

# Identifying root causes of fatal accidents at construction sites in Ho Chi Minh City

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## Abstract

This paper presents the results from a survey on root causes that led to fatal accidents in construction projects in Vietnam. The survey was conducted by means of structured questionnaires and interviews with relevant individuals such as foremen, field engineers, and project managers working in construction companies located in Ho Chi Minh City, the largest city of Vietnam. The survey sample consists of in total 91 fatal accident cases that occurred in construction projects during the years 1996-2005 and were recorded in a report at the Vietnam Department of Labor-Invalids-Social Affairs. The current effort is aimed at determining the essential measures for avoiding fatal accidents that have been increasingly taking place in Vietnam construction firms. The findings from the survey provided a necessary basis for determination of critical factors to be used as safety indexes in developing a checklist for preventing fatal accidents in future construction project

**Key Word:** Accident analysis, Construction Safety, Fatal accident

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## 1. Introduction

An exploratory study to predict causation of fatal accidents is one of the best solutions for the formulation of preventive measures or training to reduce the number of deaths in construction project. This can be done through a survey on safety issues in construction companies. This paper presents the results from the survey that revealed the variety of accident types, main root causes and major problems behind fatal accidents. The findings from the survey in turn provide a necessary basis for determination of critical safety factors for preventing fatal accidents in construction projects in Vietnam

### 1.1 Background

Many studies on the causes of construction injuries have been conducted by different researchers around the world and have received much publicity and attention (Hinze, 1978; Hinze, 1981; Jaselskis and Suazo, 1994; Hinze and Russell, 1995; Koehn et al., 1995; Sawacha et al., 1999; Hize et al.,

1998). But the majority of the previous research was aimed at identifying various categories of fatal accidents in construction projects, rather than the causes or critical factors that lead to construction injuries. Among these work, few studies specifically addressed the cause of fatal accidents. The need for a better understanding of the root causes in order to effectively implement the preventive program in the Vietnamese construction industry has motivated the current research

### 1.2 Scope of the study

The data was collected by means of survey questionnaire and interviews with a number of construction companies located in Ho Chi Minh City, the largest city of Vietnam. The survey sample consists of in total 91 fatal accident cases that occurred in construction projects during the years 1996-2005

## 2 Methodology

A questionnaire was developed to facilitate data collection by the searchers and to ensure consistency in the elements to be examined. The same set of questions may be directed to more than one person for each company to ensure the information reliability.

The data were collected from the individuals who play key roles in a construction project, including foremen, site engineers, and project managers. Each question is accompanied by a set of common safety factors that must be

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examined in the answers, which can assist the researchers in refining the replies and comparing the information obtained from different interviewees.

In preparation for an interview with a construction company, the researchers reviewed all relevant information available in accident reports obtained from the Vietnam Department of Labor-Invalids-Social Affairs.

A statistic method, named the Pearson chi-square test, was exclusively chosen to test whether there is a difference among factors that reflect fatal accident occurrence as well as differences between fatal accident characteristics and other relevant factors. A 10% level of significance is considered to be statistically significant. Different "actors" responsible for fatal accidents such as foremen, site engineers, and project managers were interviewed to cross-check for the consistency in collected information as well as to obtain more pertinent information to support the analysis

### 3. Data Analysis

#### 3.1 Root causes of non-experience /training

The survey indicated that the majority of dead workers due to accidents were unskilled workers (60.4%), followed by electricians (12.1%), masons (7.7%), welders and mechanics (5.5%), carpenters (3.3%), concrete workers (3.3%), piling workers (1.1%) and other workers (6.6%) (Table 1)

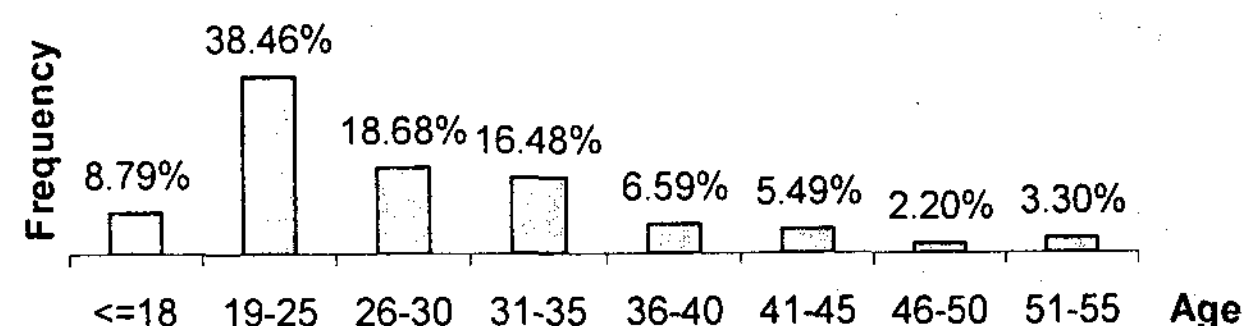
**Table 1.** Fatal Accident Rate versus Genders, Work Experience, and Trade

Variable	Description	Frequency	Percent (%)
Genders	Male	90	98.9
	Female	1	1.1
Work experience	< = 3 months	53	58
	3 ~ 6 months	9	10
	6 ~ 12 months	18	20
	1 ~ 5 years	7	8
	Over 5 years	4	4
Trades	Unskilled workers	56	61.5
	Electricians	11	12.1
	Masons	7	7.7
	Welders	5	5.5
	Carpenters	3	3.3
	Concrete workers	3	3.3
	Other trades	6	6.6

The high concentration of dead workers in the group of unskilled workers and short experience workers among victims indicates that many of them were enforced to work on a seasonal basis while being not much aware of accident prevention. In Vietnam, very few construction workers were trained for working in their trades. Because of less work experience, the unskilled workers do not perceive unsafe conditions and often get injured. Therefore, it is necessary to provide sufficient safety training to construction workers before they are assigned to specific task.

#### 3.2 Root causes of Age

Most of the victims of construction accidents were young workers, among whom the majority are less than 40 years old. This factor is reflected in the frequency distribution of dead workers' age, as illustrated by Figure 1. The low rate of dead workers with older age can be explained as follows: aged workers had good professional qualification and experience, thus usually performed their assigned tasks with more care than young workers. Besides, young workers were often assigned to carry out heavier tasks that may be prone-to-danger



**Figure 1.** Fatal Accident Rate versus Age

#### 3.3 Root causes of unsafe conditions

According to the survey results, the most common unsafe conditions on sites where fatal accidents occurred include hazardous methods/procedures (34.1%) (Table 2), inadequate supports and guards (26.4%), poor housekeeping (11.0%).

**Table 2.** Fatal Accident Rate versus Unsafe Conditions

Unsafe conditions	Frequency	Percent (%)
Hazardous methods/procedures	31	34.1
Insufficient supports/guards	24	26.4
Poor housekeeping	11	11.0
Hazardous environment around workplace	8	8.8
Improper assignment of personnel	7	7.7
Inadequate warning systems	7	7.7
Inadequate illumination	2	2.2
Unsafe storage congestion, overloading	1	1.1
Others	1	1.1

Management don't care about unsafe conditions" and "management fail to identify unsafe conditions" are also identified as causes for non-removing those unsafe conditions as expressed by respondent

### 3.4 Root causes of unsafe actions and poor on-site management

As shown on table 3, it was revealed that victims tend to commit mistakes by: failing to use/wear Personal Protective Equipment (PPE) (18.7%), using unsafe procedures/methods (18.7%), disregard of known/prescribed safety regulations, rules, codes, etc. (16.5%), psychological factors (13.2%), using defective equipment (12.1%), unsafe acts of coworkers/another (11%).

**Table 3.** Fatal Accident Rate versus Unsafe Actions

Unsafe actions	Frequency	Percent (%)
Failure to use/wear Personal Protective Equipment (PPE).	17	18.7
Using unsafe construction procedures/methods.	17	18.7
Disregards prescribed/known construction procedures.	15	16.5
Psychological factors: distraction, quarrelling, teasing, etc.	12	13.2
Using defective equipment	11	12.1
Unsafe actions of co-workers	10	11.0
Took unsafe positions/postures	4	4.4
Operated equipment without the authority	3	3.3
Remove safety devices	1	1.1
Disorderly throwing materials/objects	1	1.1

Due to poor safety management on sites, workers often select, by mistake, inappropriate (i.e. unsafe) methods to carry out their work. Moreover, neglecting or disregarding prescribed/known construction procedures was very commonly observed on sites because management staff and workers were not much aware of or did not take seriously the safety issues during the construction

### 3.5 Root causes of working time

The survey results showed that most of fatal accidents occurred during the morning, between 9:30 AM and 11:30 AM (37.4%) (refer to table 4). None of significant level was found

between fatal accident occurrence and day of the week. Unlike other safety-related studies, which revealed that more accidents tend to occur on Mondays, this survey showed that a higher rate of fatal accidents was on Tuesdays and Thursday.

In addition, it is interesting to point out that fatal accidents also occurred more often with highest frequency in April (19.8%) and during the period between March and April (28.6%) than on other months (table 5). Accident occurrence was lowest during the month of February because the Vietnamese Lunar New Year takes place in this month and during which many people take leave or are likely not to concentrate on the work

**Table 4.** Fatal Accident Rate versus Working Time

Variable	Description	Frequency	Percent (%)
Working Time	7:00 9:30	21	23.1
	9:31 11:30	34	37.4
	13:00 15:00	11	12.1
	15:31 16:30	15	16.5
	Over 16:30	10	23.1

**Table 5.** Fatal Accident Rate versus Months of the year

Variable	Description	Frequency	Percent (%)
Months of the Year	January	4	4.4
	February	1	1.1
	March	8	8.8
	April	18	19.8
	May	8	8.8
	June	9	9.9
	July	7	7.7
	August	10	11.0
	September	11	12.1
	October	4	4.3
	November	5	5.5
	December	6	6.6
Seasons of the Year	January-February	5	5.5
	March-April	26	28.6
	May-June	17	18.7
	July-August	17	18.7
	September-October	15	16.4
	November-December	11	12.1

#### 4. Further study

The current study has been conducted with a certain limitations and its scope should be extended so that the research outcomes could be obtained with a high reliability.

The first limitation concerns the size of the survey sample, in which only 91 cases of fatal incidents were collected. The limited number of cases may not reflect the actual construction safety issues as a large scope revealing more significant cases would yield a more comprehensive result. Second, some information essential for the survey could not be sufficiently collected due to the data unavailability. Next, the fatal accident data used for this study were collected from a record for a short period of time (1996-2005). The period of data collection should be extended as the survey is a work in progress and it should be steadily updated to incorporate new possibilities of accident occurrences. Finally, data used for this survey were collected from construction companies located mainly in Ho Chi Minh City urban areas, therefore may not represent a common situation on construction safety for the entire country

In order to achieve a more comprehensive study on the construction safety as well as to understand the impact of fatal accidents on construction companies, future related studies should conduct a larger-scale survey on safety with construction companies throughout the country. This will provide a greater number of accident cases in the survey sample, thus yielding more convincing results. In addition, further studies should also evaluate the impact of fatal accidents in terms of construction costs. The construction costs would be significantly increased due to delays or reworks in the case accidents occur. This would be a good warning that construction companies should implement an appropriate safety-training program.

#### 5. Conclusion

The rate of fatal accidents has been highly increased in the construction sites in Vietnam. As a consequence, it is necessary to identify and understand the root causes of these

accidents before establishing an effective injury prevention measures. This is also the major objective of the survey that has been recently conducted with the majority of construction firms in Ho Chi Minh City, Vietnam.

Root causes behind fatal accidents identified from the survey have been used to establish a checklist to prevent accidents in construction projects. The checklist should be developed as a part of a safety-management program that needs to be implemented at all levels of staff in construction firms. More future studies on safety for the Vietnam construction industry need to be accomplished before achieving effective injury preventive measures. These studies probably include a nationwide survey on construction injuries, an evaluation of the impacts of fatal accidents on the overall construction cost, and a revision/update of the Vietnam Labor Codes/Regulation

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