Safety Program Elements in Construction

Which ones best prevent injuries and control related workers' compensation costs?

By Michael Findley, Susan Smith, Tyler Kress, Gregory Petty and Kim Enoch

THIS CROSS-SECTIONAL DESCRIPTIVE STUDY was designed to identify safety programs, plans and processes commonly used within the construction industry and to determine whether they improve safety performance. A 48-item questionnaire was mailed to 305 construction companies that are members of the Tennessee Chapter of the Associated General Contractors of America (AGC). Significant differences ($p < 0.05$) between safety performance and implementation of key safety program elements were identified for construction companies that reported they 1) employ a full-time safety manager as a key member of the management team; 2) clearly define safety roles/responsibilities; 3) perform drug testing; 4) conduct prejob safety briefs; and 5) attend safety conferences sponsored by AGC. In addition, companies that reported clearly defined safety roles/responsibilities also reported a significantly higher number of key safety program elements including 1) comprehensive safety plans; 2) mechanisms for tracking injury costs, first-aid cases and near-hits; 3) safety inspections; 4) adequate first-aid and medical services; 5) return-to-work programs; 6) incentive programs; and 7) safety training. The study demonstrates that investment in key worker protection programs pays dividends in the reduction of human suffering and the economic costs related to construction fatalities and injuries.

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Construction remains the most dangerous of all U.S. industries based on the rate of days-away-from-work injuries and the overall number of on-the-job fatalities. Construction employers continue to report the highest rate of injuries with days away from work of all the major U.S. industry sectors, with a rate of 3.3 compared to the national average of 1.9 (NSC 59). The rate of construction deaths declined only one percent from 1999 to 2000, while the overall number of construction deaths increased five percent. More deaths occurred in construction in the year 2000 than in any other major U.S. industry (NSC 46). In 2000, 1,220 construction workers died as a result of on-the-job injuries.

Spurred by the highest rate of days lost due to injury and number of on-the-job fatalities, OSHA developed a focused inspection initiative aimed at reducing construction fatalities and serious medical injuries [OSHA(a)]. Evidence suggests, however, that this enforcement strategy has produced marginal results (Weil 651). Regulatory enforcement has had a modest impact on safety performance even though many large construction firms face a high probability of an annual inspection. According to Weil, the standards cited most often by OSHA are not the major sources of construction fatalities and injuries; furthermore, OSHA enforcement tends to focus on large, high-profile companies rather than on small firms that traditionally report higher fatality and injury rates.

Although regulatory enforcement has fallen short in improving the working conditions at construction worksites, the fact that injury rates vary widely among employers and projects within the construc-

tion industry (Meridian Research 2) suggests that effective safety strategies may exist. This study was designed to identify those policies, plans, procedures and processes that have led to improved safety performance.

Table 1

Key Safety Program Elements

Meridian (1994)	Liska & Goodloe (1993)	Jaselskis, et al (1996)
Management Commitment		
Safety program plans	Safety incentives	Upper management support
Responsibility/accountability		Time devoted to safety
Subcontractor relationships		Safety program length/detail
		Company expenditures
Employee Involvement		
Employee involvement		
Joint safety committee		
Hazard Analysis		
Hazard analysis	Prejob/pretask planning	Number of safety inspections
Accident investigations	Accident investigations	
Safety inspections	Recordkeeping	
Hazard Prevention & Control		
Hazard prevention/control	Drug/alcohol program	Drug/alcohol program
Fitness for duty	Personal protection	
First-aid/medical services		
Emergency response plans		
Safety Training		
Safety training	Safety training/orientation	Safety training
Safety meetings	Safety meetings	Safety meetings

The Costs of Poor Safety Performance

Despite the discounting of workers' compensation (WC) premiums in the last half of the 1990s, the high rate of lost-time injuries in construction has contributed to WC premiums remaining above 25 percent of employer payrolls (ENR 44). WC premiums in the construction industry reached a record high in the mid-1990s. Powers estimated that for three key construction trades (carpenters, bricklayers, structural ironworkers), employers paid $28.60 in WC premiums per $100 of payroll in 1994 (40).

Reform programs in some states and a flood of new insurance providers led to discounting of premiums by WC insurance providers in the late 1990s; however, reported combined losses of $1.9 billion by some providers is expected to cause premiums to rise 10 to 20 percent a year for the next several years (Krizan 44). In 2000, the average premium of $25.11 per $100 of payroll for carpenters, bricklayers and structural ironworkers had already returned to the prediscounting period levels (Krizan 45). Given the projected increase, the negative impact of premiums on a firm's ability to compete will increase. WC costs of 6.9 percent of total project costs (Everett and Frank 158) trim a construction company's average profit margin of 1.5 percent ("Management May Be" 12).

Controlling the direct and indirect costs of work-related injuries can be the difference between a profitable company and one that is forced to fold. WC premiums represent the major component of the direct costs of injuries within construction. Employers pay a premium to an insurance company in return for insurance coverage. In WC, this premium (also called "the manual premium") is calculated by multiplying a specified rate, or "manual rate," assigned to a specific industry classification by the number of hundreds of dollars of the employer's payroll. An individual company's premiums are calculated by multiplying its experience modification rate (EMR) by the manual rate set by the insurance industry for the business type. EMR is designed to reflect variation of an employer's actual experience from the expected or average experience for the industry classification.

This comparison of actual to expected losses can result in either a reduction or increase in premiums. Companies with lower-than-average losses are assigned an EMR of less than 1.0, while companies with higher-than-average losses are assigned an EMR of greater than 1.0. (This summary is intended only as a broad overview of how WC works. For a more-detailed discussion, visit the National Council on Compensation Insurance website at www.ncci.com and access the site's "eLearning Center.")

The following example dramatizes the impact of EMR on the bottom line. Assuming an average WC manual rate of $25 on every $100 dollars of payroll, a small 30-employee firm with an EMR of 1.3 (based on worse-than-average losses) and an annual payroll of $600,000 pays $195,000 in annual WC premiums. A similar-sized firm with an EMR of 0.7 (due to less-than-average losses) would pay only $105,000 per year. Understanding the impact of EMR is key to reducing WC premiums (Chaney 40). Greater savings in direct WC costs can be realized when manual rates are higher and a company's EMR is less than 1.0.

Most contractors can calculate the direct costs of injuries based on WC premiums, but many may not recognize the magnitude of the indirect costs. Consider this example in which an employee falls from a defective ladder (Chaney 41). WC pays for the direct medical expenses estimated at $7,500, but the indirect costs to the employer are more than double that amount. These costs include $8,500 in

Table 2

Number & Percentage of Companies by EMR

Variable		EMR Less than 1.0 %	n	1.0 or Greater %	n	x^2	Probability
Full-time safety manager	Yes	68%	38	33%	5		
	No	32%	18	67%	10	5.904	0.015
Prejob safety briefs	Yes	51%	31	20%	3		
	No	49%	30	80%	6	4.626	0.031
Drug/alcohol program	Yes	91%	52	67%	10		
	No	9%	5	33%	5	5.990	0.014
Attend AGC safety conference	Yes	44%	15	0%	0		
	No	56%	19	100%	7	4.870	0.027

Table 3

Number & Percentage of Companies by Size

Variable		Company Size (# of employees) 50 or fewer %	n	51 to 100 %	n	more than 100 %	n	x^2	Probability
EMR	less than 1.0	68%	23	85%	17	95%	18		
	1.0 or greater	32%	11	15%	3	5%	1	5.998	0.050
Full-time safety manager	Yes	49%	18	73%	16	79%	15		
	No	51%	19	27%	6	21%	4	6.222	0.042
Drug/alcohol program	Yes	72%	26	96%	21	95%	19		
	No	28%	10	4%	1	5%	1	7.890	0.019

production loss, $4,000 to replace the injured worker, $2,600 WC premium increase, $1,000 in overhead costs, $250 for foreman's wages connected with the accident and $1,000 in possible OSHA fines. That's a total of $17,350 that must be absorbed by the contractor. Others place the ratio of indirect to direct costs as high as a factor of 20 (Hinze and Applegate 546; Agarwal and Everett 71; Everett and Frank 158).

Elements of an Effective Construction Safety Program

In addition to a company's moral obligation to provide a safe work environment, a financial incentive exists in identifying safety policies, plans and processes that lead to superior safety performance. OSHA points to a strong correlation between the application of sound safety management practices and successful accident prevention, and identifies these elements as being essential to an effective safety program:

1) management commitment;
2) employee involvement;
3) worksite analysis;
4) hazard prevention and control;
5) safety training [OSHA(b)].

Many case studies and qualitative reviews describe individual construction safety success stories (Lanier; CII; Findley and Timmons; Weeks and McVittie; Lowery, et al; Findley); however, only a few quantitative studies have been made of the relationship between construction safety policies, plans and processes and safety performance that might permit generalizations of the specific elements necessary to ensure an effective program (Liska and Goodloe; Meridian Research; Jaselskis, et al) (Table 1).

Meridian Research Group's report described a comprehensive review of construction safety program elements. It included a review of literature to identify successful programs in construction; a comparison of construction safety management practices applied or recommended by government agencies; a description of the impact of worker protection programs on accident rates; and an analysis of the literature for secondary benefits of successful worker protection programs (Meridian Research i). The following elements were cited as essential to an effective construction safety program:

1) Written, comprehensive safety and health program/plan.
2) Safety and health responsibility and accountability clearly established and implemented.
3) Employee involvement in the design and operation of the safety and health program.
4) Employees possess the overall fitness to perform the work.
5) Worksite analysis identifies safety, health and ergonomic hazards.
6) Safe work practices are established to effectively manage worksite hazards.
7) Frequent worksite inspections are performed.
8) Emergency response planning is performed in

order to respond to rapidly changing hazards on construction worksites.

9) First aid and medical facilities are provided to address the unique requirements of each construction worksite.

10) Accidents are properly investigated, reported and analyzed.

11) Training and safety meetings are tailored to the hazards of a particular worksite.

12) Joint safety and health committees encourage employee involvement.

13) Contractor/subcontractor relationships for safety and health activities are well-defined (Meridian Research 30).

Table 4

Number & Percentage of Companies by Employment of a Full-Time Safety Manager

Variable		Yes		No			
		%	n	%	n	x^2	Probability
Perform drug testing	Yes	100%	50	82%	22		
	No	0%	0	18%	5	9.902	0.004
Drug/alcohol program	Yes	92%	43	70%	19		
	No	8%	4	30%	8	5.629	0.018
Prejob safety briefs	Yes	53%	27	23%	6		
	No	47%	24	77%	23	6.799	0.009
Track injury costs	Yes	74%	31	46%	11		
	No	26%	11	54%	13	5.166	0.023
Walkaround inspections	Yes	70%	28	30%	6		
	No	30%	12	70%	14	8.688	0.003
Attend AGC training	Yes	77%	34	54%	14		
	No	23%	10	46%	22	4.162	0.040

In their report to the Construction Industry Institute, Liska and Goodloe identified seven program elements that contributed to a reduction in recordable incidence rates of more than 50 percent and lost workday case rates of more than 65 percent. The authors attribute the 10,000 fewer injuries and estimated $350 million savings to implementation of these program elements (the Construction Industry Institute's Zero Accident Culture):

1) top management commitment to safety;
2) safety preproject and pretask planning;
3) safety orientation and training programs;
4) managing contractor safety;
5) accident and incident investigation/reporting;
6) alcohol and substance abuse programs;
7) written safety incentives programs (Liska and Goodloe).

Jaselskis, et al identified strategies for improving safety performance based on a survey of 48 construction companies. This research found significant relationships between safety performance and several company- and project-specific factors. Improvement in safety performance based on injury rates and a company's EMR were related to:

1) upper management support related to time spent with the safety coordinator;
2) time devoted to safety by the safety coordinator;
3) number of safety inspections conducted by the safety coordinator;
4) safety training and meetings with field safety representatives and craft workers;
5) company safety expenditures;
6) written drug/alcohol prevention program;
7) length and detail of the company's written safety program.

Study Design & Methods

This cross-sectional descriptive research study was designed to identify safety program elements employed by contractors who are members of AGC's Tennessee Chapter and to assess the impact of those elements on safety performance. With more than 8,000 construction contractors and 14,000 specialty contractors as members, AGC is the nation's largest and oldest construction trade association (AGC of America). For this study, 305 Tennessee-based AGC member companies were identified as potential participants.

The study instrument consisted of a 48-item self-report questionnaire designed by faculty members of the University of Tennessee Dept. of Health and Safety Sciences and the Dept. of Industrial Engineering. The 48 items were derived from a review of literature on program elements considered to be indicative of a sound safety program. The questions addressed the contractor's business; safety policies, procedures and processes; safety program elements; and safety performance. The questionnaire's validity was assessed by an expert review panel. A test/retest procedure performed over a four-week period demonstrated instrument reliability through the observed consistency of the measurements.

A cover letter describing the purpose of the study, the voluntary and confidential nature of responses, and data collection and follow-up procedures was prepared. AGC provided company names and mailing addresses, and 305 questionnaires addressed to "safety manager" were mailed. Each company also received a follow-up phone call to encourage completion of the questionnaire.

Of the 305 companies, 89 (29 percent) responded. Respondents included companies ranging in size from four to 196 employees. The average age of the businesses was 32 years, with a range between three and 110 years. Fifty-four (61 percent) of the respondents described themselves as general contractors with 58 (65 percent) stating that they worked as a subcontractor. Company locations were distributed across the state. Fifty-one (57 percent) respondents reported having a full-time safety manager.

Completed questionnaires were coded into a data file and analyzed using the Statistical Program for Social Sciences (SPSS). Demographic information was characterized using descriptive analysis (mean, frequency and percentages). Nonparametric tests

Table 5

Number & Percentage of Companies by Clearly Defined Safety Roles & Responsibilities

Variable		Yes		No			
		%	n	%	n	x^2	Probability
Drug/alcohol program	Yes	91%	50	50%	6		
	No	9%	5	50%	6	13.580	0.001
Walkaround inspections	Yes	67%	32	20%	2		
	No	33%	16	80%	8	7.555	0.023
Track near-hits	Yes	33%	17	0%	6		
	No	67%	34	100%	13	6.667	0.036
Full-time safety manager	Yes	72%	30	31%	4		
	No	28%	15	69%	9	7.568	0.023
Written safety policy	Yes	96%	52	75%	9		
	No	4%	2	25%	3	6.153	0.046
Emergency preparedness program	Yes	62%	28	17%	2		
	No	38%	17	83%	10	10.749	0.005
Track injury costs	Yes	74%	37	38%	5		
	No	26%	13	62%	8	7.334	0.026
Track first-aids cases	Yes	69%	36	15%	2		
	No	31%	16	85%	11	13.422	0.001
Employee concern program	Yes	72%	33	36%	4		
	No	28%	13	64%	7	6.716	0.035
Safety training program	Yes	86%	47	46%	6		
	No	14%	8	54%	7	9.349	0.009

performed included chi-square analysis and Spearman's Rho correlation analysis. The level of significance chosen for the study was $p = 0.05$. Significant difference between company safety policies, plans, procedures and processes was compared to safety performance. In addition, correlations between the respondents rating of the relative importance of selected safety program elements were evaluated.

Study Results

Study results identified a significant difference ($p \leq 0.05$) for those companies reporting either 1) lower WC cost as measured by EMR; 2) employment of 50 or more workers; 3) employment of a full-time safety manager; and/or 4) clearly defined safety roles/responsibilities when compared to the number reporting key safety program elements.

WC Costs

WC costs were evaluated by comparing contractor EMR (Table 2). Contractors with a higher EMR were considered to have higher WC costs. Respondents' EMRs were grouped according to whether the rate was less than 1.0 (low EMR) or equal to or greater than 1.0 (high EMR). Companies that reported an EMR below 1.0 reported a significantly higher number of key safety program elements. They also more often reported employing a full-time safety manager (68 percent) than did those reporting a higher EMR (33 percent). Companies with a lower EMR also reported a higher use of prejob safety briefs (51 percent) than did those with a higher EMR (20 percent). A greater number of written drug/alcohol use prevention program was found among those with a lower reported EMR (91 percent) compared to those with a higher EMR (67 percent). Those reporting attendance at local and regional safety days sponsored by AGC had a significantly lower reported EMR (44 percent) than did those with higher EMR (0 percent).

Company Size

Safety performance and safety program content varied by company size (Table 3). A significantly higher number of small companies—defined as having fewer than 50 employees—reported having an EMR of 1.0 or greater (68 percent) than medium companies employing 51 to 100 employees (85 percent) and large companies employing more than 100 workers (95 percent). A greater number of medium to large companies reported that they performed drug testing (and participated in safety conferences) than did smaller companies.

Full-Time Safety Manager

Employment of a full-time safety manager was predictive of the self-reporting of specific safety processes and practices (Table 4). A significantly higher number of companies reported that they presented prejob safety briefs when they also reported employing a full-time safety manager (53 percent) than those that did not employ a full-time safety manager (23 percent). A higher number of companies with a full-time safety manager reported 1) existence of a written drug/alcohol use prevention program (92 percent vs. 70 percent) and 2) company-performed drug testing (100 percent vs. 82 percent). In addition, companies with full-time safety managers were significantly more likely to report that they 1) tracked injury and illness costs (74 percent vs. 46 percent); 2) performed weekly walkaround safety inspections (70 percent vs. 30 percent); and 3) attended AGC training programs (77 percent vs. 54 percent).

Safety Roles & Responsibilities

Companies that reported defined roles and respon-

Learn More about WC

To learn more about workers' compensation (WC) insurance, visit the homepage for the National Council on Compensation Insurance (NCCI) at www.ncci.com. NCCI is a not-for-profit rating, statistical and data management services organization that helps insurers, regulators, lawmakers and industry stakeholders make informed WC decisions. Based in Boca Raton, FL, NCCI manages the nation's largest database of WC insurance information. NCCI's homepage includes an "eLearning Center" that permits access to a training module called "Introduction to Workers' Compensation." This module includes four lessons designed to provide a basic understanding of the four fundamentals of WC—classification, rate, experience rating and premium.

sibilities of persons responsible for safety reported a higher number of key safety program elements (Table 5). A significantly higher number of companies reporting written and clearly defined safety roles and responsibilities reported a higher number of written company safety policy (96 percent vs. 54 percent) and procedures for 1) drug and alcohol use prevention (91 percent vs. 50 percent) and 2) emergency preparedness (62 percent vs. 17 percent). They also reported higher numbers of tracking of 1) injury/illness costs (74 percent vs. 38 percent); 2) first-aid cases (69 percent vs. 15 percent); and 3) near-hits (33 percent vs. 0 percent), as well as reporting that they conducted 4) safety training (86 percent vs. 46 percent); and 5) walkaround safety inspections (67 percent vs. 20 percent). Companies reporting that the person responsible for safety 1) reported to executive management; and 2) attended senior management meetings also reported significantly higher numbers of key safety program elements.

Perceived Importance of Safety Program Elements

The relative importance of several safety program elements in helping to maintain a safe workplace showed significant and positive correlations based on a Spearman Rho of greater than 0.50 and a p value of less than 0.001. Clear accountability for safety was significantly correlated with 1) time devoted to safety by the company safety coordinator; 2) detailed safety and health plans; 3) employee involvement; and 4) recordkeeping. Time devoted to safety was correlated with 1) detailed safety and health plans; 2) expenditures for safety; and 3) employee involvement. Correlations existed between safety orientation and safety prejob/pretask safety planning as well as safety meetings and recordkeeping.

Discussion

This study supports the findings of previous research on effective construction safety program elements (Meridian Research; Liska and Goodloe; Jaselskis, et al) and is consistent with the elements cited by OSHA as key to successful accident prevention.

Management Commitment

These results support previous research in determining that management commitment was consistently identified as a critical component of an effective safety program (Meridian Research; Liska and Goodloe; Jaselskis, et al). A significant difference was found between companies reporting an EMR below 1.0 and the employment of a full-time safety manager; this study is also consistent with Jaselskis, et al, where time devoted to safety and company safety expenditures were cited as key program elements.

Moreover, this study found a significant difference between companies reporting the presence of recognized effective safety program elements and those having few. Firms with a higher number of program elements also reported that they more often 1) clearly define safety roles/responsibilities; 2) have the safety manager/coordinator report directly to executive management; and 3) have the safety manager/coordinator regularly attend management meetings. The importance of safety roles/responsibilities (as identified by Meridian Research) was further underscored by the finding that companies which more often clearly define safety roles/responsibilities reported significantly higher use of a written safety and health program, and safety incentives.

Employee Involvement

Employee involvement has increasingly come to be recognized as key to an effective safety program. Meridian Research cited the "ultimate shareholder" role that employees play in worksite safety and health through contribution of their unique insights about their jobs and workplace hazards (Meridian Research). The present study found that companies reporting a higher use of clearly defined roles/responsibilities also reported a higher number of two components of employee involvement—the presence of safety committees and an employee concern program.

Worksite Analysis

Worksite analysis (sometimes referred to as job safety analysis in the construction trades) has long occupied a prominent place in effective SH&E pro-

Statistics & This Study

The research methodology generated information on the frequency of occurrences within categories. For example, companies were sorted by whether they had an EMR of less than 1.0 or 1.0 and greater. The total frequency of safety attributes, such as employment of a full-time safety manager, were then counted for each of the two EMR categories. Grouping of data by category results in nominal data. The most popular statistical test of nominal data—chi-square—is used to test whether frequency differences between groups have occurred on the basis of chance. The statistical probability (p) that differences between groups are attributed only to chance is called alpha and is typically set at 0.05. For example, if p is found to be less than 0.05, then it is stated that there is less than a five-percent chance that observed differences between groups is attributed to chance alone. Referencing the results of chi-square analysis presented in Table 2, it can be said that the probability that the greater than expected number of full-time safety managers employed by companies with an EMR of less than 1.0 than companies with an EMR of 1.0 or greater can be attributed to chance is 0.015 or 15 out of 1,000. Based on an alpha of 0.05, it can be concluded that the observed difference is statistically significant. To learn more about statistical analysis of nominal data, see *Basic Statistical Analysis,* by Richard C. Sprinthall, published by Allyn & Bacon, or other basic textbooks on statistics.

Practical Applications of These Findings

Implementation of sound safety programs has led to reductions in fatalities and injuries among select construction companies, but many companies still need to improve based on a wide range of safety performance found within the construction industry.

More research is needed that quantitatively identifies effective construction safety program elements.

This study found that companies with a lower EMR also reported a high number of key safety management practices. Construction companies whose safety performance is low and incurred losses are high can improve their safety performance and reduce losses by:

1) Hiring a qualified full-time safety manager and ensuring that s/he reports to executive management and regularly attends management meetings.

2) Assign the safety manager responsibility for developing a comprehensive written safety plan that includes pre- and post-job briefs, a drug and alcohol prevention program, tracking and trending of all injuries including first-aid cases, implementation of a safety inspection program, and formation of a joint labor/management safety committee.

3) Approach safety as a skill that should be developed at all levels of the organization.

4) Send the safety manager, management and members of the joint labor/management safety committee to local safety conferences.

grams. The present study findings confirmed the importance of its role. A significant difference was found between the number of companies reporting employment of a full-time safety manager and the high number that implemented a safety inspection program or actively tracked the cost of worksite injuries and illnesses. Previous research reported similar findings, citing the importance of hazard analysis, accident investigations, prejob/pretask planning and safety inspections (Meridian Research; Liska and Goodloe; Jaselskis, et al). This study also identified a significant difference between the number of companies that reported clearly defined safety roles/responsibilities and the number which tracked injuries including first-aid cases and near-hits, and conducted safety inspections.

Hazard Prevention & Control

Hazard prevention and control, credited as the single most important element that can directly reduce workplace injuries (Meridian Research 34) was also found to be significant in the present study in which a higher number companies reporting the existence of written drug/alcohol use prevention programs also reported lower EMR. This finding is consistent with Liska and Goodloe and Jaselskis, et al, and other research (Feinauer and Havlovic; Gerber and Yacoubian) who identified the use of drug and alcohol as an important hazard to be controlled. In addition, in the present study, a significant number of companies providing adequate first-aid and medical services also reported a high use of clearly defined safety roles/responsibilities. This finding is consistent with the findings of Meridian Research, which reported a similar need for adequate first-aid and medical services.

Training

The present study supported the conclusion that training is an essential component of an effective safety program (Meridian Research; Liska, et al; Jaselskis, et al). A significant number of those firms reporting the use of prejob safety briefs also reported lower EMR. Prejob briefs were reported to be present more often when the firm reported employing a full-time safety manager. A significant number of companies reporting lower EMR also reported attending local and regional AGC safety events. Those companies that provided safety training were found to report a higher presence of clearly defined safety roles/responsibilities as well.

Conclusions

Implementation of sound safety management practices has led to fewer fatalities and serious medical cases for many contractors. However, many firms still need to follow this lead, as evidenced by the wide range of safety performance that exists within the construction industry. Many individual case studies have documented overall successes in the construction industry, but more research that quantitatively identifies effective safety management elements is needed.

This study found that companies reporting superior safety performance as measured by EMR also reported a high number of key safety management practices—including employment of a full-time safety manager, presentation of prejob briefs, implementation of drug/alcohol use prevention programs, and attendance at safety conferences. Construction companies who reported that they employed a full-time safety manager also reported a significant implementation of other key construction safety practices, including prejob safety briefs, drug/alcohol use prevention programs, injury/illness tracking mechanisms and weekly safety inspections. Clearly defined safety roles/responsibilities also supported implementation of many key construction safety practices.

The costs of construction fatalities and serious injuries include both human suffering and economic losses. Companies that implement these key safety management practices realize savings in both areas. Employers can improve the industry's safety image and positively impact their bottom lines by implementing sound safety management practices. This research demonstrates that key safety program elements contribute to improved safety performance. Construction companies that wish to improve safety performance and positively affect the bottom line should hire a full-time safety manager, if one is not already in place, and develop the qualifications of this individual through continuing education. This manager should report to senior management, be an active member of the company's management team and regularly attend management meetings. S/he must also have the responsibility and authority to fully implement a comprehensive safety program. Finally, safety should be approached as a skill to be developed at all levels within the organization. ■

References

Agarwal, P. and J. Everett. "Strategies for Construction Contractors to Reduce Workers' Compensation Costs." *Journal of Management in Engineering.* 13(1997): 70-75.

Associated General Contractors of America (AGC). "AGC Overview." Alexandria, VA: AGC, 2002. <http://www.agc.org/AGC_overview>.

Chaney, P. "The Hidden Costs of Jobsite Accidents." *Constructor.* 73(1991): 40-41.

Construction Industry Institute (CII). "Design for Safety: The Zero Accident Culture." *CII News.* 8(1995): 1-2.

Everett, J.G. and P.B. Frank. "Costs of Accidents and Injuries to the Construction Industry." *Journal of Construction Engineering and Management.* 122(1996): 158-164.

Feinauer, D.M. and S.J. Havlovic. "Drug-Testing as a Strategy to Reduce Occupational Accidents: A Longitudinal Analysis." *Journal of Safety Research.* 24(1993): 1-7.

Findley, M. "Management Needs Behavior-Based Safety Initiatives, Too." *Safety + Health.* March 2000: 44-48.

Safety Program Checklist

Taken from the 48-item questionnaire, this checklist was designed to help respondents characterize their company's current operations.

a) Principal commitment:
❑ **yes** ❑ **no** ❑ **don't know** A written safety policy statement signed by a company principal.

b) A written accident prevention program (per state or federal standards) that addresses a written new-hire orientation that contains the following:
❑ **yes** ❑ **no** 1) How, where and when to report injuries
❑ **yes** ❑ **no** 2) Location of first-aid kits/facilities
❑ **yes** ❑ **no** 3) How to report unsafe conditions and practices
❑ **yes** ❑ **no** 4) Use and care of personal protective equipment
❑ **yes** ❑ **no** 5) Actions to take in the event of emergencies
❑ **yes** ❑ **no** 6) Identification of chemical hazards and proper use
❑ **yes** ❑ **no** 7) An outline of the company's overall safety program
❑ **yes** ❑ **no** 8) A definition of your company's safety roles/responsibilities

c) A written accident prevention program (per state or federal standards) that addresses employee training documentation:
❑ **yes** ❑ **no** 1) Hazard communication
❑ **yes** ❑ **no** 2) Fire prevention
❑ **yes** ❑ **no** 3) Scaffolding
❑ **yes** ❑ **no** 4) Site specific (i.e., confined space)
❑ **yes** ❑ **no** 5) First aid/CPR

d) A written accident prevention program (per state or federal standards) that addresses a written policy on the following safety items:
❑ **yes** ❑ **no** 1) Lockout/tagout
❑ **yes** ❑ **no** 2) Bloodborne pathogens post-exposure plan
❑ **yes** ❑ **no** 3) Confined spaces
❑ **yes** ❑ **no** 4) Fall proteciton
❑ **yes** ❑ **no** 5) Fire prevention and protection
❑ **yes** ❑ **no** 6) Asbestos and lead policy
❑ **yes** ❑ **no** 7) Trenching and shoring
❑ **yes** ❑ **no** 8) Hazard communication
❑ **yes** ❑ **no** 9) Vehicle and driver program and files
❑ **yes** ❑ **no** 10) Assured grounding program
❑ **yes** ❑ **no** 11) Disciplinary procedures and enforcement of safety and health regulations for subcontractors and employees
❑ **yes** ❑ **no** 12) Written procedure to address employee safety concerns
❑ **yes** ❑ **no** 13) Workplace violence policy

e) A designated safety coordinator:
❑ **yes** ❑ **no** 1) Safety responsibilities clearly defined in writing
❑ **yes** ❑ **no** 2) Safety coordinator must report to executive management
❑ **yes** ❑ **no** 3) Safety coordinator attends management project meetings and safety meetings

f) Emergency procedures and first-aid/CPR certification:
❑ **yes** ❑ **no** 1) All supervisors first-aid/CPR cards
❑ **yes** ❑ **no** 2) Certification information posted on bulletin boards
❑ **yes** ❑ **no** 3) A written emergency procedure plan

g) Accident investigations and reports:
❑ **yes** ❑ **no** 1) Reporting procedures are clarified at the time of hire
❑ **yes** ❑ **no** 2) Investigation procedures for near-hits
❑ **yes** ❑ **no** 3) Investigations are conducted in 24 hours
❑ **yes** ❑ **no** 4) Investigations are documented on a company report form
❑ **yes** ❑ **no** 5) Investigations of accidents and near-hits are discussed during weekly safety meetings

h) Substance abuse:
❑ **yes** ❑ **no** 1) A written drug/alcohol policy, reflecting current company policies

i) Consistent use of safety posters:
❑ **yes** ❑ **no** 1) All required federal and state forms are posted on a designated safety bulletin board
❑ **yes** ❑ **no** 2) Previous year's OSHA 200 form

j) Participation in at least one construction safety activity by one or more employees:
❑ **yes** ❑ **no** 1) AGC safety classes
❑ **yes** ❑ **no** 2) AGC safety committee meetings
❑ **yes** ❑ **no** 3) NSC/ASSE monthly meeting or seminar
❑ **yes** ❑ **no** 4) Local regional safety days
❑ **yes** ❑ **no** 5) Other

k) Site specific safety plans:
❑ **yes** ❑ **no** 1) Follow protection work plan
❑ **yes** ❑ **no** 2) Confined space entry permit
❑ **yes** ❑ **no** 3) Weekly walkaround inspection documentation
❑ **yes** ❑ **no** 4) Top mangement commitment to a return-to-work program

l) Return-to-work program:
❑ **yes** ❑ **no** 1) Written return-to-work program
❑ **yes** ❑ **no** 2) Written modified duty job description
❑ **yes** ❑ **no** 3) Documentation of supervisory training in return-to-work criteria
❑ **yes** ❑ **no** 4) Top management commitment to a return-to-work program

Findley, M. and N. Timmons. "Team Safety in Construction: Tapping Into Underground Knowledge." *Professional Safety.* July 1995: 35-41.

Gerber, J.K. and G.S. Yacoubian. "An Assessment of Drug Testing Within the Construction Industry." *Journal of Drug Education.* 32(2002): 53-68.

Hinze, J. and L.L. Applegate. "Costs of Construction Injuries." *Journal of Construction Engineering & Management.* 117(1991): 537-550.

Jaselskis, E.J., et al. "Strategies for Achieving Excellence in Construction Safety Performance." *Journal of Construction Engineering and Management.* 122(1996): 61-70.

Krizan, W. "Insurance: Party Is Over for Cheap Workers' Compensation." *Engineering News Record.* 245(2000): 44-45.

Lanier, E.B. "Reducing Injuries and Cost through Team Safety." *Professional Safety.* July 1992: 21-25.

Liska, R.W. and S.E. Goodloe. "Zero Accident Techniques: A Report to the Construction Industry Institute." Source Document #86. Austin, TX: University of Texas, 1993.

Lowery, J.T., et al. "Risk Factors for Injury Among Construction Workers at Denver International Airport." *American Journal of Industrial Medicine.* 34(1998): 113-120.

"Management May Be Better But Margins Remain Thin." *Engineering News Record.* 237(1996): 12.

Meridian Research. "Worker Protection Programs in Construction: Final Report." Silver Spring, MD: Meridian Research, 1994.

NSC. *Injury Facts.* 2001 ed. Itasca, IL: NSC, 2001.

OSHA(a). "Focused Inspections in Construction." Washington, DC: U.S. Dept. of Labor, OSHA, 1996. <http://www.osha.gov/doc/outreachtraining/htmlfiles/focused.html>.

OSHA(b). "Safety and Health Program Management Guidelines." Washington, DC: U.S. Dept. of Labor, OSHA, 1989. <http://www.osha.gov/Publications/Const_Res_Man/1926_C_SH_guide.html>.

Powers, M.B. "Cost Fever Breaks." *Engineers News Record.* 233(1996): 48-49.

Sprinthall, R.C. *Basic Statistical Analysis.* 7th ed. Boston: Allyn & Bacon, 2003.

Weeks, J.L. and D.J. McVittie. "Controlling Industry Hazards in Construction." *Occupational Medicine.* 10(1995): 395-405.

Weil, D. "Assessing OSHA Performance: New Evidence from the Construction Industry." *Journal of Policy Analysis Management.* 20(2001): 651-674.

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