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# **Safety and Health Training in Construction in Kentucky**

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## **Abbreviations**

eLCOSH	Electronic Library of Construction Safety and Health
NIOSH	National Institute for Occupational Safety and Health
OSHA	U.S. Occupational Safety and Health Administration

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Compared to many other industries, construction workers have experienced a high rate of deaths and injuries. U.S. Bureau of Labor Statistics (BLS) data show that, in 2003, construction workers were 7% of the U.S. workforce, but suffered 21% of the nation's 5,575 reported work-related deaths. That same year, nonfatal rates of injury and illness involving days away from construction work were 259.4 per 10,000 full-time equivalents (FTEs),<sup>1</sup> higher than for agriculture, mining, and manufacturing (BLS 2003). Although there is general agreement that worker safety and health training can help prevent injuries and deaths, data are lacking on the nature, extent, and effectiveness of such training. Also, there is a lack of consensus about how to define and measure training effectiveness. The purpose of this pilot study was to provide insight into these issues. For this study the authors conducted the following activities:

1. Reviewed construction safety and health training materials, courses, and programs and developed a database of the sources believed to be most relevant and useful to construction workers.
2. Conducted focus group sessions with highway and general construction workers in Kentucky to learn more about their safety and health training.
3. Created a questionnaire to be completed by a national sample of construction workers and their immediate supervisors, to be conducted as a follow-up to this pilot study. The questionnaire is designed to measure the types and effectiveness of safety and health training received by construction workers.

## **Background**

There are many safety and health training programs available to construction industry workers, but there has been little investigation into the effectiveness of such programs. Still, the limited evidence suggests that there are benefits from implementing such training. One study, conducted to assess the effect of first aid training on occupational safety and health behavior in the construction industry, found that the intervention appeared to reduce workers' willingness to engage in risky behavior at work and reduced their willingness to tolerate unsafe conditions (Lingard 2002).

A 1993 study by the Construction Industry Institute (CII) identified practices among industrial construction firms that were associated with significantly lower accident rates compared to other industrial construction firms (Liska and others 1993). The 1993 CII study, which termed these practices "zero-accident" techniques, included site orientation for new workers and safety and health training. Hinze and Wilson (2000) followed up the 1993 study by conducting a survey of 18 mainly large construction firms, some of whom were part of the earlier study. The survey found that participating firms performed well in all leading safety performance indicators, including injuries per hour of worker time, lost-time injury rates, and experience modification rates (EMR). The EMR is used to adjust

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<sup>1</sup> Because many construction workers work part time at construction, safety and health statistics are defined in terms of full-time equivalents to allow comparisons with other industries. Full-time work is defined as 2,000 hours worked per year.

workers' compensation insurance rates, and is based on both the frequency and severity of accidents experienced over a three-year period.

Hinze and Wilson (2000) found that the respondents, who were in management positions, felt training was key to improvements in safety performance. They also found that some of the firms had adopted formal training programs, such as Wheels of Learning, OSHA 10-hour, and the DuPont STOP program. Hinze and Wilson noted significant improvements in many firms' safety training efforts since the 1993 study, including the following: implementation of construction site safety training on all projects, hiring a full-time corporate training director, formalized supervisor training, increased evaluation of workers' skills and knowledge upon hiring, and computerized tracking of worker training.

The American Association of State Highway and Transportation Officials (AASHTO) conducted two pilot studies that addressed the effectiveness of interactive compact-disc (CD) based learning. In tests administered after taking the CD-based course, trainees showed an average 25% improvement over pre-test results. The authors concluded that CD-ROM technology is an effective training tool and will play a greater role in future training of transportation workers (Paniati and Wilson 1995).

Formal education and training programs, which include apprenticeships, certification programs, continuing education courses, and "train-the-trainer" programs, have been measured and reported in the Current Population Survey (CPWR 2002). Informal training, which consists mainly of mentoring by co-workers and supervisors, is more difficult to measure and evaluate, but it is recognized as a useful training method. For instance, research has shown that a substantial amount of work planning occurs within occupational communities in the construction trades (Stinchcombe 1959). Also, organizational research in other non-construction industries has long recognized the importance of "communities of practice" within an organization. Such occupational communities produce and sustain work practices, standards for acceptable and unacceptable behavior, benchmarks for work quality, and information-sharing among workers (Stinchcombe 1959).

## **Research Methods**

### **Development of database of construction safety and health training programs**

The authors conducted a literature search to identify safety and health training programs, materials, and courses available to the construction industry. In addition to reviewing training references from professional and trade journals, the authors reviewed online websites and external databases, including Compendex/Engineering Village, American Society of Civil Engineers (ASCE), ScienceDirect, Electronic Library of Construction Safety and Health (eLCOSH), American Society of Safety Engineers (ASSE), SciFinder, Nation Center WorkZone Safety, and MedLine. Many other websites, such as the sites for the National Institute for Occupational Safety and Health (NIOSH), the U.S.

Occupational Safety and Health Administration (OSHA), and The Center to Protect Workers' Rights (CPWR) were also searched.

The following key words were used to search the databases: accident prevention, construction, construction worker health, safety and health training, highway, human factors, operations, and safety education. The search results were used to create a database (in Microsoft Access) of safety and health training programs believed to be most relevant and useful to construction workers. The database is described further in the Results section (*see* page 5).

### **Focus groups**

The research team organized and conducted eight focus group sessions with construction workers in central and northern Kentucky, from August 2004 through January 2005. The workers were employed on both highway and general construction projects. Four sessions had union participants and four had non-union participants; there were 66 participants in all, of whom 38 were highway construction workers (*see* tables 1 and 2).

#### **1. Focus group locations and union status of participants**

<b>Group</b>	<b>Location</b>	<b>Union</b>	<b>Non-union</b>
A	Mt. Sterling, KY		*
B	Louisville, KY	*	
C	Louisville, KY	*	
D	Lexington, KY	*	
E	Frankfort, KY	*	
F	Dry Ridge, KY		*
G	Lexington, KY		*
H	Frankfort, KY		*

#### **2. Focus group labels and number of participants**

<b>Group</b>	<b>Number of participants</b>
A	13
B	18
C	9
D	5
E	5
F	5
G	6
H	5
Total	66

The researchers recruited participating contractors through contacts at the local Associated General Contractors chapter, the local Associated Builders and Contractors chapter, and the Kentucky Association of Highway Contractors. Contacts with contractors were made by telephone and e-mail, with follow-up letters. The team met also with officers of local trade unions to recruit focus group participants from their memberships. Since this was a pilot study, the authors did not collect detailed

demographic data on age or ethnicity from the participants. Although the authors attempted to recruit participants from a variety of backgrounds and locations in Kentucky, this project was not intended to be a representative sampling of the construction industry either in Kentucky or nationally.

The research team asked the focus group participants the following questions (not necessarily in this order):

1. How many of you receive formal safety and health training from your company?  
How many training sessions have you received in the past year?
2. What type of safety and health training have you received?
3. How many of you receive informal safety and health training from your co-workers?
4. Which is most useful for you: training from your company or training from your co-workers?
5. In your opinion, what makes safety and health training most effective for you?
6. What is the greatest hazard you face and is it addressed by the safety and health training you've received? If not, do you think the hazard could be addressed by training?

The research team recorded the sessions on audiotape and took notes using key words. In addition to recording participants' comments, the team also noted non-verbal responses and behaviors. Every effort was made to ensure an informal atmosphere that promoted discussion and participation. Before closing each session, the moderator asked any questions listed above that had not already been discussed. Detailed procedures and transcriptions of the focus group sessions are available from the main author at [pgoodrum@engr.uky.edu](mailto:pgoodrum@engr.uky.edu).

In addition to the eight sessions with workers, a separate focus group session was held with five training directors from local unions representing Laborers, Carpenters, Iron workers, Operating engineers, and Pipe fitters/plumbers. Finally, the training director for the local Associated General Contractors was interviewed separately. The objectives of the focus group sessions with the training directors were to identify:

1. Sources and providers of their safety and health training programs, such as a contractor association, consultant, commercially available materials, or a joint labor/management apprenticeship and training fund
2. Types, duration, depth, and costs of safety and health training provided
3. Training for different job categories within the organization
4. Location of training, such as classroom or on-the-job
5. Major barriers to providing safety and health training
6. Opinions on the effectiveness and deficiencies of their safety and health training efforts.

## Questionnaire

The first phase of the research project involved the two projects described above. Using the information from the focus group sessions, the research team created a questionnaire designed to be completed by a national sample of construction trade workers and their immediate supervisors. The objective of the questionnaire is to further identify types of training received by construction workers as well as gaps in training that need to be addressed. A copy of the questionnaire may be obtained by contacting the main author at [pgoodrum@engr.uky.edu](mailto:pgoodrum@engr.uky.edu).

## Results

### Database of training programs

The final database contains 123 entries and identifies 78 organizations that provide safety and health training for the construction industry. The database includes 18 programs available in Spanish. The database, in Microsoft Access, is available from the author at [pgoodrum@engr.uky.edu](mailto:pgoodrum@engr.uky.edu) or on CPWR's website at <http://www.cpwr.com/safetyhealthdbase.html>. An overview of the database is provided below.

*Format.* The formats of the training programs listed in the database include textbooks, CD-ROMs, DVDs, online learning programs, databases, manuals, hazard alert flyers, toolbox safety talks, and videotapes. The authors found that the most common training program format was a videotaped presentation with accompanying instructional guide; 30 of 123 programs identified were videotaped programs.

*Content.* The authors found a wide variety of training program contents, ranging from general safety and health topics, such as cardiopulmonary resuscitation (CPR), first aid, and fall protection, to job-specific topics such as heavy equipment operation. Hands-on training was provided mainly through apprenticeship programs and interaction among employees and their supervisors. Only two “train-the-trainer” programs were identified and included in the database.

*Sources of training.* Many different organizations produce, distribute, and/or sell training materials. Organizations that offer training materials include safety councils, construction unions, and construction industry contractors. Also, many materials suitable for use in training programs, such as “hazard alerts” and fact sheets, can be readily obtained from organizations such as NIOSH (<http://www.cdc.gov/niosh/alerts2.html>), and OSHA (<http://www.osha.gov>), as well as CPWR (<http://www.cpwr.com/>) and eLCOSH (<http://www.cdc.gov/elcosh/>).

### Worker focus group sessions

As described in the Research Methods section, eight focus groups were held with construction workers from central and northern Kentucky (*see* tables 1 and 2). The 66

focus group participants identified important issues pertaining to safety and health training, in response to both planned questions and open discussion. The main topics to emerge during the sessions were as follows: types of formal training, formal vs. informal training, training effectiveness, job hazards, barriers to training, and safety policies, procedures, and culture.

The focus groups reported receiving a variety of formal safety and health training (table 3). All of the focus group participants reported receiving some type of safety orientation for new employees. All participants said they were offered CPR/first aid training, and half the groups (4 of 8) were provided training on fall protection and the use of harnesses. Participants from only two groups mentioned that they had job- and hazard-specific informal training programs.

### 3. Formal safety and health training reported by worker focus groups

<b>Formal training</b>	<b>Group A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>G</b>	<b>H</b>
Orientation	X	X	X	X	X	X	X	X
Toolbox talks	X	X	X	X	X	X	X	X
OSHA 10-hour training		X		X	X			X
CPR/First aid	X	X	X	X	X	X	X	X
Automatic electronic defibrillator								
Hazmat and waste removal		X		X	X			
Fall protection	X			X		X	X	
Scaffold safety		X		X	X			X
Lockout/tagout		X		X				
Use of personal protective equipment	X	X		X	X			X
Welding safety		X						
Equipment operation							X	X
Trench/excavation safety			X				X	
Confined space entry			X		X			

*Formal vs. informal training.* Participants in every focus group said formal programs were needed but recognized informal training as a significant contribution to their knowledge of worksite safety and health. The participants described informal training as undocumented training received outside of a classroom setting. The informal training generally consisted of on-the-job training, co-worker mentoring, and lead-worker supervision during the first month or so on the job.

Informal mentoring was consistently mentioned as crucial to safe job performance. Sometimes the person who delivers the informal training is a co-worker giving on-the-job-training, and sometimes it is the supervisor. In most cases, the informal trainer is a person with leadership skills and mastery of the job. The mentoring seems to benefit new

workers most during the first six months on the job. Informal training topics mentioned by the participants include traffic signaling, temporary barricades, and the use of safety nets. By contrast, formal training programs (such as “canned” videotape programs) fail to address the “real-life” hazards, according to the focus groups. For instance, an iron worker noted that formal training rarely covers the very common fall hazard associated with walking across wet reinforcement steel; the worker learned about this hazard from his co-workers.

*Training effectiveness.* The focus group participants rated training effectiveness based on its relevance to their work. Generic toolbox safety talks, for instance, were rated as not very effective, whereas toolbox talks with job-specific content, such as those focusing on the use of harnesses and tie-offs for fall protection, were considered more beneficial. Informal training on equipment operation often was rated as very beneficial. The participants emphasized that practical, hands-on knowledge and a focus on job-specific skill sets were critical to the effectiveness of the training. The consensus was that training is more effective when delivered by someone who knows the subject, has experience in the job, and is familiar with the job-specific risks. Several participants in at least two focus groups mentioned that the training videos they viewed did not realistically depict their jobs or the hazards they face. In this regard, ladder safety training was singled out as ineffective.

Participants in three focus groups mentioned that they had received effective training for handling chemicals, removing lead paint, and using material safety data sheets (MSDS), such as the MSDS for concrete sealants.

*Job hazards.* Focus group participants were asked about the specific job hazards they face and the tasks associated with those hazards. Following are the most frequent hazards mentioned by participants overall, presented according to union or non-union status (table 4).

#### 4. Reported worksite hazards and union status of focus groups

<b>Hazard</b>	<b>Union</b>	<b>Non-union</b>
Work zone/traffic		*
Falls	*	*
Rollovers		*
Electrocution	*	
Burns	*	
Hazardous materials exposure	*	*
Equipment operation	*	
Unclean worksite	*	
Wet surfaces		*
Forklift operation		*
Cold stress/heat stress		*
Exposure to biting insects		*
Risk of chronic health conditions		*

The job hazards mentioned by the 38 highway construction worker participants include moving vehicles, traffic, pedestrians, moving equipment, and materials handling. Working with poorly trained subcontractors was also mentioned as a hazard. In one focus group, many of those interviewed said that the majority of the work zone accidents did not result from a lack of training but from workers' inattention to their surroundings.

*Barriers to training.* Focus group participants said that attending training programs was difficult because of travel time, scheduling problems, and costs of the programs. Many focus group participants who have to pay for their own training indicated that they did not believe the benefits of training outweighed the cost. Two focus groups said they were reluctant to register for classes that require them to travel to a location that is not near the jobsite. The problem is compounded by the fact that their jobsites often change, making it difficult to schedule training in advance.

*Safety policies, procedures, and culture.* All focus groups said that their employers require them to wear personal protective equipment (PPE) and clothing, mainly hard hats, steel-toe safety shoes, safety glasses, and reflective vests. One group of highway construction workers reported they are required to use safety manuals and have regularly scheduled safety committee meetings to promote safe job performance.

One non-union contractor reportedly provided in-house safety orientation videos in English and Spanish. This company conducts both daily safety inspections and job-specific inspections of activities such as excavation, trenching, shoring, scaffolds, equipment operation (including the use of safety belts), and barricades. The company also provides toolbox talks that are job-specific and uses MSDS sheets for training on hazardous chemical use.

One focus group described what seems to be a successful balance of formal and informal training, driven by the company's commitment to safety. The company uses a process of identifying newer workers by colored stickers on their hardhats during the first 18 months of their employment, so their co-workers can assist them if they are having trouble. Some informal training has in fact evolved into a more formalized process, as supervisors offer onsite training in work processes and create opportunities for experienced workers to mentor their less experienced co-workers.

### **Training directors' comments**

The focus group session conducted with five training directors from local construction trade unions centered on three areas of concern related to safety and health training: motivating workers to attend training programs, mentoring of apprentices, and relevance of training.

*Motivation.* The training directors said it was difficult to motivate workers to attend training, even if their travel expenses were covered. Offering continuing education units does not seem to provide much incentive, particularly for those workers who are

already licensed and certified. Journeymen in particular “think the training is a joke,” said one participant.

Nonetheless, there is pressure to ensure that workers receive proper safety training and certification. For road work, contractors are requiring certification for workers to be qualified to bid for the job. The directors mentioned the 7-hour International Municipal Signal Association (IMSA) training program in Kentucky provided by the state, which covers basic work zone traffic control, such as work area flagging.

*Mentoring and on-the-job training.* The training directors said that apprentices needed more on-the-job training and mentoring by journeymen. Younger workers have reported that they learned much from their senior colleagues, but, according to one training director, journeymen do not realize they have an obligation to instruct the inexperienced workers on the safety aspects of the job. Furthermore, sometimes the journeymen expect too much of the inexperienced workers, assuming the apprentices are trained in certain functions when in fact they are not.

*Relevance of training.* The training directors reported that some training programs are using innovative learning technologies, such as computer-based learning and simulations to improve learner retention and provide “real-world” experience. The Operating engineers’ union director noted specific success with their heavy equipment simulator in this regard.

## **Conclusions and Recommendations**

In the course of developing the database of training programs, the authors found an abundance of safety and health training programs and formats available to construction industry employers and contractors. However, the focus group participants were sometimes critical of formal programs, claiming that such programs fail to address the “real-life” hazards faced by construction workers. The challenge for employers may be to find customized training relevant to their individual worksites and site-specific hazards.

Training program scheduling and costs are a concern for union and non-union workers alike. This issue may warrant attention from supervisors and employers, who could make jobsite training more accessible and affordable in order to motivate more workers to participate.

*Project limitation.* Although the authors sought to learn more about the specific training needs of Hispanic construction workers, they were unable to recruit Hispanic workers for the focus group sessions, mainly because most Hispanic workers are employed in the residential building sector rather than in highway construction in Kentucky and thus were not part of the target group. Since this was a pilot study and not intended as a representative sampling of the population, the authors did not collect detailed demographic data on age or ethnicity from the participants.

The authors’ recommendations for future research and training efforts are as follows:

- Employers and training directors should consider implementing formalized mentoring programs designed to take advantage of the knowledge and skills gained through the work experience of the journeymen.
- Training providers should expand the availability of “train-the-trainer” programs.
- Future research should study the effectiveness of training programs, both formal and informal, in preventing injuries to construction workers and improving safety at the worksite.

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