



**SUBCONTRACTOR SAFETY AS INFLUENCED BY
GENERAL CONTRACTORS ON
SMALL AND MEDIUM SIZED PROJECTS**

by

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EXECUTIVE SUMMARY

This source document is one of two reports that present the findings on research conducted on subcontractor safety. This report presents information related to the study of subcontractor safety on small to medium sized projects. Results show that subcontractor safety is influenced differently by general contractors on the small to medium sized projects than on large projects. Reference is to be made to the companion source document for information about subcontractor safety on large projects.

Chapter 1 of this report provides an introduction to the problem addressed by this research study. Briefly, the problem consists of a need to minimize worker injuries in a sector of the construction industry that is rarely addressed by researchers. Specialty contractors, often employed as subcontractors, are responsible for a significant portion of the actual construction work that is performed. It is common, particularly on building projects, for over 80 percent of the work to be done by these specialty contractors or subcontractors. Despite this, little prior research has been conducted in this highly fragmented sector of the industry. This study helps to address those issues past research efforts have ignored. Specifically, this study is focused on determining the means by which general contractors influence the safety performances of subcontractors.

Chapter 2 provides a limited literature review on the topic of subcontractor safety. A more extensive literature review of

safety in the construction industry is provided in the companion source document. The limited review highlights the findings of a pilot study conducted in Canada that preceded this research effort. The results of this pilot study provided the framework by which this research was formulated.

The Canadian study of subcontractor safety was conducted on large projects, primarily building projects, and was completed in 1986. That study found that subcontractor safety is improved when the general contractors have safety personnel assigned to the projects and when subcontractor safety is actively addressed at the project level by the general contractor's employees. Subcontractor safety is adversely impacted by projects that run behind schedule and over budget. Negotiated contracts were associated with lower injury frequencies among the subcontractors' workers. The study also noted that subcontractor safety is improved when the general contractor is more effective at coordinating project activities.

Chapter 3 presents the hypotheses that were tested in this research. The fundamental hypothesis is that general contractors have a significant influence on the safety performances of their subcontractors.

Chapter 4 describes the methodology used to conduct this research. The research was conducted in two geographic areas, the San Francisco Bay area and the Puget Sound area. In each location general contractors were interviewed to gather

information on how each contractor administered subcontracts at the project level. More than 100 interviews (in person or by telephone) were conducted. The responses to the prepared questions were then compared with the corresponding safety performance measures of subcontractors.

The subcontractor safety measures were derived directly from numerous local subcontractors. The subcontractors provided these ratings of general contractors on the basis of how safe they felt that their workers were on projects constructed by each known general contractor. This measure of safety is unique to this study as it is based on the perception of safety rather than an actual injury frequency rate. Other measures were considered for this study, but no acceptable alternatives could be identified. The safety measures were compared to the various interview question responses to identify those practices of general contractors to which the safety of subcontractors is most sensitive.

Chapter 5 presents the results of the study. Several practices of general contractors, to varying degrees, were noted as having an influence on the safety performances of subcontractors. It was noted that subcontractor safety performances were adversely impacted by job pressures. These pressures relate to those initially experienced by the employees of the general contractors. Pressures may consist of a general sense of pressure or the pressures may be directly imposed. The

most apparent forms of pressure that were noted consist of being behind schedule, functioning in an environment where profitability is the only concern, and operating on a fixed price contract instead of a negotiated contract.

One of the findings revealed that subcontractor safety is associated with project size. That is, subcontractor safety performances are better on smaller projects. This finding was assumed to be associated with the degree of coordination that is required on the larger projects. Smaller projects tend to be simpler, cover a smaller area, and in general are easier to control. An associated finding was that better safety performances were associated with projects with fewer subcontractors. The degree of coordination effort required on a project with many subcontractors is obviously going to drain more of the available resources of the general contractor. Additionally, it was found that safer subcontractor performances are realized when the general contractor has a policy of contracting with selected or known subcontractors. Working with subcontractors who are already familiar with company policies and practices will clearly simplify coordination efforts.

Subcontractor safety is also influenced by the general contractor's emphasis on safety, i.e., emphasizing profits without regard for safety can have an adverse impact on subcontractor safety performance. This emphasis on safety must originate with top management and can be communicated to the

projects in written communications, during telephone conversations with project personnel, and during site visits.

Although not as strong as previous findings, the research showed that project-level personnel of the general contractor should be people oriented. They should recognize that workers and subcontractors have individualized and human needs that are not to be ignored. They must be sensitive to these needs. For example, this individualized concern can be effectively demonstrated with new workers that are assigned to the project.

The last finding of the study showed that the physical environment at the project level is to be maintained free of known hazards. One such effective means is to insure that major injuries are minimized by covering all floor openings and maintaining handrails at all appropriate locations. The general safety of the job site can also be effectively maintained by periodically inspecting the project for physical hazards. It is important that the work areas controlled by subcontractors also be included in this site inspection.

Chapter 6 presents the summary and conclusions of this study. The essential conclusion is that general contractors do have a significant influence on the safety performances of their subcontractors and that identifiable actions can be taken to improve subcontractor safety performances. Most notable of the findings is that job pressures have the most adverse impact on subcontractor safety performances and that effective project

coordination has the most favorable impact on subcontractor safety performances.

Chapter 7 presents recommendations of how to apply the results of this study to reduce subcontractor injuries. Suggestions are also offered on additional and related research studies on subcontractor safety.

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CHAPTER 1

INTRODUCTION

The construction industry has historically been noted for its high injury and fatality rates. Annual statistics for the industry never fail to indicate this high injury frequency. In fact, a 1987 survey by the National Institute of Occupational Safety and Health (NIOSH) reported that the construction industry was responsible for more than 20% of all traumatic occupational deaths from 1980 through 1984 (ENR).

Besides the obvious loss of life or worker livelihood, when an injury occurs on a project direct costs escalate, worker confidence declines, and productivity is hampered. But regardless of whether these job-related injuries happen to the general contractor's workers or to their subcontractor's workers, the effect is felt throughout the entire project.

Many research studies have been conducted to investigate the factors affecting general contractor safety. These past studies have recognized the need for improving injury frequencies on construction

projects for both humanitarian and economic reasons. The associated economic reasons include direct effects on insurance premiums, interference with job productivity, and increased direct costs of construction (Hinze & Pannullo). For these very same reasons, factors affecting subcontractor safety also need to be researched.

Subcontractor workers can make up a large majority of the workforce on a construction project, yet they have been neglected in past studies of construction safety. A conscious effort must be put forth to define the factors affecting subcontractor injuries and even more importantly, a conscious effort must be put forth to use these findings to decrease subcontractor injury frequencies. Instead of adding indemnity clauses releasing themselves from any liability, general contractors are advised to work with their subcontractors to improve the safety of their jobs for all workers. Only through team effort and cooperation will job safety improve for subcontractors and general contractors alike.

The aim of this research is to help identify the general contractor's role in subcontractor safety on small to medium sized projects in the \$1 million to \$50

million range. By defining those factors of general contractor management that most significantly effect subcontractor safety, this study could be the first step in a cooperative effort of overall job safety improvement.



CHAPTER 2

LITERATURE REVIEW

An extensive literature review was not conducted prior to conducting the research. A carefully conducted literature review was conducted as a part of the research performed by Paul Raboud for the Construction Industry Institute (CII). The information presented here will reference the prior literature review of Raboud and will provide current information gleaned from more recent studies.

The most notable work relating to subcontractors was conducted by Raboud who studied general contractors and subcontractors on large building projects valued between \$5 million and \$400 million located in 6 major Canadian cities. Data for Raboud's study was gathered by conducting telephone interviews with general contractors, as well as subcontractors, on these building projects.

The specific findings from Raboud's study of large projects in Canada which were used to help model the study are described herein. Raboud's findings were separated into two groups: variables which influence

general contractor injury rates and variables which influence subcontractor injury rates. Raboud correlated the variables with actual general contractor and subcontractor injury rates. Specifically, the number of medical aid injuries per million manhours of worker exposure was used as the safety measure.

2.1 SAFETY PROGRAMS

Companies implementing effective safety programs were found to have lower injury rates among their own workers. Raboud found that superintendents who rated their company safety program highly had lower injury rates on their projects. Some of the components of an effective safety program are evident in Raboud's findings. These components include a designated corporate safety director, company monitoring of individual safety performances, and a concern for safety being expressed by top management.

Besides an effective company safety program, Raboud found that an effective project-level safety program also influenced injury rates. The components of an effective project-level safety program identified in Raboud's study were the presence of a project safety

director, superintendents conducting safety meetings, integration of safety into the regular work process, and formal safety inspections of the project.

In his study, Raboud found that a successful general contractor safety program also resulted in lower injury rates for the subcontractors. There were several components of the general contractor's safety program which Raboud found to significantly influence subcontractor safety. These components will be briefly summarized.

Lower injury rates were noted for subcontractors working on jobs with general contractor superintendents who recognized the multitude of factors involved in safety. Raboud felt that the superintendents who understood the many factors influencing safety would have better control over those factors.

Raboud also found that general contractors that take an active role in tool-box meetings have much safer subcontractors. This participation could consist of holding individual meetings for each subcontractor or meeting with all subcontractors on the job at once. In addition, general contractors that had a safety officer assigned to the project were found to have subcontractors with lower injury rates.

Two other components of the general contractor's safety program which Raboud found to influence subcontractor injury rates were formal safety inspections of the work areas of subcontractors and the conscientious maintenance of safety devices such as rails and barricades.

2.2 PRESSURE

In the portion of his study focusing on general contractor injury rates, Raboud found that economic pressures on a job adversely affect job safety. Jobs running over budget were shown to be less safe for the contractor's workers than those jobs running on or under budget. Negotiated contracts, a more indirect measure of economic pressure, were shown to be associated with lower injury rates than competitively bid projects, though the finding was not a strong one ($p=.094$).

Raboud attributed the adverse effect of economic pressure on worker injury rates to several factors: anxiety of workers brought on by economic tensions, excessive production pressure applied by management that creates tension among workers, use of less

expensive and less safe production methods, and management's preoccupation with the budget resulting in a neglect of safety.

Raboud's study then looked at how pressure applied to subcontractors by the general contractors affects subcontractor injury rates. Along with several other variables, Raboud found that two variables significantly affected general contractor injury rates as well as subcontractor injury rates. These variables were the contractor budget status and the type of contract between the general contractor and the owner. Besides budget status, Raboud found that the general contractor's schedule status also influenced subcontractor injury rates. Those contractors whose jobs were on or ahead of schedule had lower injury rates among their subcontractors than those contractors whose jobs were running behind schedule. In addition to schedule status, the actual use of schedules by the general contractor was related to the subcontractor injury rates. Those contractors who relied heavily on schedules had lower injury rates among their subcontractors. The use of short term schedules to coordinate work also resulted in lower injury rates among the subcontractors.

2.3 JOB COORDINATION

Raboud's study found that projects where the work was more effectively coordinated had lower injury frequencies among the workers of the general contractor and the subcontractors. Raboud attributes the positive effect of coordination on safety to the fact that a well coordinated job will reduce pressure on the workers. Workers are then able to perform their work safely. Two of the important components of coordination are project scheduling and communication. In his study, Raboud found that regular use of schedules resulted in lower injury rates for all workers. Projects where architects attended the subcontractor job coordination meetings also had lower injury rates among the workers. Raboud attributes this to the improved flow of communication that results from all parties of the project meeting together and exchanging information.



CHAPTER 3

DETAILED HYPOTHESES

FUNDAMENTAL HYPOTHESIS:

General contractors have a significant influence on the safety performance of their subcontractors.

SPECIFIC HYPOTHESES:

1) Those general contractors who manage projects efficiently will have safer subcontractors. A well run project will reduce demands on subcontractors and result in better subcontractor safety performance.

2) The effectiveness of general contractors in increasing subcontractor safety performance depends upon the level of safety performance expected and required of their subcontractors and the extent to which they help their subcontractors implement safety measures.

3) Those general contractors who manage projects without placing or creating a great amount of pressure on the superintendents and workers will have safer subcontractors.

CHAPTER 4

RESEARCH METHODOLOGY

4.1 INTRODUCTION

The specific aim of this research is to study small and medium sized general contractor operations. Historically, safety-related studies have been performed which considered only general contractors and subcontractors on large projects, neglecting the smaller firms and smaller projects. This study was designed to obtain safety information from small to medium firms which conducted a large portion of their work on smaller projects. Thus, the study was focused on a segment of the construction industry that has been largely ignored by previous research studies.

In order to get a large cross-section of small to medium sized general contractors, the research was confined to two geographical areas: the San Francisco Bay Area in California and the Puget Sound Area in Washington. By conducting the research in two separate areas, any geographical biases were hoped to be eliminated from the results.

The study focused on subcontractor safety as experienced on construction projects; therefore, the logical location to conduct the research was at the field level. Research at the field level is justified by the fact that the subcontractors and their workers are in direct contact with the field-level workers of the general contractor, not the top managers. It was decided that the best data could be obtained through interviews. At the field level of most small to medium sized projects, the project superintendents are the subcontractors' key contact with the general contractor and for this reason were selected as the subjects of the interviews for this research.

4.2 IDENTIFYING GENERAL CONTRACTORS

WASHINGTON: The research was originated by mailing questionnaires to 117 subcontractors in the Puget Sound Area of Washington. The questionnaires were sent to subcontractors listed in the Associated General Contractors' directory, the Associated Builders and Contractors' directory, and the area telephone directory. In the questionnaire, the subcontractors were asked to give the names of general contractors

they had worked with in the last 5 years, how many jobs they had worked on for each of these general contractors in the past 5 years, and how safe the subcontractors felt their workers were on that general contractor's projects (see Appendix A). Of the 117 subcontractor questionnaires mailed out, 28 were returned. From these 28 returned questionnaires a total of 32 general contractors were mentioned by 2 or more subcontractors. These 32 contractors were the initial group to be included in the study. General contractors that were mentioned by 2 or more subcontractors were then contacted for an interview. In order to obtain a larger sample or a broader data base, however, more responses were needed from the subcontractors. A second mailing was made, thanking those who had participated and again asking for assistance from those who had not returned the original questionnaire (see Appendix B). Eighteen questionnaires were received from the second mailing which provided the names of 13 additional general contractors to be included in the study.

Questionnaires were received from a large cross section of subcontractors. Subcontracting firms responding to the survey ranged in size from an annual

dollar volume of \$600,000 to an annual dollar volume of \$25 million. The annual number of manhours worked by the subcontracting firms ranged from 4500 to 300,000. The type of specialty contractors represented in the research include, but are not limited to, electrical, mechanical, roofing, HVAC, insulation, structural steel placement, interior finish, and plumbing. Although smaller subcontracting firms may not spend as much time on a project as major subcontractors do, all subs were judged to be important to the research. As one respondent noted, all subcontractors are important to a job, as even the smallest subcontract can delay the whole project.

CALIFORNIA: General contractor interviews were conducted in the San Francisco Bay Area by a second researcher, a construction safety consultant, Dr. Nancy Samelson. In total, 83 interviews were conducted in the San Francisco Bay Area. Not all of the interviews were used, however, due to the method of collecting the data.

As opposed to the Washington study, the California researcher conducted interviews with general contractors prior to obtaining ratings from subcontractors. After interviewing 83 general

contractors, questionnaires were sent to subcontractors asking for ratings on the list of the 83 general contractors (see Appendix C). Those general contractors who were rated by 2 or more subcontractors were included in the study. A total of 63 of the 83 general contractors interviewed were rated by 2 or more subcontractors.

The questionnaire sent to the subcontractors in California differed slightly from the questionnaire sent to subcontractors in Washington. The California researcher asked subcontractors to rate general contractors on a scale of 1 to 5, whereas the Washington subcontractors rated general contractors on a scale of 1 to 7. The completed questionnaires of the California study were sent to Seattle to be analyzed along with the Washington questionnaires. As in the Washington study, ratings were not viewed until all of the coding had been completed.

4.3 SURVEY DEVELOPMENT

Raboud's findings for large projects were tested in this research study to see if any of the same findings applied to smaller projects. In addition, the