Project Level Targeting of Occupational Risk Areas for Construction Workers Using OSHA Accident Investigation Reports

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The occupational health and safety information in the United States are recorded using a standard classification system defined by the government regulations. For over sixty years, the Standard Industrial Classification (SIC) system has served as the structure for the collection and analysis of the occupational health and safety data. In 2004, this system was replaced by the North American Industry Classification System (NAICS) which was developed in cooperation with Canada and Mexico. Although the new classification system includes additional sectors, both code definitions are primarily based on the main industry sectors and the types of activities performed. This approach provides information for identifying the high risk activities; however, it does not present any project level information. The type of the project and related circumstances make a significant difference for the level of risk exposure and severity of the injuries. This paper presents an effort to identify the type of construction projects from the existing SIC/NAICS based occupational safety data using Occupational Safety and Health Administration accident reports. An analysis of the fatal accident reports from 1999 to 2002 coded under "electrical work" (SIC 1731) is included as an illustration case.

Keywords: Construction Safety, Construction Worker Fatalities, OSHA Investigation Reports, Industry Codes

Introduction

Construction industry shares about 4.5% of national total gross domestic product annually, and is considered one of the largest sources of employment in the United States [Lindberg and Monaldo, 2008]. Construction industry also accounts high number of fatalities compared to other industries. Over 16,000 construction workers died from occupational injuries in the United States from years 1992 to 2005, at an average of about 1,142 deaths every year [BLS, 2005]. However, information is limited for details of the fatalities and high risk subsectors within the industry. This is due to the difficulties in assembling data on both fatalities and populations at risk in an industry characterized by a high proportion of small companies and by large turnover in the work force [Dong, Men, and Haile 2005]. In the 2007 Construction Chart Book, lack of detailed industry data is noted as a limitation for researchers in identifying the high risk areas [CPWR, 2007]. In the same report, collection and accessibility of project-level data is noted as a significant need.

The Occupational Safety and Health Administration (OSHA) have been investigating workplace accidents since its inception in 1970. The data from the OSHA investigations and statistics collected by Bureau of Labor Statistics (BLS) are used to establish OSHA's programs and targeting high risk activities and industries. OSHA and BLS use a standard classification system for accident/investigation records and labor statistics defined by the government regulations. For over sixty years, the Standard Industrial Classification (SIC) system has served as the structure for the collection and analysis of the occupational health and safety data. In 2004, SIC was replaced by the North American Industry Classification System (NAICS) which was developed in cooperation with Canada and Mexico.

Although the new classification system includes additional categories, the definitions are primarily based on the main industry sectors and the types of activities performed.

This approach provides detailed information for identifying the high risk activities; however, it does not present any project level information. The type of the project and related circumstances make a significant difference for the level of risk exposure and severity of the injuries. Considering the high number of small companies performing limited type of activities in specific types of construction projects, identification of the high risk activities for each type of project may provide an effective tool. For example, an incident might be classified as "electrical work" under construction industry sector but this classification usually is not detailed enough. There are significant differences in operation and environment between "electrical works" performed in a residential construction setting compared to an industrial construction setting.

This paper presents an effort to identify the type of construction projects from the existing SIC/NAICS based occupational safety data using OSHA accident reports. An analysis of the investigation reports from 1999 to 2002 coded under "electrical work" (SIC 1731) is included as an illustration case.

Classification System and Data Collection

In 2004 NAICS documentation, the construction sector is defined as [BLS, 2007]:

> "The construction sector comprises establishments primarily engaged in the construction of buildings or engineering projects (e.g., highways and utility systems). Establishments primarily engaged in the preparation of sites for new construction and establishments primarily engaged in subdividing land for sale as building sites also are included in this sector.
>
> Construction work done may include new work, additions, alterations, or maintenance and repairs. Activities of these establishments generally are managed at a fixed place of business, but they usually perform construction activities at multiple project sites. Production responsibilities for establishments in this sector are usually specified in (1) contracts with the owners of construction projects (prime contracts) or (2) contracts with other construction establishments (subcontracts)."

NAICS uses a six-digit hierarchical coding system to classify twenty industry sectors including five sectors for goods-producing and fifteen sectors for services-producing. NAICS allows for the identification of 1,170 industries compared to the 1,004 found in the SIC system. Construction sector is classified under NAICS 23600-23899 with three major subsectors: Construction of Buildings, Heavy and Civil Engineering Construction, and Specialty Trade Contractors [BLS, 2007]. In the SIC system, the coding structure was similar. Construction industry was numbered between 1500-1799 and included "CCCC" for construction sectors that couldn't be categorized in any SIC [OMB, 1987].

Although the new NAICS code provides additional subsectors for the coding structure, both coding system are primarily based on the performed activities. For example, if an electrical contractor, whose primary occupational activity is "electrical work", has a recordable incident on the job site, the incident would be recorded under NAICS 238210 (SIC 1731) regardless of the type of the construction project.

Data Collection

OSHA maintains an online database of accident investigations that includes the fatal and non-fatal injuries searchable for specific SIC codes available at http://www.osha.gov/pls/imis/accidentsearch.html. It should be noted here that accident investigation reports are used for fatality statistics (for example Schriver, and Cressler, 2008; Schriver, Cressler, and Beavers, 2007) or detailed analysis of specific hazards (for example Beavers et. al, 2005), however; these studies do not include project level comparison.

The data presented in this paper was collected in May 2005 for SIC 1731 code (electrical work). The search results were filtered for non-fatal accidents and multiple coded accidents between January 1, 1999 and December 31, 2002.

The filtered search resulted in 127 accidents. The detailed accident reports were downloaded for each of the 127 accidents for further analysis. Figure 1 illustrates a sample accident report from the database.

U.S. Department of Labor
Occupational Safety & Health Administration
www.osha.gov
Search | Advanced Search | A-Z Index

Search Results
Accident Report Detail
[Find It! in DOL]

Return to Result Page

Accident: 202317236 - Employee Killed From Fall Off Of Scaffold

Accident: 202317236 -- Report ID: 0420600 -- Event Date: 07/25/2001

Inspection	Open Date	SIC	Establishment Name
304706963	07/30/2001	1731	Merit Electric Company

On July 25, 2001, Employee #1, an electrician, was using a Baker scaffold to wire a junction box located at a height of 16 ft without fall protection. The scaffold was erected at a height of 9.67 ft and did not have guardrails installed on the work platform. While he was working, he lost his balance falling from the scaffold. He hit his head upon the concrete floor causing traumatic head injuries that were fatal.

Keywords: scaffold, guardrail, work platform, lost balance, fall, head

End Use	Proj Type	Proj Cost	Stories	NonBldgHt	Fatality
Commercial building	New project or new addition	$500,000 to $1,000,000	1	16	X

	Inspection	Age	Sex	Degree	Nature	Occupation	Construction
1	304706963	27	M	Fatality	Fracture	Construction laborers	**FallDist**: 10 **FallHt**:10 **Cause**: Fencing, installing lights, signs, etc. **FatCause**: Fall from/with scaffold

Figure 1. Sample Accident Investigation Report

The report illustrated in Figure 1 is for an accident where an employee was killed from fall off of a scaffold. The fatality was reported under SIC 1731 under electrical work and the end use was reported as commercial building. It should be noted that SIC 1731 includes special trade contractors primarily engaged in electrical work at the site. The construction of transmission lines (SIC 1623) and electrical work carried on in repair shops (SIC 762) are not included in this category.

Project Type and Cause of Fatality

The information in the detailed accident reports include the causes of fatality for each incident. Figure 2 shows the number and distribution of the reported causes of fatality in the 127 accident reports.

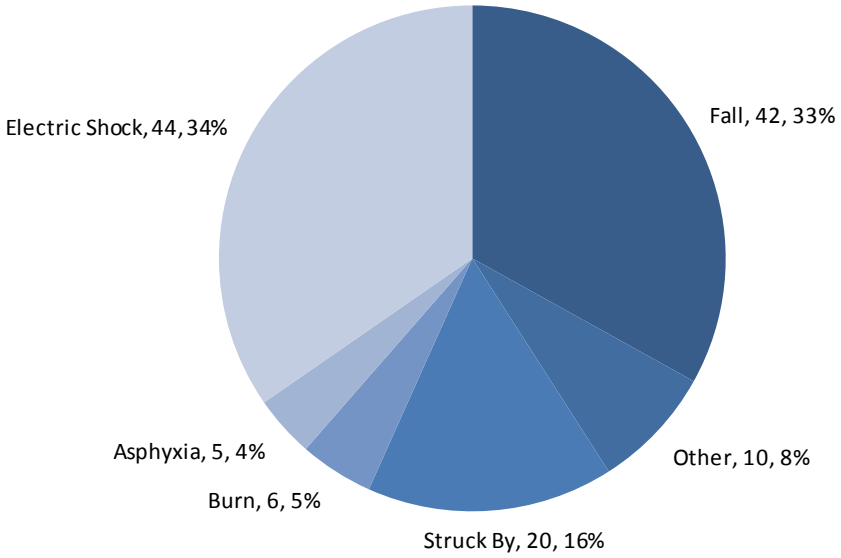

Figure 2. Causes of Fatality for the 127 Accidents Reported under SIC 1731 (1999-2002).

In Figure 2, electrocution has the highest fatality rate of 34% followed by falls with 33% and struck by with 16%. These three are the major causes of fatality during the four year period causing 83% of the fatalities. Without the project level information, it is very likely to identify electrocution, falls and struck by as the primary high risk areas for electrical work. However, when the accident reports are analyzed in detailed, it is possible to identify the project type. Figure 3 shows project types for the 127 fatal accidents reported under SIC 1731.

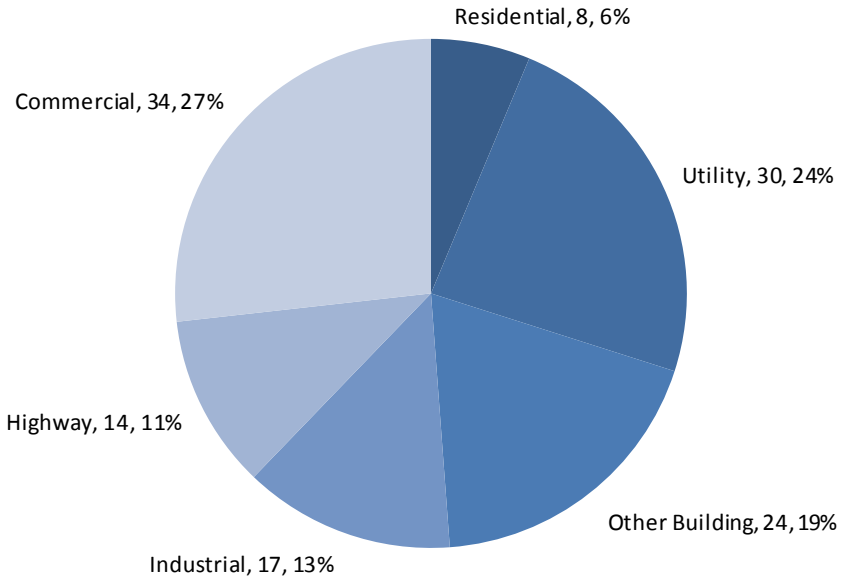

Figure 3. Project Types for the 127 Accidents Reported under SIC 1731 (1999-2002).

In Figure 3, project types are assigned for the recorded fatalities where commercial projects have the highest rate of the incidents with 27% followed by utility projects with 24%. This categorization makes it possible to detail the causes of fatalities at the project level. Figure 4 presents the causes of fatality for the 127 fatal accidents categorized for different project types.

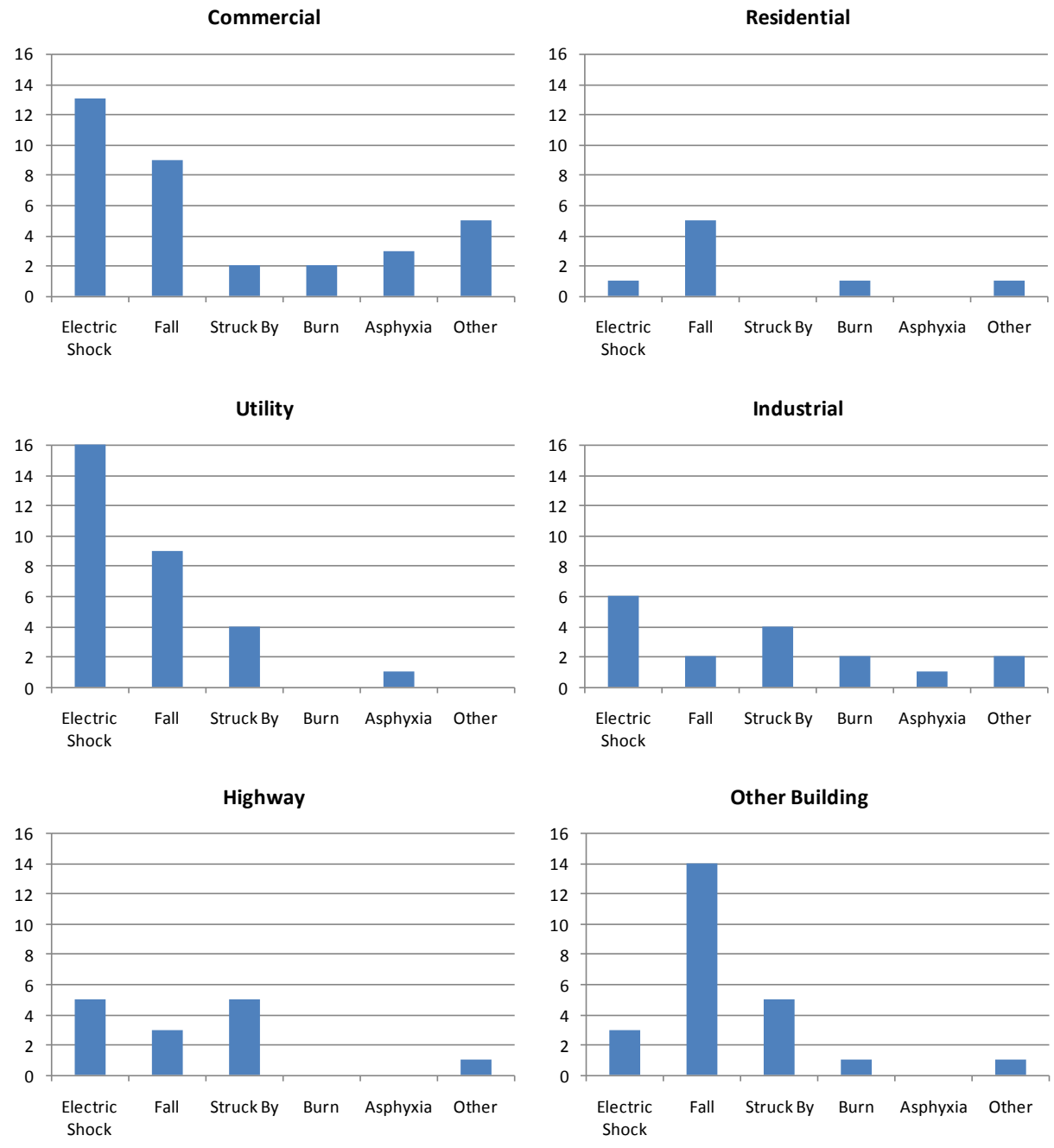

Figure 4. Causes of Fatality of Different Project Types for the 127 Accidents Reported under SIC 1731 (1999-2002).

Figure 4 shows a significant difference for the causes of fatalities at project-level. The highest number for commercial (13 fatalities) and utility projects (16 fatalities) are electric shock while in residential projects the same cause is observed only once. Similarly, asphyxia is recorded as the cause for three fatalities in commercial projects but residential, highway and other building projects did not record any asphyxia cases for the four year period.

These observations can be utilized for targeting the high risk areas for electrical work by considering the project type in the analysis. For example, if the electrical work is performed in a utility project, the safety preparations and procedures should emphasize prevention of electrical shocks, falls and struck by incidents. Similarly, in residential projects the efforts should be primarily targeting the fall incidents.

Conclusions

Construction is among the most dangerous industries in the United States accounting for thousands of fatalities every year. Almost all of the occupational injuries are preventable through measures including strengthened safety regulations, safety training, better planning and engineering controls, awareness and cooperation among industry stakeholders. Such efforts should focus on high-risk areas for construction workers. Project level information may improve the accuracy of these efforts significantly.

The existing systems combined with recorded data provides considerable amount of information on the high risk areas but the project-level detail is not readily available. The classification approach for the project types presented in this paper can be used to address this need resulting in a better understanding of the high risk areas and better concentration of resources. For example, if the high risk areas for a special trade are identified under specific project conditions, the contractor may increase prevention and training efforts in the high risk areas while the designer may explore design modification options to eliminate the risk. Project level trends may also lead to changes in policies and regulations to properly address the high risk areas. The leading causes of injuries and fatalities in the construction are included in construction safety classes at a global scale. Incorporation of project level information may highlight the differences under specific conditions and better prepare the students for the safety challenges of the industry.

Similar project-level analysis can be performed for each NAICS or SIC category for the construction industry sector based on the available reports. In addition to the identification of high risk areas for different project types, this analysis may also produce a series of "best practices" from the project types with low number of incidents. This approach may also be extended towards other industries that have project- type operations including mining and manufacturing.

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