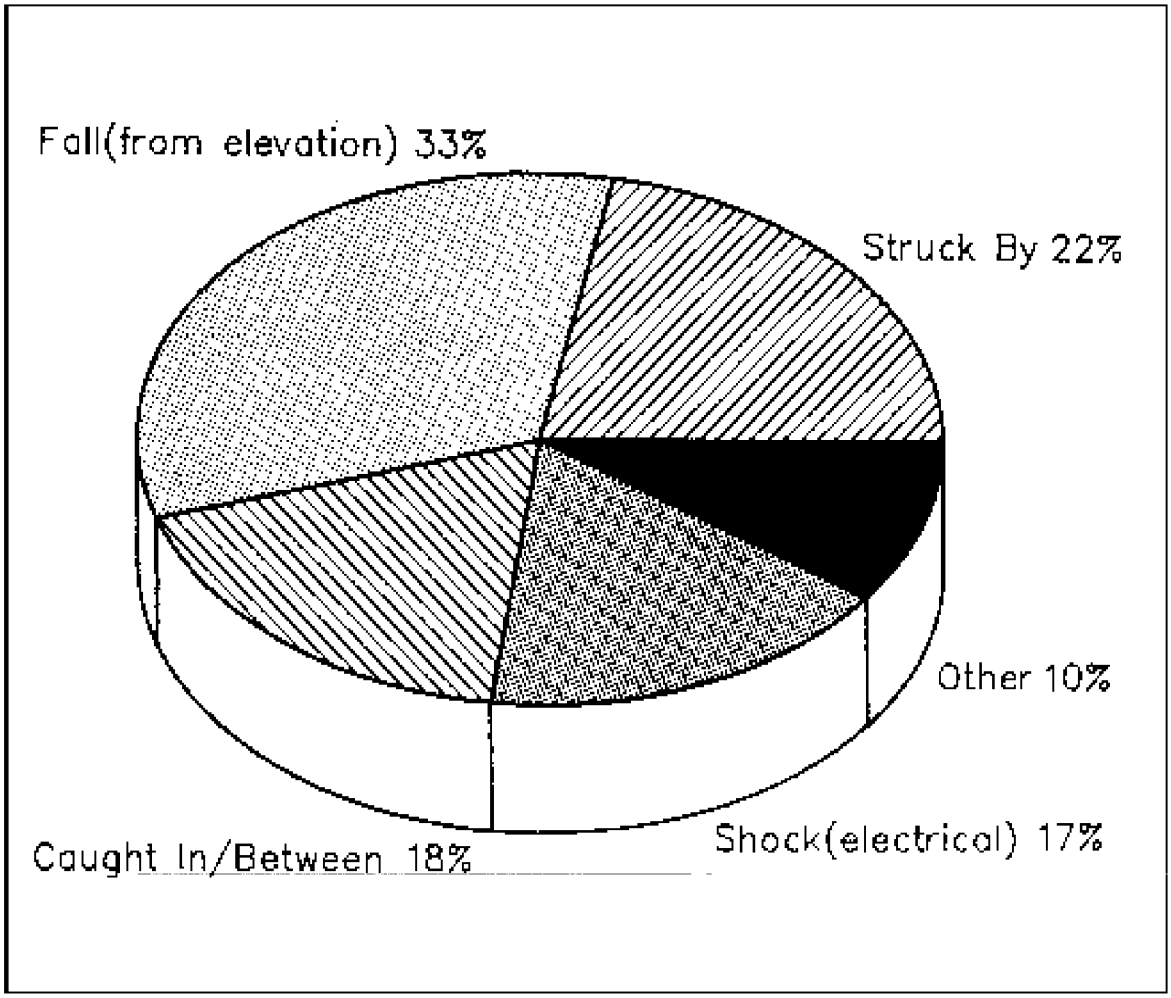
Analysis of Construction Fatalities - The OSHA Data Base 1985-1989

U.S. Department of Labor
Occupational Safety and Health Administration

November 1990



Analysis of Construction Fatalities - The OSHA Data Base 1985-1989

U.S. Department of Labor
Elizabeth Dole, Secretary

Occupational Safety and Health Administration
Gerard F. Scannell, Assistant Secretary

Office of Construction and Engineering
Charles Culver
Glenn Florczak
Richard Castell, Jr.
Constance Connolly
Gary Pelton

November 1990

ABSTRACT

This report presents the results of an analysis of the 3,496 construction fatalities investigated by the Occupational Safety and Health Administration and included in the Agency's Integrated Management Information System data base for the period 1985 to 1989. The analysis considered the variation of the number of fatalities over the 5-year period and the influence of factors such as geography and characteristics of the workforce, e.g., industry group, age, and union affiliation on these fatality statistics. The analysis also examined the causes of fatalities and the factors influencing accidents. Statistics from the OSHA data base are compared with construction fatality data from the Bureau of Labor Statistics, the National Institute for Occupational Safety and Health and the National Safety Council.

Keywords: accidents; construction; construction safety; fatalities.

EXECUTIVE SUMMARY

Construction is one of the most hazardous industries. Each year a substantial number of construction workers lose their lives; many others are injured. Estimates of the number of fatalities range from several hundred to over 2,000 per year. More important than the total number of construction fatalities is information on the causes of these accidents. It is this type of information that can be used to develop programs to improve construction safety through the reduction of accidents.

The Occupational Safety and Health Administration (OSHA) has been investigating workplace accidents since its inception in 1970. This report includes documentation of the methodology used by OSHA to collect data on construction accidents. The results of an analysis of 3,496 construction fatalities investigated by OSHA and states operating OSHA approved state plans from 1985 to 1989 are presented. The analysis considered the influence of factors such as geography and characteristics of the workforce including construction activity, worker age and union affiliation on these fatalities. The analysis also examined the causes of fatalities and the factors influencing accidents.

The following conclusions are based on the analysis of the 3,496 construction fatalities investigated by OSHA for the period 1985 to 1989:

1. The number of construction fatalities investigated by OSHA each year fluctuates around 700 and there is no general trend with time of this number or the number of fatalities reported to the Agency.

2. In some cases, there were large changes in the number of fatalities from year to year in the various OSHA regions. The trend in the number of fatalities in Region VI was continually downward, decreasing by 47 percent from 1985 to 1989. There was no apparent trend in the number of fatalities over time for the other OSHA regions.

3. The general trend in fatality rates (number of fatalities per 100,000 workers) for the fatalities investigated by OSHA is downward. Region II has the lowest average fatality rate, Region VI has the highest for the period 1985 to 1989.

4. There is no significant difference in the number of fatalities for the various days of the normal 5-day work week. The percentage of fatalities occurring on the weekend reflect the reduced hours worked during this period.

5. Special trade contractors (SIC 17) account for 53 percent of the total construction fatalities; heavy construction other than building construction (SIC 16) accounts for 34 percent and building construction (SIC 15) 13 percent.

6. The percentage of fatalities in various age groups is within 2 percent of the percentage of the workforce population in that age group; older workers or younger workers do not experience a disproportionate share of construction fatalities.

7. The distribution of fatalities among union and nonunion worksites is similar to the composition of the construction workforce in terms of numbers of union and nonunion workers.

8. The percentage of fatalities for various size construction firms, as defined by the number of employees employed by the firm, is similar to the representation of the construction workforce in terms of firm size.

9. Falls from elevation represent the largest cause, 33 percent, of all construction fatalities. Struck by, caught in/between and electrical shock represent 22 percent, 18 percent and 17 percent, respectively.

10. The relationship among the causes of fatalities for the State-Plan states is similar to that for the Federal OSHA states.

11. The relative contribution of the, four major causes (falls from elevation, struck by, caught in/between, electrical shock) to the total number of fatalities does not vary significantly over the 5-year period, i.e., the same types of fatal accidents are continuing to occur with the same relative frequency.

12. The percent of fatalities associated with each of the four major causes of fatalities varies among the OSHA regions.

13. The causes of fatalities are related to construction activity. Fatalities due to falls from elevation, for example, occur most frequently among special trade contractors, whereas, caught in/between fatalities occur most frequently in heavy construction.

14. There does not appear to be a correlation between the age of the worker and the causes of fatalities. The distribution of each of the major causes of fatalities among various age groups is similar to the age distribution of the construction workforce.

15. Roofs and scaffolds are the major locations of fatalities due to falls fro m elevation.

16. Approximately 40 percent of the fatalities due to falls from elevation involved falls from elevations of greater than 30 feet. Twenty-five percent of the fatalities occurred from falls from elevation between 11 and 20 feet and a similar percentage from 21 to 30 thirty feet.

17. Approximately 75 percent of the fatalities due to being struck by a machine involve heavy construction equipment such as trucks, cranes, graders, or scrapers. Many of the fatalities caused by being struck by material involve poor rigging of loads being moved or poor storage of materials.

18. Seventy-nine percent of trenching fatalities occur in trenches less than 15 feet deep. Thirty-eight percent of the fatalities occur in trenches less than 10 feet deep.

19. Seventy-four percent of the fatalities due to electric shock involve electrical sources with voltages exceeding 480 volts.

20. Sixty-five percent of the fatalities due to electrical shock involve contact with overhead power lines.

21. Fifty-three percent of the fatalities associated with contacting overhead power lines involve construction equipment.

22. The National Institute for Occupational Safety and Health (NIOSH), the Bureau of Labor Statistics (BLS) and the Occupational Safety and Health Administration (OSHA) data on the number of fatalities occurring each year are comparable. These data indicate that for 1988, approximately 800 construction workers lost their lives due to work-related accidents. The number of fatalities reported by the National Safety Council is over 250 percent higher at 2,200 construction fatalities for 1988.

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

Construction is one of the most hazardous industries. Each year a substantial number of construction workers lose their lives; countless others are injured. Estimates of the number of fatalities range from several hundred to over 2,000 per year. The number of fatalities is one means to compare hazards in construction with those in other occupations. Changes in these data, over time, also serve as a measure of trends in construction safety. More important than the total number of construction fatalities is information on the causes of these accidents. It is this type of information that can be used to develop programs to improve construction safety through the reduction of accidents.

The Occupational Safety and Health Administration (OSHA) has been investigating workplace accidents since its inception in 1970. Data from these investigations conducted by Federal OSHA and states operating OSHA approved state plans and related information such as statistics collected by the Bureau of Labor Statistics have been used in establishing OSHA's program. Regulatory analysis conducted prior to establishing new or modifying existing regulations and special emphasis programs targeting high hazard activities or industries are two examples. In the past, these analyses of construction fatality data have focused on a particular aspect of construction such as fall protection, vehicle safety or steel erection. These same data can also be used to look at trends or changes over time and also in detail at the important factors that influence accidents. The purpose of this report is to provide such analysis.

This report includes documentation of the methodology used by OSHA to collect data on construction accidents. Results of the analysis of these construction fatality accident data for the period 1985 to 1989 are presented. Other methodologies used to collect accident data are also discussed and results obtained from these data are compared with those from the OSHA data. The information in this report can be used for a number of purposes. These include: (1) better targeting of construction safety programs, e.g., regional or geographically focused efforts, emphasis

on hazardous trades, etc., (2) improved training and regulations directed toward the causes of accidents and (3) improved accident data collection procedures to better identify the underlying causes of accidents.

Care should be used in interpreting the results presented in this report, particularly in establishing cause-effect relationships. Factors other than workplace safety and health conditions may affect the observed trends or the influence of various parameters.

CHAPTER 2

THE OSHA DATA BASE

2.1 Background

The Occupational Safety and Health Act of 1970 (PL 91-596) requires that fatalities be reported to OSHA within 48 hours of the occurrence of a fatality or catastrophe (five or more people hospitalized) caused by a work-related accident. This reporting requirement extends to all firms, not just those with 11 or more employees that are subject to normal programmed OSHA inspections. Fatalities involving employees of Federal agencies are also reported to OSHA. The employer can report the occurrence of an accident by telephone or by direct contact. OSHA also learns of the occurrence of accidents through the news media, during the course of inspections and referrals from state, municipal and other Federal agencies.

The number of fatalities reported to OSHA varies from year to year. Not all fatalities are investigated. The fatalities reported and investigated over the 5-year period from 1985 to 1989 were:

	Fatalities Reported	Fatalities Investigated
1985	1,092	729
1986	836	660
1987	1,136	724
1988	909	720
1989	819	663

Fatalities involving highway vehicles, homicides and non work-related accidents are generally not investigated by OSHA. State-Plan states investigate fatalities and catastrophes occurring in their jurisdiction.

The purpose of this chapter is to document the data collection procedure and describe the data collected by OSHA in the investigation of work-related fatalities.

2.2 Fatality Investigations

This section describes the data collection procedure for an OSHA fatality investigation. The procedure OSHA follows in conducting these investigations is described in the Field Operations Manual (1)*. The data collection forms used are included in Appendix A.

The employers report of a fatality/catastrophe is normally received by a Compliance Officer and the information is recorded on an OSHA 36(F) form in Federal States and an OSHA 36(S) form in State-Plan states. The primary purpose of these forms is to gather enough information to allow an OSHA supervisor to determine whether or not an investigation will be conducted. Information such as: establishment name, site address, site contact, date and time of occurrence, site telephone number, type of event, and preliminary description of the occurrence is recorded on the form. The data on the OSHA 36(F) or 36(S) form is entered in the OSHA Integrated Management Information System (IMIS) (2) directly by the area office, district office or state office which has jurisdiction over the fatality/catastrophe investigation. If it is determined that an investigation will be conducted, additional forms containing information pertinent to the investigation will be filled out by the Compliance Officer assigned to do the investigation. Two of these forms are:

1. The OSHA-1, Inspection Report - this form is a basic information form which provides a specific case number for each investigation.

2. The OSHA-170, Investigation Summary - this form is filled out by the assigned Compliance Officer upon completion of the investigation and gives specific data relating to the fatality/catastrophe.

The OSHA-1 form is normally the first form filled out by the Compliance Officer upon contact with the employer. The exception to this

---

* Numerals in parenthesis refer to references in Chapter 7.

is when a fatality/catastrophe occurs and an OSHA 36(F) or 36(S) form is the first form filled out. The OSHA-1 has two primary purposes:

1. To assign a specific case file number to the investigation which is used for tracking purposes for all information relating to the case.

2. To collect basic data such as: employer name, employer's mailing address if different from the site address, union or nonunion affiliation, recordkeeping information, type of inspection, and other related case files.

Data from the OSHA-1 are entered into the microcomputer data base of the Federal or state office which conducts the inspection and is also transmitted electronically to the host data base where current and historical information on enforcement activity for all offices is stored on a mainframe computer.

The OSHA-170 form is filled out by the Compliance Officer upon completion of the fatality/catastrophe investigation. The purpose of the form is to record a summary of all events relating to the fatality/catastrophe. The form is divided into three parts:

1. Part 1 (blocks 1-4) -- identifies the OSHA office and region involved, summary number, related inspections and total number of related inspections.

2. Part 2 (blocks 5-19) -- provides information concerning the accident such as the deceased name, sex, age, source of injury, and event type.

3. Part 3 (block 20) -- a brief abstract or summary of what happened.

The information on the sample OSHA-170 form in Appendix A which was used in this study includes:

1. Block 13 -- a listing of 14 general causes of the fatality (accident) or event type codes.

2. Block 20 - the abstract which contains information such as: depth of trench, height of fall, voltage, type of equipment associated with the accident and the specific work being performed.

The OSHA-170 forms are collected by the OSHA area offices, district offices and state offices and sent to the OSHA's Office of Management Data Systems in Washington, D.C. where the data contained on them is entered in the IMIS system. There is limited data editing at the time the data are entered into the system. These data are checked for consistency and completeness after entering them in the computer.

2.3 Integrated Management Information System

The OSHA IMIS system came online in April 1984. At that time, the area and district offices were supplied with microcomputers in order to input information directly into the OSHA data base. The area offices, district offices and state offices can retrieve information which they input and maintain in their own computer and also special programmed reports.

The IMIS data base currently includes over 1.7 million inspection records. The total currently includes approximately 35,000 OSHA-170 records covering 57,000 accident victims. Note that one OSHA-170 form for an accident may include multiple injuries or fatalities. The fatality records include most fatal and catastrophic accidents investigated by OSHA in the 50 states, Puerto Rico, the Virgin Islands and the District of Columbia. Accidents that occur in 29 states and the District of Columbia are investigated by Federal OSHA. Investigation of all other accidents is the responsibility of the Occupational Safety and Health departments of each of the 23 State-Plan states. Not all fatal accidents are investigated by OSHA. OSHA investigates primarily those fatalities that appear to be related to workplace safety and health. Jobsite fatalities resulting from personal illness or some other nonsafety-related cause are not usually subject to routine investigation. State-Plan states may define catastrophic accidents differently for their investigations. All such investigations are

supposed to be included in the IMIS data base, though it is possible that some are inadvertently excluded. Federal OSHA and the states also investigate any accident that receives major publicity from the media.

Table 2.3.1 summarizes the participation of the State-Plan states in the IMIS data base. In Connecticut and New York, the state safety and health programs cover only the public sector, while Federal OSHA investigates accidents involving private sector employees. In all other State-Plan states, Federal OSHA investigates an accident only in specific jurisdictional and hazard areas where Federal authority is maintained (military bases, state standard not yet adopted, etc.) The number of construction workers in each state for the period 1985 to 1989 is given in Table 2.3.2. The values in Table 2.3.2. obtained from the Bureau of Labor Statistics, represent the average number of workers employed in construction for that year; they do not reflect the number of hours actually worked. Using this information together with that in Table 2.3.1, the coverage of the construction workforce represented by the IMIS data base is shown in Figure 2.3.1. In computing this coverage, California was considered part of the system for calendar year 1988. For that year, Califonia was a Federal OSHA state and fatality data were included in IMIS. For calendar years 1987 and 1989, both the state and Federal governments were involved for varying periods of time and fatality data were not provided to IMIS for the full year. Califonia data were not included, therefore, in Figure 2.3.1 for 1987 and 1989 as well as 1985 and 1986.

Each accident record in the IMIS data base is identified by a unique activity number. Each record contains information such as the name and address of the company affected, its Standard Industrial Classification Code (SIC) and states whether or not the job-site was union or nonunion. Using this activity number, the accident record can be traced back to the OSHA case file which contains all the information related to the event. Each record also indicates the date and nature of the accident and lists all violations for which the company received citations and any penalties assessed. In addition, most accident reports contain summaries, describing what the worker was doing at the time of the accident, the accident itself and the injuries sustained. The abstract also often contains the cause of an accident or suggests safety measures that could potentially prevent the

occurrence of similar accidents. A sample IMIS output record of an accident inspection involving a fatality is shown in Table A-1 in Appendix A.

TABLE 2.3.1

SUMMARY OF STATE-PLAN STATES PARTICIPATION IN THE IMIS FATALITY DATA BASE

	Dates of Participation
Alaska	Since January 1, 1984
Arizona	Since January 1, 1984
Connecticut	Since January 1, 1984 (public sector employees)
California	Participation from July 1, 1990
Hawaii	Since January 1, 1984
Indiana	Since January 1, 1984
Iowa	Since January 1, 1984
Kentucky	Since January 1, 1984
Maryland	Since January 1, 1984
Michigan	Since October 1989
Minnesota	Since January 1, 1984
Nevada	Since January 1, 1984
New Mexico	Since January 1, 1984
New York	Since January 1, 1984 (public sector employees)
North Carolina	Since January 1, 1984
Oregon	Since January 1, 1984. Did not participate from January 1988 to January 1989.
South Carolina	Since March 1985
Tennessee	Since April 1984
Utah	Since January 1, 1984
Vermont	Since January 1, 1984
Virginia	Since January 1, 1984
Washington	Began participation in June 1990
Wyoming	Since January 1, 1984
Puerto Rico	Since January 1, 1984

TABLE 2.3.2

CONSTRUCTION INDUSTRY WORKFORCE

Number of Construction Workers
(Thousands)

STATE	1985	1986	1987	1988	1989
Alabama	71.4	74.9	75.1	78.0	75.9
Alaska	18.6	13.4	10.1	9.0	9.8
Arizona	112.1	113.1	103.2	93.7	85.9
Arkansas	35.3	36.2	34.1	33.3	32.5
California	496.2	531.0	574.6	603.3	643.6
Colorado	86.3	77.6	67.3	60.4	58.5
Connecticut	65.6	77.3	78.0	81.3	76.3
Delaware	17.6	18.9	20.2	21.7	20.4
Florida	334.3	339.5	341.5	346.3	341.1
Georgia	143.8	151.9	152.2	149.8	146.5
Hawaii	17.2	18.6	21.2	23.4	29.2
Idaho	15.1	14.6	13.6	14.2	16.0
Illinois	171.6	181.3	196.2	204.7	209.5
Indiana	87.0	92.9	99.0	107.3	115.0
Iowa	36.6	35.2	35.6	38.0	40.5
Kansas	42.3	43.9	45.4	41.6	40.5
Kentucky	54.0	56.3	61.6	63.0	66.1
Louisiana	105.2	90.5	81.3	81.3	82.3
Maine	23.4	26.9	31.5	33.3	33.1
Maryland	128.8	139.5	152.3	161.1	162.3
Massachusetts	109.4	123.2	137.7	142.1	127.7
Michigan	107.8	115.2	123.3	132.2	137.8
Minnesota	71.3	75.0	80.1	77.8	79.3
Mississippi	36.7	35.2	33.9	35.2	36.4
Missouri	92.9	98.1	98.7	97.4	97.5

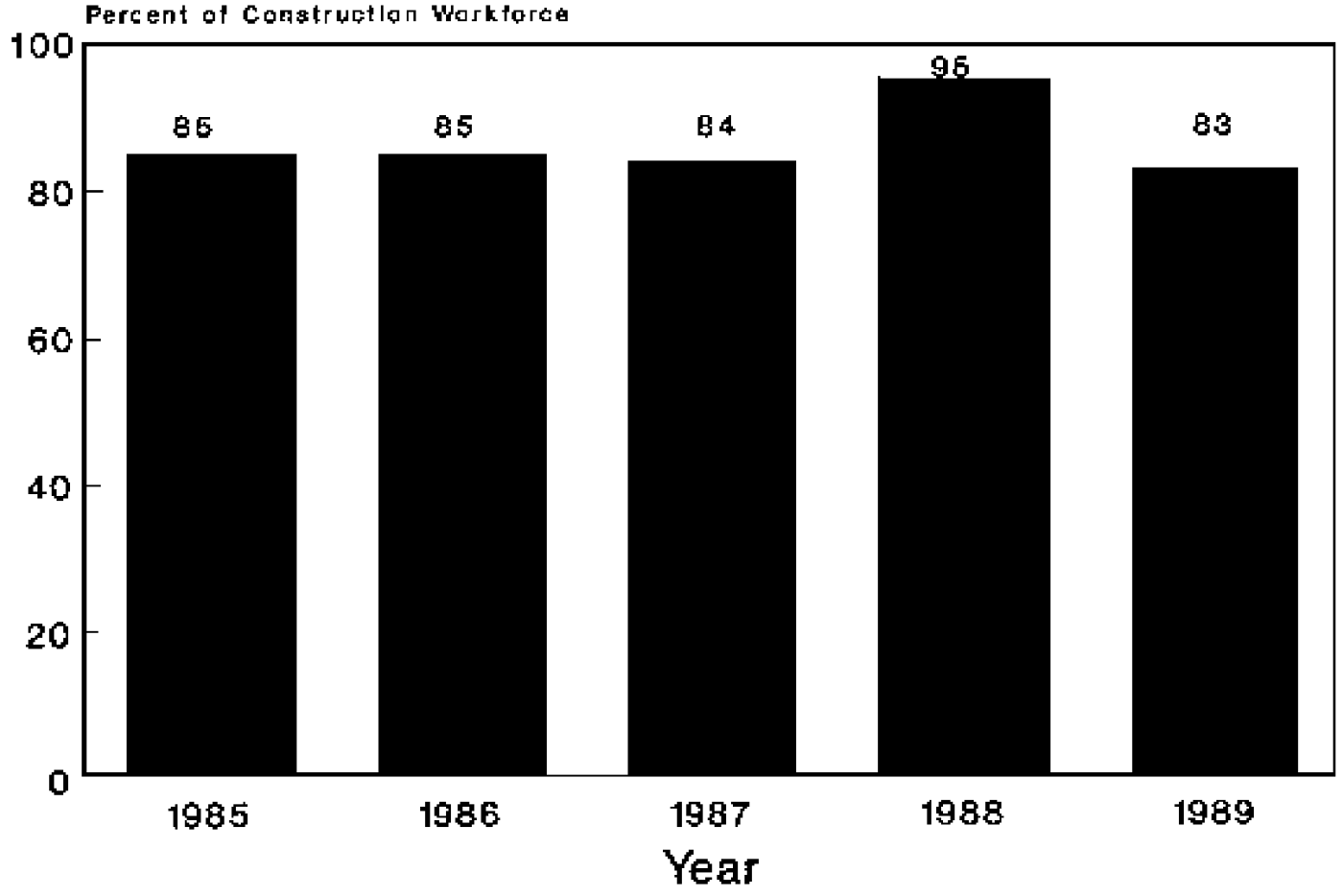
TABLE 2.3.2 (Continued)

Montana	11.5	10.2	8.8	9.0	9.7
Nebraska	26.1	24.6	24.5	24.5	23.9
Nevada	23.9	27.7	30.1	36.3	45.6
New Hampshire	30.9	35.2	36.8	35.9	31.1
New Jersey	141.0	153.4	164.4	170.5	167.5
New Mexico	37.5	35.1	32.1	31.0	30.6
New York	285.6	308.9	328.8	337.8	336.1
North Carolina	149.2	155.2	159.9	165.1	163.7
North Dakota	11.7	10.8	10.8	9.8	9.8
Ohio	154.0	160.7	176.4	185.6	193.1
Oklahoma	45.1	38.0	34.6	35.1	35.0
Oregon	33.1	34.3	35.3	39.9	45.2
Pennsylvania	187.1	201.8	218.3	229.6	235.3
Puerto Rico	26.3	28.6	35.5	41.5	43.7
Rhode Island	15.2	17.4	19.6	21.2	20.1
South Carolina	80.8	83.8	87.8	86.7	90.7
South Dakota	9.5	9.6	9.6	9.5	10.1
Tennessee	85.6	90.0	95.2	96.7	97.4
Texas	443.8	404.2	345.3	328.8	315.2
Utah	35.5	32.2	26.7	24.9	26.2
Vermont	13.8	15.3	16.5	17.5	18.2
Virginia	152.0	169.5	182.9	191.0	195.9
Virgin Islands	1.9	2.4	2.0	2.3	2.4
Washington	80.6	84.5	88.9	96.6	106.6
Washington, DC	13.6	14.1	14.7	14.0	14.3
West Virginia	22.8	22.8	24.0	24.3	23.4
Wisconsin	64.6	68.0	72.2	76.4	80.8
Wyoming	18.2	16.2	10.8	10.4	10.1
TOTAL	4,681.4	4,828.4	4,960.2	5,081.4	5,145.4

FIGURE 2.3.1
CONSTRUCTION WORKFORCE COVERAGE BY IMIS DATA BASE

Number of Construction Workers [IMIS]

1985 - 3,996,800
1986 - 4,108,950
1987 - 4,173,400
1988 - 4,852,600
1989 - 4,267,400



CHAPTER 3

ANALYSIS OF THE DATA

3.1 Introduction

A 5-year period was selected for the purpose of this study. This length of time should be sufficient to discern any trends that might be apparent in the data. In addition, fully computerized records were available in the IMIS data base for this length of time. Calendar years 1985 through 1989 were selected as the 5-year period.

The analysis had two objectives. The first was to determine any general trends in construction fatalities associated with factors such as geography, time, industry group or age of worker. This information would be useful for overall safety planning purposes, for example, to develop regional emphasis programs. The second objective was to look in detail at the causes of fatalities. Targeted inspection programs focused on high hazard activities could be developed and possibly new or improved standards developed on the basis of this information.

The OSHA-170 fatality investigation report contains a considerable amount of information. Twenty entries ranging from the location of the accident to the specific cause are included. The analysis in this report deals primarily with data directly available on the OSHA-170. The report also includes related information which is useful in interpreting the results of the analysis. For example, data on the age distribution of the construction workforce population is included for use in understanding the relationship between the number of fatalities and age group.

The analyses included in this report were intended to identify the variables having a significant influence on fatalities. Other analyses are possible. Subsequent studies to determine the relationship between the parameters not considered in this study may be conducted in the future.

3.2 Analysis Procedure

The IMIS data base is maintained by the OSHA Office of Management Data Systems. The data resides on a mainframe computer at

Boeing Computer Services, Inc., located in Vienna, Virginia. Remote access data entry and search capability via telephone line is available in the OSHA area offices around the country, the National Office in Washington, D.C. and the State-Plan states. For the purpose of this study, the construction fatality data was downloaded to a personal computer in the National Office prior to analysis. Construction fatalities were defined as fatalities associated with firms in Standard Industrial Classification Codes, SICs 15, 16 or 17. The data were downloaded to a personal computer to improve processing efficiency since only that portion of the complete IMIS data base of interest needed to be searched. Since some changes were made to the data prior to processing, this also permitted maintaining the integrity of the original data base. Additional data were obtained on the number of fatalities occurring in California, Michigan and Washington for those years in which they did not participate in IMIS. This information was obtained through direct contact with state agencies.

Each fatality record in the data base was reviewed for consistency and completeness after downloading to the personal computer. Some changes were made to the cause of the accident indicated in the record. No attempt was made to second guess the original accident investigator but in some cases a different accident cause from that originally cited was deemed more appropriate. For example, where a fatality was due to an employee contacting an electrical source and the event type cited on the OSHA-170 was struck by, this was changed to the event type shock. Of the 3,496 total fatalities (2,422 Federal fatalities, 1,074 state fatalities) in the data base, the event type for 577 or 17 percent was changed. The narrative summary of the accident on the OSHA-170 contained important descriptive information relating to the nature of the accident. For trenching fatalities, for example, the narrative provided data on the depth of the trench. For fatalities due to falls, the height of the fall was included in the narrative summary. This information was specially coded into preselected categories for each type of event causing a fatality prior to processing the data.

Data were arranged and stored in an accessible format on the personal computer using the DBASE IV software package (3). This software has built-in capabilities which allow searching, sorting, counting,

merging, and editing data to extract that needed to produce the type of tables and figures included in this report.

The number of useful fatality records available for each of the analyses presented in Sections 3.3 and 3.4 varied depending on the completeness of the information provided on the OSHA-170. For example, for fatalities caused by falls, there were 1,148 records in the data base. Records usually contained the basic information such as the accident location and age of the worker. The height of the fall, however, was not given in the written summary for 142 of these records. Thus, when analyzing the variation with time of fatalities due to falls, 1,148 records were available. For analyses relating to the height of the fall, however, only 1,006 records were available. For each analysis in Sections 3.3 and 3.4, the number of records or number of fatalities used in the analysis is indicated.

3.3. Distribution of Fatalities

The number of fatalities for each year for the period 1985 to 1989 is shown in Figure 3.3.1. The number of fatalities investigated by OSHA fluctuates around 700 per year and there is no general trend with time. The percent change in the number of fatalities from year to year is approximately 10 percent. Similarly, there is no general trend with time of the number of fatalities reported to the Agency given in Chapter 2.

The geographic distribution of fatalities by OSHA region is given in Table 3.3.1 for each of the 5 years. The data in the table are listed separately for the Federal and State-Plan states for each region. Table 3.3.lb lists the states included in each OSHA region. Referring to Table 3.3.1, the data for all the regions except Region VI do not indicate any trend with time. For Region II, for example, the total fatalities increased from 49 to 90 from 1985 to 1988 then decreased to 42 in 1989. For Region I, the total fatalities decreased from 1985 to 1986, increased from 1986 to 1987 then began decreasing. In some cases, there were significant changes from one year to the next. For example, in Region I, the number of fatalities decreased by 35 percent from 1985 to 1986 then increased 100 percent from 1986 to 1987. The reasons for these large changes from year to year are not apparent. For Region VI, the trend in the number of fatalities is continually downward decreasing from 159 in

1985 to 85 in 1989, a 47 percent decrease in 5 years. This decrease occurred in the four Federal OSHA states in the region; very few fatalities occurred in New Mexico, the State-Plan state in Region VI.

It is important when comparing the number of fatalities between regions to recognize the difference in the size and nature of the regions and consequently the amount of construction activity or the construction workforce at risk. One way to take these differences into account is to compare fatality rates or the number of fatalities as a function of the number of workers. Fatality rates for the regions are given in Table 3.3.2. The number of construction workers for each region taking into account the states participating in the IMIS system and the number of workers in the states given in Table 2.3.2 used to calculate these rates is given in Table 3.3.2b. This calculation takes into account both the size of the region (number of workers in any given year) and changes in construction activity in any region from one year to the next assuming the size of the workforce reflects these changes. California data, both the number of fatalities and the construction workforce, were not included in determining the rates for 1987 and 1989, in view of the lack of complete fatality data. The fatality rates for Regions VI and X decrease over the 5-year period; the rate for Region on VIII generally increases. There is no consistent pattern for the other regions. Regions V, VI and X have the highest average fatality rate, Regions I and II the lowest average rate.

The fatality rates for 1985 to 1989 for the entire United States are shown in Figure 3.3.2. These values are the same as the average of the 10 regions given for each year in Table 3.3.2. The fatality rate increases from 1985 to 1987 then decreases for 1988 and 1989.

When comparing these rates with other published values it is important to consider the procedure used to make the calculation. The BLS fatality rates, for example, are based on the actual number of hours worked in a given year rather than simply the number of construction workers. The total hours worked by all employees in a calendar year used in the BLS calculations of fatality rates (EH in Appendix B) corresponds to approximately 70 percent of the number of hours for full employment (2,000 hours) for the total workforce. Converting the BLS construction fatality rate of 24.5 fatalities per 100,000 workers for 1988 to the same

basis as used in this report, (full employment of the workforce) by multiplying by 0.7 gives a rate of 17.2. This rate is comparable to the values in Figure 3.3.2.

The variation of construction fatalities as a function of the day of the week is shown in Figure 3.3.3. There is no significant difference between the various days of the normal 5-day work week. The percentage of fatalities occurring on the weekend is significantly lower than during the week due to the reduced amount of hours worked during this period.

It is of interest to determine the relationship between the number of fatalities and various characteristics of the construction activity or the workforce. Table 3.3.3 and Figures 3.3.4, 3.3.5, 3.3.6 and 3.3.7 present data related to the industry group or SIC code, worker age and union affiliation. The number of fatalities for each of the three digit SIC codes for the industry groups (business activity) comprising construction, SICs 15, 16 and 17 (4) is given in Table 3.3.3. The largest number of fatalities for each of the 5 years occurs in SIC 162, Heavy Construction. The fatalities for this activity represent 25 percent of the total fatalities for the 5-year period. The number of fatalities for Special Trade Contractors (SIC 179) is almost as high and represents 21 percent of the total fatalities.

The number of fatalities for SIC 162, Heavy Construction decreased from 198 in 1985 to 160 in 1989, a 19 percent decrease over the 5-year period. Further study is required to determine the reason for the decrease. It could be due to improved safety practices, a reduction in the workforce at risk due to changes in the construction market or some other cause. The data for the other industry groups do not follow any trends over time.

The distribution of construction fatalities among the three industry groups (SIC 15, 16 and 17), is presented in Figure 3.3.4. The percentages shown differ slightly from those in Table 3.3.3 due to rounding. Special trade contractors (SIC 17) account for 53 percent of the total fatalities. Special trade contractors may work on subcontract for the general contractor or they may work directly for the owner. Heavy construction other than building construction (SIC 16) accounts for 34 percent and building construction (SIC 15) 13 percent. These results can be used as a criteria for targeting OSHA construction inspections.

The influence of age of the worker on fatalities is presented in Figure 3.3.5. The percentage of the total fatalities occurring in each age group is shown. The percentage of the construction workforce in each age group is also shown for comparison. The largest percentage of fatalities, 32 percent, occurs in the 25 to 34 year age group. Workers between the ages of 25 and 44 account for over 50 percent of the fatalities. The percentage of fatalities in each age group is within 2 percent of the percentage of the workforce population in that age group; older workers or younger workers do not experience a disproportionate share of construction fatalities.

Figure 3.3.6 provides a comparison of the fatalities for worksites with a union or nonunion workforce for the 5-year period, 1985 to 1989. Data recorded on the OSHA 1 accident investigation form indicate whether employees at the jobsite of the employer of the deceased worker were union or nonunion workers. If any of these employees were organized by a union, the entry on the OSHA 1 was marked "union". If none of the workers were organized by a union then the entry was marked "nonunion". An entry marked "union", therefore, does not necessarily indicate that the worker killed in the accident was a member of a union. Of the 3,496 total fatalities from 1985 to 1989, 973 or 28 percent occurred at sites with union representation; 2,523 or 72 percent occurred at worksites were there was no union representation.

A yearly comparison of the union versus nonunion worksite fatalities is given in Figure 3.3.7. The composition of the total construction workforce in terms of union and nonunion workers is provided for comparison. Data on the union membership was obtained from a special survey done as part of the yearly House-Hold Survey conducted by the Bureau of Compensation and Working Conditions (5), a unit of the Bureau of Labor Statistics. Referring to Figure 3.3.7, for 1985, 30 percent of the fatalities occurred at union worksites, 70 percent at nonunion worksites. For that year, union membership accounted for 22 percent of the workforce, 78 percent was nonunion. The distribution of fatalities among union and nonunion worksites is similar to the composition of the construction workforce in terms of union and nonunion workers for the 5-year period shown in the figure.

The relationship between the number of fatalities for various size firms, defined in terms of the number of employees employed by the firm, and the representation of the construction workforce by the size of the firm is shown in Figure 3.3.8. Information is recorded on the OSHA-1 form indicating the number of employees on the site and the number of employees "controlled" by the company. This later figure represents the total number of employees employed by the company (firm size) for which the fatality occurred. This information was used to determine the percentage of the total fatalities occurring for the various size firms shown in the figure. Data on the representation of the construction workforce by the size of the firm was obtained from the Bureau of the Census (16, 17, 18) and is also shown. Referring to Figure 3.3.8, 10 percent of the fatalities for the period 1985 to 1987 occurred for firms with one to four employees. Firms of this size controlled 11 percent of the workforce. Firms with less than 100 employees account for 75 percent of the construction workforce. Sixty-eight percent of the fatalities occurred for these firms. The percentage of fatalities for the various size construction firms is similar to the representation of the construction workforce in terms of firm size.

3.4 Causes of Fatalities

Identifying the causes of fatalities is the first step in developing a prevention strategy. Table 3.4.1 summarizes the causes of fatalities based on the 14 categories included on the OSHA-170 accident form. Falls from elevation represent the largest cause, 33 percent, of all construction fatalities. Struck by, caught in/between and electrical shock in that order represent the next three largest causes. These four causes or types of accidents represent 90 percent of the total. The relationship among the causes of fatalities for the State-Plan states is similar to that for the Federal OSHA states.

The variation with time of the causes of fatalities is presented in Table 3.4.2 and Figure 3.4.1. The relative contribution of the four major causes (falls from elevation, struck by, caught in/between, electrical shock) to the total number of fatalities does not vary significantly over the 5-year period. This would seem to indicate the same types of fatal accidents are continuing to occur with the same relative frequency.

Table 3.4.3 illustrates the variation of the causes of fatalities between the OSHA regions. There is some variation between regions of the percent of fatalities associated with each of the four major causes of fatalities. The caught in/between category, for example, ranges from a low of 16 percent of the total fatalities in Regions V, VI and IX to a high of 28 percent in Region X. Similarly, falls from elevation range from a low of 28 percent of the total fatalities in Regions VII and VIII to a high of 41 percent in Region X. There are similar variations in the struck by and electrical shock categories.

The influence of construction activity on the causes of fatalities is given in Table 3.4.4. The largest percentage of falls, for example, occur for special trade contractors, 27 percent. The largest percentage of struck by events, on the other hand, 28 percent, occur in heavy construction. It is of interest to note, that the percentage of fatalities due to electrical shock is almost the same for heavy construction (SIC 162) and electrical work (SIC 173). This warrants further study and may be due in one case to contacting overhead power lines with heavy equipment and in the other simply due to the hazards of general electrical work (installation, etc.).

The data in Table 3.4.4 also illustrate the variation of the causes of fatalities for each industry group. For general building contractors (SIC 152), for example, 57 of the 126 fatalities or 45 percent were due to falls. By contrast, for electrical workers (SIC 173) 126 of the 211 fatalities or 60 percent were due to shock.

The relationship between the causes of fatalities and worker age is given in Table 3.4.5. There does not appear to be a correlation between the two parameters. The largest percentage of fatalities for each of the causes occurs in the 25 to 34 year age group. Similarly the next largest occurs generally in the 35 to 44 year age group. These age groups correspond to those with the largest percentage of the workforce (see Figure 3.3.5).

It is of interest to look beyond the causes of fatalities and attempt to identify contributing factors or characteristics of the accidents which underlie these causes. Table 3.4.6, for example, identifies the type of

activity or location associated with falls, the major cause of construction fatalities. The fall location or activity indicated should not be confused with the trade of the worker involved in the accident. Falls from scaffolds, for example, include painters, masons, ironworkers, etc. Roofs and scaffolds are the major sources of falls. The data also indicate that fall hazards are greater for steel erection than concrete erection based on the significant difference in the number of fatalities and the assumption that the number of workers exposed is approximately the same for the two activities. The number of fatalities due to falls involving steel erection is also larger than falls from ladders.

The height involved for the fatalities due to falls is shown in Figure 3.4.2. Approximately 40 percent of the fatalities involved falls of greater than 30 feet. Twenty-five percent of the fatalities occurred for falls between 11 and 20 feet and a similar percentage from 21 to 30 feet.

The contributing factors involved in fatalities due to being struck by an object are shown in Figure 3.4.3. Approximately 75 percent of the fatalities over the 5-year period caused by being struck by machines involve primarily heavy construction equipment such as trucks, cranes, graders, and scrapers. Many of the fatalities caused by being struck by materials involve poor rigging of loads being moved or poor storage of materials. Tools account for very few of these fatalities. There does not appear to be any significant trend with time.

The analysis of fatalities due to being caught in or between is shown in Figure 3.4.4. The majority of the accidents involving being caught in are related to trenching collapses. Caught between fatalities primarily involve the worker being caught between a vehicle and another surface. As can be seen in Figure 3.4.4 accidents involving being caught in are considerably more numerous than those involving being caught between two objects. This relationship does not vary with time.

For fatalities due to trench cave-ins, it is of interest to look at the depth of the trench involved. This relationship is shown in Figure 3.4.5. Seventy-nine percent of trenching fatalities occur in trenches less than 15

feet deep. Thirty-eight percent of the fatalities occur in trenches less than 10 feet deep. These results are similar to those obtained by Suruda, et. al. (6).

Results of the analysis of fatalities caused by electrical shock are given in Figure 3.4.6 and Tables 3.4.7 and 3.4.8. Of the total fatalities due to electric shock, 95 percent were due to contact with live parts and 5 percent were due to ungrounded tools. As shown in Figure 3.4.7, 74 percent of the fatalities involve electrical sources with voltages exceeding 480 volts. The type of equipment involved with fatalities caused by electrical shock is listed in Table 3.4.7. A high percentage of the fatalities involving electrical boxes were associated with the lack of lock-out tag-out protection, use of personal protective equipment or other fonns of protection. Contact with overhead wires account for 65 percent of the total. Sources of contact with the overhead wires are listed in Table 3.4.8. Cranes account for 29 percent of these sources. For the "other" category in Table 3.4.8, about 25 percent or 8 percent of the total are due to contacts with hand carried items such as metal pipe, rebar, paint rollers, etc. The remaining 75 percent of the "other" category or about 24 percent of the total are due to contacts of miscellaneous equipment such as back hoes, trucks, drill rigs, aerial lifts, etc. Thus, 53 percent of the fatalities associated with contacting overhead power lines involve construction equipment.

TABLE 3.3.1

GEOGRAPHIC DISTRIBUTION OF FATALITIES

Number of Fatalities

		1985	1986	1987	1988	1989	Total
Region I	Federal State Combined	41 1 42	24 3 27	52 2 54	32 1 33	34 1 35	191
Region II	Federal State Combined	46 3 49	50 8 58	51 12 63	73 17 90	35 7 42	302
Region III	Federal State Combined	40 57 97	38 35 73	46 55 101	33 67 100	46 42 88	459
Region IV	Federal State Combined	102 54 156	135 58 193	108 71 179	109 65 174	90 81 171	873
Region V	Federal State Combined	77 43 120	85 24 109	69 39 108	71 36 107	89 44 133	577
Region VI	Federal State Combined	153 6 159	105 4 109	95 2 97	86 6 92	84 1 85	542
Region VII	Federal State Combined	28 13 41	23 13 36	29 10 39	26 14 40	22 11 33	189
Region VIII	Federal State Combined	16 10 26	21 9 30	21 5 26	14 6 20	16 9 25	127
Region IX	Federal State Combined	2 22 24	0 14 14	33 11 44	42 15 57	20 23 43	182
Region X	Federal State Combined	1 14 15	3 8 11	2 11 13	4 3 7	0 8 8	54
Total		729	660	724	720	663	3496

TABLE 3.3.1b

OSHA REGIONS

Region I

Connecticut*, Massachusetts, Maine, New Hampshire, Rhode Island, Vermont*.

Region II

New Jersey, New York*, Puerto Rico*, Virgin Islands*.

Region III

District of Columbia, Delaware, Maryland*, Pennsylvania, Virginia*, West Virginia.

Region IV

Alabama, Florida, Georgia, Kentucky*, Mississippi, North Carolina*, South Carolina*, Tennessee*.

Region V

Illinois, Indiana*, Michigan*, Minnesota*, Ohio, Wisconsin.

Region VI

Arkansas, Louisiana, New Mexico*, Oklahoma, Texas

Region VII

Iowa*, Kansas, Missouri Nebraska

Region VIII

Colorado, Montana, North Dakota, South Dakota, Utah*, Wyoming*.

Region IX

Arizona*, California*, Hawaii*, Nevada*.

Region X

Alaska*, Idaho, Oregon*, Washington*.

* These states and territories operate their own OSHA-approved job safety and health programs (the Connecticut and New York plans cover public employees only).

TABLE 3.3.2
FATALITY RATES

Fatality Rate *

	1985	1986	1987	1988	1989	Average
Region I	16.3	9.3	16.9	10.0	11.4	12.8
Region II	10.8	11.8	11.9	16.3	7.6	11.7
Region III	18.6	12.9	16.5	15.6	13.5	15.4
Region IV	16.3	19.6	17.7	17.1	16.8	17.5
Region V	21.6	19.8	18.3	16.7	18.6	19.0
Region VI	23.8	18.1	18.4	18.1	17.2	19.1
Region VII	20.7	17.8	19.1	19.9	16.3	18.8
Region VIII	15.1	19.2	19.0	16.1	20.1	17.9
Region IX	14.8	11.6	28.5**	7.8	26.8**	17.9
Region X	24.4	18.4	18.9	18.2	15.2	19.0
Average	18.2	15.8	18.6	15.6	16.4	16.9

$$\text{* } \frac{\text{Number of fatalities}}{\text{Number of construction workers in Region (Table 3.3.2b)}} \times 100{,}000$$

** Excluding California

TABLE 3.3.2b

Number of Construction Workers
(Thousands)

	1985	1986	1987	1988	1989
Region I	258.3	289.3	320.1	331.3	306.5
Region II	454.8	493.3	530.7	552.1	549.7
Region III	521.9	566.6	612.4	641.7	651.6
Region IV	955.8	986.6	1007.2	1020.8	1017.8
Region V	656.3	693.1	747.2	784.0	815.5
Region VI	666.9	604.0	527.4	509.5	495.6
Region VII	197.9	201.8	204.2	201.5	202.4
Region VIII	172.7	156.6	134.0	124.1	124.4
Region IX	649.4	690.4	154.5*	756.7	160.7*
Region X	147.4	146.8	147.9	159.7	177.6
TOTAL	4681.4	4828.5	4385.6	5081.4	4501.8

* Excluding California

Numbers reflect states participating in the IMIS system and were obtained using data in Table 2.3.2.

TABLE 3.3.3

TIME VARIATION OF FATALITIES BY CONSTRUCTION ACTIVITY

Number of Fatalities

Industry Group (SIC)	1985	1986	1987	1988	1989	Total (1985-89)	Percent Total
General Building Contractors - Residential Buildings (152)	26	24	32	23	21	126	4
Operative Builders (153)	2	1	3	3	1	10	*
General Building Contractors - Nonresidential Buildings (154)	70	51	69	79	64	333	10
Highway and Street Construction, except Elevated Highways (161)	68	59	68	63	49	307	9
Heavy Construction, Except Highway and Street Construction (162)	198	182	178	162	160	880	25
Plumbing, Heating and Air Conditioning (171)	44	29	42	35	34	184	5
Painting and Paper Hanging (172)	28	25	27	32	22	134	4
Electrical Work (173)	40	38	36	48	49	211	6
Masonry, Stonework, Tile Setting, and Plastering (174)	30	37	36	31	22	156	4
Carpentry and Floor Work (175)	17	12	11	12	18	70	2
Roofing, Siding , and Sheet Metal Work (176)	41	47	43	58	49	238	7
Concrete Work (177)	18	15	17	18	19	87	2
Water Well Drilling (178)	2	2	2	2	7	15	*
Miscelaneoue Special Trade Contractors (179)	145	138	160	154	148	745	21

* Less than 0.5 percent.

NOTE: Because of rounding, percentages may not add to 100 percent.

TABLE 3.4.1

SUMMARY OF CAUSES OF FATALITIES
1985-1989

Cause	Number of Fatalities: Federal	State-Plan States	Total Fatalities	Percent of All Fatalities
Struck By	548	233	781	22
Caught In/Between	432	207	639	18
Bite/Sting/Scratch	1	0	1	*
Fall (same level)	5	5	10	*
Fall (from elevation)	829	319	1148	33
Struck Against	35	11	46	1
Rubbed/Abraded	0	1	1	*
Inhalation	47	15	62	2
Ingestion	2	2	4	*
Absorption	0	0	0	0
Repetitive Motion/Pressure	0	0	0	0
Cardiovascular/ Respiratory	74	35	109	3
Shock (electrical)	394	186	580	17
Other	55	60	115	3
Total	2422	1074	3496	

*Less than 0.5 percent.

NOTE: Because of rounding, percentages may not add to 100 pecent.

TABLE 3.4.2

VARIATION OF CAUSES OF FATALITIES WITH TIME

Percent of Fatalities*

Cause	1985	1986	1987	1988	1989	Average
Struck By	22	26	20	23	22	23
Caught In/Between	17	18	23	15	19	18
Bite/Sting/Scratch	0	0	0	0	**	**
Fall (same level)	0	1	**	**	**	**
Fall (from elevation)	36	28	30	36	34	33
Struck Against	1	2	2	1	**	1
Rubbed/Abraded	0	0	0	0	0	0
Inhalation	1	2	1	2	3	2
Ingestion	**	**	0	**	0	**
Absorption	0	0	0	0	0	0
Repetitive Motion/ Pressure	0	0	0	0	0	0
Cardiovascular/ Respiratory	3	4	3	3	3	3
Shock (electrical)	14	18	17	18	16	17
Other	4	3	4	2	3	3

* $\frac{\text{Number of fatalities due to a specific cause}}{\text{Total fatalities in a given year}}$

** Less than 0.5 percent.

NOTE: Because of rounding, percentages may not add to 100 pecent.

TABLE 3.4.3

GEOGRAPHIC DISTRIBUTION OF CAUSES OF FATALITIES 1985-1989

Percent of Fatalities*

Causes	Region I	Region II	Region III	Region IV	Region V	Region VI	Region VII	Region VIII	Region IX	Region X
Stuck By	22	25	27	20	18	27	19	21	26	11
Caught In/Between	23	21	17	17	16	16	25	20	16	28
Bite/Sting/Scratch	**	**	**	**	**	**	**	**	**	**
Fall (same level)	**	**	**	1	**	**	**	**	**	**
Fall (from elevation)	33	34	31	30	39	33	28	28	33	41
Struck Against	1	1	1	1	1	1	2	3	2	**
Rubbed/Abraded	**	**	**	**	**	**	**	**	**	**
Inhalation	2	1	1	3	2	2	1	2	2	**
Ingestion	**	**	**	**	**	**	**	**	**	**
Absortion	**	**	**	**	**	**	**	**	**	**
Reptetive Motion/Pressure	**	**	**	**	**	**	**	**	**	**
Cardiovascular/Respiratory	4	2	2	4	5	2	3	8	1	**
Shock	13	14	17	20	15	16	20	13	17	11
Other	2	1	3	4	4	3	2	4	3	9

* $\frac{\text{Number of fatalities}}{\text{Total fatalities in region}}$

** Less than 0.5 percent

TABLE 3.4.4

RELATIONSHIP BETWEEN CONSTRUCTION ACTIVITY AND CAUSE OF FATALITY 1985-1989

Number of Fatalities
(Percent of Total)*

Industry Group (SIC)	Falls	Struck By	Caught In/ Between	Shock	Other	Total
General Building Contractors - Residential Buildings (152)	57 (5%)	29 (4%)	16 (3%)	18 (3%)	6 (2%)	126
Operative Builders (153)	5 (**)	4 (**)	1 (**)	0 (**)	0 (**)	10
General Building Contractors - Nonresidential Buildings (154)	141 (12%)	70 (9%)	44 (7%)	47 (8%)	31 (9%)	333
Highway and Street Construction, except Elevated Highways (161)	13 (1%)	181 (23%)	64 (10%)	27 (5%)	22 (6%)	307
Heavy Construction, Except Highway and Street Construction (162)	129 (11%)	216 (28%)	278 (44%)	137 (24%)	120 (35%)	880
Plumbing, Heating and Air Conditioning (171)	50 (4%)	25 (3%)	47 (7%)	21 (4%)	41 (12%)	184
Painting and Paper Hanging (172)	74 (6%)	1 (**)	4 (1%)	38 (7%)	17 (5%)	134
Electrical Work (173)	36 (3%)	14 (2%)	8 (1%)	126 (22%)	27 (8%)	211
Masonry, Stonework, Tile Setting, and Plastering (174)	94 (8%)	32 (4%)	16 (3%)	7 (1%)	7 (2%)	156
Carpentry and Floor Work (175)	44 (4%)	10 (1%)	3 (**)	10 (2%)	3 (1%)	70
Roofing, Siding, and Sheet Metal Work (176)	174 (15%)	9 (1%)	5 (1%)	42 (7%)	8 (2%)	238
Concrete Work (177)	22 (2%)	35 (4%)	10 (2%)	11 (2%)	9 (3%)	87
Water Well Drilling (178)	0	4 (1%)	4 (1%)	5 (1%)	2 (1%)	15
Miscellaneous Special Trade Contractors (179)	309 (27%)	151 (19%)	139 (22%)	91 (16%)	55 (16%)	745
Total	1148	781	639	580	348	3496

* $\frac{\text{Number of fatalities}}{\text{Total fatalities due to a specific cause}}$

** Less than 0.5 percent.

NOTE: Because of rounding, percentages may not add to 100 percent.

TABLE 3.4.5

REIATIONSHIP BETWEEN AGE AND CAUSE OF FATALITY
1985-1989

Number of Fatalities
(Percent Total)*

Age Group	Falls	Struck By	Caught In/Between	Shock	Other	Total
16-19 years	35 (3%)	33 (4%)	24 (4%)	30 (5%)	11 (3%)	133
20-24 years	153 (13%)	101 (13%)	111 (17%)	131 (23%)	36 (10%)	532
25-34 years	374 (33%)	215 (28%)	191 (30%)	222 (38%)	115 (33%)	1117
35-44 years	244 (21%)	172 (22%)	142 (22%)	122 (21%)	91 (26%)	771
45-54 years	189 (17%)	152 (19%)	85 (13%)	46 (8%)	42 (12%)	514
55-64 years	128 (11%)	92 (12%)	76 (12%)	25 (4%)	47 (14%)	368
65 years and older	22 (2%)	14 (2%)	9 (1%)	2 **	5 (1%)	52
Total	1145	779	638	578	347	3487

* $\frac{\text{Number of fatalities}}{\text{Total fatalities due to specific cause}}$

** Less than 0.5 percent

NOTE: Because of rounding, percentages may not add to 100 percent.

TABLE 3.4.6

SUMMARY OF ACTIVITIES INVOLVING FATALITIES DUE TO FALLS 1985-1989

Fall Location/Activity	Number of Fatalitites	Percent of Total
Roof	297	26
Open Sided Floor	43	4
Scaffold	214	19
Steel Erection	123	11
Concrete Erection	34	3
Aerial Lift/Basket	31	3
Suspended Platform	25	2
Vehicle	6	1
Ladder	73	6
Floor Opening	74	6
Other	228	20

NOTE: Because of rounding, percentages may not add to 100 percent.

TABLE 3.4.7

EQUIPMENT INVOLVED WITH FATALITIES CAUSED BY SHOCK

Equipment Involved	Number of Fatalities	Percent Total
Hand Held Tool	18	3
Non Hand Held Tool/Equipment	16	3
Electric Cord	34	6
Electrical Box	63	11
Overhead Wires	377	65
Other	72	12

NOTE: Because of rounding, percentages may not add to 100 percent.

TABLE 3.4.8

FATALITIES DUE TO CONTRACT WITH OVERHEAD WIRES -- SOURCE OF CONTACT

Type of Contact	Number of Fatalities	Percent Total
Ladder	55	15
Scaffold	28	7
Direct Employee Contact	65	17
Crane	111	29
Other	120	32

FIGURE 3.3.1
CONSTRUCTION FATALITIES
1985-1989

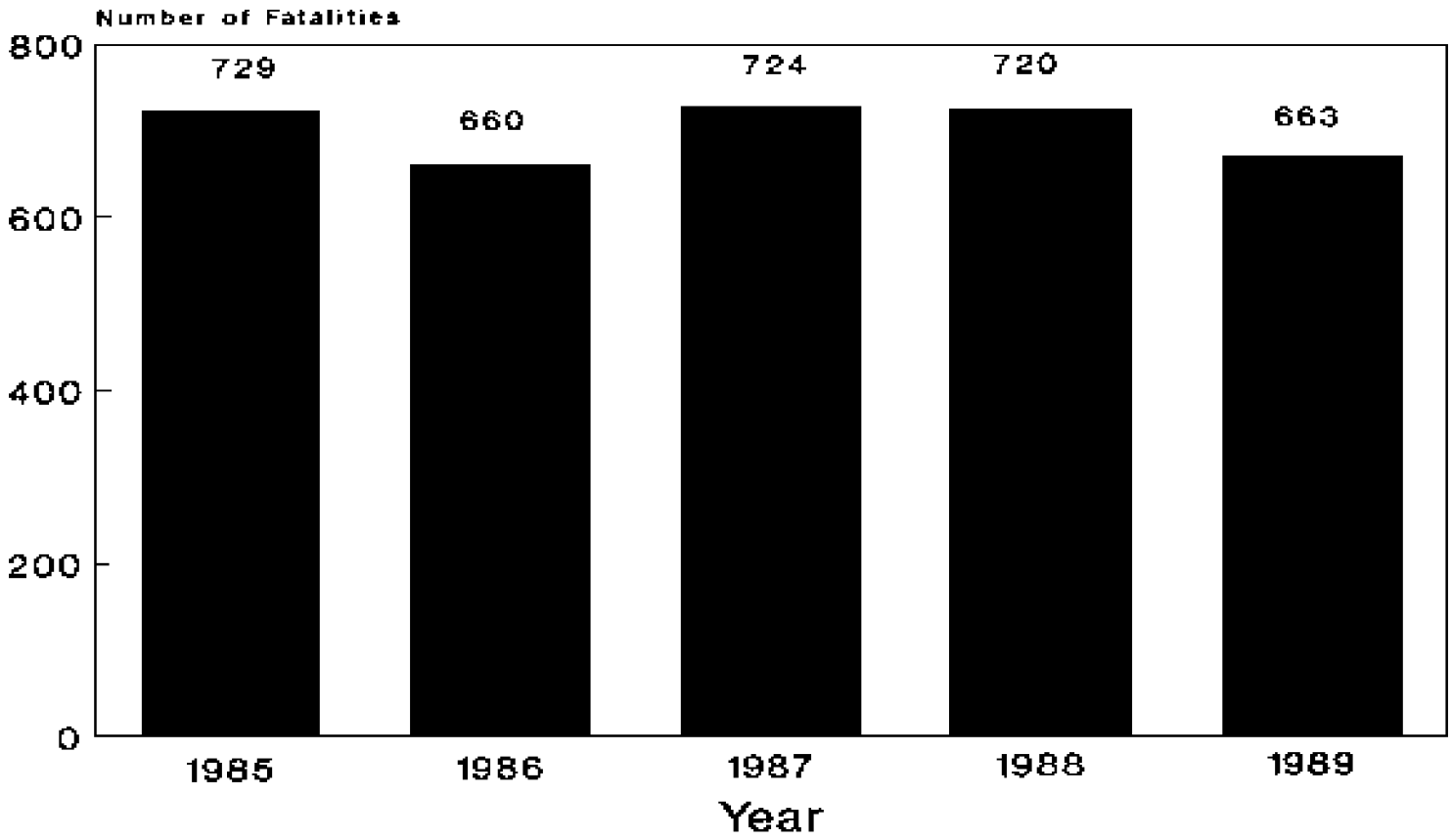


FIGURE 3.3.2
U.S. CONSTRUCTION FATALITY RATE

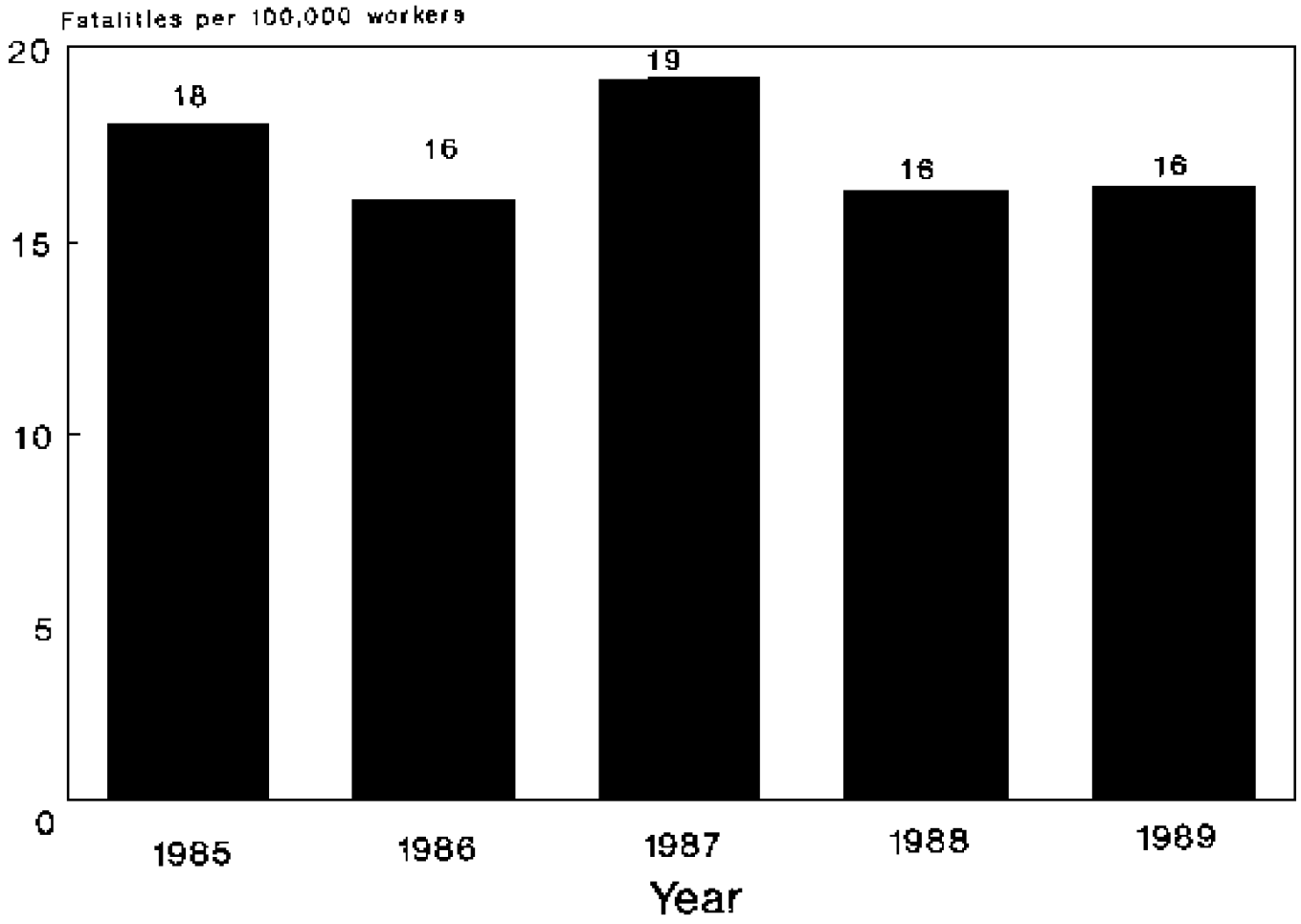


FIGURE 3.3.3
DISTRIBUTION OF FATALITIES
BY DAY OF THE WEEK

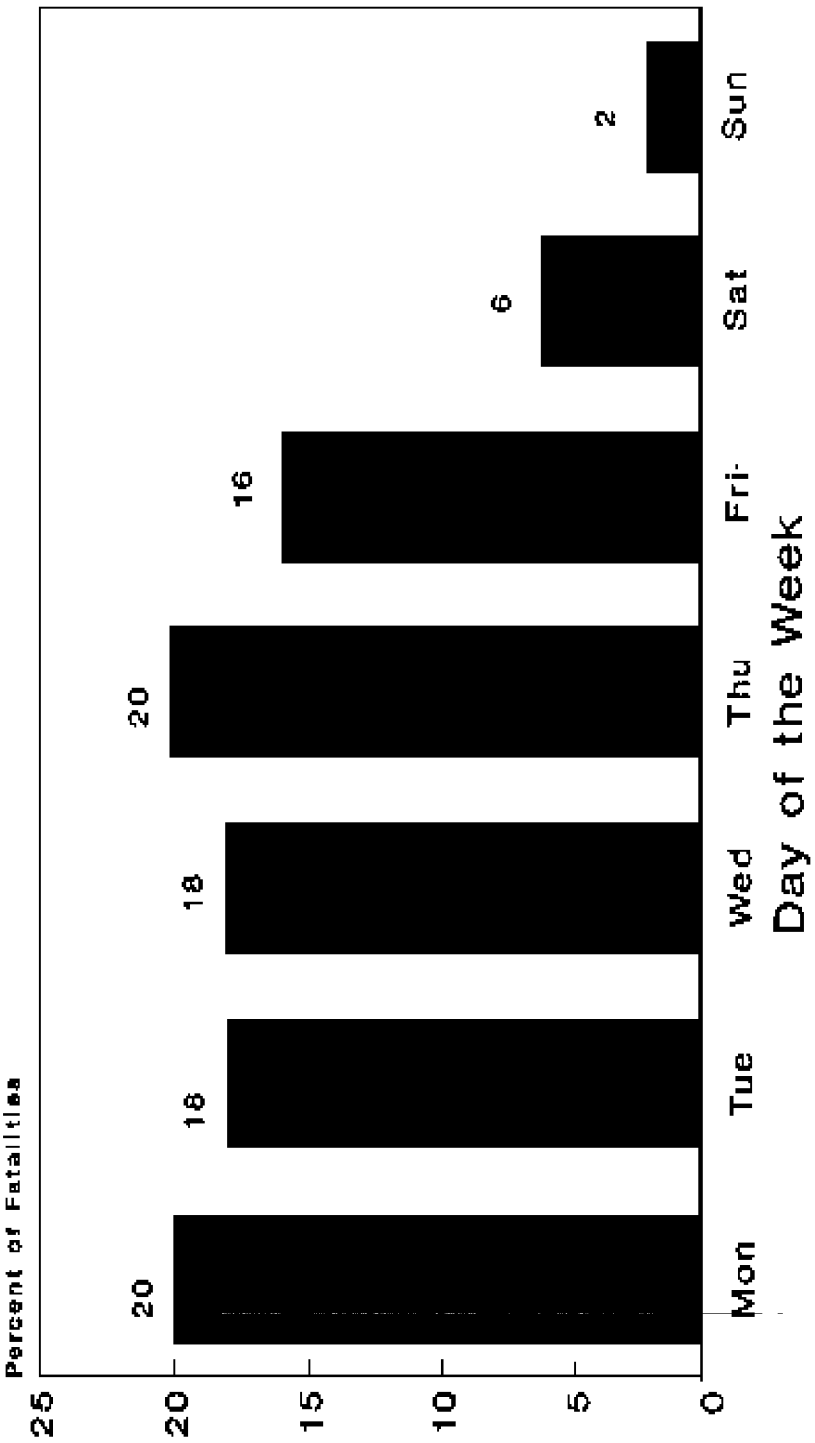


FIGURE 3.3.4
DISTRIBUTION OF FATALITIES
BY INDUSTRY GROUP
1985-1989

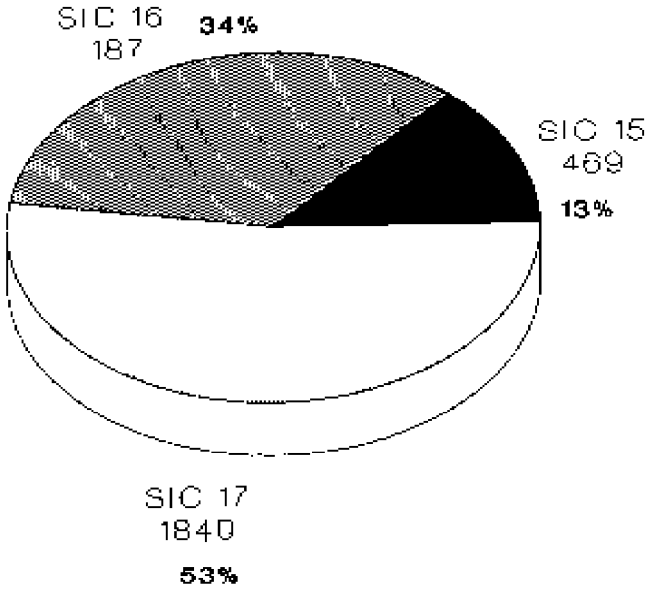


FIGURE 3.3.5
ANALYSIS OF FATALITIES BY AGE GROUP AND PERCENTAGE OF WORKFORCE

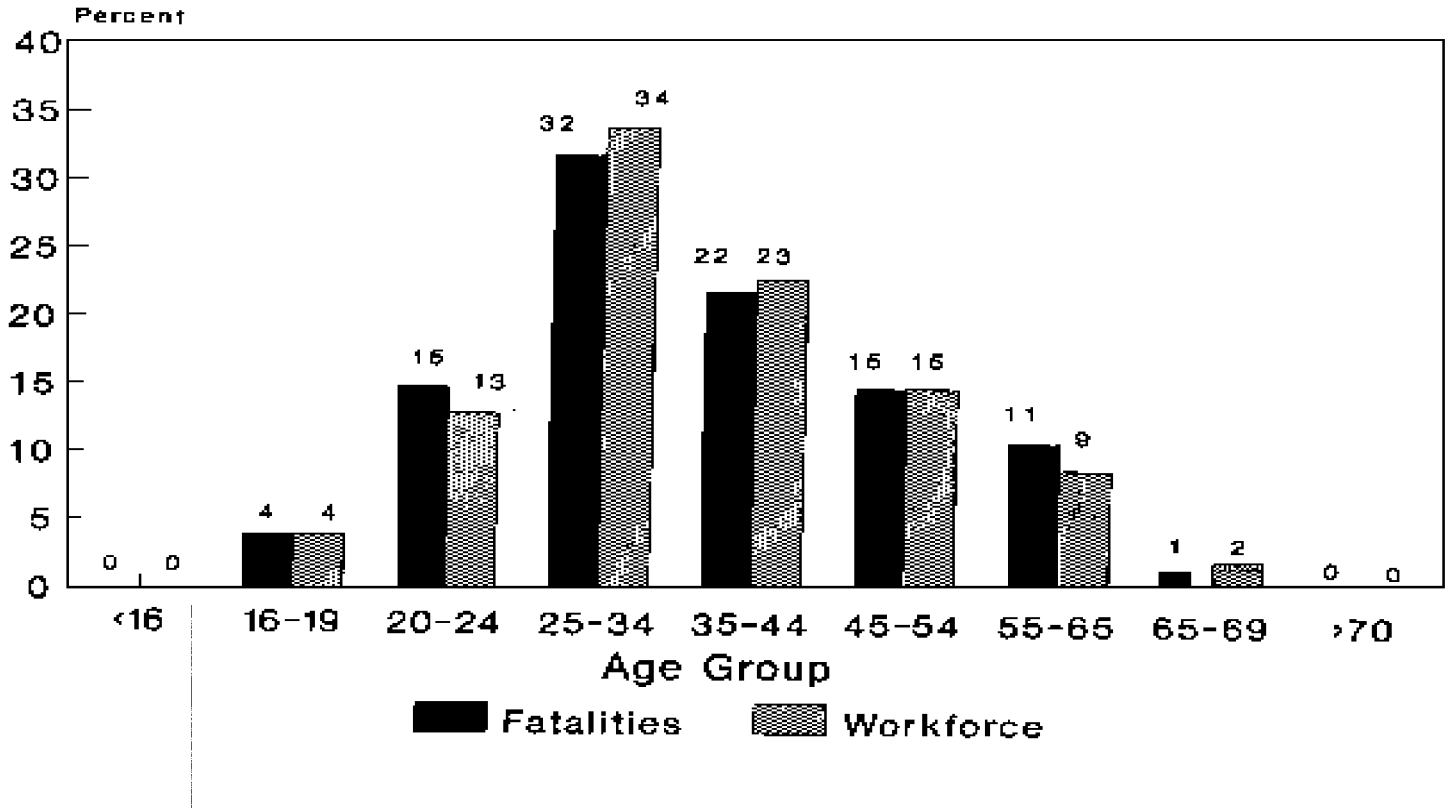


FIGURE 3.3.6
COMPARISON OF UNION VERSUS NONUNION WORKSITE FATALITIES (1985-1989)

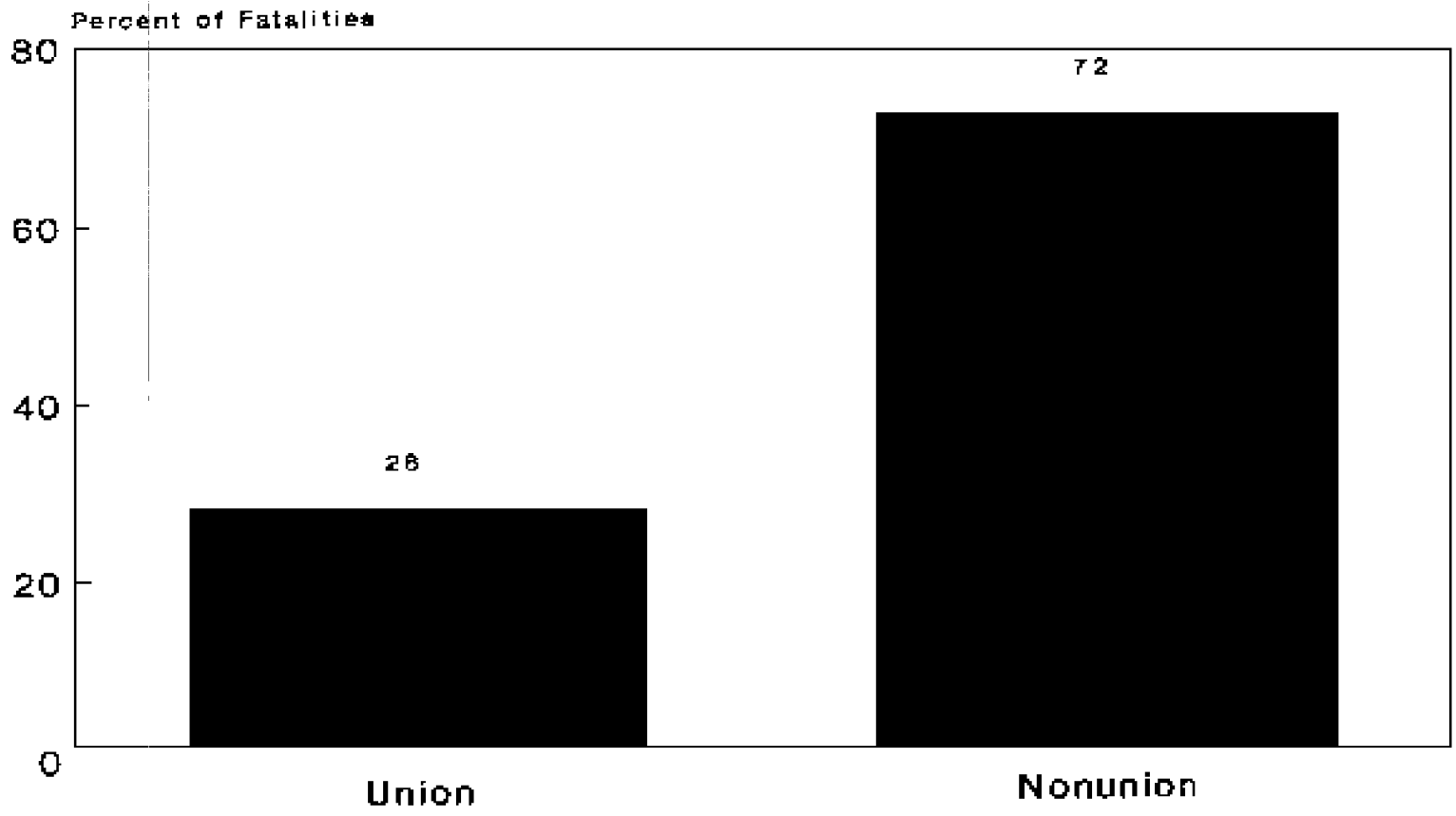


FIGURE 3.3.7
COMPARISON OF FATALITIES AT UNION VERSUS NONUNION WORKSITES

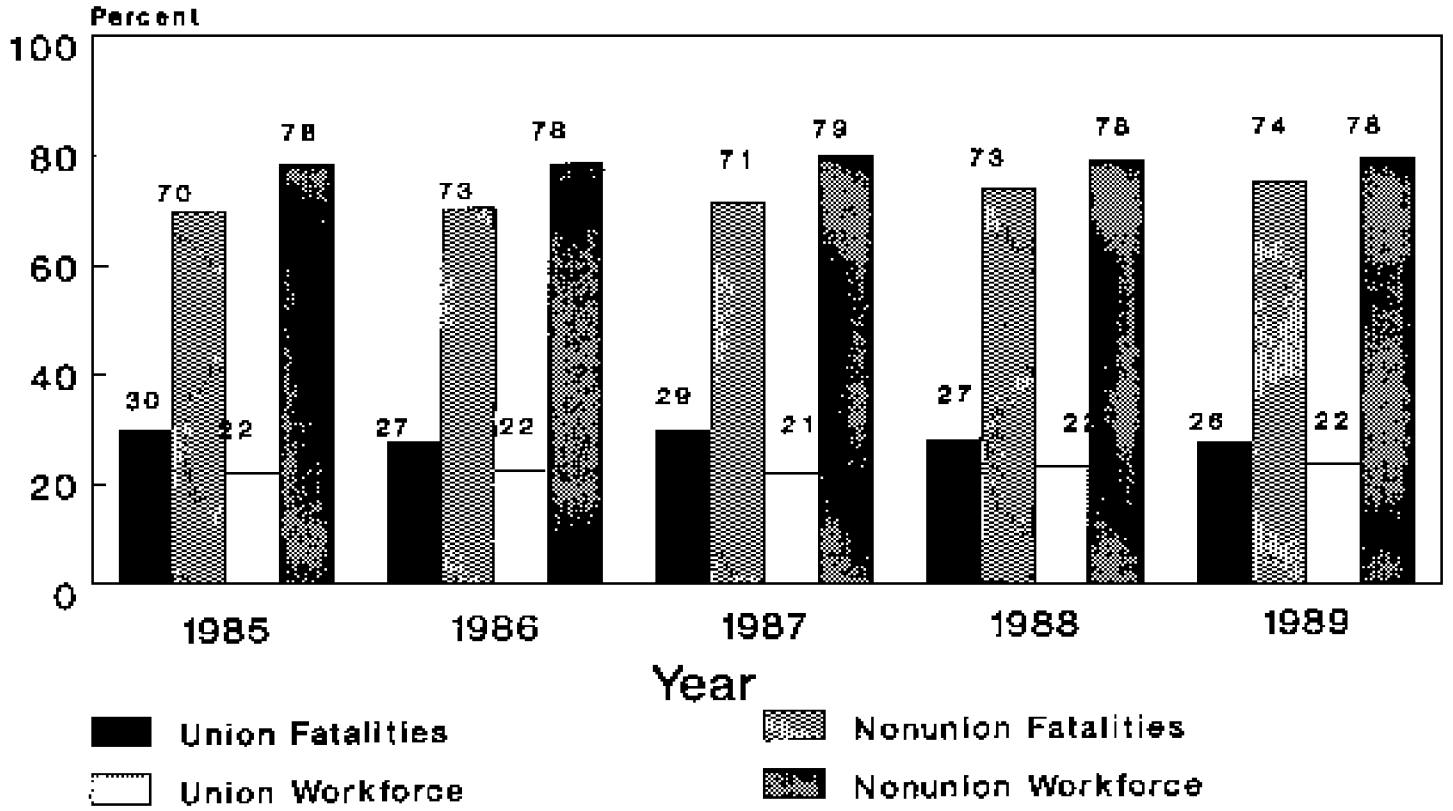


FIGURE 3.3.8
ANALYSIS OF FATALITIES BY SIZE OF FIRM AND COMPOSITION OF CONSTRUCTION INDUSTRY 1985-1987

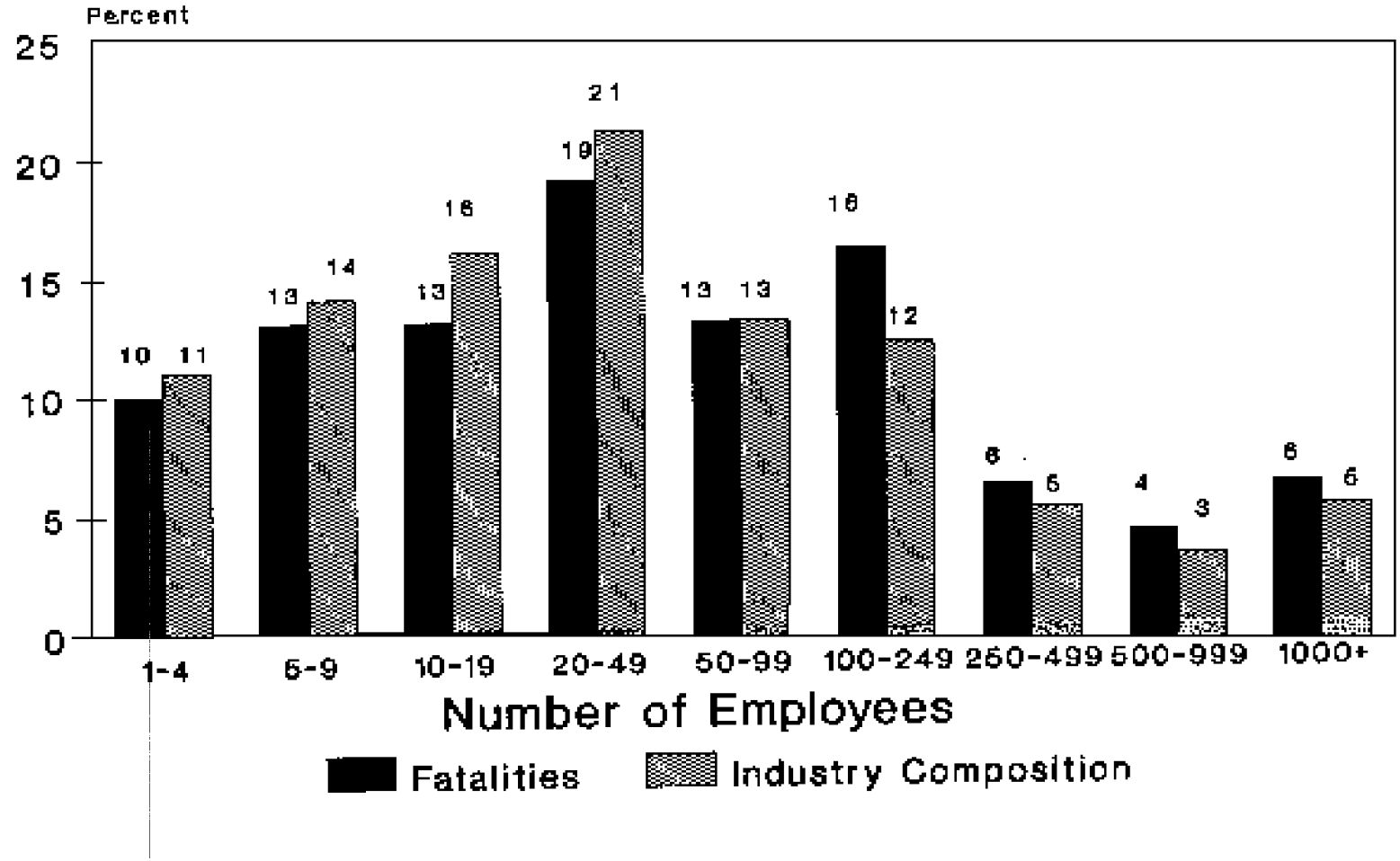


FIGURE 3.4.1
CAUSES OF FATALITIES

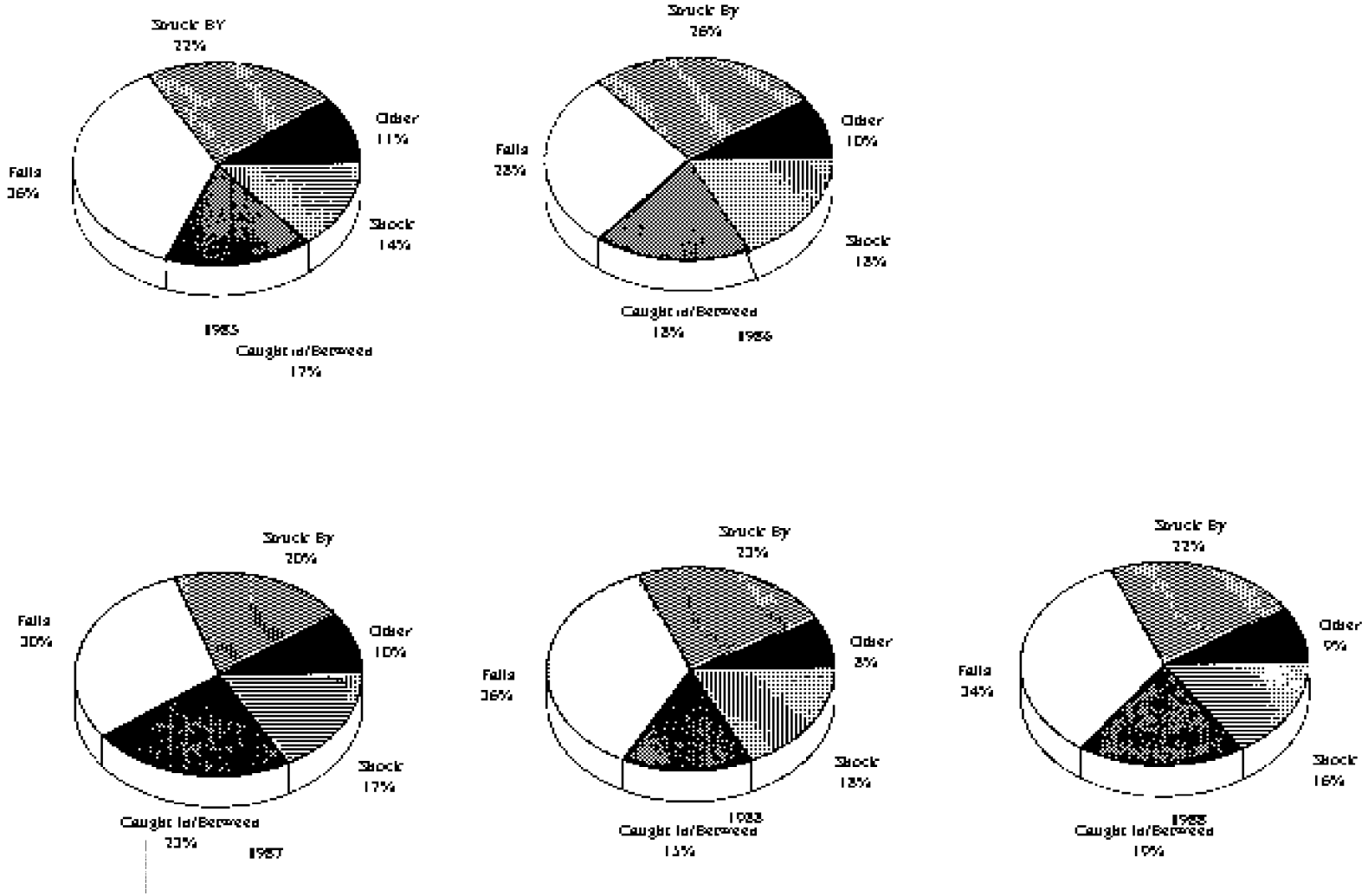


FIGURE 3.4.2
ANALYSIS OF FATALITIES
CAUSED BY FALLS

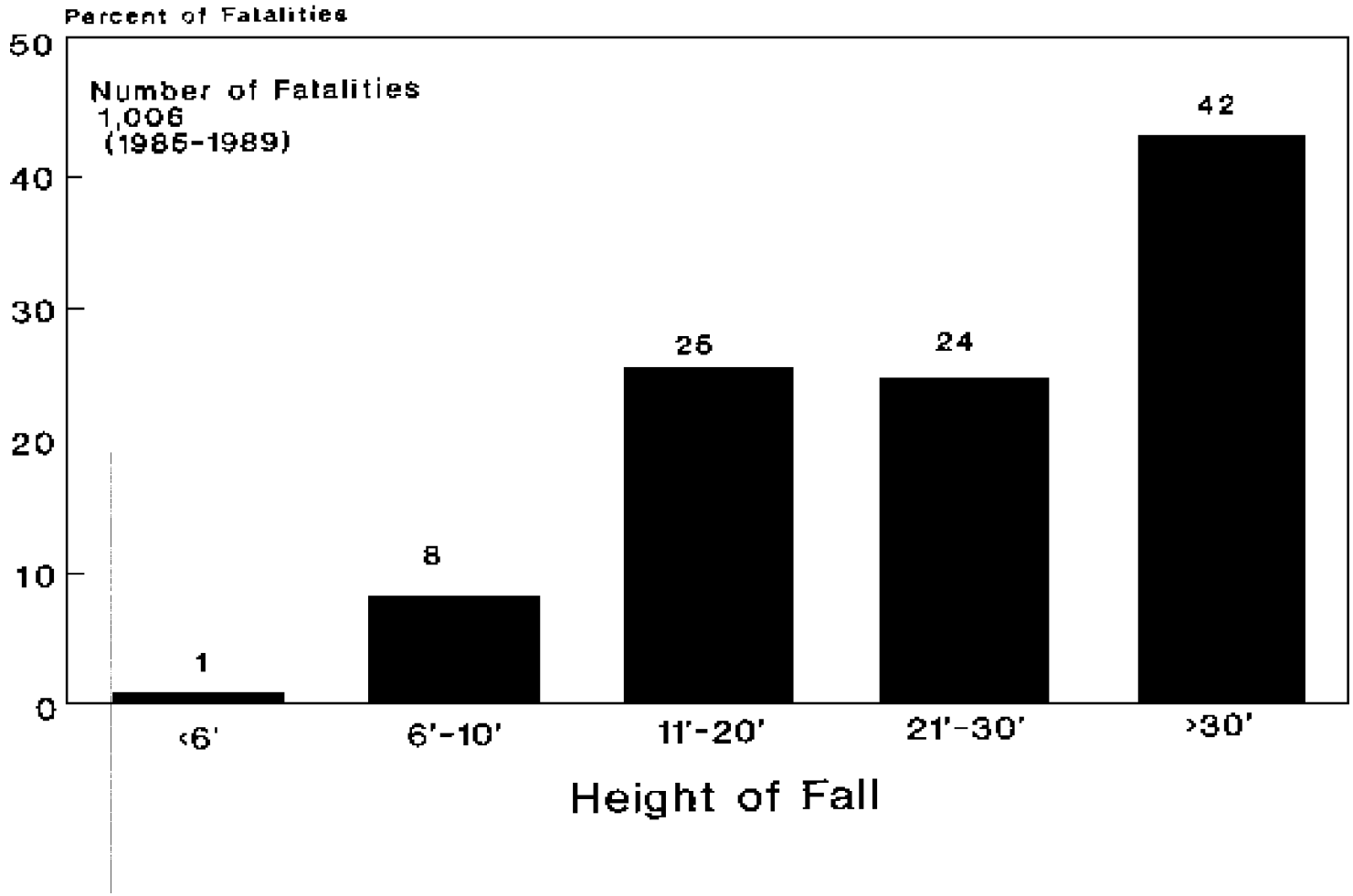


FIGURE 3.4.3
ANALYSIS OF FATALITIES CAUSED BY STRUCK BY

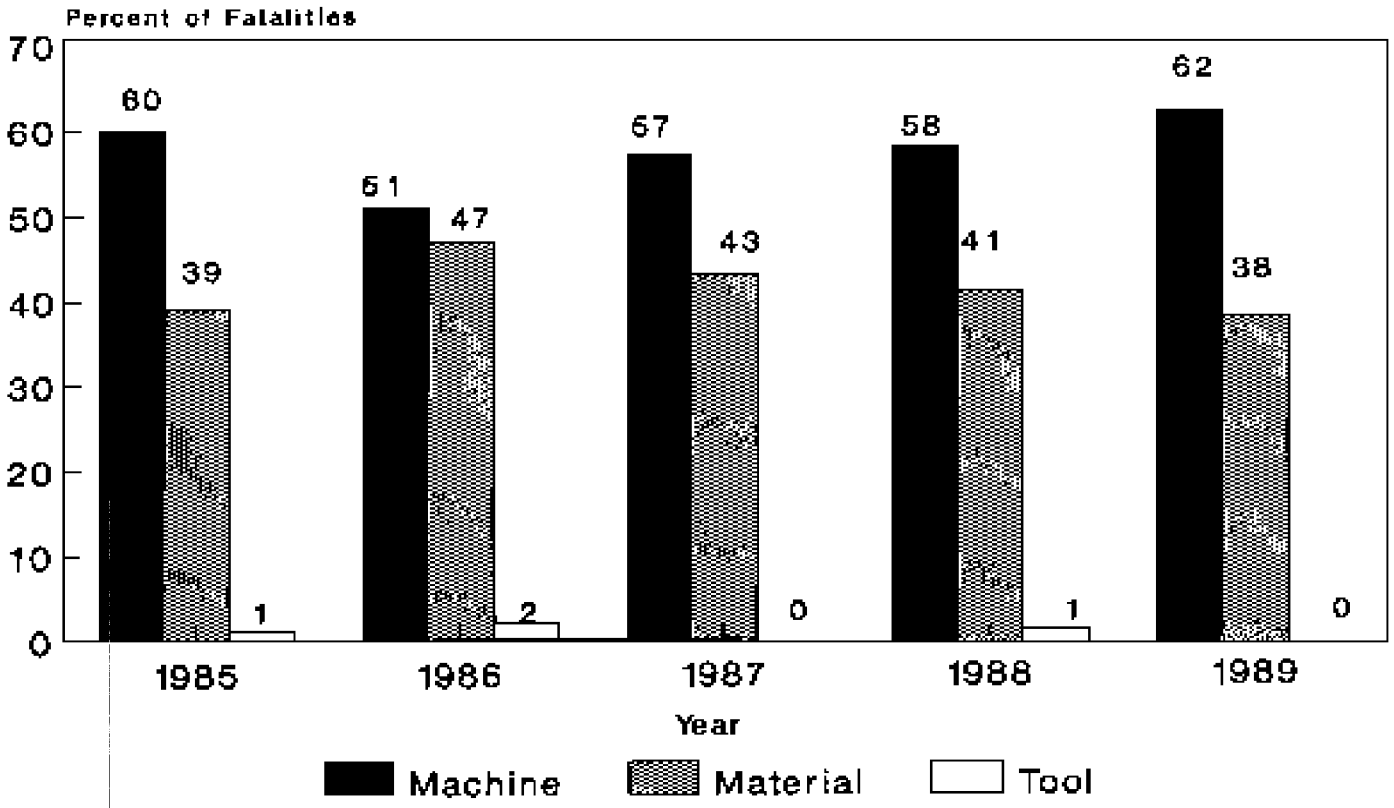


FIGURE 3.4.4
ANALYSIS OF FATALITIES CAUSED BY CAUGHT IN/BETWEEN

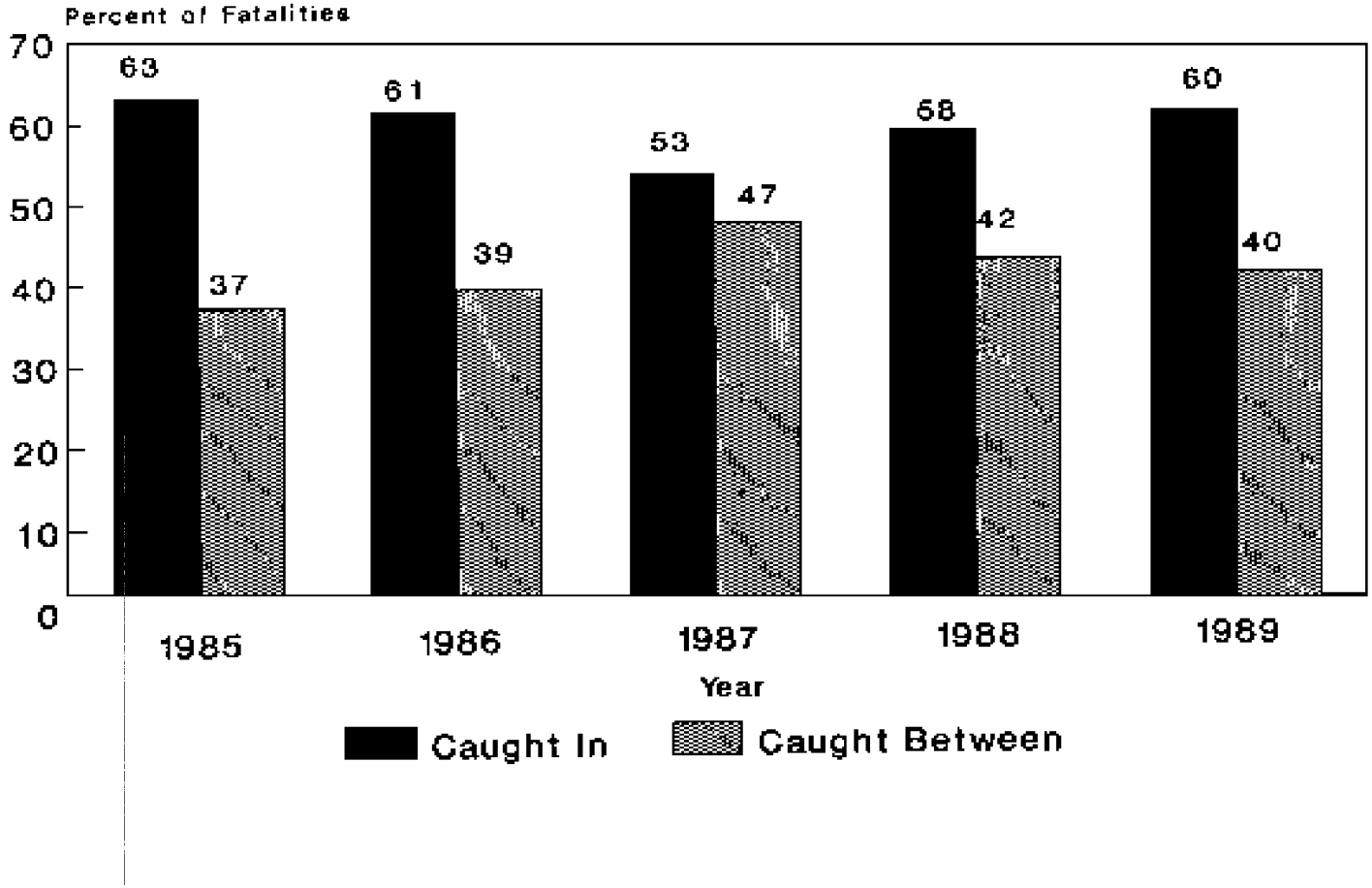


FIGURE 3.4.5
ANALYSIS OF TRENCHING FATALITIES

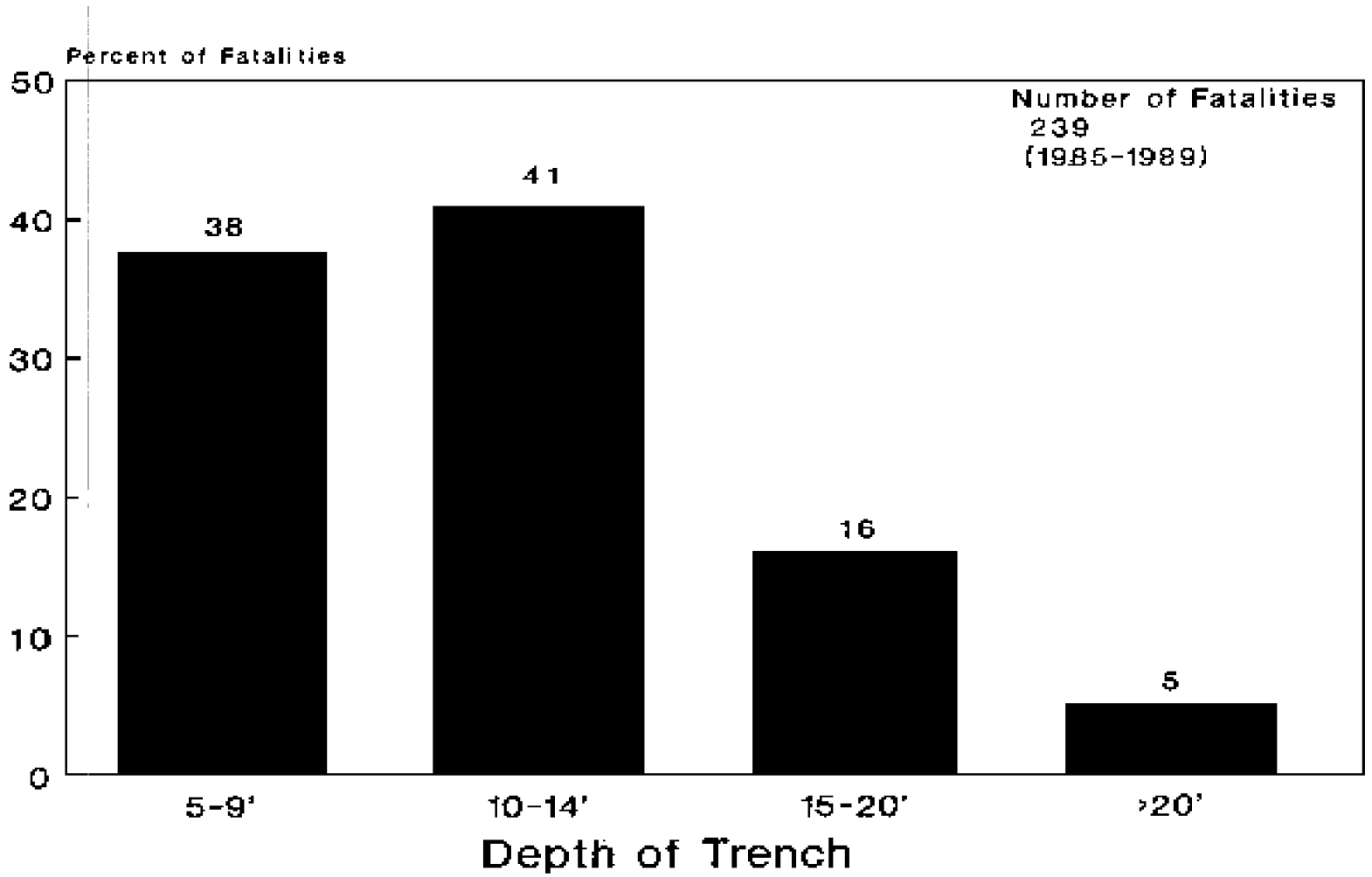
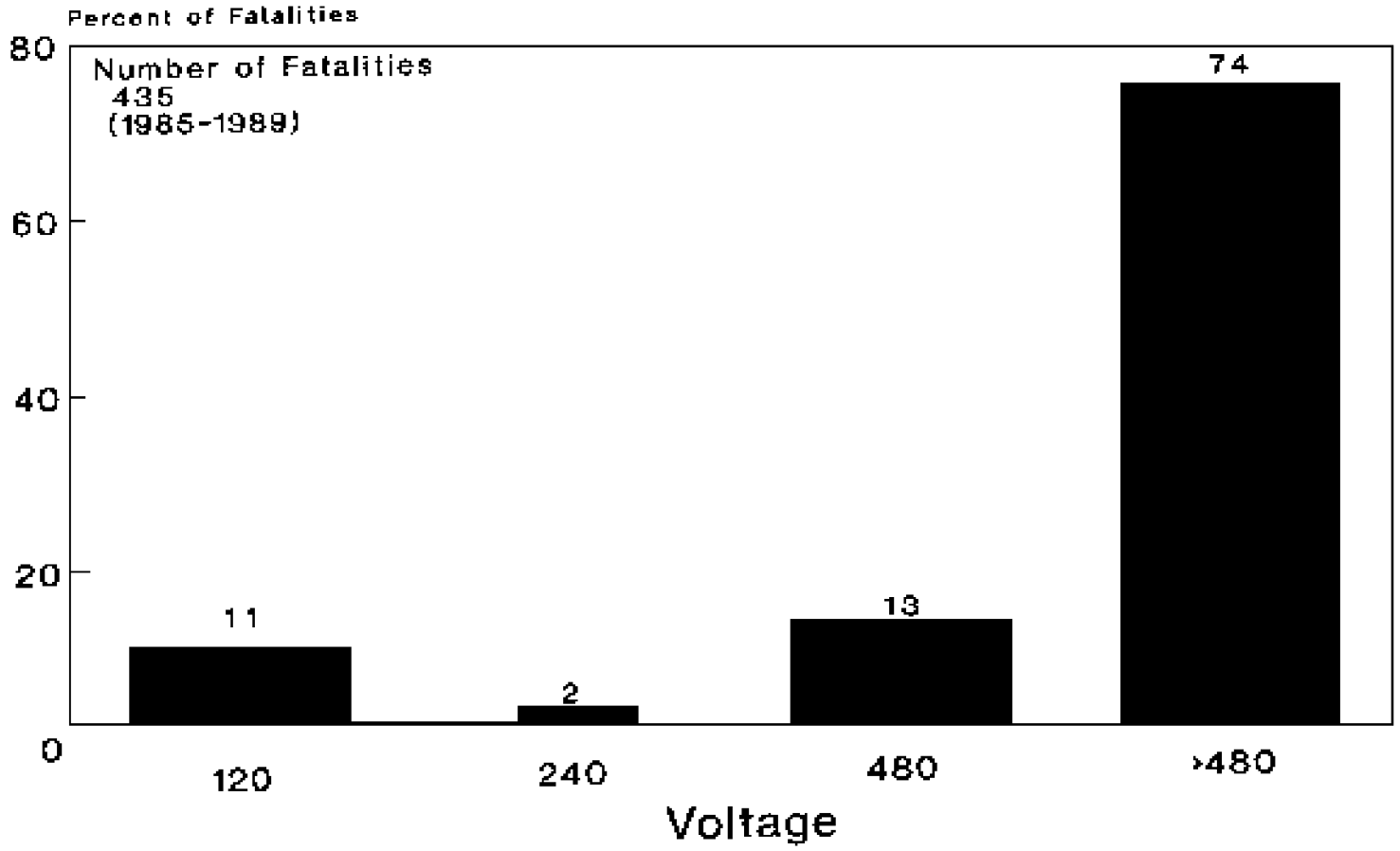


FIGURE 3.4.6
ANALYSIS OF FATALITIES
CAUSED BY SHOCK



BLANK PAGE IN REPORT -- NO PAGE NUMBER

CHAPTER 4

COMPARISON OF DATA BASES

4.1 Introduction

Numerous estimates of occupational fatalities have been published over the years. In some cases, the methodology and source of the data used to develop the estimate have been documented; in other cases, this has not been done. For the purposes of this report, results obtained from the OSHA data base will be compared with results from the following organizations: (1) Bureau of Labor Statistics, (2) National Safety Council and (3) National Institute for Occupational Safety and Health. These three organizations are generally recognized sources of information on occupational illness and injury data.

4.2 Data and Data Collection Procedures

A detailed description of the methodology used by each of the organizations is presented in the Appendices. Additional published information on these data bases is available (7 through 15). Table 4.2.1 provides a comparison of the key elements of the three methodologies with those used for the OSHA data base. Different data collection procedures are used by the various organizations. OSHA relies primarily on employer reporting or coverage by the news media to initiate a fatality investigation. The Bureau of Labor Statistics also relies on information from the employer but collects the data through a questionnaire. Both the National Safety Council and the National Institute for Occupational Safety and Health rely on death certificate data.

Each of these data collection procedures has shortcomings. Underreporting of fatalities by the firms with fatalities is a possibility for the OSHA and BLS methods, data accuracy and the ability to identify the appropriate death certificates are potential problems for the NSC and NIOSH surveys. BLS obtains a response rate for their survey of approximately 95 percent. In the NIOSH study, workers whose industry of employment was unknown or unclassiflable amounted to 13 percent of all the workers killed. Some portion of these were undoubtedly construction fatalities.

The population, limitations and exclusions, for each methodology are given in Table 4.2.1 and must be recognized in any comparison of results. OSHA includes primarily private sector fatalities. The NSC and NIOSH populations include both the public and private sectors, whereas the BLS covers only the private sector. BLS includes only firms with 11 employees or more. OSHA does investigate fatalities for firms with fewer than 11 employees. The size of the firm in which the fatality occurs is not a limitation in the NSC or NIOSH methods. The BLS includes occupational deaths caused by heart attacks, the other three organizations do not. OSHA normally does not include deaths involving over the road vehicles and the other three organizations do include them. Also, the OSHA-170 form is completed at the time of the inspection and the IMIS record is not updated if an injury later becomes a death. The BLS data for construction indicate that fatalities involving highway vehicles account for between 12 to 17 percent of the total construction fatalities and heart attacks about 8 percent (7,8,9,10).

4.3. Results

A summary of the construction fatality statistics from the OSHA, BLS, NSC and NIOSH data bases is presented in Table 4.3.1. These values were obtained from published data (7-10, 11, 14) and direct contact with staff from each organization. The NIOSH data covers only the periods 1980 to 1985, the OSHA data covers the period 1985 to 1989, the BLS data 1980 to 1988 and the NSC data 1980 to 1989.

For the period 1980 to 1985, the number of construction fatalities reported by BLS and NIOSH each year differ by about 20 percent. It is important to note that the methods used to collect the NIOSH and BLS data are distinctly different. The National Institute for Occupational Safety and Health used a total count from death certificates. The Bureau of Labor Statistics obtained data from employers using a questionnaire sent to a random sample of employers and estimated the total count. The NIOSH values are higher than the BLS values. This is possibly due to the fact that the NIOSH data includes both public and private sector fatalities whereas BLS includes only private sector fatalities and NIOSH includes fatalities from firms with less than 11 employees.

The values reported by the NSC are over two and one-half times the values reported by NIOSH for the period 1980 to 1985 and the values reported by BLS for the period 1980 to 1988. Both NSC and NIOSH use death certificates. NSC uses death certificates from the National Center for Health Statistics (NCHS). Since the NCHS data does not include information on the injury at work item on the death certificate, NSC uses an estimation procedure described in Appendix C to obtain their values. The National Institute for Occupational Safety and Health, on the other hand, uses death certificates including an indication of injury at work item provided by the state vital statistics agencies. Although there may be some "error" by these state agencies in classifying deaths by industry, it does not seem reasonable that the NIOSH data underestimates construction fatalities by over 200 percent.

The OSHA fatality data in Table 4.3.1 are somewhat lower than the BLS data but, nevertheless, comparable in magnitude. One reason for these lower totals is due to the general exclusion of highway vehicle fatalities by OSHA. Using the percentage of total construction fatalities due to highway vehicles reported by BLS (17% - 1985, 12% - 1986, 16% - 1987, 17% - 1988) gives the following number of fatalities due to highway vehicles: 166 - 1985, 92 -1986, 126 - 1987, 139-1988. Adding these to the OSHA figures gives the following totals and percent difference from the BLS totals:

	Number of OSHA Fatalities (adjusted)	Percent Difference from BLS Values
1985	895	- 8.7%
1986	752	- 2.3%
1987	850	+ 7.6%
1988	859	+ 3.6%

The percent differences are small.

The difference between the number of fatalities reported by OSHA and those from the NSC are comparable to those between NSC and NIOSH and BLS. It is unlikely that this difference of approximately 250 percent is due to underreporting of fatalities to OSHA.

In summary the NIOSH, BLS and OSHA data on the number of fatalities are comparable. These data indicate that for 1988, approximately 800 construction workers lost their lives due to work-related accidents. The number of fatalities reported by the NSC is over 250 percent higher at 2,200 construction fatalities for 1988.

The Bureau of Labor Statistics also provides data on the causes of construction accidents. Data for the period 1985 to 1988 are presented in Table 4.3.2. Similar data for the OSHA data base was presented in Table 3.4.1. Note that the categories used for the causes of fatalities by BLS are somewhat different than those used for the OSHA data in this report. There are some significant differences between the two data bases. The percentage of fatalities due to falls in the BLS data is approximately one-half of that according to the OSHA data. Results for the caught in/between category for the two data bases are comparable. Combining the BLS percentages for the industrial vehicles or equipment and the struck by objects other than vehicles or equipment gives results comparable to the struck by category in the OSHA data base.

The distribution of fatalities by age group from the OSHA data base is similar to that obtained by NIOSH in an earlier study (15).

TABLE 4.2.1.

COMPARISON OF METHODOLOGIES

Methodology	Survey Procedure	Population	Limitation	Exclusions	Potential Problems
OSHA	Reported Accidents	Primarily Private Sector	No Limits	Self-employed, Workers Covered by Other Legislation, Personal Illness, Non-Safety-Related Cause, Highway Vehicle Accidents	Reliance on External Reporting
BLS	Random Samples Survey Using Questionnaire	Private Sector	Firms with 11 Employees or More	Under Age 14, Family Members, Self Employed Individuals, Employers Not Regulated by OSHA	Employer Reporting Sample Survey
NSC	Death Certificates from National Center For Health Statistics and State Vital Statistics Reporting Units	Public and Private Sector Self-employed *	No Limits	Heart Attacks, Homicides Suicides	Variation in Collection Methods Within States, Accuracy of Estimation Procedures
NIOSH	Death Certificates From State Vital Statistics Reporting Units	Public and Private Sector Self-employed *	16 Years of Age or Older	Heart Attacks or Other Internal Causes	Data Accuracy, Ability to Identify and Retrieve Appropriate Death Certificates

* Includes nonworkers killed at work sites.

55

TABLE 4.3.1
SUMMARY OF CONSTRUCTION FATALITY STATISTIC

(a) 1980-1985

Number of Fatalities

	1980	1981	1982	1983	1984	1985
National Institute for Occupational Safety and Health	1106	1073	947	926	956	1033
Bureau of Labor Statistics	830	800	720	670	660	980
National Safety Council	2500	2300	2100	2100	2200	2400

(b) 1985-1989

Number of Fatalities

	1985	1986	1987	1988	1989
Occupational Safety and Health Administration	729	660	724	720	663
Bureau of Labor Statistics	980	770	790	820	*
National Safety Council	2400	2300	2100	2200	2100

*Data not yet available.

TABLE 4.3.2

SUMMARY OF CAUSES OF FATALITIES - BUREAU OF LABOR STATISTICS DATA

Percent of Fatalities

Cause	1984-85 Avg.	1985-86 Avg.	1986-87 Avg.	1987-88 Avg.	Average
Highway Vehicles	17	12	16	18	16
Industrial Vehicles or Equipment	16	17	13	11	14
Heart Attacks	8	8	6	9	8
Falls	16	16	17	21	18
Electrocutions	17	16	12	15	15
Caught In, Under, or Between Objects Other Than Vehicles or Equipment	10	17	18	10	14
Aircraft Crashes	2	3	1	1	2
Explosions	2	2	3	3	2
Struck By Objects Other Than Vehicles or Equipment	3	2	4	6	4
Assaults	*	*	*	*	*
Gas Inhalation	3	2	1	2	2
Fires	2	1	2	2	2
Plant Machinery Operations	*	*	1	1	*
Other	4	2	4	2	3

*Between 0.1 and 0.5 percent.

NOTE: Because of rounding, percentages may not add to 100 percent.

CHAPTER 5

CONCLUSIONS

The following conclusions are based on the analysis presented in this report of the 3,496 construction fatalities investigated by OSHA for the period 1985 to 1989:

1. The number of construction fatalities investigated by OSHA each year fluctuates around 700 and there is no general trend with time of this number or the number of fatalities reported to the Agency (Figure 3.3.1).

2. In some cases, there were large changes in the number of fatalities from year to year in the various OSHA regions. The trend in the number of fatalities in Region VI was continually downward, decreasing by 47 percent from 1985 to 1989. There was no apparent trend in the number of fatalities over time for the other OSHA regions (Table 3.3.1).

3. The general trend in fatality rates (number of fatalities per 100,000 workers) for the fatalities investigated by OSHA is downward. Region II has the lowest average fatality rate, Region VI has the highest for the period 1985 to 1989 (Table 3.3.2).

4. There is no significant difference in the number of fatalities for the various days of the normal 5-day work week. The percentage of fatalities occurring on the weekend reflect the reduced hours worked during this period (Figure 3.3.3).

5. Special trade contractors (SIC 17) account for 53 percent of the total construction fatalities; heavy construction other than building construction (SIC 16) accounts for 34 percent and building construction (SIC 15) 13 percent (Figure 3.3.4).

6. The percentage of fatalities in various age groups is within 2 percent of the percentage of the workforce population in that age group; older workers or younger workers do not experience a disproportionate share of construction fatalities (Figure 3.3.5).

7. The distribution of fatalities among union and nonunion worksites is similar to the composition of the construction workforce in terms of numbers of union and nonunion workers (Figure 3.3.6).

8. The percentage of fatalities for various size construction firms, as defined by the number of employees employed by the firm, is similar to the representation of the construction workforce in terms of firm size (Figure 3.3.8).

9. Falls from elevation represent the largest cause, 33 percent, of all construction fatalities. Struck by, caught in/between and electrical shock represent 22 percent, 18 percent and 17 percent, respectively (Table 3.4.1).

10. The relationship among the causes of fatalities for the State-Plan states is similar to that for the Federal OSHA states (Table 3.4.1).

11. The relative contribution, of the four major causes (falls from elevation, struck by, caught in/between, electrical shock) to the total number of fatalities does not vary significantly over the 5-year period, i.e., the same types of fatal accidents are continuing to occur with the same relative frequency (Table 3.4.2, Figure 3.4.1).

12. The percent of fatalities associated with each of the four major causes of fatalities varies amon the OSHA regions (Table 3.4.3).

13. The causes of fatalities are related to construction activity. Fatalities due to falls, for example, occur most frequently among special trade contractors, whereas, caught in/between fatalities occur most frequently in heavy construction (Table 3.4.4).

14. There does not appear to be a correlation between the age of the worker and the causes of fatalities. The distribution of each of the major causes of fatalities among various age groups is similar to the age distribution of the construction workforce (Table 3.4.5).

15. Roofs and scaffolds are the major locations of fatalities due to falls from elevation (Table 3.4.6).

16. Approximately 40 percent of the fatalities due to falls from elevation involved falls of greater than 30 feet. Twenty-five percent of the fatalities occurred from falls between 11 and 20 feet and a similar percentage from 21 to 30 feet (Figure 3.4.2).

17. Approximately 75 percent of the fatalities due to being struck by a machine involve heavy construction equipment such as trucks, cranes, graders, or scrapers. Many of the fatalities caused by struck by material involve poor rigging of loads being moved or poor storage of materials (Figure 3.4.3).

18. Seventy-nine percent of trenching fatalities occur in trenches less than 15 feet deep. Thirty-eight percent of the fatalities occur in trenches less than 10 feet deep (Figure 3.4.5).

19. Seventy-four percent of the fatalities due to electric shock involve electrical sources with voltages exceeding 480 volts (Figure 3.4.6).

20. Sixty-five percent of the fatalities due to electric shock involve contact with overhead power lines (Table 3.4.7).

2l. Fifty-three percent of the fatalities associated with contacting overhead power lines involve construction equipment (Table 3.4.8).

22. The National Institute for Occupational Safety and Health (NIOSH), the Bureau of Labor Statistics (BLS) and the Occupational Safety and Health Administration (OSHA) data on the number of fatalities occurring each year are comparable. These data indicate that for 1988, approximately 800 construction workers lost their lives due to work-related accidents. The number of fatalities reported by the National Safety Council is over 250 percent higher at 2,200 construction fatalities for 1988 (Section 4.3).

BLANK PAGE IN REPORT -- NO PAGE NUMBER

CHAPTER 6

ACKNOWLEDGEMENTS

Staff from the OSHA National Office provided assistance in the preparation of this report. John Katalinas, Bruce Beveridge, Dorothy Hankinson and Jerry Bigsby, of the Office of Management Data Systems provided the information from the IMIS data base. Dr. Joseph DuBois from the Office of Data Analysis assisted in creating the data base for the analysis in this report, including extracting information from the IMIS data base, formatting the data and inputting into the computer. Mason Ferratt and Margaret Buckley, two summer interns with the Office of Construction and Engineering spent a considerable amount of time extracting information from the abstracts on the OSHA 170 form.

The following staff from other Federal agencies contributed to the report:

Dr. Nancy Stout from the National Institute for Occupational Safety and Health (NIOSH), Division Safety Reserch, Surveillance and Field Inventory Branch, Injury Surveillance Section, provided an explanation of NIOSH's National Traumatic Occupational Fatality Project. She also made available background information on fatality statistics, and NIOSH's method of collecting data described in Appendix D.

Jeffrey Maurer from the National Center for Health Statistics (NCHS), Division of Vital Statistics, Mortality Statistics Branch, described how information is collected by NCHS.

Ethel Cherry Jackson, Chief, Bureau of Labor Statistics, Office of Safety, Health and Working Conditions, Branch of the Annual Survey, provided information on the BLS Annual Survey and supplied excellent sources for statistical information.

John Osborne, with the Bureau of Labor Statistics, Division of Monthly Industry Employment Statistics, State and Average Branch, provided a detailed break down by state, of the construction workers in the United States.

John Stinson, Bureau of Labor Statistics, Office of Employment and Unemployment Statistics, Branch of Data User's and Publication Services Group provided age group distribution charts for the construction workforce.

Alan F. Hoskin and Steve R. Landas, statisticians with the National Safety Council, provided background information and described the Council's methods of tabulating work fatalities presented in Appendix C.

Charity Lancaster and Beverly Kephart, with the Office of Construction and Engineering, typed the report and prepared the computer graphics.

CHAPTER 7

REFERENCES

1 U.S. Department of Labor. Occupational Safety and Health Administration. Field Operations Manual. CPL2.45B. Washington, DC, June 15, 1989.

2. U. S. Department of Labor. Occupational Safety and Health Administration. Directorate of Administrative Programs. Office of Management Data Systems. Integrated Management Information Systems Forms Manual , Washington, DC, December 29, 1989.

3. Alan, Simpson. Understanding DBase IV . Alameda, CA, SYBEX, Inc., 1989.

4. Executive Office of The President. Office of Management and Budget. Standard Industrial Classification Manual . Washington, DC, U.S. Govemment Printing Office, 1987.

5. U.S. Department of Labor. Bureau of Labor Statistics. Employment and Earnings, vol. 37, no. 1. Washington, DC, January 1990.

6. Anthony Suruda, Gordon Smith, Susan Baker. "Deaths from Trench Cave-ins in the Construction Industry." Journal of Occupational Medicine, vol. 30, no.7, pp. 552-55, July 1988.

7. U.S. Department of Labor. Bureau of Labor Statistics. Occupational Injuries and Illnesses in the United States by Industry, 1985 . Bulletin 2278. Washington, DC, May 1987.

8. U.S. Department of Labor. Bureau of Labor Statistics. Occupational Injuries and Illnesses in the United States by Industry, 1986 . Bulletin 2328. Washington, DC, May 1988.

9. U.S. Department of Labor. Bureau of Labor Statistics. Occupational Injuries and Illnesses in the United States by Industry, 1987. Bulletin 2328. Washington, DC, May 1989.

10. U.S. Department of Labor. Bureau of Labor Statistics. Occupational Injuries and Illnesses in the United States by Industry. 1988 . Bulletin 2366. Washington, DC, August 1990.

11. National Safety Council. Accident Facts - 1989 Edition . Chicago, IL, 1989.

12. National Safety Council. Standard Reporting System for Accidental Deaths. Bulletin T-072-78. Chicago, IL, 1978.

13. National Safety Council. Estimating Procedures for Motor Vehicle, Work, Home, and Public Deaths and Death Rates . Chicago, IL 1982.

14. U.S. Department of Health and Human Services. Public Health Service. Center for Disease Control. National Institute for Occupational Safety and Health. National Traumatic Occupational Fatalities: 1980-1986 . Morgantown, WV, March 1989.

15. Catherine A. Bell, Nancy A. Stout, Thomas R. Stout, Caros S. Conroy, William E. Crouse, John R. Myers. "Fatal Occupational Injuries in the United States, 1980 through 1985." Journal of American Medical Association, vol. 263, no. 22, pp. 3047-3050, June 13, 1990.

16. U.S. Department of Commerce, Bureau of the Census, County Business Patterns 1985. CP-85-1. Washington, DC, November 1987.

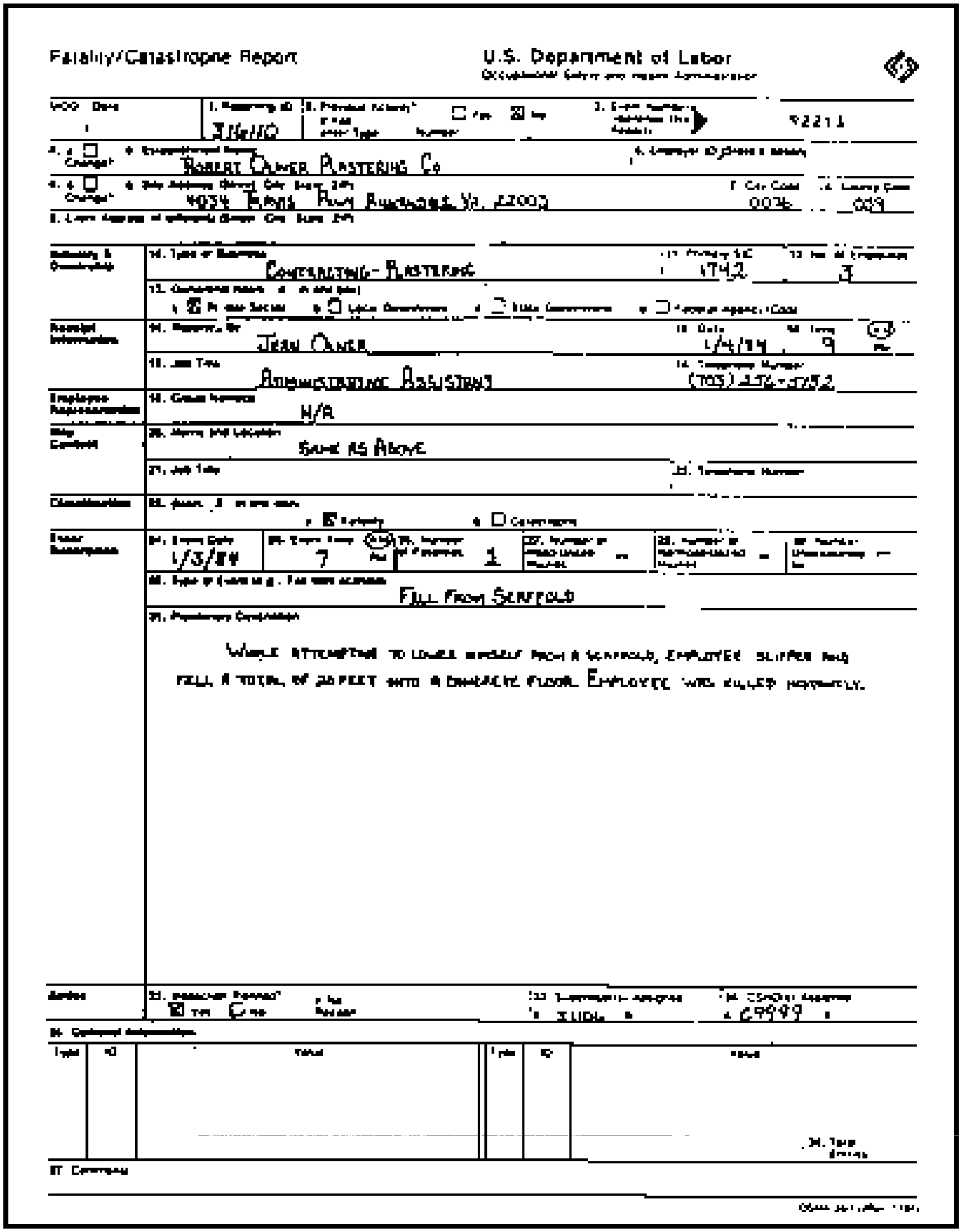
17. U.S. Department of Commerce, Bureau of the Census, County Business Patterns 1986. CP-86-1. Washington, DC, October 1988.

18. U.S. Department of Commerce, Bureau of the Census, County Business Patterns 1987. CP-87-01. Washington, DC, February 1990.

APPENDIX A

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION DATA COLLECTION FORMS

Fatality/Catastrophe Report, OSHA-36(F) Form


Fatality/Catastrophe Report

U.S. Department of Labor

92211

Robert Owner Plastering Co

Contracting - Plastering

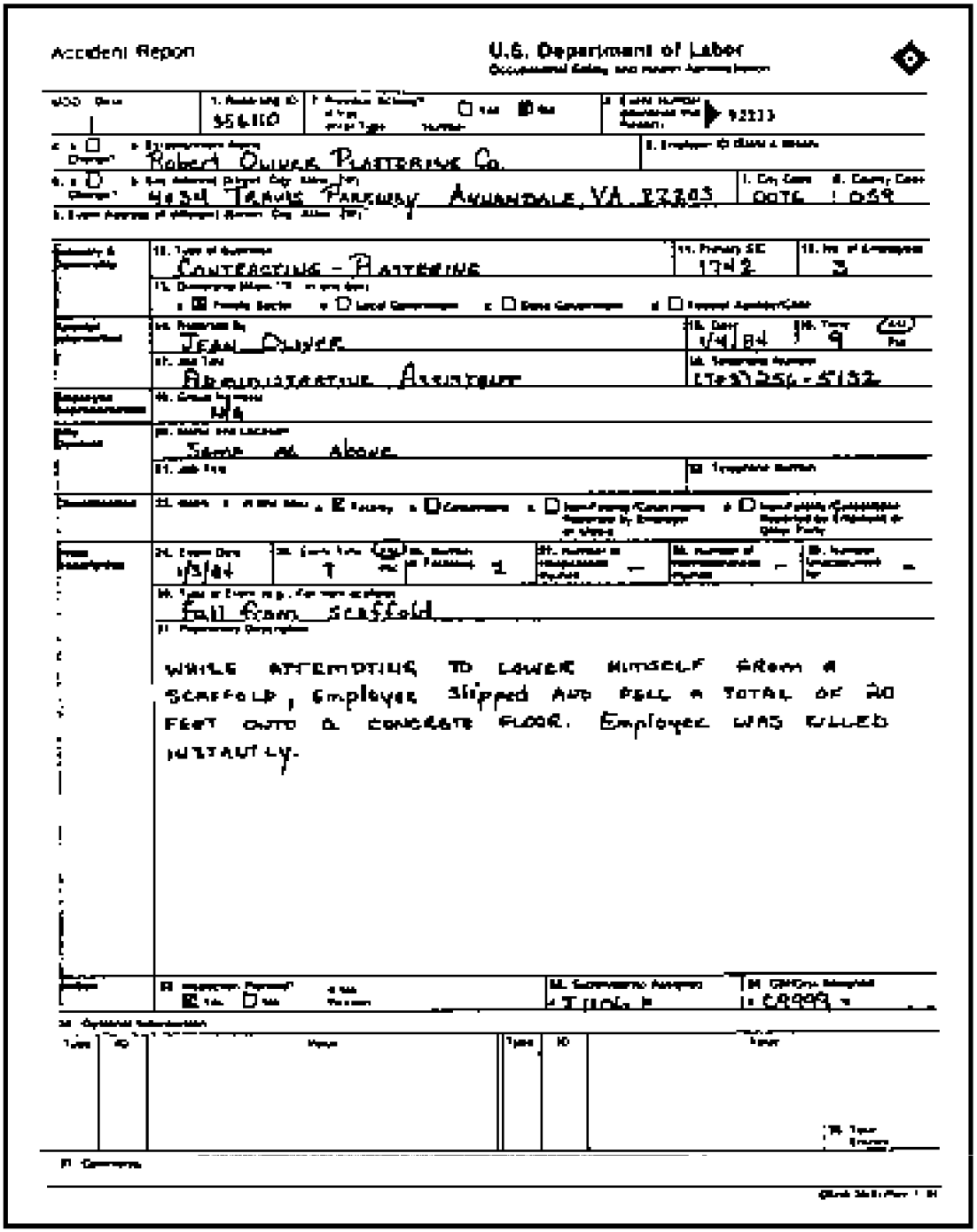
N/A

Same as Above

1/3/ 7 1

Fall From Scaffold

Accident Report, OSHA-36(S) Form



Accident Report

U.S. Department of Labor

956110

92113

Robert Oliver Plastering Co.

4434 Travis Parkway Annandale, VA 22303

0076 | 059

Contracting - Plastering

1742

3

Jean Oliver

1/4/84 9 AM

Administrative Assistant

(703) 256-5132

N/A

Same as Above

1/3/84 1 1

Fall from Scaffold

WHILE ATTEMPTING TO LOWER HIMSELF FROM A SCAFFOLD, Employee slipped and fell a total of 20 feet onto a concrete floor. Employee was killed instantly.

C0999

Inspection Report, OSHA-1 Form (ADD)

Inspection Report

U.S. Department of Labor

ASSIGNMENT NBR

1. Reporting ID: 317700
2. OSHO ID: A1234

107970915

Closed

C1 43901

Establishment Name: Zone Foundry Company

Site Address: 2812 Post Rd. Allentown, PA 18106

Mailing Address: P.O. Box 596 Allentown, PA 18106

City Code: 0110

County Code: 077

Telephone Number: (212) 555-1717

Opening Conference Date: 10-24-89

Primary SIC: 3361

Number of Employees: 520 | 250 | 320

Year: 1988

LWDI Rate: 8.6

(1)	(2)	(3)	(4)	(5)	(6)	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(9)	(10)	(11)	(12)	(13)
0	21	20	83	5	34	0	0	0	0	0	0	0	0	0	0	0	0	0

Number of Days: 3

Type | ID | Value

3 | 1 | C.

DT CLOSED

Closing Conference Date (On Site): 10/27/89

CSHO Signature: John Adams   Date: 10/27/89

CASE FILE COPY

Investigation Summary, OSHA-170 Form (ADD)

Investigation Summary — U.S. Department of Labor, Occupational Safety and Health Administration

1. [illegible]	714790	Summary Number: 1354
Number: 91358		Total: 1

8. Injured/Deceased Person	9.	10. Sex	11. Age	12. Injury	13.	14.	15.	16.	17.	18.	19. Task	20.	21.
1. John Brown	3.1	M	41	X	12	03	12	01	15	14	X		
2. Charles Smith	↓	M	31	X	12	09	12	01	15	14	K		

Type of Event: trench cave-in

Abstract:

On January 18, 1988, at approximately 2:15 pm, employee #1 and #2 were preparing to lay a length of pipe in a trench that was 16 feet long, 6 feet wide, and 9 feet deep. The walls were almost vertical and not shored. Employee #1 had just graded the trench and the employees were getting ready to climb out so that pipe could be lowered. The east bank caved in and both employees were knocked against the west bank and were partially covered with dirt. Employee #1 received a broken right arm and 3 cracked ribs. Employee #2 received a broken jaw, for which he was hospitalized.

Case File Page 10 / of 12

TABLE A-1

SAMPLE FATALITY INVESTIGATION RECORD FROM IMIS SYSTEM

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
FEDERAL FATALITY INSPECTIONS IN THE CONSTRUCTION INDUSTRY -- OCTOBER 1985 - SEPTEMBER 1986
10/01/85 THROUGH 09/30/86

PAGE:

ABLISHMENT INSPECTED — REPORT ID / ACTIVITY# / CSHO / SIC1/SIC2 / SUMHRS
RESS — OPEN DATE / INSP TYPE / CATEGORY / #REMITTED / EMPESTAB
Y STATE ZIP — CLOSECONF / OPT REPT# / SCOPE / OWNERSHIP / EMPINSP / LWDI
NTY (NAME/CODE) — CASE CLSD / PREV ACT / UNION / CLASS / EMPCNTRL
RELTD ACT

STANDARD	CITATION TYP	IDENT	R E C	ISSUANCE DATE	ABATE DATE	ABT CMP CDE	INITIAL PENALTY	CURRENT PENALTY	CURRENT F-T-A PENALTY	C M T	SETTLM'T DISPOS'N	HAZC SUBS CODE
XXXXXXXXXXXXXXXXXXXXXXXXXX												
	D111400	101832244		04651-C	1742		46.0					
	3/04/86	UN-FATCAT		SAFETY	160		5					
	3/07/86	625		PARTIAL	PRIV SEC		5					
	6/23/86	I9I0192011 A360665665 R90D825266		UNION	SPG-CONST		25	(PENALTIES PAID)				
1926.100 A		S 01001A	A	3/31/86	4/01/86		180	180	0			
1926.451 A04		S 01001B	A	3/31/86	4/01/86		0	0	0			
1926.451 E38		S 01001C	A	3/31/86	4/01/86		0	0	0			
1926.400 M31		O 020D1	A	5/31/86	4/01/86		0	0	0			

XXXX ACCIDENT DATA XXXX

UMMARY # 14265276 DATE: 3-03-86 KEYWDS: DESCRIP: FALL FROM MOBILE BAKER SCAFFOLD
BSTRACT: EMPLOYEE #1 WAS WORKING ON A 6 BAKER SCAFFOLD INSTALLING FIBER GLASS CEILING TILES OVERHEAD. EMPLOYEE #1 PLACED HI-HAKEI SCREWGUN ON TWO PIPES THAT WERE APPROX. EYE LEVEL WITH EMPLOYEE. EMPLOYEE STEPPED ON CORD PULLING DRILL ONTO EMPLOYEE #1 HEAD AND CAUSING EMPLOYEE TO STAGGER, EMPLOYEE #1 FALL AGAINST WALL (WHICH WAS AT HIS BACK) CAUSING EMPLOYEE #1 TO PUSH MOBILE SCAFFOLD AWAY FROM WALL WHICH PROVIDE A FALL HAZARD TO EMPLOYEE. EMPLOYEE LANDED ON HIS HEAD WITH FEET IN THE AIR. SCAFFOLD WHEELS WERE NOT LOCKED AND NO GUARD RAILS WERE INSTALLED. SCAFFOLD HEIGHT TO PLATFORM WAS 6', WIDTH WAS 2' 9", AND LENGTH OF SCAFFOLD WAS 6-31/2'' LONG.
---(ABSTRACT NOT REVIEWED)

VICTIM: 001 AGE: 55 SEX: M
DISPOSITION : FATALITY — EVENT-TYPE : FALL(FROM ELEVATION)
INJ NATURE : FRACTURE — ENVIR FACTOR: OVERHEAD MOVING/FALLING OBJ AC
INJ SOURCE : WORKING SURFACE — HUMAN FACTOR: INSUF/LACK/PROTCV WRK CLTHG/EQUIP
PART-OF-BODY: HEAD — HAZ SUBSTANCE: NO SUBSTANCE IMPLICATED

APPENDIX B

BUREAU OF LABOR STATISTICS METHODOLOGY

The Bureau of Labor Statistics (BLS) is one of the principal data gathering agencies of the Federal government. The Bureau collects, processes, analyzes and disseminates data relating to employment, unemployment and other characteristics of the labor force; prices and family expenditures; wages, other worker compensation, and industrial relations; productivity and technological change; and occupational safety and health. Most of the data are collected in surveys conducted by the Bureau of Census (on a contract basis), or on a cooperative basis with State Agencies.

Information on construction fatalities is collected by BLS as part of their survey of occupational injuries and illnesses conducted in accordance with the provisions of the Occupational Safety and Health Act of 1970. The survey is conducted annually. Due to the length of time required to collect and analyze the data, the annual report published by BLS reflects statistics for the year 2 years prior to publication, i.e., the report issued in 1990 reflects data collected in 1988. Data are collected and tabulated by the Office of Survey Processing in cooperation with the regional offices of BLS and State agencies. BLS collects data from establishments in six states and the District of Columbia; the remaining states collect data from establishments through grants or cooperative agreements with BLS and provide these data to BLS for the calculation of National estimates.

The survey uses a sampling procedure. Approximately 5 million establishments are included in the sampling frame for the survey. Because the survey is a Federal-State cooperative program and the data must meet the needs of participating State agencies, an independent sample is selected for each State. The sample is selected to represent all private industries in the States and Territories. National estimates are obtained from these samples using a weighting procedure. The influence of sampling errors are considered and the reliability of the survey estimates are presented with the BLS data. The Standard Industrial Classiflcation (SIC) code is used to stratify the establishments for the survey. SIC 15-17 are used for

construction and the survey sample is designed to produce data at the 3-digit SIC level. The 1988 survey sample was composed of approximately, 280,000 sample units (establishments, companies) of which 47,000 were from the construction industry.

Data for fatalities represent all private employers having 11 employees or more, except private households. Excluded from the survey are self employed individuals; farmers with fewer than 11 employees; employers regulated by other Federal safety and health laws (other than the OSH Act); and Federal, State and local government agencies.

The survey is conducted by mail using the OSHA No. 200S form (7) with instructions for reporting the data. Original and followup mailings result in a response rate of approximately 94 percent. For fatalities, the survey form provides for reporting the number of fatality cases and a brief description of the object or event which caused the fatality. Fatalities due to highway vehicles, heart attacks and aircraft crashes are included for the construction industry in addition to those associated with falls, electrocution, industrial vehicles, etc. Fatality incidence rates per 100,000 full-time workers are calculated as:

$$\text{Rate} = (N/EH) \times 200{,}000{,}000$$

where: N = number of fatalities.

E H = total hours worked by all construction employees during the calendar year.

200,000,000 = base for 100,000 full-time equivalent workers (working 40 hours per week, 50 weeks per year).

APPENDIX C

NATIONAL SAFETY COUNCIL METHODOLOGY

The description of the methodology presented in this appendix was developed from National Safety Council (NSC) publications (11, 12) and consultations with staff from the Statistics Department of the NSC.

The NSC has been collecting and disseminating accident data since the early 1920's. Prior to 1965, NSC estimated work-related fatalities using information from death certificates followed by a reconciliation of their annual estimate and distribution of the fatalities among eight major industry divisions with estimates obtained by the Bureau of Labor Statistics (BLS). Since 1965 the NSC no longer reconciles their estimates with BLS. Instead, they update or bring forward for succeeding years the 1964 values of workplace fatalities for each of the eight major industry divisions. The update or incremental change is determined using a procedure involving death certificate data from the National Center for Health Statistics (NCHS), a group within the U.S. Department of Health and Human Services and data from vital statistics reporting units within state governments.

The first step in this updating procedure involves estimating the total number of work-related fatalities from the NCHS data for the year under consideration. The NCHS non motor vehicle accidental deaths must first be broken down into three classes, i.e., 1. home, 2. public, 3. workplace. This breakdown uses a procedure developed from studies performed by the NSC in the 1930's. Although the same equations are still used, the original data giving the rationale is no longer available. The original procedure was updated in 1953 and minor changes were made in 1985. The method is currently under review.

The NSC then adds a percentage of the motor vehicle fatalities to the nonmotor vehicle work fatalities to obtain the total estimated work fatalities for the year. The percentage of the total motor vehicle fatalities attributed to the workplace is based on studies done in 1975 of data from state traffic authorities, state school bus authorities, the Census Bureau, workers' compensation organizations and life insurance groups.

Since the original fatality data obtained from the NCHS is approximately 2 years old, the estimated number of workplace fatalities determined as described

above must be updated to obtain an estimate for the current year. This is done using fatality data for the current and previous years obtained from state government level vital statistics reporting units. The NSC uses data from 25 to 30 state level units assuming the percentage change from the previous year to the current year for these state level units reflects the percentage change for the entire United States. To obtain the workplace fatalities for 1989, for example, the NCHS values plus the estimated motor vehicle fatalities for 1989 are multiplied by the change between the 1987 and 1988 state level data and then by the change in the state level data from 1988 to 1989.

The number of fatalities for the year under consideration for the eight major industry divisions is determined using a similar procedure. The percentage change from the previous year is first determined for each industry division using the data from the 25 to 30 state level units. Again, assuming these changes reflect changes for the entire United States, the NSC fatality data for each industry division for the previous year are then multiplied by the respective changes in the state level values. These eight industry division estimates are then adjusted proportionally so that they add up to the previously calculated total number of workplace fatalities.

The NSC does not include heart attacks, homicides and suicides as workplace fatalities. They do include workers 14 years of age or older if they are gainfully employed including unpaid family members. NSC makes no distinction based on number of employees but since reporting requirements vary from state to state it is not possible to tell which if any states are using a cutoff for reporting such as the BLS cutoff of 11 or more employees. The NSC estimates are published annually in the magazine entitled, Accident Facts.

APPENDIX D

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH METHODOLOGY

The National Institute for Occupational Safety and Health (NIOSH) is conducting a surveillance project dealing with workplace fatalities. The study, referred to as the National Traumatic Occupational Fatality (NTOF) project is being done by the NIOSH Division of Safety Research. The study was designed to gather demographic employment and injury information for all deaths due to injuries at work in the United States.

The NTOF study utilizes information from death certificates. The 52 separate vital statistics reporting units in the United States -- one within each of the state governments, New York City and the District of Columbia submit copies of the death certificates to the NTOF project. Only death certificates for fatalities meeting the following criteria are included: (1) age at death - 16 years or older; (2) an "external" cause of death reported as immediate, underlying or contributory and (3) a positive response to the "injury at work" item on the certificate. Homicides and suicides are included.

Information from death certificates for the 6 year period, 1980 through 1985 have been entered in a NIOSH computer file. Industry and occupation information was coded from the narrative entries on the death certificates using special software developed by NIOSH for the NTOF project. Death certificates that either lacked industry or occupation information or had entries such as "housewife" or "student" and "self-employed" were coded into a "not classified" group. Approximately 13 percent of all the workers killed were unclassifiable due to lack of information on the certificate for industry of employment.

The NTOF project identified about 7,000 workers who die from injuries each year from 1980 through 1985. Construction accounted for approximately 15 percent of these fatalities. Analyses of the data have been presented (14, 15) including mortality trends and the influence of factors such as age, sex and industry group on fatality rates.