greater influence on community college instruction, especially through local industry advisory councils.

As noted above, most key informants spoke about the need for standards and competencies to reflect industry needs, and at the postsecondary level, this was often the primary driver in terms of standards. In Florida, for example, all CTE programs are required to align with industry certification, or they will not be funded. NCCER offers assessments and credentials or certification for more than 60 craft areas.

Instructors looking for industry certification in the health and safety arena in construction described the OSHA 10 card as key. Informants noted that many contractors are requiring an OSHA 10 card for all their employees, even when there is no regulation requiring this.

The other industry certification mentioned by informants was NCCER's certification—a general skills certification, in which questions on safety make up 14% of the test. While the community college instructors we spoke to did not typically participate in this certification program, several different trainers at a recent conference for community-based pre-apprenticeship programs mentioned that they sought NCCER certification for their participants. Two instructors also mentioned the Building Performance Institute (BPI) certification as a driver in their programs—certification of individuals in building analysis, heating, AC/heat pump, shell/envelope and multi-family designations.

At the secondary level, instructors also mentioned the 21st Century Framework, developed to describe the kinds of career-ready skills generally sought by employers. These skills and competencies emphasize critical thinking and problem-solving skills, and were developed by the Partnership for 21st Century Skills, a national coalition of business, education and policy leaders (55).

In addition to specific industry certifications, some postsecondary institutions develop industry-specific, or even sometimes company-specific programs, if a significant number of new skilled workers are needed.

Two instructors mentioned that in the past, they worked hard to align their community college construction programs with local joint apprenticeship program requirements, where their top students were always able to find spots after completing the program. Now, with no openings available, they are not currently partnered with the local Joint Apprenticeship Training Council (JATC).

Other variables that change from system to system that were mentioned by key informants as drivers of what is taught included: 1) Local district or school level leadership; and 2) Availability of grants that include specific requirements regarding OSH training for students, or that provide professional development. These include programs such as stimulus programs funded by the American Recovery and Reinvestment Act of 2009 (ARRA), targeting workforce development in energy efficiency/weatherization, workforce development for individuals on probation, and Brownfields training programs. One instructor noted that teachers teach "what's in the textbook," highlighting the importance of making sure that all textbook information is complete and up-to-date. The NCCER textbook materials were the only ones mentioned by key informants, but a broader survey would likely reveal others.

D. Barriers to OSH Integration

Key Findings

- Most instructors did not themselves perceive barriers to teaching about OSH in their programs.
- Instructors did report feeling overwhelmed by all of their responsibilities, indicating that limited time to adequately prepare (including staying up to date) might be a barrier.
- Many informants identified barriers to teaching a high quality OSHA 10 class.
- Instructors reported that teaching students who have a broad range of academic preparation is challenging.
- Finding a way to systematically ensure integration of quality OSH training is challenging, due to the complex construction CTE landscape.

Most instructors did not themselves perceive barriers to teaching about OSH in their programs.

> ***"I think most instructors spend a lot of time on safety, because they've kind of had it banged into their heads that they have to."***
> —Instructor

When asked about barriers, instructors' initial response was universally to say "there are none." While they admitted that it might sometimes take persistence and legwork to acquire the necessary equipment or training resources, the administration is ultimately supportive, because students' safety is at stake.

While we expected to hear concerns about inadequate resources for making shops safe—especially engineering controls—only one instructor mentioned equipment needs. He described the "trainers" (training equipment they used for practicing lock out/tag out, etc.), as a key part of their hands-on OSH training. But he admitted that they had only recently acquired the equipment due to a training grant they had received.

> ***"Our instructors know that it's absolutely critical that it [safety training] be done. There's no compromise on that issue. Without safety training, that teacher's probably not going to survive in that job."***
> —Educational Organization Representative

Instructors did report feeling overwhelmed by all of their responsibilities, indicating that limited time to adequately prepare (including staying up to date) might be a barrier.

Instructors did acknowledge the pressures of having to meet both educational and industry standards, including staying abreast of new developments or changes in those standards. Several commented on the fact that creating teaching activities and instructional materials is very time-consuming, so that they appreciated any read-to-use materials that were available. Another instructor talked about the importance of having OSH instruction embedded into all of their activities. "If you have to fit it in, as opposed to embedding it in the curriculum, that's when you have a problem. "

OSH trainers from outside the instructor community also commented that some instructors, while very comfortable teaching specific hands-on skills, where less comfortable with classroom teaching, and especially with using more participatory activities. Many CTE instructors in the trades have come from industry, and have less pedagogical training. Others noted that while instructors may have originally come from industry, after many years in the classroom they sometimes lacked up-to-date practical experience.

Many informants identified barriers to teaching a high quality OSHA 10 class.

Many key informants noted recent changes in OSHA's practices regarding who can be authorized as trainers to be able to provide OSHA 10 cards to students—an effort to reduce the number of fraudulent cards being issued. They explained that this has made it challenging for instructors to become authorized trainers, as many do not meet the requirement for "5 years of OSH experience". Yet others reported that they are authorized trainers, or that instructors in their states are still being authorized as trainers. Two informants were also frustrated that now they need to charge students (or find funding within the school) to pay for OSHA 10 cards ($5 each), due to OSHA's new requirements. While the amount seems small, some programs and/or students find it prohibitive.

All key informants were also frustrated with the amount of information required to be taught during the 10 hours (with one specific complaint about the additional hour now required on OSHA itself). Instructors (as opposed to OSH trainers from outside the education system) felt they had to teach the course by following the OSHA-provided PowerPoint presentations very closely. Both of these issues generate a very lecture-focused training environment. Some trainers recognized that alternative curricula could be used, but thought that those alternative materials had to be pre-approved by OTI. This is not the case: while OTI training materials do say "the trainer may not vary from these objectives when planning the training session", the materials also state that instructors "may" use the PowerPoint presentations and other activities made available on OSHA's website—not that they "must" use them—and that the instructor's own materials can be integrated or used, as long as the learning objectives are achieved. The OTI-provided training materials also emphasize the importance of classroom discussion and suggest some limited small group activities (56, 57). However, even the most experienced trainers found it challenging to teach the OSHA 10 content in a participatory way, given the amount of material that needs to be covered, as well as the emphasis on the need for participants to understand OSHA regulations.

One instructor noted the need for some kind of assessment (on what students really need to know—not the details of all the regulations), rather than the current "seat time" requirement. This was particularly challenging in a classroom environment where students might miss a class, leaving no easy way to make up the "seat time" without the instructor spending time with individual students as needed—as opposed to using an assessment to test their understanding.

Several informants felt that 10 hours of OSH training was too long for a typical high school student with no job experience to relate it to. See Georgia Tech's approach described on p. 20.

Instructors reported that teaching students who have a broad range of academic preparation is challenging.

Reported more by those teaching at the high school level, instructors noted that many of their students were already working (and often tired), and some had significant academic challenges, including low literacy levels. Keeping students engaged, especially if they have limited relevant work experience is challenging. Students at the community college level tend to be older, and more likely to be engaged, but still reflected a broad range of academic skills. These challenges are even greater in the pre-apprenticeship programs targeting at risk populations, pointing to a need for training resources that are effective with workers with limited literacy and/or academic preparation.

Finding a way to systematically ensure integration of quality OSH training is challenging, due to the complex construction CTE landscape.

Although there are basic OSH skills that all students in construction programs need to learn, there are also many additional trade-specific skills that are needed. In addition, as described above, there is no systematic way to reach all construction CTE instructors, given the fact that each state has its own, autonomous structure. The secondary and community college level programs are not always well articulated, although this was mentioned as a goal that is being pursued in national and state-level efforts. Community college instructors are the most difficult to reach, although again, this is not true in every state.

E. OSH Curricula and Resources Needed

Key Findings

- Instructors need instructional material that is "ready to go," but which they can also easily adapt.
- Instructors seek online resources.
- Instructors need mechanisms to share and learn about new resources.

> ***"Often we hear from teachers: 'Something easy, something simple, something clear, something real.'"***
> —Educational Organization Representative

Instructors need instructional material that is "ready to go," but which they can also easily adapt.

Instructors noted that creating curriculum and instructional materials takes a lot of time. They appreciate clearly written materials or other ready-to-use resources, with clear instructions. One OSH trainer explained that teachers were very comfortable with teaching hazard mapping, for example,

because it is simple and easy to do, and provides concrete skills. Hazard mapping is an activity used to teach hazard identification where students work together in groups to draw a floor plan of the relevant worksite, and then use different color markers to show the presence of different categories of hazards, such as physical, chemical and biological hazards. Several OSH trainers noted the need for materials that explicitly guide instructors through teaching OSH content in more participatory ways in the classroom.

> ***"You're so busy with completing what you have to complete in that certain amount of time, and dealing with students and their issues…that anything that you get that gets provided to you, any kind of training kit or video or anything, I'm open to any of that because that makes my job that much easier."*** —Instructor

At the same time, instructors noted a need for materials that they can adapt to meet their own instructional style or content, and in some cases so that the materials can be tailored to add school information, and be approved by their school or district. This means providing materials in word or PowerPoint versions.

Instructors seek online resources.

Instructors talked about the need for high quality videos (Georgia Tech's CYWSH is working on an app that can be used to find vetted, high quality OSH training videos.) One OSH trainer described how instructors are finding ways to integrate smart phones into students' research and learning. Another instructor wanted interactive online resources that could be tied to classroom learning and assessment – "where I can tell if they're getting it or not."

Instructors need mechanisms to share and learn about new resources.

One instructor suggested a chat room, where instructors from similar trades could come together to share ideas. Another instructor wanted guidelines regarding what a high quality health and safety program should look like.

> ***"What distinguishes a gold star safety course—you know, like a five-star hotel—versus a one-star course?"*** —Instructor

F. Reaching CTE Instructors

Key Findings:

- Instructors can be reached through each state's CTE agency structure.
- Instructors can be reached through professional CTE organizations and conferences.
- Information can be shared through industry-sponsored conferences/meetings.

The first three channels were described as priority channels to use by the majority of the key informants, with a strong focus on working at the state level. Only a small percentage of instructors participate in national professional organizations, although these organizations clearly can influence

what happens at the state and local level. A handful of other potential channels were also mentioned by some, described in the last paragraph, and may be worth exploring for specific projects or states.

Instructors can be reached through each state's CTE agency structure.

As described in the CTE landscape section (p. 9), each state has its own structure. In some states there are strong top-down mandates, making it critical to work with these state educational agencies. Even in states where there is more autonomy at the school or even classroom level, state agencies have mechanisms for communication with their CTE programs. Both ACTE (32) and NASDCTEc (33) have web-based resources that describe each state's structure.

Instructors can be reached through professional CTE organizations and conferences.

Through our internet search and conversations with key informants, the following five organizations emerged as key channels of information and influence:

- Association for Career and Technical Education (ACTE)
- Association for Skilled and Technical Sciences (ASTS)
- Skills USA
- National Association of State Directors of Career Technical Education Consortium (NASDCTEc)
- American Association of Community Colleges (AACC)

Each of these organizations is described in more detail in Appendix 5. This section describes how these organizations fit in the CTE landscape, and their potential role in providing information to construction CTE instructors.

ACTE and ASTS are professional organizations for ***instructors***. Skills USA is an organization for CTE ***students***, but which also links with instructors through their student competitions, and by providing separate training activities for instructors at their annual conference. NASDCTEc and AACC are organizations for ***state and institutional leadership and managers***, described below.

Key informants described extensive overlap between the three organizations targeting construction CTE instructors (ASTS, the Trade and Industrial Education Division of ACTE, and Skills USA). One informant noted that in a Venn Diagram of members in the three organizations, there would be lots of overlap in the middle. All three organizations have vastly more engagement among secondary level CTE programs and instructors. Key informants estimated that about 20% of the members in these organizations were involved in postsecondary level programs. In addition, informants also said that some states were overrepresented – such as Oklahoma, Ohio and Missouri– probably due to the fact that these states have stronger CTE programs, with more commitment to and resources available for professional development.

NASDCTEc includes directors of all CTE programs (many of which may only have jurisdiction over secondary-level programs), but also includes education staff who have links to the community college CTE programs where they are not structurally linked. Thus they provide a potential communication link, but much of the advocacy and policy-level work done by the organization is focused on high school level programs.

The American Association of Community Colleges (AACC) is the primary advocacy organization for the nation's community colleges. It's a member organization made up of managers and leaders of nationally accredited 2-year colleges that grant certification and credentials. The association represents nearly 1,200 two-year, associate degree–granting institutions and more than 13 million students.
All key informants reported that while these national level organizations may play an important role in information dissemination to those instructors who are involved, they directly reach only a fraction of instructors and programs, with even more limited reach at the postsecondary level. However, every state has its own professional CTE organization(s), many of which are affiliated with these national organizations. It is therefore much more likely that an individual instructor and/or local construction CTE program would get information at their state conference. In some states, attendance is mandatory (such as Oklahoma, where both secondary and postsecondary level instructors must attend). In others, reach is much more limited, again especially at the postsecondary level. See Appendix 5 for examples of state-level CTE organizations for California.

Other organizations we came across that play a role in the CTE world include the Aspen Institute (both their community-college-focused initiative, "Skills for America's Future", and their "Workforce Strategies Initiative"), the Center on Education and the Workforce, the National Academy Foundation, the National Association of Career Technical Education Information, and the National Research Center for Career Technical Education (NRCCTE). The NRCCTE was a great source of information, but focused on secondary level programs. They could be a potential partner for research at the secondary level.

Information can be shared through industry-sponsored conferences/meetings.

As noted earlier (in Section IIIB. The Landscape), all CTE programs that receive Perkins funding are required to have a local industry advisory committee. Some states, such as Florida, require that all CTE programs lead to an industry-accepted certification. Especially at the community college level, the measure of success of the program is based on whether they are graduating students who have the skills to fill local jobs – in some cases, programs explicitly requested and designed for particular industries or companies. As a result, especially at the postsecondary level, but also at the high school level, many instructors look to industry for information on the latest best practices, including in health and safety. Among the community college instructors we interviewed, all of them mentioned various local industry organizations first, as a source of information for new developments in the industry. This information might then get shared through local school leadership or curriculum coordinators, at professional organizations, or word of mouth among fellow instructors. Local chapters of the following construction industry organizations were mentioned.

- Builders' Exchange
- Building Industry Association
- National Association of the Remodeling Industry
- National Association of Women in Construction

Figure 13: Safety Expo Sponsored by Sacramento Regional Builders Exchange

- Supported by building contractors, building trades unions, safety suppliers
- 3-day conference, held during spring break, over 100 sessions
- Participants can attend sessions to obtain OSHA 10 cards and other industry certifications
- Many high school and community college construction CTE instructors bring their students
- Includes student competition activities

http://sacsafetyexpo.com/about/what-is-the-safety-expo/

- Homebuilders Association
- A local building inspector group

The National Association of the Remodeling Industry (NARI) was mentioned by instructors as particularly important for connecting with small residential contractors. The local chapter mentioned by one instructor was active in supporting both secondary and community college construction programs. See Figure 13 for an example of how one local Builders Exchange helps provide OSH training opportunities to CTE students.

Instructors also reported the following sources for OSH information:

- Agency websites for OSHA, NIOSH, CPWR
- Textbook updates (noted NCCER)
- NCCER communications, beyond textbook updates
- Joint Apprenticeship Training Council
- Other CTE programs they may use as a model, to develop new programs
- OTI/OSHA training centers
- Teacher training (original teacher credential, professional development opportunities through new grants, refresher training in states where it is required)

IV. Discussion

One clear theme that emerged was that teachers who are teaching construction skills to students are well aware of the need for OSH training—they are unlikely to need convincing on that point. What they could use, is access to effective teaching tools. While some of these kinds of resources exist, there may well be many others which did not emerge in this small study. In addition, in some cases, instructors would benefit from skill-building of their own to conduct classroom training, including basic OSH content, in more engaging and participatory ways. In particular, they need help teaching soft skills, including critical thinking, problem-solving and communication—which employers say they want. These skills might be the ones that really end up saving a student's life or finger, once he or she is out on the job. We did not identify any online resource-sharing tools for construction instructors. This could use further exploration.

Because the OSHA 10-hour Training Program has become a standard of practice in much of the construction industry, and consequently in CTE training programs as well, it seems important to ensure that OSHA 10 training is conducted as effectively as possible. While OTI has taken steps to promote more participatory training, as evidenced in their newer instructor guides, it is not actually possible to use those activities and cover all the content contained in those materials using a 10-hour timeframe. In addition, by relying on the OSHA 10 as the primary classroom content, students may not be learning the basic foundational and leadership OSH skills they will need, including the ability to identify hazards, understand how those hazards should be controlled, and being able to problem-solve and speak up in the workplace. Extending or complementing the OSHA 10 with these additional learning objectives and effective teaching tools could significantly strengthen the quality of OSH training received by CTE students.

One surprise was the lack of discussion about the need for OSH equipment resources for the classroom. In a previous scan (58), this was a concern raised by vocational education instructors at the time. Again,

this may be a result of the fact that we spoke primarily to people from well-regarded programs. It is also possible that our question about what resources were needed felt very focused on training needs. In future research, this should be further explored.

This project only offers a snapshot regarding what's happening in construction CTE training programs—a snapshot based on talking primarily to instructors in well-regarded programs, experienced OSH experts, and CTE leadership. Because of the clear message that "every state is unique"—and of the relative autonomy of instructors in postsecondary programs in many states—this report cannot presume to describe the state of OSH training in construction CTE programs in a comprehensive way. Given the repetition of some of the themes presented, however, this study can be used to guide future research, or exploration of new initiatives. We present recommendations in the next section.

V. Recommendations

1. Conduct further research with instructors. Because this project was very small, and only included information from a small number of instructors, further research is needed to understand what kinds of resources are most needed by the greatest number of instructors. Using the preliminary findings of this small study, a broad, systematic survey with instructors at the community college or technical school level should be conducted, either at the national level or in a selection of states. In-depth interviews and site-visits to specific programs are also needed.

2. Create a system for instructors to share best practices and resources. Several of the key CTE organizations (ACTE, NASDCTEc) have websites with the potential to add resource-sharing tools. Even though their membership is made up primarily of secondary instructors, they are still the primary CTE resources, and all instructors could have access. AACC and other organizations could link to this resource. At least one instructor also expressed interest in a chat room or other mechanism for direct communication among instructors. This should be explored further. Given the pervasive use of the OSHA 10-Hour Training Program, the OSHA Training Institute (OTI), which oversees the delivery of OSHA 10 training, could be another mechanism for reaching instructors.

3. Strengthen and extend educational and industry standards for OSH skill development. All federal programs that provide funding for construction training should explicitly require the full range of OSH skills needed, including communication and jobsite problem-solving skills.

4. Promote the "critical thinking/problem-solving" OSH skills that should be included in quality OSH training. Clear articulation of what this entails can be developed and tailored to construction settings using some of the resources described in this document. Easy-to-use, clear teaching activities will greatly increase the chance that instructors will teach this as a skill, rather than just as something students "should know."

5. Develop, evaluate, and disseminate a model "OSHA 10-plus" training curriculum. Work with the OSHA Training Institute (OTI) to design an extended OSHA 10 training curriculum based on evidence-based best training practices, targeting new and young workers. Add teaching activities to develop leadership, problem-solving and communication skills (Recommendation

#4). If OSHA 10 is going to be a core tool for OSH training in construction, it is imperative that trainers and instructors have effective teaching resources that are approved by OTI. School-based programs, where assessments are a standard of practice, would also benefit from a standard assessment tool to evaluate student learning, without making it an OSHA requirement.

6. Conduct outreach to local industry advisory committees to increase industry's "pull" for safety. Local industry/employers are critical "clients" in the CTE system, especially at the postsecondary level, where students are most likely to seek employment directly after the educational program. Instructors look for guidance both formally (as required by Perkins funding) and informally (as they seek the most current information from these industry sources). If these employers are asking for students who are prepared to be critical thinkers, and can articulate what this means in the OSH skill set, instructors will respond.

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APPENDIX 1

Integrating Occupational Safety and Health into Industrial and Technical Education in Construction

Key Informant Interview Questions

Introduction: Thank you for agreeing to speak with me. Before we start, I want to explain again that I work at UC Berkeley's Labor Occupational Health Program, and I am a project researcher for a "Research to Practice" initiative in construction health and safety through the Center for Construction Research and Training (CPWR) and sponsored by the National Institute for Occupational Safety and Health (NIOSH). In this part of the project, we hope to better understand what occupational safety and health training is included in community college and high school level career/technical education classes in construction, and how we can do a better job sharing new and innovative resources as they become available.

Procedures: With your permission, I will audio record and take notes during the interview. The recording is to accurately record the information you provide. If you choose not be to audio recorded, I will take notes instead. I will turn off the recorder at your request at any time during the interview. You can also stop the interview at any time.

Confidentiality: The information you share with me will be handled as confidentially as possible. Only I and my colleagues working directly on this study will have access to my interview notes or audio files. We will not use your name or other identifying information in any reports or publications of our discussion unless you grant explicit permission to do so.

Do I have your permission to audio record the interview?

Interview Questions

1. What is your role in community college/technical education in construction? If you are an instructor, what classes do you teach? How many courses per term? How did you get into teaching? How long have you been teaching?

2. What are your main teaching objectives when you teach your courses? How much time is spent on occupational safety and health in a typical semester-long course? What is typically covered? Probe on why is there so much/so little time devoted to OSH.

    a. OSH includes both <u>safety</u> (such as falls, electrocution, trench collapse, etc.) and <u>health</u> (such as exposure to lead, silica, asbestos, noise, awkward postures). Could you say how much time you spend on <u>safety</u> versus <u>health</u>?

3. Where do you think students usually acquire OSH skills? Where should they acquire these skills?

4. In your experience, what is the reaction of students to OSH training?

5. What standards or competencies do instructors use to guide their OSH instruction?

    a. How is achievement of these competencies measured?

6. What curricula, text books, or other teaching materials or resources (eg speakers, videos, online programs) are used? Where do you find them?

    a. Can you describe any practices that you or other instructors use that you think work well for OSH education in construction CTE programs? (curricula, video, student materials, who teaches it, how instructors are trained)

7. Who decides what teaching materials or resources are used? What are you looking for when you look for materials?

8. What barriers prevent teachers and/or programs from spending time on occupational safety and health? What prevents teachers from using the most effective methods (such as those you described earlier) to teach about OSH?

    a. What resources are needed?
        i. Classroom health and safety equipment?
        ii. Up-to-date effective teaching materials/curricula?
        iii. Training for teachers?
        iv. Other?

9. What is the most effective motivator for teachers to spend time on OSH?

10. What kinds of OSH curricula and resources would be of greatest use to instructors involved in ITE programs, in addition to any best practices you already described?

11. What is the best way to reach CTE/ITE instructors to introduce new teaching materials to them? Where do you/they get information about new resources?

    b. Key organizations?
    c. Newsletters? (electronic, paper—which ones)
    d. Websites
    e. Listserves
    f. Conferences
    g. Other

12. Can you give an example of a successful curriculum innovation (i. e. an example of another topic that has been successfully integrated into the curriculum)? What made it easy or challenging to adopt? Why do you think the integration was ultimately successful?

13. Would you be willing to share your syllabus? We would only use it for research purposes to better understand the content of ITE curricula.

14. Is there anything else you would like to add before we conclude?

APPENDIX 2

Teaching Resources Identified by instructors

OSHA 10 http://www. osha. gov/dte/outreach/construction/index. html
The OSHA Outreach Training Program for the Construction Industry provides training for workers and employers on the recognition, avoidance, abatement, and prevention of safety and health hazards in workplaces in the construction industry. The program also provides information regarding workers' rights, employer responsibilities, and how to file a complaint. Through this program, workers can attend 10-hour classes delivered by OSHA-authorized trainers. The 10-hour class is intended for entry level workers.

CareerSafe http://www. careersafeonline. com/index. php/OSHA 10-hour-construction-industry
This OSHA-approved online training program for Construction Industry provides training for entry level workers and employers on the recognition, avoidance, abatement, and prevention of safety and health hazards in workplaces in Construction industry. The program also provides information regarding workers' rights, employer responsibilities, and how to file a complaint.

Students who successfully complete the CareerSafe OSHA 10-Hour Construction Industry course receive an OSHA 10-Hour Construction Industry wallet card from the OSHA Training Institute (OTI). The cost for the CareerSafe OSHA 10-Hour Construction Industry Training is $25 per student. This includes the $18 training course and the $7 mandatory OSHA processing fees.

National Center for Construction Education and Research (NCCER) Core Curriculum http://www. nccer. org/core-curriculum
The NCCER Core Curriculum is a prerequisite to all other Level 1 craft curriculum. Its modules cover topics such as Basic Safety, Communication Skills and Introduction to Construction Drawings. Completing this curriculum gives the trainee the basic skills needed to continue education in any craft area he or she chooses. The curriculum complies with OSHA 10-Hour Construction Industry Outreach Training Regulations when taught by an OSHA Authorized Construction Outreach Safety Instructor.

AFL-CIO Multi-Craft Core Curriculum http://www. bctd. org/Newsroom/Video-Gallery/BCTD-Videos/Core-Curriculum-Program. aspx/?path=/oswego/bctd/corecurriculum_sd_final_bctd

http://www. efficiencycities. org/wp-content/uploads/062309/BCTD%20TriFold_v6. pdf
The Building Trades National Standing Committee on Apprenticeship and Training has identified courses in all building trades' apprenticeship programs that are offered in common without regard to a particular craft, a common core curriculum. The courses are: general orientation to apprenticeship; cardiopulmonary resuscitation (CPR) and first aid; the OSHA 10 hour certification course; blueprint reading; applied mathematics for construction applications; history of the construction industry and the heritage of the American worker. The general orientation course includes construction industry structure and the construction process; orientation to apprenticeship itself; tools of the various trades, and industry standards of work responsibility. The total core includes 120 hours of classroom training

Youth @ Work: Talking Safety http://www. cdc. gov/niosh/talkingsafety/
Youth@Work: Talking Safety is a foundation curriculum in occupational safety and health developed with OSHA and NIOSH funding by the Labor Occupational Health Program at U. C Berkeley, Education

Development Center, Inc. , and includes activities developed by the Occupational Health Surveillance Program of the Massachusetts Department of Public Health. This curriculum is meant to be used in a classroom or other group training setting, and has been customized for each state, Puerto Rico, Washington D. C. , and the U. S. Virgin Islands to address their specific child labor rules and regulations. The entire booklet includes instructions for teachers and a step-by-step guide for presenting the material.

A draft construction version was developed by the Oregon Building Congress. http://www. cbs. state. or. us/osha/video/youthworkers/youth_construction_curr. pdf

WISC Online http://www. wisc-online. com/Category. aspx?ID=40 (Learning Objects in Technical – Safety)
Wisc-Online is a digital library of Web-based learning resources called "learning objects. " The digital library of objects has been developed primarily by faculty from the Wisconsin Technical College System (WTCS) and produced by multimedia technicians who create the learning objects.

OSHA's 11 http://www. uwworksafe. com/request/#osha
This curriculum was developed by the Labor Occupational Health Program at U. C. Berkeley, the Education Development Center Inc. , and the OSHA Education Center at the University of Washington to teach OSHA 10-hour general industry course content in a more participatory and youth-oriented way. Contains interactive lessons and activities on foundational skills including hazard identification and control and problem-solving on the job, as well as topic-specific lessons on electrical safety, chemical hazards, bloodborne pathogens, ergonomics and workplace violence.

Young Worker Safety and Health Training for the Construction Industry
http://www. youngworker. gatech. edu/online-training-and-training-materials
These materials—a 1-hour lesson plan, PowerPoint presentation, and short training videos—are designed to provide construction-specific content after students have participated in foundational OSH training activities, based in large part on the *Youth@Work--Talking Safety* curriculum activities.

Basics of Occupational Safety *1st Edition* by David L. Goetsch, University of West Florida and Okaloosa-Walton, 2009. Provides an up-to-date, practical teaching resource that focuses on the basic safety-related needs of people in the workplace. It is intended for use in universities, colleges, community colleges, and corporate training settings that offer programs, courses, workshops, and seminars in occupational safety and health.

APPENDIX 3

CTE Model Curriculum Standards
California Department of Education
Building and Construction Trades (excerpt)
http://www. cde. ca. gov/ci/ct/sf/ctemcstandards. asp
Adopted January 2013

6. 0 Health and Safety

Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the Building and Construction Trades sector workplace environment. (Direct alignment with RSTS 9-10, 11-12. 4)

6. 1 Interpret policies, procedures, and regulations for the workplace environment, including employer and employee responsibilities.
6. 2 Use health and safety practices for storing, cleaning, and maintaining tools, equipment, and supplies.
6. 3 Set up a work area, or shop, to avoid potential health concerns and safety hazards, including but not limited to electrical (shock), wires (tripping), fumes (lung health), noise (hearing loss), fire (burns), and so forth, incorporating ergonomics.
6. 4 Practice personal safety when lifting, bending, or moving equipment and supplies.
6. 5 Demonstrate how to prevent and respond to work-related accidents or injuries; this includes demonstrating an understanding of ergonomics.
6. 6 Maintain a safe and healthful working environment.
6. 7 Be informed of laws/acts pertaining to the Occupational Safety and Health Administration (OSHA).
6. 8 Report hazards found on the job site to supervisor/teacher.
6. 9 Locate, and adhere to, Material Safety Data Sheet (MSDS) instructions.
6. 10 Maintain proper use of safety apparel at all times, including but not limited to, eye protection, hearing protection, skin protection, head protection, footwear and protection from airborne particulate matter.
6. 11 Comply with the safe handling, storage and disposal of chemicals, materials and adhesives in accordance with local, state, and federal safety and environmental regulations (OSHA, Environmental Protection Agency [EPA], Hazard Communication [HazCom], Material Safety Data Sheets [MSDS], etc.).
6. 12 Demonstrate the proper care and safe use of hand, portable and stationary power tools.

APPENDIX 4

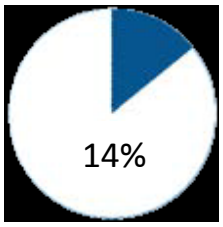
Carpentry Blueprint

This Blueprint contains the subject matter content of this Skill Connect Assessment. This Blueprint does **NOT** contain the information one would need to fully prepare for a SkillsUSA Championships contest. Please refer to the *SkillsUSA Championships Technical Standards* CD-ROM for the current year or purchase and download the relevant "Contest Singles." Both are available through *www.skillsusa.org* > Shop > Educational Materials Catalog.

Standards and Competencies

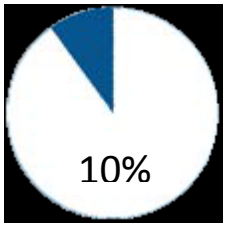
Competencies are weighted throughout the assessment. The percent shown is the weight of the competency. There are 50 questions per assessment.

Safety



- ☐ Identify common causes of construction accidents.
- ☐ Explain the role of OSHA and the 10 hour certification.
- ☐ Explain fall protection, ladder, stair, and scaffold procedures and requirements.
- ☐ Recognize hazard recognition and risk assessment techniques.
- ☐ Identify struck-by hazards and demonstrate safe working procedures and requirements.
- ☐ Identify caught-in-between hazards and demonstrate safe working procedures and requirements.
- ☐ Define safe work procedures to use around electrical hazards.
- ☐ Demonstrate the use and care of appropriate personal protective equipment (PPE).
- ☐ Explain the importance of hazard communications (HazCom) and Material Safety Data Sheets (MSDSs).
- ☐ Identify other construction hazards on your job site, including hazardous material exposures, environmental elements, welding and cutting hazards, confined spaces, and fires.

Using and maintaining hand tools

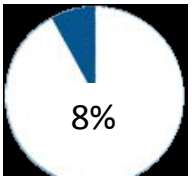


- ☐ Recognize and identify some of the basic hand tools and their proper uses in the construction trade.
- ☐ Visually inspect hand tools to determine if they are safe to use.
- ☐ Safety use hand tools.
- ☐ Utilize measurement devices.

Using and maintaining power tools

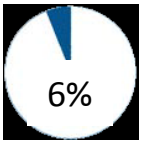
- ☐ Identify power tools commonly used in the construction trades.
- ☐ Use power tools safely.
- ☐ Explain how to maintain power tools properly.

Read and interpret plans and elevations from blueprints



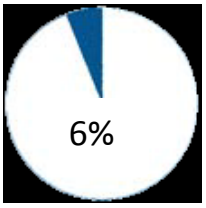
- ☐ Recognize and identify basic construction drawing terms, components, and symbols.
- ☐ Relate information on construction drawings to actual locations on the print.
- ☐ Recognize different classifications of construction drawings.
- ☐ Interpret and use drawing dimensions.

Understanding material handling



- ☐ Use proper materials-handling techniques.
- ☐ Choose appropriate materials-handling equipment for the task.
- Recognize hazards and follow safety procedures required for materials handling

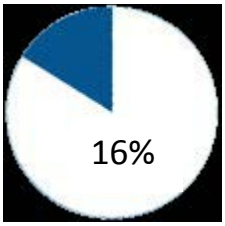
Understand concrete, reinforcing materials, and forms



- ☐ Identify the properties and composition of cement and concrete.
- ☐ Perform volume estimates for concrete.
- ☐ Identify types of concrete reinforcement materials.
- ☐ Identify various types of footings and forms.
- ☐ Erect, plumb, and brace a simple concrete form with reinforcement.

Identify and understand floor, wall, and ceiling systems

Understand floor systems

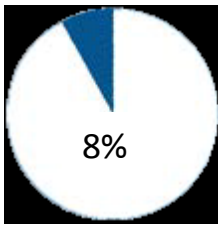


- ☐ Read and interpret drawings and specifications to determine floor system requirements.
- ☐ Identify floor and sill framing and support members.
- ☐ List and recognize different types of floor joists.
- ☐ List and recognize different types of bridging.
- ☐ List and recognize different types of flooring materials.
- ☐ Match selected fasteners used in floor framing to their correct uses.
- ☐ Estimate the amount of material needed to frame a floor assembly.
- ☐ Demonstrate the ability to lay out and construct a floor assembly.
- ☐ Demonstrate the ability to install bridging.
- Demonstrate the ability to install a subfloor using butt-joint tongue and groove.

Understand wall and ceiling systems.

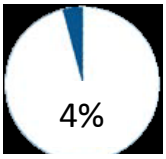
- ☐ Identify the components of a wall and ceiling layout.
- ☐ Describe the procedure for laying out, assembling, erecting, and bracing an exterior wall.
- ☐ Identify the common materials and methods used for installing sheathing on walls.
- ☐ Identify tools used in the construction of cold formed steel framing.
- ☐ Describe the correct procedure for laying out, cutting and installing ceiling joists.

Understand roof framing



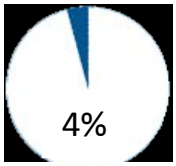
- ☐ Understand the terms associated with roof framing.
- ☐ Identify the roof framing members used in gable and hip roofs.
- ☐ Identify the methods used to calculate the length of the rafter.
- ☐ Identify the various types of trusses used in roof framing.
- ☐ Demonstrate the usage of a rafter framing square and speed square in laying out a roof.
- ☐ Identify various types of sheathing used in roof construction.
- ☐ Identify the parts of a common rafter.
- ☐ Frame a roof opening.
- ☐ Erect a gable roof using trusses.
- ☐ Estimate the materials used in framing and sheathing a roof.

Understand exterior finishes



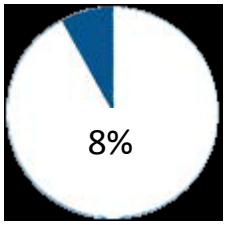
- ☐ Describe the purpose of wall insulation and flashing.
- ☐ Describe the types and styles of siding.
- ☐ Describe the types and styles of veneer finishes.

Understand drywall installation



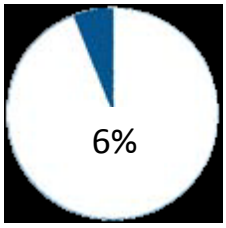
- ☐ Identify the different types of drywall and their uses.
- ☐ Measure, cut and install gypsum board.
- ☐ Select fasteners for drywall installation.
- ☐ Estimate square footage for materials needed in drywall installation.

Understand stair systems



- ☐ Identify the types of stairs.
- ☐ Identify the various stair parts, including railing.
- ☐ Calculate rise and run for stair stringers.
- ☐ Layout and cut stringers, risers, and treads.
- ☐ Identify the types of material used in stair construction.

Understand the installation of windows and doors



- ☐ Identify the styles of doors and windows.
- ☐ Identify the parts of a window and door.
- ☐ Install a pre-hung door.
- ☐ Install a pre-hung window.
- ☐ Identify the hardware needed for door installation.
- ☐ Identify various types of flashings.

Demonstrate professional development skills in a simulated customer service or employment situation. Examples may include:

☐ Job interview

☐ Customer service scenario

☐ Communications

☐ Decision making, problem solving and/or critical thinking

Committee Identified Academic Skills

The SkillsUSA national technical committee has identified that the following academic skills are embedded in the carpentry training program and assessment:

Math Skills

- Use fractions to solve practical problems
- Use proportions and ratios to solve practical problems
- Measure angles
- Find surface area and perimeter of two dimensional objects
- Apply transformations (rotate or turn, reflect or flip, translate or slide, and dilate or scale) to geometric figures
- Construct three-dimensional models
- Apply Pythagorean Theorem
- Make comparisons, predictions and inferences using graphs and charts
- Find slope of a line
- Solve practical problems involving complementary, supplementary and congruent angles
- Solve problems involving symmetry and transformation

Science Skills

- Use knowledge of work, force, mechanical advantage, efficiency and power
- Use knowledge of simple machines, compound machines, powered vehicles, rockets and restraining Devices

Language Arts Skills

- Provide information in conversations and in group discussions
- Provide information in oral presentations
- Demonstrate use of nonverbal communication skills, such as eye contact, posture and gestures using interviewing techniques to gain information
- Demonstrate comprehension of a variety of informational texts
- Use text structures to aid comprehension
- Identify words and phrases that signal an author's organizational pattern to aid comprehension
- Understand source, viewpoint, and purpose of texts

Connections to National Standards

State-level academic curriculum specialists identified the following connections to national academic Standards

.

Math Standards

- Numbers and operations
- Geometry
- Measurement
- Data analysis and probability
- Problem Solving
- Communication
- Connections
- Representation

Source: NCTM Principles and Standards for School Mathematics. To view high school standards, visit: http://www.nctm.org/standards/content.aspx?id=16909**.**

Science Standards

- Understands the structure and function of cells and organisms
- Understands relationships among organisms and their physical environment
- Understands the sources and properties of energy
- Understands forces and motion
- Understands the nature of scientific inquiry

Source: McREL compendium of national science standards. To view and search the compendium, visit: www.mcrel.org/standards-benchmarks/.

Language Arts Standards

- Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes
- Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge

Source: IRA/NCTE Standards for the English Language Arts. To view the standards, visit: www.readwritethink.org/standards/index.html.

APPENDIX 5

Career Technical Education Organizations

NATIONAL

The Aspen Institute
http://www. aspeninstitute. org/
One Dupont Circle, NW, Suite 700, Washington, DC 20036
Ph: 202.736.1071
Fax: 202.467.0790

The Aspen Institute is an educational and policy studies organization based in Washington, DC. Its mission is to foster leadership based on enduring values and to provide a nonpartisan venue for dealing with critical issues. The Institute has campuses in Aspen, Colorado, and on the Wye River on Maryland's Eastern Shore. It also maintains offices in New York City and has an international network of partners. The Aspen Institute does this primarily in four ways: through seminars, young-leader fellowships, policy programs, and public conferences and events. Two program initiatives at the Aspen Institute most relevant to construction workforce development:

> **Skills for America's Future**, an employer-led policy initiative of the Economic Opportunities Program at the Aspen Institute. SAF identifies solutions in which education and training providers (with a focus on community colleges) work together with employers to prepare individuals with the skills that will allow American businesses to be more productive, innovative and competitive. http://www. aspeninstitute. org/policy-work/economic-opportunities/skills-for-americas-future
>
> **Workforce Strategies Initiative**, a national organization that works to identify and promote strategies that help low-income individuals gain access to quality education and employment opportunities to succeed in today's economy. Through research, evaluations, facilitated meetings, and technical assistance, AspenWSI helps job training and adult education initiatives as well as investors in these initiatives improve their practices, services, and strategies to meet the needs of workers and industry partners. http://www. aspenwsi. org/

American Association of Community Colleges (AACC)
http://www. aacc. nche. edu/Pages/default. aspx
One Dupont Circle NW, Suite 410, Washington, DC 20036
Ph: 202.728.0200
Fax: 202.833.2467 or 202.223.9390

The American Association of Community Colleges (AACC) is the primary advocacy organization for the nation's community colleges. The association represents nearly 1,200 two-year, associate degree–granting institutions and more than 13 million students. AACC promotes community colleges through five strategic action areas: recognition and advocacy for community colleges; student access, learning, and success; community college leadership development; economic and workforce development; and global and intercultural education

Association for Career and Technical Education (ACTE)
http://www. acteonline. org/
1410 King Street, Alexandria, VA 22314
Ph: 800.826.9972

ACTE is the largest national education association dedicated to the advancement of education that prepares youth and adults for successful careers.

Trade and Industrial Education Division
https://www. acteonline. org/tie. aspx

State Profiles
http://www. acteonline. org/stateprofiles. aspx

Association for Skilled and Technical Sciences (ASTS)
www. astsonline. org/

The Association for Skilled and Technical Sciences (ASTS) is a new organization for all instructors, administrators, teacher educators, industry representatives and others interested in the skilled trades. ASTS is recognized nationally by education, business, and government as the premier organization representing technical educators in shaping policy and programs to build a skilled global work force. The Georgetown University Center on Education and the Workforce is an independent, nonprofit research and policy institute affiliated with the Georgetown Public Policy Institute that studies the link between education, career qualifications, and workforce demands.

Center on Education and the Workforce
http://cew.georgetown.edu/
The Georgetown University Center on Education and the Workforce
3300 Whitehaven Street, NW, Suite 5000
Box 571444
Washington, D.C. 20009
Ph: 202.687.0873
Fax: 202.687.3110

The Center conducts research in three core areas with the goal of better aligning education and training with workforce and labor market demand: jobs, skills, and people. The Center also seeks to inform and educate federal, state, and local policymakers and stakeholders on ways to better align education and training with labor market demand and qualifications. It also seeks to create tools that enable decision makers to access and customize the data to allow for national, state, and sub-state analysis.

National Academy Foundation
http://naf. org/
218 West 40th Street, 5th Floor, New York, NY 10018
Ph: 212.635.2400
Fax: 212.635.2409

For 30 years, NAF has refined a proven educational model which includes industry-focused curricula, work-based learning experiences, and business partner expertise from our five themes: Finance, Hospitality & Tourism, Information Technology, Engineering, and Health Sciences. Employees of more than 2,500 companies volunteer in classrooms, act as mentors, engage NAF students in paid internships and serve on local Advisory Boards.

National Association of Career Technical Education Information
http://www. nactei. org/index. php

NACTEI is dedicated to the development and improvement of career-technical education information, finance and accountability systems.

National Association of State Directors of Career Technical Education Consortium (NASDCTEc)
http://www. careertech. org/
8484 Georgia Avenue, Suite 320, Silver Spring, Maryland 20910
Ph: 301.588.9630
Fax: 301.588.9631

NASDCTEc was established in 1920 to represent the state and territory heads of secondary, postsecondary and adult career technical education (CTE) across the nation. NASDCTEc, through leadership, advocacy and partnerships, aims to support an innovative CTE system that prepares individuals to succeed in education and their careers, and poises the United States to flourish in a global, dynamic economy.

> Common Career Technical Core
> http://www. careertech. org/career-technical-education/cctc/info. html
> The Common Career Technical Core (CCTC) is a state-led initiative to establish a set of rigorous, high-quality standards for Career Technical Education (CTE) that states can adopt voluntarily. The standards have been informed by state and industry standards and developed by a diverse group of teachers, business and industry experts, administrators and researchers.
>
> State CTE Profiles
> http://cteworks. careertech. org/state-profile/

National Center for Construction Education and Research (NCCER)
http://www. nccer. org/
13614 Progress Boulevard, Alachua, FL 32615
Ph: 386.518.6500 Fax: 386.518.6303

NCCER is a not-for-profit 501(c)(3) education foundation created in 1996 as The National Center for Construction Education and Research. It was developed with the support of more than 125 construction CEOs and various association and academic leaders who united to revolutionize training for the construction industry. Sharing the common goal of developing a safe and productive workforce, these companies created a standardized training and credentialing program for the industry. This progressive program has evolved into curricula for more than 60 craft areas and a complete series of more than 70 assessments offered in over 4,000 NCCER-accredited training and assessment locations across the United States.

National Research Center for Career and Technical Education (NRCCTE)
http://www. nrccte. org/
University of Louisville
College of Education and Human Development
Louisville KY 40292
Ph: 502.852.4727

The National Research Center for Career and Technical Education (NRCCTE) at the University of Louisville is committed to providing evidence-based solutions to the most vexing problems confronting CTE today.

SkillsUSA
http://www. skillsusa. org/
14001 SkillsUSA Way
Leesburg, Virginia 20176
Ph: 703.777.8810

SkillsUSA is a partnership of students, teachers and industry working together to ensure America has a skilled workforce. SkillsUSA's mission is to help its members become world-class workers, leaders and responsible American citizens. Serves more than 4000 schools and colleges across a wide range of occupations, including construction (131 occupational specialties/pathways). A Skills University is held every summer for students, with a separate track for instructors.

Skill Assessment Blueprints for cabinetmaking, carpentry, electrical construction wiring (residential), masonry, plumbing, and welding (among many others not related to construction) can be found here: http://www. workforcereadysystem. org/technical_areas. shtml The assessments were created by industry to ensure relevance to entry level skills, meet Perkins IV accountability requirements, and provide credentials to students who achieve industry defined scores.

CALIFORNIA

Association of California School Administrators CTE Council
http://www. acsa. org/FunctionalMenuCategories/AboutACSA/Councils/CareerTechnicalEducation/CTE-Presentations. aspx
1029 J Street, Suite 500
Sacramento, CA 95814
Phone: 916.444.3216 | Toll-Free: 800.608.ACSA(2272)

California Industrial and Technology Education Association (CITEA)
http://www. citea. org/
P. O. Box 729
Diamond Springs, CA 95619

CITEA promotes and supports Industrial Technology Education, Vocational Education, and Regional Occupational Programs, ITE teachers, students, administrators and programs throughout the State of California, through teacher training, professional communication, and advocacy.

California Association of Regional Occupational Centers/Programs (CAROCP)

http://www. carocp. org/

The mission of the California Association of Regional Occupational Centers and Programs (CAROCP) is to promote and support ROCPs in providing exemplary career education, career development and workforce preparation that contribute to student academic and career success and to the economic development of California.