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A Study of Construction Safety in Washington State, USA

Etude de la sécurité sur les chantiers dans l'Etat de Washington, Etats-Unis

Eine Studie zur Arbeitssicherheit im Bauwesen des Staates Washington, USA

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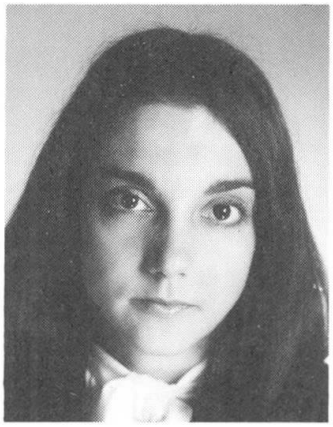

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SUMMARY

Results obtained from questionnaires received from seventy-five construction firms in Washington State were analyzed. The results of the business and labor survey show that injury-rate is a better measure of safety than experience modification rate and that safe companies are less geographically diverse in their operations, have a high supervisor to employee ratio, have few levels of management and have more work that is not obtained in a competitive environment. The questionnaire used is included in the appendix.

RÉSUMÉ

Les résultats d'une enquête réalisée à l'aide de questionnaires auprès de 75 entreprises de construction dans l'Etat de Washington sont étudiés. Les résultats du contrôle de l'exploitation et du personnel de chantier montre que le facteur «accident» est une meilleure mesure de sécurité que le facteur «modification suite à l'expérience». Les entreprises de construction considérées comme sûres, ont leurs activités moins dispersées du point de vue géographique, ont une proportion cadres-employés supérieure, ont un nombre limité de niveaux de conduite, et obtiennent plus de mandats directement que par appels d'offre. Le questionnaire utilisé est présenté en annexe.

ZUSAMMENFASSUNG

Ein von fünfundsiebzig Baufirmen des Staates Washington beantworteter Fragebogen wurde ausgewertet. Die Resultate der Betriebs- und Arbeitsüberwachung zeigen, dass das Verletzungs-Risiko ein besseres Sicherheitsmass ist als andere gebräuchliche Massstäbe. Die als sicherer zu bezeichnenden Baufirmen sind in ihren Aktivitäten räumlich auf kleinere Regionen beschränkt, haben ein grösseres Leiter-Angestellten-Verhältnis, operieren mit wenigen Führungs-Ebenen und haben mehr direkt erteilte, nicht im Konkurrenzkampf gewonnene Aufträge. Im Anhang befindet sich der verwendete Fragebogen.

Construction-related accidents frequently occur within major metropolitan areas which can clearly be attributed to human error (e.g., 1). It has been shown that the construction industry, which may employ five percent of the industrial workforce in the United States, accounts for approximately twenty percent of the total number of industrial fatalities. This situation has created concern within the industry. Although it has been shown through case studies that management style, the education and awareness of workers, foreman-worker relationships, organization size, etc., of a construction firm significantly affect its safety performance (e.g., 2-5), the degree to which these factors in relation to other factors beyond the control of the firm, such as the financial, social and political climate of the locality and country, contribute to the number, rate and severity of accidents is not known. In addition, the inherent risk-taking nature of the industry cannot be ignored. At the present time, the major strategy for reducing the number of accidents at a construction site is to implement a safety awareness program. The long-term goal of providing a uniform level of safety at construction sites is a much more difficult task.

It appears that major efforts may be required to reduce the number of injuries within the construction industry. Such efforts can be successful only if worker safety is better understood. Of the many factors mentioned above which affect injury occurrence, preliminary research suggests that the nature of the organization in which the workers are employed may be one of the most influential on safety performance. At the present time, however, a body of knowledge does not exist which describes the environment that a company should provide its workers for optimal safety performance. If such information were known, corporate changes might be made to reduce losses caused by job injuries.

Because of the high costs associated with construction injuries and the human suffering that invariably accompanies their occurrences, a study of construction safety has been undertaken at the University of Washington. The specific focus of the study is to develop a model profile of a construction firm with an outstanding safety record. Data have been obtained through questionnaires sent to firms located in the state of Washington. A copy of the questionnaire appears in the appendix. Of 200 firms contacted (obtained from the 1985 listing of the Associated General Contractors), 75 responses were received and analyzed. The average annual volume of the respondent firms ranged from $10,000 to $350 million.

As can be seen from the questionnaire, each firm was asked to provide information concerning organizational structure, volume of work undertaken, number of employees, levels of management, percentage of volume that is public construction, geographic dispersion of the firm's operations, percentage of work that is subcontracted, number of projects undertaken per year, employee turnover rates, employee benefit offerings, age of the firm, job injury history, etc.

The data were analyzed by means of the Kendall Correlation Coefficient (6). This coefficient provides a general measure of correlation -either negative or positive- with an associated level of significance, p. A correlation for which the value of p is less than 5% is considered significant. In a preliminary study, correlations for which a value of p is less than 10% is considered important as they may be indicators of a trend or represent a tendency of significance. For the firms considered, two measures of safety were examined: injury-rate and the insurance experience modification rate (EMR). The EMR has been used extensively by the Stanford Construction Institute (e.g., 5). The process for calculating it is quite complicated and will not be examined. However, it is noted that it is used as a multiplier for manual insurance rates established at the state level for each work class or category. For example, an EMR of 55% would be used to multiply

the manual insurance rate by 55% and effectively reduce the premium paid whereas an EMR of 105% would increase a company's premium above the manual rate by 5%. Although it would appear logical that injury rates and the EMR are related, the results of the present study do not show a statistically significant correlation between the injury-rate and the EMR. In fact, the results do not appear to even suggest a trend. In addition, while injury-rate was correlated with nineteen of the variables examined in the study, out of approximately thirty which were considered, the EMR was only correlated with two. These preliminary results suggest that the EMR is not an appropriate measure of safety. This result is not surprising when it is taken into consideration that EMRs are determined on the basis of three year averages and that a one year lag time exists before the newly-calculated EMR is used. In terms of the EMR, the effect of a current injury would not affect a contractor for two years. Since the EMR's of firms appear to be unreliable indicators of current safety performance, further analysis utilized only the injury rate information to represent safety performance.

The injury-rate was found to be negatively correlated with the following elements : percent of work within 50 miles of the firm's home office ($p < 0.001$) and supervisor to worker ratio ($p < 0.001$). The latter result would mean that firms with fewer workers per foreman have better safety performance. A positive correlation was found with the following elements: the number of average, peak and winter workers ($p < 0.001$ for all three); the number of W-2 forms filed ($p < 0.001$); the number layers of management ($p < 0.001$); the age of the firm ($p = 0.015$); the ratio of public to private work ($p < 0.02$); the number of WISHA (state administered OSHA program) fines successfully contested ($p < 0.06$); and the number of bidders on most projects ($p < 0.10$). Of these elements, previous results which are corroborated are : the correlation of injury-rate with the number of workers and work performed within 50 miles. In addition, Levitt (5) has shown that safer firms contest more fines and citations than do less safe firms. This result appears to be confirmed. It appears that injury-rates are higher for larger firms, as many of the aforementioned factors which were positively correlated with injury-rate are measures of size. Hinze has shown that the size of the firm in annual dollar volume is correlated with the injury-rate (3).

From these findings, several conclusions can be drawn. Indications are that the owner/designer can influence the safety performance in the construction stage. This could be done in the selection process by using an effective measure of safety performance. Research indicates that this measure should be the recent history of injury-rates as opposed to the EMR. In addition, negotiated contracts appear to result in fewer job injuries. Thus, negotiated contracts, which often result in lower pressure cost-plus arrangements, may have merit where worker safety is a particular concern.

Recommendations to increase worker safety for contractors include: (1) establish acceptable ratios of workers per supervisor; (2) maintain good project control exemplified by a shallow hierarchy in the company; and (3) avoid geographic dispersion. High incidences of injuries were noted in those firms that were larger and in those which were more geographically diverse in their operations. Indications are that the impact of these influences could be reduced by the firm. One possible means of accomplishing this may be by decentralization of company operations. This would be true for the large firms as well as for those firms that are geographically diverse in their operations.

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APPENDIX: Questionnaire

CONSTRUCTION COMPANY
LABOR AND BUSINESS SURVEY

1. What is the general nature of type of work done by the company?

   Check all that apply:

   ___ highway-heavy
   ___ utility construction
   ___ industrial construction
   ___ other:_____
   ___ residential
   ___ small commercial
   ___ maintenance

2. What is the size of the company:

   Average annual volume of work under contract? $_____

   Number of salaried employees in the firm? _____

   Number of hourly workers in the firm (average)? _____

   Number of hourly workers at the season peak? _____

   Number of W-2's completed by the firm per year? _____

   Number of permanent field supervisory personnel in the firm? _____

3. What amount was spent on labor in the past year? _____

   What percent of the contracted volume is consumed by the cost of labor? _____%

   Approximately how many man-hours were worked by company employees last year? _____ man-hours

4. What percent of the company's work is subcontracted? _____%

5. Which of the following best describes your firm? (Check all that apply)

   ___ union shop
   ___ general contractor
   ___ merit shop
   ___ specialty contractor

6. What percent of the company's work is done within 50 miles of the home office? _____%

7. What percent of the company's work is competitively bid? _____%

8. What percent of the company's work is done for public owners (as opposed to private)? _____% is for public owners

9. How many layers of management are between the workers and the president of the company?

   __0 __1 __2 __3 __4 __5 __6

10. Approximately how many different projects are completed each year?
_____ projects

11. What is the average length of time needed to complete a typical project?
_____ months or _____ weeks

12. How long has the firm been in business? _____ years

13. How many worker injuries requiring a doctor's attention occurred last year? _____

14. What is the average number of bidders on most jobs on which the company submits bids? _____

15. Does the company have a full-time labor-relations officer?
____ yes ____ no

16. Does the company have a full-time safety officer?
_____ yes ____ no

17. What percent of the field personnel have had some type of formalized training in first aid? _____%

18. If known, what is the insurance experience modification rating for the company? _____

19. In the last five years, how many WISHA jobsite inspections has the company had? _____

Of these, how many resulted in fines? _____

Has the company successfully contested any fines? _____ yes ____ no

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