

Improving Construction Safety Performance

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SUMMARY

Jobsite accidents have a costly impact on the \$300 billion-a-year United States construction industry. Work-related injuries and illnesses, including fatalities, in construction occur at a rate that is 54% higher than the rate for all industries, making it one of the most hazardous occupations.

Data developed for this study indicate that accidents cost \$8.9 billion or 6.5% of the \$137 billion (1979 dollars) spent annually by users of industrial, utility, and commercial construction. This estimate includes both direct and indirect costs of accidents. These may be loosely defined as insured versus non-insured costs. The direct (insured) costs of accidents include medical costs and premiums of workers' compensation benefits, liability and property losses. Significantly, the indirect (non-insured) costs form the bulk of the total cost. They include such items as reduced productivity, delays in project schedules, administrative time, and damage to equipment and the facility.

Owners have long recognized and honored a moral obligation to provide a safe work environment to minimize injuries. The primary purpose of this study report is to demonstrate that owners have, in addition to their moral commitment, an economic incentive to help reduce the number of accidents that occur on their construction projects. The high cost of accidents gives owners as construction users good reason to concern themselves with the safety efforts of the contractors they hire. Past research has shown that accidents are, to some extent, controllable by all levels of construction management. Reasonable reductions in the frequency and severity of accident would lower the \$8.9 billion cost of accidents by as much as \$2.75 billion, or 8% of direct construction labor payroll, a year. So there is ample economic incentive, in addition to humanitarian concerns, for owners to play an important role in construction safety.

One way that an owner can carry out this responsibility is to hire contractors who have a record of good safety performance. This requires attention during the processes of qualifying contractors for bidding work and selecting contractors for a contract award. A prospective contractor with a history of good safety performance is more likely to perform safely in the future than a contractor with a poor, or less-than-average, safety record. Several relatively objective measures of past safety performance are available, notably the experience modification rate which is applied to workers' compensation premiums, and OSHA recordable injury and illness incidence rates. Both may be obtained from contractors. Both indicate a contractor's accident experience on past work. Contractors who hold their management accountable for accidents, as well as productivity, costs, schedules, and quality generally have the best safety records. Therefore, owners can help themselves in evaluating and selecting safe contractors by investigating contractors' safety attitudes and practices.

Past practice indicates that contractors are seldom awarded contracts solely on the basis of anticipated safety performance. An owner, particularly when employing a contractor with a history of poor safety performance, can and should require the contractor to operate in accordance with acceptable industrial safety practices. Both the contractor and the owner will reap cost savings from better safety performance. Owners can take measures to achieve better safety performance such as:

- Provide safety and health guidelines that the contractor must follow
- Require the use of permit systems for potentially hazardous activities.
- Require the contractor to designate a responsible supervisor to coordinate safety on the site.
- Discuss safety at owner-contractor meetings.
- Conduct safety audits during construction.
- Require prompt reporting and full investigation of accidents.

Owners cannot maintain a completely hands-off policy towards construction activity on the owner's property. The owner is charged with the legal duty to use reasonable care to correct or warn against non-apparent site hazards which may be faced by the construction contractor in the course of his performance. Owners could face third-party lawsuits brought by contractor's employees for injuries caused by the owner's breach of this duty even if the independent contractor status of the construction contractor has been maintained. The owner's duty often extends to unsafe activities by contractors which create dangers for others on the site. Thus, the owner could be liable for injuries to persons on the site caused by apparent unsafe practices of the construction contractor.

Owners should recognize that the principles of management control commonly applied to costs, schedules, quality and productivity are equally applicable to safety and that, if used, will improve safety performance. By showing more concern for construction safety, owners can help reduce injuries and loss of life and the billions of dollars needlessly wasted by construction accidents.

II STUDY OBJECTIVES

Improved construction safety and the resulting cost benefits require more awareness and understanding by owners of:

- The economic impact of accidents and accident insurance costs on project costs.
- Criteria to be used in the evaluation of contractor safety performance.
- Criteria to be used to enhance contractor safety performance.

To address these needs, the following objectives were established:

1. The assembly and analysis of data to provide economic incentive for owners to work with their construction contractors to improve safety performance. Owners need to know costs of accidents in construction and how safety performance can affect other dimensions of contractor performance, such as adherence to schedules, productivity, quality, absenteeism, and personnel turnover.
2. The development of methods or systems for owners' use in evaluating a contractor's safety performance. Owners need to know how reliable the workers' compensation experience modification rate, or other insurance data, is in measuring past safety performance and what alternate objective measures are available. They need to know which safety-management-auditing procedures will most accurately predict a contractor's future safety performance from his current safety-management procedures.
3. The determination of the elements of a safety program that owners can implement, or require their contractors to implement, to improve safety performance. Owners need to know which safety-management practices and procedures have been shown to improve contractor safety performance and what the owner's optimum role is in managing construction safety. This role generally varies for differing types and sizes of projects.

III INTRODUCTION

This study calls upon owners to be concerned and involved in construction-contractor safety performance. In addition to the humanitarian reasons for preventing personal injury and loss of life, increased attention to safety and health is essential to the long-term economic health of the construction industry. Costs related to construction accidents are borne by owners, directly or indirectly. An effective construction-safety program will result in lower job costs.

An effective safety program should cost significantly less than the dollar losses in accidents that otherwise are apt to occur. Improvement can be accomplished by hiring contractors with a record of good safety performance or, when the selection is limited, by identifying contractors with mediocre safety performance as targets for owner involvement. Contractor attitudes toward safety range from minimal compliance to total commitment, so concerned owners should consider past safety performance of contractors during the bidding process and when awarding the contract.

The research in this study report was limited to industrial, utility and commercial construction , but the finding make it clear that the recommendations of the study apply to all segments of construction and to contract-maintenance work as well. People who work in construction safety believe that safety performance is an important managerial concern that is often overlooked or given too little attention by contractors and owners.

IV STUDY APPROACH

This study was conducted by a team of nine men who have responsibility in areas of safety and health and who represent industrial owners, construction contractors, and the insurance industry. They agreed that, in addition to many currently available sources of construction -safety information, new data must be developed. Stanford University's Department of Civil Engineering was selected to do the research for this study. The expertise of personnel in this department's Construction Engineering and Management Center was extremely valuable to The Business Roundtable team. The methods and systems developed and used, and the data assembled and analyzed by the Stanford research team, form the foundation of this study.¹ The cooperation of, and the information supplied by, member companies of The Business Roundtable, and business associates of those companies, in completing questionnaires and surveys for the study are greatly appreciated.

To develop data providing economic justification for owners' involvement in construction safety, the research team began by examining workers' compensation and other costs of accidents. Then a survey was made of experience modification rates for workers' compensation to indicate the potential percentage variation in the costs of construction accidents. To obtain data on the indirect costs of accidents, a questionnaire was developed and mailed to a number of owners and contractors. Further, data were assembled to permit an estimate of the cost of a construction-safety program.

To develop methods for owners to evaluate a contractor's safety performance, Stanford researchers investigated workers' compensation experience modification rates and OSHA recordable injury and illness incidence rates. A form Items for Inclusion in Prequalification Form (see Appendix), was developed for use by owners to survey accident experience and to determine the safety attitudes and practices of prospective contractors.

To define the elements of a safety program which owners can put into effect, or require their contractors to adopt, the Stanford researches investigated what safety management practices and procedures have actually improved contractors' safety performance. Two questionnaires, one for owners and one for construction contractors, were prepared and mailed to selected Business Roundtable member companies, and their contractors, respectively. Data from the questionnaires were analyzed to determine the extent to which owners actively participate in construction-safety programs and to identify the practices and procedure those owners use. The data were also analyzed to see whether owners' involvement tends to improve contractors' safety performance.

¹ Stanford University Department of Civil Engineering Technical Report #260

V

THE ECONOMIC IMPACT OF CONSTRUCTION ACCIDENTS

FINDINGS

A separate study by the Construction Industry Cost effectiveness Project determined that construction is a \$300 billion per year industry in the United States with industrial, utility and commercial construction accounting for \$137 billion of this total.² Accident costs account for a significant 6.5% of that \$137 billion.

Owners have a direct economic stake in the safety performance of their contractors because accident costs are an expense to the contractor and are passed on, one way or another, to the client. This is obvious in cost-reimbursable contracts, but it also applies to fixed-price contracts.

Owners must consider three kinds of costs when dealing with safety in construction:

- Direct costs of accidents and insurance
- Indirect costs of accidents
- Costs of safety programs

Direct Costs of Accidents and Insurance

Workers' Compensation

Most contractors buy insurance for their workers' compensation (WC) exposure. Those that do not are either self-insured or are covered by insurance carried by their client. The cost of insurance coverage varied with the contractor's accident record, which is based on the contractor's injury costs in a given geographical area, expressed as an experience modification rate (EMR). The other part of the premium formula involves the workers' compensation insurance rate set for a particular type of work (i.e., carpentry, plumbing, steel erection), by a state rating bureau, expressed in dollars per \$100 of payroll and based on the injury experience for that type of work in the rating state. The contractor's insurance premium is the product of the state rates multiplied by the contractor's EMR for that state. It is important to note that the work classification rates are constant for all contractors doing similar work in a specific state, so it is a contractor's EMR that effects his cost. (For a more de tailed explanation of EMR, see Section VI.) A survey of national contractors found that their EMR multipliers varied from 50% to 205%. A summary of the WC insurance premiums paid as a function of the contractor's EMR appears below.

TABLE 1

EMR IMPACT ON COST OF WORKER'S COMPENSATION INSURANCE³³
(per \$100 million of project cost)

² The Business Rountable's estimate of the size of the construction industry in 1979,

³ Based on Stanford University Department of Civil Engineering *Technical Report #260*

Percentile	EMR	Cost of WC Insurance
Lowest EMR	Under 50	\$1,054,500
10th	67	1,413,030
Median	88	1,855,920
90th	140	2,952,600
Highest	205	4,323,450

Assuming that direct labor is 25% of the project cost, it can be shown from this table that the cost of workers' compensation insurance for a contractor in the 10th percentile would be 5.7% of direct labor payroll.

$$\frac{\$1,413,030}{\$100 \text{ million} \times 25\%} = 5.7\%$$

The cost of WC insurance for a contractor in the 90th. percentile would be 11.8% of direct labor payroll.

$$\frac{\$2,952,600}{\$100 \text{ million} \times 25\%} = 11.8\%$$

The cost of WC insurance for a contractor at the median EMR would be 7.4% of direct labor payroll.

$$\frac{\$1,855,920}{\$100 \text{ million} \times 25\%} = 7.4\%$$

The difference in workers' compensation insurance costs between a contractor in the 10th percentile and one in the 90th percentile is \$1.5 million, or more than 6% of direct labor payroll.

Next, consider workers' compensation insurance costs per \$100 million of project cost for safer versus less safe contractors on a variety of typical industrial projects:

TABLE 2
 COSTS OF WORKERS' COMPENSATION INSURANCE
 FOR "TYPICAL" CONSTRUCTION PROJECTS⁴⁴
 (per \$100 million of total project cost, using California WC type-of-work rates).

Contractor Position Type of Facility	Lower	Lower		Higher	Higher
	Decile	Qaurtile	Mean	Quartile	Decile
Paint Plant	\$ 480,000	\$ 620,000	760,000	\$ 920,000	1,060,000
Paper Mill	530,000	680,000	835,000	1,010,000	1,116,000
Chemical Plant	575,000	747,500	920,000	1,115,500	1,276,500
Power Plant (Coal)	1,320,000	1,700,000	2,100,000	2,540,000	2,920,000
Power Plant (Nuclear)	1,360,000	1,750,000	2,160,000	2,610,000	3,000,000

It can be shown from this table that the difference between a contractor in the lower decile and one in the higher decile ranges from 0.6% of project costs for paint plant contractors to 1.6% for nuclear power plant contractors.

$$\begin{aligned}
 \text{Paint Plant:} & \quad \frac{\$1,060,000 - 480,000}{\$100 \text{ million}} = 0.58\% \\
 \text{Paint Plant (Nuclear):} & \quad \frac{\$3,000,000 - 1,360,000}{\$100 \text{ million}} = 1.64\%
 \end{aligned}$$

Liability

Accidents resulting in injury to anyone other than one's own employees or damage to the property of others constitute liability exposures. Coverage for general liability, automobile liability, and completed operations is considered to be a part of liability costs. In addition to the actual insurance premium, other expenses such as deductibles and legal fees should be considered in compiling total costs to the contractor for liability. Published rates exist for liability insurance coverage; however, the cost is relatively insignificant compared to workers' compensation rates. There are certain high risk operations which may command insurance premiums in the range of 15% of direct labor payroll; however, most contractors pay about 1% for liability coverage.

⁴ Based on Stanford University Department of Civil Engineering Technical Report #260

Property

Real property, such as the facility under construction and construction equipment, provide a potential for accident and resulting losses. The costs of such insurance as builder's risks, equipment floaters, and installation floaters must be considered. In addition to the insurance premiums, deductibles and the possibility of losses affecting uninsured property should be considered. Accidents in construction work that is underway may bring catastrophic losses, either because of the severity of the accident itself, or because of resulting long delays in completing the work - or both.

Indirect Costs of Accidents

The insurance costs discussed so far are readily identifiable as a specific cost of doing business and may therefore be projected. However, when an accident occurs, not only direct but indirect costs are involved. Indirect costs include:

- Loss of productivity
- Disrupted schedules
- Administrative time for investigations and reports
- Training of replacement personnel
- Wages paid to the injured worker (s) and other workers for time not worked
- Clean up and repair
- Adverse publicity
- Third-party liability claims against the owner
- Equipment damage

Estimates of the ratio between indirect and direct costs have varied from 4 to 1 to 17 to 1. This ratio varies greatly with the magnitude of the accident, however, it is not necessarily linked to the severity of the injury. In other words, an extremely serious and costly accident may occur without any person sustaining injury.

In the Stanford report, data collected for 49 construction accidents were analyzed. None of the accidents included any costs for punitive damages or for third-party liability.

TABLE 3
ANALYSIS OF ACCIDENT COSTS⁵

Range of Benefits Paid	Number of Cases	Average Benefits Paid (Direct Costs)	Average Indirect Cost	Average Ratio - Indirect Cost: Benefits Paid
No lost time:				
\$0 to 199	13	\$ 125	\$ 530	4.2
200 to 399	7	250	1,275	5.1
400 plus	4	940	4,740	5.0
Lost time:				
\$0 to 2999	9	869	3,600	4.1
3000 to 4999	8	3,947	6,100	1.6
5000 to 9999	4	6,602	7,900	1.2
10000 plus	4	17,137	19,640	1.1

In the 24 accidents involving no lost time, benefits paid per injured worker varied from \$90 to \$2500 (with a median of \$135 and a mean of \$298); the measurable indirect costs varied from \$220 to \$11,300 per accident (with a median of \$600 and a mean of \$1450).

In the 25 accidents involving lost time, benefits paid per injured worker ranged from \$90 to \$24,000 (with a median of \$3500 and a mean of \$5380); the measurable indirect costs varied from \$460 to \$30600 per accident (with a median of \$4500 and a mean of \$7700).

Analysis of the compiled data shows that the indirect cost ratio (or multiplier) is affected by a great many variables. These variables include the type of project, the diligence of the investigation, the severity of the accident, how critical the affected project is to the construction contractor's clients activities, and more. So many variables are involved that it is not possible to provide a single multiplier for all construction industry accidents. Still, if the accident data are separated into two general groups, large and small claims, it can be seen that smaller accidents have a larger multiplier. Larger accidents, despite a smaller multiplier, require large benefits to be paid; so the magnitude of the indirect costs is still substantial.

The varied multipliers in Table 3 are believed to be conservatively low; the total indirect costs are apt to be considerably higher.

Cost of Safety Programs

Insurance costs, costs of injuries, and the expense of liability suits are easily documented and rather readily available. the cost of establishing and administering a construction

⁵ Based on Stanford University Department of Civil Engineering Technical Report #260

safety and health program is somewhat less tangible, but can be estimated with reasonable accuracy. Data collected from a significant sample of contractors working at various construction sites in 1980 indicate that the cost of administering a construction safety and health program usually account to about 2.5% of direct labor costs. These costs include:

- Salaries for safety, medical and clerical personnel
- Safety meetings
- Inspection of tools and equipment
- Orientation sessions
- Site inspections
- Personal protective equipment
- Health programs such as respirator-fit tests
- Miscellaneous supplies and equipment

In the most recent four years for which data were available, the OSHA recordable incident rate for the same sample of contractors has been only 36% of the average rate for the construction industry as published by the National Safety Council⁶ as shown below:

TABLE 4
OSHA RECORDABLE INJURY INCIDENCE RATES
(per 200,000 hours-per-year worked)

	Incidence Rates for Contractors in Sample Survey	Incidence Rates for Construction Industry (National Safety Council)	Column 1 as a % of Column 2
1980	3.62	12.03	30.1
1979	4.50	12.62	35.7
1978	4.69	11.84	39.6
1977	5.00	13.64	36.7

⁶ National Safety Council: Accident Facts

In 1980, the contractors in this survey had workers' compensation losses averaging 6.1 cents per hour worked. Had these contractors experienced accidents at the national average rate in construction as published by the National Safety Council, it can be assumed that their worker' compensation losses would have increased accordingly. In that case, their total losses for worker's compensation would have reached 16.9 cents per hour, nearly triple their actual loss.

$$\frac{6.1 \text{ cents}}{36\%} = 16.9 \text{ cents}$$

Similarly, the OSHA lost-workday case incidence rate for these same contractors, collectively, has been an outstanding 2.7% of the average rate for the construction industry as published by the National Safety Council, as shown below:

TABLE 5
OSHA LOST-WORKDAY CASE INCIDENCE RATES
(PER 200,000 hours-per-year worked)

	Incidence Rates for Contractors in Sample Survey	Incidence Rates for Construction Industry (National Safety Council)	Column 1 as a % of Column 2
1980	0.098	4.29	2.3
1979	0.100	3.89	2.6
1978	0.104	3.98	2.6
1977	0.124	4.07	3.1

As noted earlier, the cost per hour for workers' compensation losses was 6.1 cents for the contractors in this survey. Had these contractors experienced accidents at the published lost-workday cases incidence rates, it can be assumed that their workers' compensation loses would have risen accordingly. If so, the total WC losses would be \$2.26 per hour worked, or 37 times as great!

$$\frac{6.1 \text{ cents}}{2.7\%} = \$2.26$$

Together, the two illustrations above offer strong evidence of the magnitude of savings that can be realized from effective safety programs.

CONCLUSIONS

The value of industrial, utility and commercial construction in the United States amounted to \$137 billion-a-year in 1979 dollars. Insurance premiums on typical projects cost 1% of direct labor payroll for liability insurance plus 7% of direct labor payroll for workers' compensation insurance at the median experience modification rate. Labor is usually about 25% of the total cost of a project, so insurance represents 2% of total project cost. Insurance costs to the industry are \$2.74 billion annually. ($\$137 \text{ billion} \times 25\% \times (1\% + 7\%) = \2.74 billion). of the 2.74 billion total, 65% is paid for accident losses, the remaining 35% represents administrative costs of the insurance industry. Therefore, accidents cost the construction industry 65% of \$2.74 billion of \$1.78 billion in direct costs.

Using a conservative figure of 4 as the indirect cost multiplier, the industry absorbs an additional cost of \$7.12 billion ($4 \times \1.78 billion). As a result, accidents cost owners a minimum of \$1.78 billion directly plus \$7.12 billion indirectly, or a total of \$8.9 billion annually, in 1979 dollars.

In the not too distant future, workers' compensation costs can be expected to increase as the construction industry becomes subject to new regulations covering occupational health. The portion of costs attributable to illnesses in this study is quite modest when compared with the projected costs of administering a comprehensive industrial hygiene program. The time is coming when illness problems will be addressed and appropriate funding must be provided.

Worker's compensation benefits have been rising steadily at an ever-increasing rate. During the period from 1975 to 1980, WC benefits increased by 300% in two states, by 200% in eight states, and by 100% in twenty-two states. these increase are partly a response to the National Commission on State Workmen's Compensation Laws which was created to study WC benefits.⁷ In its report to the President and Congress in 1972, the Commission recommended a number of changes in state workers' compensation laws to improve the system's effectiveness and broaden protection for work-related injuries and diseases.

For these reasons, 7% of direct labor payroll for workers' compensation insurance premium costs, as used in this study is conservative.

⁷ Established in response to Section 27, Occupational Safety and Health Act, 1970

The figure of \$8.9 billion for accidents represents a controllable cost in the construction industry; it can and should be reduced. An effective construction safety program, carried out by contractors and monitored by owners, should reduce both the number and severity of accidents. It follows that the workers' compensation losses will be lower and, of course, the OSHA incidence rates for recordable injuries and workday cases will be lower.

If, because of lower worker's compensation losses, the 65% of insurance costs currently paid for accident were reduce to 45%, the direct costs of accidents to the industry would fall to 45% of \$2.74 billion, or \$1.23 billion. Based on the performance of national contractors surveyed, this is an achievable goal. Total costs of accidents including indirect costs, would therefore decline to \$6.15 billion a year (\$1.23 billion plus 4 X \$1.23 billion). The savings thus achieved (\$8.9 billion less \$6.15 billion) would be \$2.75 billion annually. \$2.75 billion is 8% of direct labor payroll - a substantial saving.

$$\frac{\$2.75 \text{ billion}}{\$137 \text{ billion} \times 25\%} = 8\%$$

The ratio of savings to the cost of administering safety and health program would then be 8%: 2.5% or 3.2 to 1.

Owners should take particular note of the magnitude of third party liability costs as one of the indirect costs of accidents. Litigation against a third party has become more common in recent years, and dollar losses in some jurisdictions can be significant for the owner when an employee of a contractor sustains an injury or illness. Agreements of indemnification (hold-harmless clauses) sometimes tend to be ineffectual in protecting owners from either dollar loss or adverse publicity. However, when carefully drafted, such clauses can provide significant protection to owners and should be considered in all contracts.

One cannot, of course, place a dollar value on the humanitarian aspects of a good safety program. Nor is it possible to do so with other intangibles such as adverse publicity and the negative effects of accidents on labor relations., Owners should realize, however, that merely adopting a safety program will not yield the desired results without a serious and persistent management commitment to make the program work.

Both owners and contractors should be concerned with the cost and control of **all** accidents. Small, or minor, accidents have a larger indirect cost multiplier, and a high frequency of accidents is a warning that a severe injury is more likely to occur. In considering whether a construction safety program is justified, the total cost of **all** type of accidents should be measured against the costs of the safety program. Help in developing a meaningful safety program and in determining priorities for attacking major areas of loss is available to both owners and contractors. Sources include insurance carriers or brokers, trade associations, and contractor groups.

VI SELECTION OF SAFE CONTRACTORS

FINDINGS

This part of the study deals with reducing the number and severity of construction accidents by choosing a safe contractor.

Three sources of information provide ways for owners to evaluate the probable safety performance of prospective contractors:

- Experience modification rates for workers' compensation insurance
- OSHA incidence rates for recordable injuries and illnesses
- Contractor safety attitudes and practices

Experience Modification Rates for Workers' Compensation Insurance

The insurance industry has developed experience rating systems as an equitable means of determining premiums for workers' compensation insurance. These rating systems consider the average workers' compensation losses for a given firm's type of work and amount of payroll and predict the dollar amount of expected losses to be paid by that employee in a designated rating period, usually three years. Rating is based on comparison of firms doing similar types of work, and the employer is rated against the average expected performance in each work classification. Losses incurred by the employer for the rating period are then compared to the expected losses to develop an experience rating.

Workers' compensation insurance premiums for a contractor are adjusted by this rate, which is called the experience modification rate adjusted by this rate, which is called the experience modification rate (EMR). Lower rates, meaning that fewer or less severe accidents had occurred than were expected, result in lower insurance costs. A contractor's EMR is adjusted annually by using the rate for the first three of the last four years.

There are three different types of experience rating, none comparable with any of the others:

- Interstate experience modification rating. This is used in 40 states.
- Intrastate experience modification rating. This is used in 4 states (California, Delaware, New Jersey and Pennsylvania).
- Monopolistic state fund. This is used in 6 states (Nevada, North Dakota, Ohio, Washington, West Virginia and Wyoming).

Stanford researchers found, in an investigation of interstate and intrastate EMR's, that contractor experience modification rates ranged from a loss of 50% to a high of 205%. This remarkable span indicates the difference in WC insurance premium costs between

contractors with good accident experience and those with poor accident experience. The data also show a clustering of contractors with EMR's of 80%.

OSHA Incidence Rates

The Occupational Safety and Health Act (1970) requires employers to record and report accident information on Occupational Injuries and Illnesses Annual Survey Form No. 200. The employer must retain completed forms for five years.

Information available from a contractor's OSHA Form No. 200 includes:

- Number of fatalities
- Number of injuries and illnesses involving lost workdays
- Number of injuries and illnesses involving restricted workdays.
- Number of days away from work
- Number of days of restricted work activity
- Number of injuries and illnesses without lost workdays

A contractor, having the number of hours his employees worked during the year, can compute incidence rates for any or all of the items above using the following formula:

$$\frac{\text{No. of incidents X 200,000 hours}}{\text{No. of hours worked}} = \text{Incidence Rate}$$

(The 200,000 hours in the formula represents the equivalent of 100 employees working 40 hours per week, 50 weeks per year, and is the standard base for incidence rates.)

In calculating the OSHA recordable incidence rate, the number of incidents in the formula are the total of the numbers of fatalities, injuries and illnesses involving lost and restricted workdays, and injuries and illness without lost workdays. The Bureau of Labor statistics compiles construction industry incidence-rate averages each year for 14 separate classifications of construction work and various employee size groupings.

Contractor Safety Attitudes and Practices

Management accountability for safety performance is a very important factor in determining a company's safety record. Companies which hold their project management accountable for accidents along with productivity, schedules, quality, etc. are the ones which have the best safety records⁹. Based on the results from the research on the effects of top management on safety in construction, the following five measures of managerial accountability for safety were suggested by Stanford:¹⁰

1. The recipients of accident reports and frequency distribution of the reports (field superintendent, vice president of construction, president of firm).
2. The frequency of project safety inspections and the degree to which they include project and field superintendents.
3. The frequency of safety meetings for field supervisors.
4. The compilation method for accident records and the frequency of reporting. (Those contractors who subtotal their accidents by superintendent and foreman, rather than just by company, have a more detailed accountability system.)
5. The compilation method for accident costs and the frequency of reporting. (Again, greater accountability comes from a more detailed system, so that individual foremen and superintendents are measured in terms of their accident costs on the job.)

CONCLUSIONS

The experience modification rate is a widely used indicator of a contractor's past safety performance. Owners should request, from prospective contractors, EMRs for the three most recent years, which will show the firm's trend in safety performance. Interstate EMRs, intrastate EMRs and monopolistic state ratings should not be compared with each other because different data bases are used for each system. Interstate EMRs of different contractors can be compared, as can intrastate EMRs of different contractors operating in the same state.

The OSHA incidence rates also show past safety performance. Since these are uniform national statistics, there are no limitations in comparing rates in one part of the country with those in another. Moreover, OSHA incidence rates reflect more recent experience than EMR's.. Owners should request, from contractors, OSHA incidence rates for recordable injuries and illnesses for the three most recent years.

⁹ Based on Stanford University Department of Civil Engineering Technical Report # 196

¹⁰ Based on Stanford University Department of Civil Engineering Technical Report #260

The reliability of OSHA incidence rates is solely dependent of judicious reporting by the employer, while the EMRs are established by independent rating bureaus. Although the EMR is a more objective measure than the OSHA incidence rate, there is a correlation between them. Both, will indicate past safety performance.

The safety attitudes and practices of a contractor are helpful in evaluating his safety and health capabilities. Owners should look for: Management accountability; a qualified staff; written safety and health programs; regular orientation of foremen and new workers; and management commitment. Past research on effective safety performance in construction indicates that the comparative measures, such as the experience modification rate and OSHA incidence rates, are more reliable and objective than the management accountability items.

A questionnaire for the use of owners in obtaining safety information from prospective contractors was developed for the task force by Stanford University (See Appendix). Use of the questionnaire will give owners a way to evaluate safety as they consider contractor qualification and selection.

VII THE OWNER'S INFLUENCE ON CONTRACTOR SAFETY PROGRAMS

FINDINGS

This part of the study considers what a concerned owner can do to improve the on-the-job safety performance of construction contractors.

Questionnaires to owners and contractors were used by Stanford University to determine what safety requirements owners placed on construction contractors. The responses are arranged in decreasing order of use by the respondents.

1. Require use of a system of permits for potentially hazardous activities.
2. Require the contractor to designate a responsible supervisor for safety coordination on the job site.
3. Provide the contractor with safety guidelines that must be followed.
4. Discuss safety at owner-contractor meetings.
5. Discuss safety audits of the contractor during construction.
6. Require immediate reporting of contractor accidents.
7. Stress safety as part of the contract during pre-bid walk-arounds.
8. Investigate contractor's accidents.
9. Maintain statistics of contractor's accidents.
10. Conduct periodic safety inspections.
11. Set goals for construction safety.
12. Consider safety in pre-qualifying contractors to bid.
13. Set up a construction safety monitor contractor safety.
14. Set safety guidelines in the body of the contract.
15. Be involved in orientation sessions alerting workers to safety hazards on the job.

None of the owners responding to the survey used all 15 of the above elements; about two-thirds of the owners used 6 to 8 of the elements in their programs; and a few used only 2.

OSHA incidence rates of contractors were averaged for each owner, and owners were grouped into two categories - those with construction accident rates below the industry average, and those with rates higher than the industry average. Information from owners about the specific content of their contractor safety programs was then correlated with the group to which the owner belonged according to the frequency of accidents. The findings:

- All owners with better-than-average construction safety records require contractors to obtain work permits for specific activities. Owners in the other group either do not require work permits or allow permits to remain in effect for extended periods of time.
- All the safer owners either consider the contractor's safety record or actually use safety statistics in awarding negotiated contracts. Half of the owners in the other group give no consideration to previous safety records before awarding contracts.
- All the owners in the safe group conduct formal site inspections, and about 60% of them regularly audit contractors' safety practices. Owners in the other group take a more "hands-off" approach to site safety and take action only when imminent danger appears.
- All of the owners in the group with better safety statistics use some form of goal setting for contractors to reduce accidents. Only 15% of the owners in the other group set goals.
- About 75% of the safer owners keep statistics separately by contractor; more than 50% of the of the other group do not maintain any type of construction accident statistics.
- Seventy-five percent of the safer group have established construction safety departments to monitor and confer with contractors on job-site safety. Only one-third of the owners with higher accident rates have a construction safety manager.
- By a ratio of about 2 to 1, the owners with better safety records stress safety as a necessary part of the job during pre-bid activities and site visits.
- The contract specification of most safe owners (60%) go beyond requiring compliance with OSHA regulations or broad corporate safety policies and further specify that contractors are to observe more detailed plant safety rules.
- More than half of the safer owners are involved in training sessions about plant hazards and safety procedures for construction site supervisors and workers. Only 10% of the owners in the other group are involved in any safety training.
- Practices that appear to be common to both groups are:
 - Delegating safety coordination to on-site contractor personnel.
 - Issuing construction safety guidelines.

- Discussing safety during owner-contractor meetings.
- Requiring contractors to provide accident reports. (However, safer owners tend to use the reports to analyze job-site problems, whereas owners in the other group tend to require the reports merely for legal reasons.)
- Participating with contractors in investigating serious accidents.

Specific programs and steps used by conscientious owners can be classified under several broad principles that underlie good safety performance. These include:

- Management emphasis on good safety performance (i.e., previous statistics, goal setting, contract safety specifications and pre-bid safety discussions).
- Job and safety training (job orientation).
- Audit (site inspection/audit, separate contractor statistics, owner safety people).

Further, three additional basic principles were recognized:

- Acceptance of responsibility for safety performance by the line organization (project engineer, construction superintendent and foreman).
- Use of safe equipment.
- Maintenance of safety awareness.

These principles for improved safety performance are the same principles that managements use to achieve effective cost control, quality control, productivity, etc. It is not surprising that many companies have found a good safety record to be directly related to improved cost performance.

CONCLUSIONS

Construction job safety can be successfully influenced by owners. The degree to which owners should involve themselves in this process should be based on the costs, benefits and risks involved. All owners have a legal and moral responsibility to use reasonable care to correct or warn contractors of any non-apparent hazards present on the site which could affect the safe performance of the construction and to use reasonable care to prevent contractors from injuring others on the site. Owners must make sure that contractors recognize their contractual responsibility to perform safely.

Beyond essentials such as these, the owner has considerable flexibility to adjust the degree of involvement and control to each situation. The incentives for increased involvement are lower costs, quality work, improved productivity, adherence to schedule, reduced exposure to bad publicity, and minimal disruption of the owner's employees and facilities.

On the other hand, increased owner involvement, if not handled adroitly, can interfere with the contractor's productivity and may cause ill will between an owner and the contractor. Each situation should be considered separately by management, and a decision should be made regarding the appropriate degree of involvement. (Obviously, the involvement would be less for a totally new construction site than for a job close to the owner's operating facilities.)

Once this decision is made, the success of the program will depend on good owner-contractor communications. These communications should include the owner's safety expectations, understanding of the contractor's safety program, and effective dialogue at all levels throughout the life of a project.

Owners can be successful in their effort to improve job safety on construction projects. Comments from contractors indicate positive support for such owner programs. Proper management by owners of this phase of their business can make a significant contribution to a reduction of injuries in construction and to a reduction of construction costs.

VII RECOMMENDATIONS

It is fully recognized by The Business Roundtable that contractors have the primary responsibility for execution of onsite safety. Nothing in this report is intended to change this. Rather, the recommendations of the report are intended to establish the supportive role required of owners in the effort to improve construction safety performance.

Owners should:

1. Become familiar with the high cost of construction accidents to reinforce their moral commitments to provide a safe work environment.
2. Be prepared to financially support contractors' efforts to insure an effective safety program.
3. Realize that merely adopting a safety program will not yield the desired results without a serious and persistent management commitment.
4. Recognize that the principles of management control commonly applied to cost, schedule, quality and productivity are equally applicable to safety and that, when used, they will improve safety performance.
5. Make safety an important consideration in the selection of contractors for bidding on their construction projects, including evaluation of contractors' past safety performance, safety attitude, and present programs and practices.
6. Explain to the contractor prior to the bidding process what is expected regarding safety performance.
7. Evaluate in the bid analysis the ability of the contractor to achieve expected safety performance and from this determine the degree of owner involvement required to meet safety objectives.
8. Become more directly involved in the safety activities of their construction projects and take proper measures to achieve better safety performance, such as:
 - Provide safety and health guidelines that the contractor must follow.
 - Require a formal site safety program.
 - Require the use of permit systems for potentially hazardous activities.
 - Require the contractor to designate the responsible supervisor to coordinate safety on the site.

- Discuss safety at owner-contractor meetings.
 - Conduct safety audits during construction.
 - Require prompt reporting and full investigation of accidents.
9. Function with the contractor as a cohesive safety team during the planning and execution of a construction project.
 10. Establish with the contractor lines of communication at all levels so that safe work practices are understood by both parties.

APPENDIX

ITEMS FOR INCLUSION IN CONTRACTOR PRE-QUALIFICATION AND QUALIFICATION FORMS

1. List your firm's Interstate Experience Modification Rate for the three most recent years.

19____ _____

19____ _____

19____ _____

2. Please use your last year's OSHA No. 200 Log to fill in: Number of injuries and Illnesses:

a)	Number of lost workday cases:	_____
b)	Number of restricted workday cases:	_____
c)	Number of cases with medical attention only:	_____
d)	Number of fatalities:	_____

3.

Employee hours worked last year (do not include any nonwork time even though paid).	_____
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4. Check your type of work:

Non Residential Building	_____
Heavy (Non Highway) Construction	_____
Plumbing, Heating and Air Conditioning	_____
Other	_____

5. Are accident reports (OSHA 200) and report summaries send to the following?
How often?

	No	Yes	Monthly	Quarterly	Annually
Field Superintendent	_____	_____	_____	_____	_____
Vice President of Construction	_____	_____	_____	_____	_____
President of Firm	_____	_____	_____	_____	_____

6. Do you hold site safety meetings for field supervisors?
Yes_____No_____

How often? _____

Weekly _____

Bi-Weekly _____

Monthly _____

Less often, as needed _____

7. Do you conduct project safety inspections?

Yes_____No_____

If yes, who conducts this inspection (title)_____.

And how often?_____

8. How are accident records and accident summaries kept? How often are they reported

	No	Yes	Monthly	Annually
Accidents totaled for the entire company	_____	_____	_____	_____
Accidents totaled by project	_____	_____	_____	_____
-Subtotalled by superintendent	_____	_____	_____	_____
-Subtotalled by foreman	_____	_____	_____	_____

9. How are the costs of individual accidents kept? How often are they reported?

No	Yes	Monthly	Annually
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Costs totaled for entire company				
Costs totaled by project				
-Subtotalled by superintendent				
-Subtotalled by foreman				

10. List key personnel planned for this project. Please list names, expected positions and safety performance on last three projects worked on.

11. Do you have a written safety program? Yes _____ No _____

12. Do you have an orientation program for new hires? Yes _____ No _____
If yes, does it include instruction on the following?

	Yes	No
a. Head protection	_____	_____
b. Eye protection	_____	_____
c. Hearing protection	_____	_____
d. Respiratory protection	_____	_____
e. Safety belts and lifeline	_____	_____
f. Scaffolding	_____	_____
g. Perimeter guarding	_____	_____
h. Housekeeping	_____	_____
i. Fire Protection	_____	_____
j. First aid facilities	_____	_____
k. Emergency procedures	_____	_____
l. Toxic substances	_____	_____
m. Trenching and excavation	_____	_____
n. Signs, barricades, flagging	_____	_____
o. Electrical safety	_____	_____
p. Rigging and crane safety	_____	_____

13. Do you have a program for newly hired or promoted foreman?

No _____ Yes _____

If yes, does it include instruction on the following?

a. Safe work practices	_____	_____
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- b. Safety supervision _____
- c. Toolbox meetings _____
- d. Emergency procedures _____
- e. First aid procedures _____
- f. Accident investigation _____
- g. Fire protection and prevention _____
- h. New worker orientation _____

14. Do you hold craft "toolbox" safety meetings? Yes _____ No _____

How often?

Weekly _____

Bi-weekly _____

Monthly _____

Less often, as needed _____