Analysis of Occupational Construction Accidents in North Cyprus

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ABSTRACT

Providing a safe environment in the construction industry is an important criterion which should be followed by all companies in order to reduce the life threatening risks encountered by the employees. Over the past three decades, the field of Occupational Health and Safety (OHS) has become an interesting subject for most of the construction companies. However, this issue has not been strictly addressed in the construction industry of Northern Cyprus. This study thereby aims to identify the effects of variables such as personal, business, material, temporal, and spatial or geographic factors on the occurrence of accidents. Thus, the purpose of this study is to investigate a number of parameters such as the type, time, and place of accidents, as well as the age category of the workers who have been involved in accidents in North Cyprus. In order to identify the mentioned parameters, an analysis was performed using government statistics between the years 2006-2013 and the results were compared to those of other countries. A case study was analyzed in detail and compared to the general outcomes of the country statistics. Finally, some recommendations and guidelines were proposed to the Labor Department and State Planning Organization of North Cyprus for the sake of improving occupational health and safety in the construction industry of Northern Cyprus.

Keywords: Construction industry, North Cyprus, Occupational health and safety.

ÖZ

İnşaat sahasında güvenli bir ortam yaratmak, sektörde çalışan tüm şirketlerin çalışanların yaşamını tehdit eden riskleri minimize etmede en önemli kriterlerden biridir. Otuz yılı aşkın bir süredir, iş güvenliği ve işçi sağlığı disiplini çoğu şirket için son derece ilginç bir konu haline gelmiştir. Ancak bu konu kıbrısın kuzeyinde yeterince gündeme gelmemiştir. Bu nedenle çalışma, bireysel, işle ilgili, malzemeyle alakalı, geçici, mekansal ve coğrafi etkiler gibi değişkenlerin kaza yaşanmasına olan etkilerini tanımlamayı amaçlamaktadır. Dolayısıyla, çalışma kuzey Kıbrista kaza tipi, kaza zamanı, kaza yeri bunun yanında kazazedenin yaş kategorisi gibi birdizi parametreyi incelemeyi hedeflemiştir. Söz konusu parametreleri tanımlarken 2006-2013 yıllaarındaki hükümet istatistikleri analiz edilmiş ve elde edilen veriler farkı ülkelerle karşılaştırılmıştır. Bir örnek durum çalışması tüm detaylarıyla analiz edilerek ülke istatistiklerinin nin genel durumu ile karşılaştırılmıştır. Sonuç olarak, Kuzey Kıbrıs Türk Cumhuriyeti Çalışma Dairesi ve Devlet Planlama Teşkilatına ülkenin inşaat sektöründeki iş güvenliği konusunun iyileştirilmesi amacıyla bir dizi tavsiyeler ve klavuz niteliğinde öneriler sunulmuştur.

Anahtar Kelimeler: İnşaat sektörü, Kuzey Kıbrıs, İş Güvenliği ve İşçi Sağlığı

This thesis is dedicated to my family for their love, endless support, and encouragements.

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LIST OF ABBREVIATIONS

OHS.....Occupational Health and Safety

ILO.....International Labor Organization

CNAE.....National Classification of Economic Activities

LPH.....Lara Park Hotel

PPE.....Personal Protective Equipment

Chapter 1

INTRODUCTION

1.1 Background

The construction industry is one of the most hazardous industries in the world due to its dangerous working conditions. Construction workers are always exposed to great risk of accidents. By increasing the number of construction projects and workers in North Cyprus during the past years, the identification of the factors which can increase the probability of accidents has become a necessity for construction companies.

Construction sector activities were very low prior to 2002 but the rate of construction activities increased gradually between the years of 2002-2004 [1] . After 2004, the rate of building construction was increased drastically which was called ‘explosion of construction sector phenomenon’ [2]. The rate of construction in 2008 was increased by about 338% compared to 2002 [3].

1.2 Research Question

The main question is; what is the condition or situation of occupational accidents in the construction industry of North Cyprus?

How was the rate of accidents affected by the increase in the construction activities sector during the recent decade?

Due to the rising rate of accidents in the construction industry, most of the companies organized and planned some strategies for reducing the causes of the accidents. But the question arises; are companies capable of reducing accidents? And if so, how should they do it?

1.3 Objectives of Study

The occupational health and safety (OHS) is a vital matter in the construction industry and many research studies have been done on it in several countries around the world. Since analyzing the occupational health and safety in construction industry in North Cyprus has only been done in a few researches, the present work aims to readdress this shortage in a more detailed study via statistical investigation. The conduction of this study was performed in the following trend:

- Studying the condition of occupational health and safety in North Cyprus.
- Inspecting the situation of the construction sector in North Cyprus.
- Collecting statistics and information from the Labor Department and State Planning Organization of North Cyprus.
- Comparing the rates of occupational health and safety statistics of North Cyprus to those of other countries.
- Considering a case study in North Cyprus for determining construction health and safety in North Cyprus.
- Analyzing various parameters such as accident types, times and places in addition to ages of workers, types of professions etc.

1.4 Achievement

This study shows the role of the age and experience of workers in accidents, dangerous equipment, the vulnerable body parts, the days of the week with highest chances of accident occurrences, and the necessity of the presence of a doctor at

construction sites as well as some members from the Labor Department to record details of the occupational health and safety. Finally, some recommendations and guidelines were proposed to improve occupational health and safety in the construction industry of North Cyprus.

1.5 Thesis Outline

The current thesis includes 6 chapters. The first chapter describes the basic introduction and discusses the objective and motivation of the study. In the second chapter, a brief and concise review about occupational health and safety will be carried out. In addition, the previous researches about the occupational health and safety in the construction industry in different countries will be reviewed. Chapter 3 presents data about the construction industry and accident statistics in North Cyprus. A complete analysis of the main information is then performed in chapter 4. The fifth chapter contains explanation about the case study to analyze the information about accidents recorded in it during the construction process while the last chapter summarizes the discussions and provides a conclusion to the study along with some recommendations for further studies.

Chapter 2

OCCUPATIONAL SAFETY IN CONSTRUCTION INDUSTRY

2.1 Introduction

Over the last three decades, the field of Occupational Health and Safety (OHS) has become an interesting subject for most of the construction companies. In 1970, by establishing the Occupational Safety and Health Administration (OSHA), it was observed that safety of employees in a workplace is an initial outlook [4].

The stages of construction are briefing, designing, tendering, construction, and commissioning. Some of which can increase the risk of accidents such as inappropriate design of the construction where as others deal with dangerous situations directly. Therefore, it is necessary that all stages should be managed. Fulfilling the health and safety management would be possible when each person involved in the building project carries out his/her job; from client, project supervisor of design process (PSDP), designer, project supervisor of construction stage (PSCS), to contractor and employees.

This chapter will represent major definitions and an overview of the construction industry, occupational safety management, occupational safety management in construction industry, as well as occupational safety and management in the construction industry of North Cyprus.

2.2 Construction Industry

A construction project can be divided into a wide range of activities such as construction alterations and repair which can occur in places involving residential construction, bridge erection, roadway paving, excavations, demolitions, and large scale painting jobs.

Many risks threaten the construction workers on site such as falling from height, unguarded machinery, being struck by heavy construction equipment, electrocution, silica dust, asbestos, and even being buried alive [5].

Based on information provided by the International Labor Organization ILO, at least 60000 fatal accidents occur on construction sites yearly which approximates to one fatal accident every ten minutes over the world [6]. They also estimated:

1. About 16% of fatal occupational accidents occur on construction sites.
2. About 25-40 percent of work fatal deaths in industrialized countries occurred on construction sites, although the sector employs only 6-10 percent of the workforce.
3. In some countries, about 1/3 of the construction workers suffered from back pain or other musculoskeletal disorders [6].

2.3 Occupational Safety Management

Recently, one of the most pressing concerns for the construction industry has become the occupational safety and health because of the increase in accidents and health hazards.

Due to the fact that the construction industry deals with processes leading to many accidents and fatalities, dissatisfaction in occupational safety and health has been found to be an important matter.

2.4 Occupational Safety Management in Construction Industry

Throughout recent decades, many researchers have tried to introduce health and safety in construction sites in their studies. Most of them tried to explain it by defining some main parameters related to the causes of accidents [7-14].

Lopez Arquillos et al. [11] performed a study on finding the causes of construction accidents in Spain with the aim of decreasing the reasons for the incidents to take place. They considered all sector accidents in Spain during the period of 2003 and 2008 based on a total of 1,163,178 accidents. The aim of the study was to identify the effect of different variables such as age, CNAE (National Classification of Economic Activities) code, size of companies, length of service, place of accident, day of the week, number of days of absence, deviation, injury, and climatic zones of the occurred accident on the construction sites. They concluded that the size of the company will not guarantee safety, the experience of the workers had direct relation with the fatal accidents, and that the consequences of the accidents which had occurred away from the usual workplace were more serious. Hadjimanolis and Boustras [12] conducted a study about the determination of the safety implementation in the workplace in Cyprus. A questionnaire was prepared in order to observe the workplace safety policies, employee attitudes, and safety performance. It was answered by ten respondents chosen from different sectors and the results demonstrated that safety performance depended fundamentally on different factors such as safety education, policies, organizational commitment, and the safety

climate. Thereby, firms should establish clear safety policies that include safety training and support. These policies should aim to create a positive safety climate and a risk prevention culture by emphasizing management commitment to safety. Their final conclusion was that by taking the mentioned actions, the organization could provide a good working atmosphere due to the positive impact and improvement of work attitudes.

The description of occupational risk in a building construction project was introduced by Anerziris et al. [15]. They prepared an occupational risk model called ORCA under the workgroup occupational risk model project (WORM) in order to recognize the risk in the workplace. The accidents were categorized into different types such as falls from ladders, scaffold, roofs, falling objects, strikes by moving vehicles, contact with moving parts, etc. The model was prepared for a construction site in Netherlands consisting of thirty eight workers with different job descriptions like operators of excavators, loaders, compaction equipment, excavation workers, etc. The harm risk of accidents was categorized into three different levels namely recoverable injury, permanent injury, and fatality based on a set of 63 hazards.

Ale et al. [16] proposed a model which made the organizations and incorporations capable of reducing the damage risks. The most crucial risks which threaten a worker's life in a project are falling from height (scaffold, platforms), getting hit by falling objects, struck by vehicles, burnt while performing hot work and making contact with electricity–hot lines. Saifullah and Ismail [9] carried out a study about recognition of the occupational health and safety elements during preconstruction in Malaysia. The study was performed statistically where they used information such as classification of the accidents, date, place and the reason for the accidents. Accidents

were categorized into many kinds like for example pinched, fallen, crushed, buried alive, hit by an object etc. The causes could be lacking safe work procedures, competence, monitoring etc. They proved that more gaps still exist in the construction industry of Malaysia. Koh [17] conducted a study about encountered problems and obstacles while providing an appropriate occupational safety and health environment in the construction industry (also known as justification and advent of wellness programs). In order to fulfill the performance goal, he established some stages for getting started including program planning, program implantation, and program evaluation. The mentioned programs led to two favorable conclusions which were the reduction of health care cost and the increase in productivity. Unsar and Sut [7] established a study about analyzing the occupational accidents between the periods of 2000-2005 in Turkey on the basis of various criteria. Provided, a comparison was made between the accidents that had taken place in Turkey and Europe throughout the mentioned years. The results indicated that permanent disabilities was decreased and majority of accidents had happened in the sectors involving the manufacture of metal goods (except machines), construction, textile industry, coal mining, and the manufacture of transportation vehicles. They came to the conclusion that in order to reduce the number of occupational accidents, components causing them should be identified. The identification should be carried out by applying analyses and assessments. Necessary measures should also be taken and audits should be used to note whether the measures are implemented effectively or not.

Gurcanli [13] showed the characteristics of the accidents which affect the third parties for the sake of attracting the attention of safety managers to non-employee and child deaths caused by construction activities. The main purpose of their studies

was to analyze cases and description of accidents in order to urge the safety professionals, contractors, and subcontractors to provide a safer construction site not only for the employees but also for non employees and the public.

Mungen and Gurcanli [18] investigated a study about different construction injuries in Turkey. In the scope of this study, about 40,000 occupational accidents in all industries have been considered. 4347 of these injuries occurred at construction sites, out of which 1774 of them were fatal injury records. The hazards for pedestrians, drivers, equipment operators, and auxiliary personnel such as flaggers, were identified and taken into account according to the results obtained regarding the conditions of the Turkish construction industry, certain suggestions were made relatively.

Saloniemi and Oksanen [8] analyzed the relationship between the occupational fatal accidents and the macro-structural properties of life productivity in Finland in the years 1977-1991. A model was prepared by using linear regression for finding the variables' effects on fatality rate and the results showed no rational connection between fatal accidents and business cycles. Also, the fatal and non-fatal accidents in the construction sector had an indirect relation with each other. The fatality rate was enhanced with the increase in cubic meters under construction.

A study about the features of occupational accidents in the construction industry of South Korea during the period of 1991-1994 was conducted by Jeong [19]. The data were discussed and analyzed in terms of parameters such as the size of a company, age and experience of the injured person, type of the accident, type of the injury,

injured part of the body, and the agency responsible for the accident. The following conclusions were drawn through the study:

1. Deaths occur more frequently in the older workers.
2. Falling from height is the most typical kind of fatality.
3. Fracture is the most common type of injury.
4. The vital parts of non fatal injuries are leg, foot, and toe where as for fatal injuries they are head, face, and neck.
5. Most accidents happened in temporary construction or fabric.

Macedo and Silva [20] conducted a study about examining the accidents in work environment during the years 1991-2001 in order to create a theme of a working life situation in Portugal. They observed that the highest number of fatal accidents occurred in the age range of 25-44 years throughout the mentioned years due to the explicit fact that this is the range with highest percentage of employment. Increasing labor flexibility and overtime working during this decade led to a significant increase in fatal accidents on Saturdays and Mondays.

Pires and Maneta [10] analyzed 115 different kinds of occupational accidents such as falling form height, getting crushed, burning and electrocution in 2009 for Portugal. They concluded that the training should be guaranteed by companies. The governments should have big duties for safety procedures of occupational hazards, and large construction companies should implement high quality safety systems. They made some suggestions that educational actions ought to be carried out by surveys and inspections with the target of emphasizing the importance of safety at work.

De Silva and Wimalaratne [14] carried out a study about the identification of the health and safety framework in Sri Lanka. Their methodology was to prepare a comprehensive literature work and pilot survey among the health and safety experts. They finalized the study with the recognition of 35 significant policies, unsafe and unhealthy issues. Also, ten occupational health and safety management methods were instituted as safety supervision, site environment, behavior control, generalizing the management units, resources and insurance, management assurance, supportive devices, health and safety documentation, education, and awareness.

Guo et al. [21] introduced a new safety training method to offer workers and trainees knowledge about the health and safety behaviors. The method was a technology-based multi-user game platform which assisted in the safety training of construction plant operations. The main advantage of the platform was that it allowed the workers to study and practice the operating methods by visualizing the 3D models of the area into the virtual environment. Additionally, it encouraged the trainees to collaborate in operating the construction plant. Camino Lopez et al. [22] performed a study about the effect of the exact time of the day on the fatality accidents rate. They analyzed 2,155,954 occupational accidents over the period of 1990-2002 in Spain. It was seen that between the hours of 13:00 - 17:00, which was after the time of lunch, fatality rates were increased. Chi and Han [23] attempted a study about realizing the relationships between risk factors and construction accidents. They applied Heinrich's domino theory to recognize the connection between the risks and accidents. This study was made by analyzing both empirical and statistical statistics of 9,358 accidents which happened in U.S during the period of 2002 to 2011. Some main parameters such as worker behavior, injury source, and environmental

conditions had been assumed. The outcomes of their study helped the managers prioritize risks which were more likely to cause accidents.

Im et al. [24] investigated the characteristics of fatal occupational accidents in Korea in the years 1997-2004 by comparing the reasons in various occupations. From the total 10,276 of accidents, about 42.2% (4,333) were fatal occupational injuries. The main cause of fatality was falling from height which was about 52.7% of the total accidents followed by death due to structural collapses and electric shocks.

By the analysis of occupational accidents at small construction sites in Taiwan during 2000-2007, the following conclusion was made by Cheng et al. [25]; the probability of accidents tended to be higher on the first day of the week, when the construction project had low health and safety management, the workers' protection was not suitable, and when the workers did not pay attention to safety signs. For decreasing the rate of fatality, they recommended proper training and practices toward the health and safety actions.

A study about fatal occupational falls in the construction industry of Taiwan during the years of 1996-2007 was carried out by Lin et al. [26]. Analyzed data from 1,062 reported accidents indicated that the roofing work was the most dangerous part for fatal falls (12.1%, 128 victims). Most accidents occurred for the workers within the age range of 34-44. Also, about 218 victims (20.5%) had died in the first year of their experience and about 536 victims, which consisted of about 50.4% of the accidents, fell from a height of less than 10 meters.

Ling et al. [27] reviewed different causes of 40 fatalities between 2006 and 2008 in Singapore's construction industry. A comparison was also made between the statistics of fatal accidents between 2003-2006 in the US and the mentioned data from Singapore. They interviewed seven Singapore and US safety managers for their ideas and strategies for enhancing the effectiveness of their management. They then developed 41 strategies for preventing the fatality rate from rising. Additionally, they stated that the safety culture, increasing the penalty system and effective communication, was vital for helping the aim of the study.

2.5 International Labor Organization (ILO)

The history of ILO goes back to the end of the First World War in 1919 after the conference held in Paris. The idea of the ILO development arose from security, humanitarian, political, and economic consideration. From the early days, ILO showed an appropriate contribution to the world of work by holding some main conferences in different countries. Since the ILO met some failure because of massive unemployment in 1932, the ILO realized that the labor issues required international cooperation. After years had passed, the ILO aimed for four main objectives [28]:

1. Development of skills, creation of jobs, providing opportunities for investment and entrepreneurship.
2. Creating an environment in which all employees respect the rights of workers.
3. Extending social protection – to support both addition and output by ensuring that all people like working conditions that are safe, allow adequate free time and rest, take into account family and social values, provide for adequate

payment in case of lost or reduced income, and permit access to adequate healthcare.

4. Promoting social dialogue – involving strong and independent workers' and employers' organizations is central to increasing productivity, avoiding disputes at work, and building cohesive societies.

In North Cyprus, the Labor Department has contributed to the health and safety of workers at construction sites. The strategy of the Labor Department in North Cyprus is in the process of being harmonized with EU standards and supervising all construction sites. Unfortunately, the Labor Department does not pay enough attention to practical health and safety and the regulations and laws are not effectively employed for the construction industry which results in unsafe construction methods and procedures on construction sites [29]. One of the duties of the Labor Department in North Cyprus is to collect information about all industrial accidents and present it in the form of monthly reports. However, this information has some limitations as it does not describe the accidents in full detail.

2.6 Occupational Safety Management in Construction Industry of North Cyprus

According to HSE, in the construction sector, one of the most common reasons for accidents to occur is poor behavior of the workers who recently entered the job. Some of the factors that led beginner workers to act wrongly include the fact that they are uneducated, inexperienced in situations, and have inappropriate inspection controls on the site. Çelik et al. [30] performed an analysis which is now carried out in North Cyprus to measure the success of health and safety induction courses of a construction project. They concluded that the main reason for these problems could

be the lack of appropriate training and it is necessary for employers to be more serious about these training procedures.

Çelikağ and Özbilen [29] proposed a study about H&S issues in construction sites of North Cyprus during the period of 2000 to 2008. They analyzed the main parameters of accidents involving the causes of accidents, equipment involved, number of injuries, number of deaths and loss of working days. They concluded that increasing the requested number of workers resulted in an increase in the number of unqualified employees. They also concluded that health and safety management should be considered during all stages of the projects. Education and training were also mentioned to be two very necessary acts to be fulfilled.

Chapter 3

OCCUPATIONAL SAFETY MANAGEMENT IN NORTH CYPRUS CONSTRUCTION INDUSTRY

3.1 Introduction

The objective of an occupational health and safety management system is to prevent the occupational injuries or illnesses. The management system should guarantee the productive performance of a company by providing an environment in which all workers accept occupational health and safety measures and managers make decisions through a systematic assessment of health and safety risks and hazards [31]

North Cyprus is located at the North-Eastern end of the Eastern Mediterranean basin at a distance of 380 kilometers North of Egypt, 105 kilometers West of Syria, and 75 kilometers South of Turkey [32]. According to the Government Web Portal (2006), Cyprus is the third largest island in the Mediterranean after Sicily and Sardinia and North Cyprus has an area of 3354 km^2 with a population of about 300,000 [1].

In 1992 the Parliament of North Cyprus set regulations with 94 articles which were published in formal newspapers. The new TRNC OSH law was passed in 2008 and is being enforced since April 2009 with new regulations prepared in harmony with the European Union [33].

This chapter will represent some fundamental information about the construction industry and occupational accidents in North Cyprus during the years 2006 to 2013.

But it should be noted that all the information and statistics within this study do not include the last 3 months of 2013.

3.2 Construction Industry of North Cyprus

Occupational accidents are in a direct relation with the number of construction projects and workers. The more the construction sites, the higher the probability of accidents. In order to evaluate and analyze the accidents, it is necessary to have general statistics of the construction industry [34].

Different types of construction techniques and framing are applied but of the most frequently applied ones is reinforced concrete which is used in North Cyprus. Reinforced concrete structures started becoming popular since the mid 1960s and they are still leading building construction in North Cyprus [35].

Devlet Planlama Örgütü, or the State Planning Organization in North Cyprus, set the report up to 2009. Based on the statistics, it is possible to estimate the growth rate of building construction within the past 3 years. It should also be noted that all the statistics and information of this thesis were provided by the State Planning Organization and Labor Department of North Cyprus. All the Figures and Tables shown in this thesis are based on the raw information from these departments.

Figure 3.1 represents the total number of buildings (rural and urban) during the years1990 to 2009. The duration was chosen to clearly show the growth rate number of construction during the last two decades. In the years 1990 to 2002, this number increased gradually and in the remaining period, it increased drastically. The number of buildings was 421 in 1990; with an increment of 576% in 2008 compared to 1990.

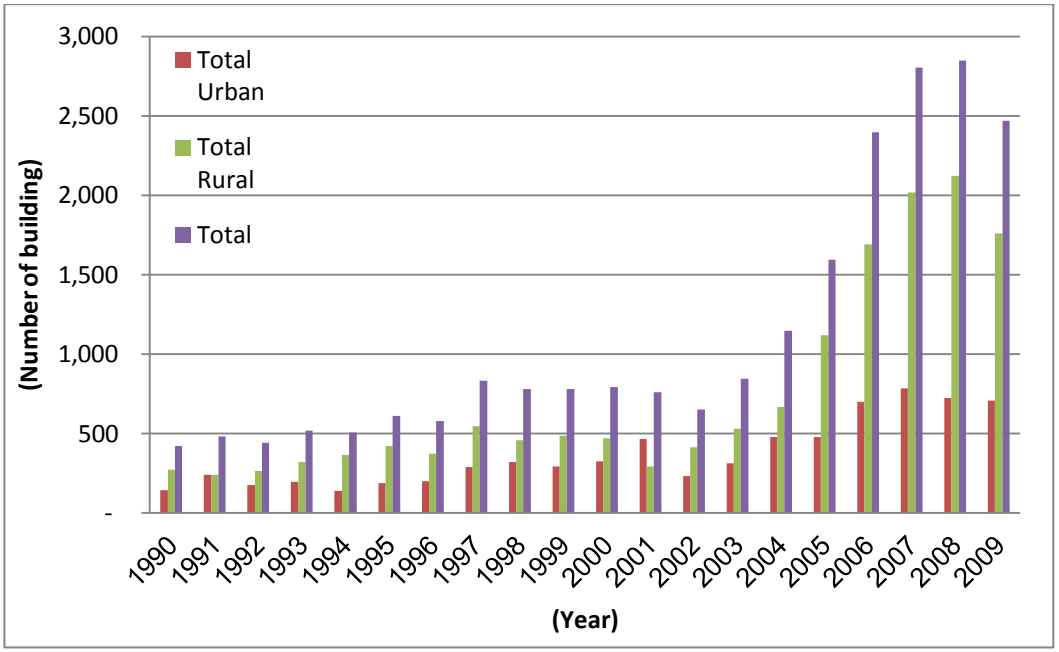

Figure 3.1. The total number of buildings in North Cyprus during 1990-2009 [3]

North Cyprus is divided into five districts which are further divided into sub-districts. Figure 3.2 represents the number of construction projects in different cities of North Cyprus during the years 2005 to 2009. It is explicit that the bigger city has a higher amount of construction. Lefkoşa, Girne and Gazimağusa covered 47.5%, 21.7% and 11.1 % of the total number of construction projects in North Cyprus, respectively.

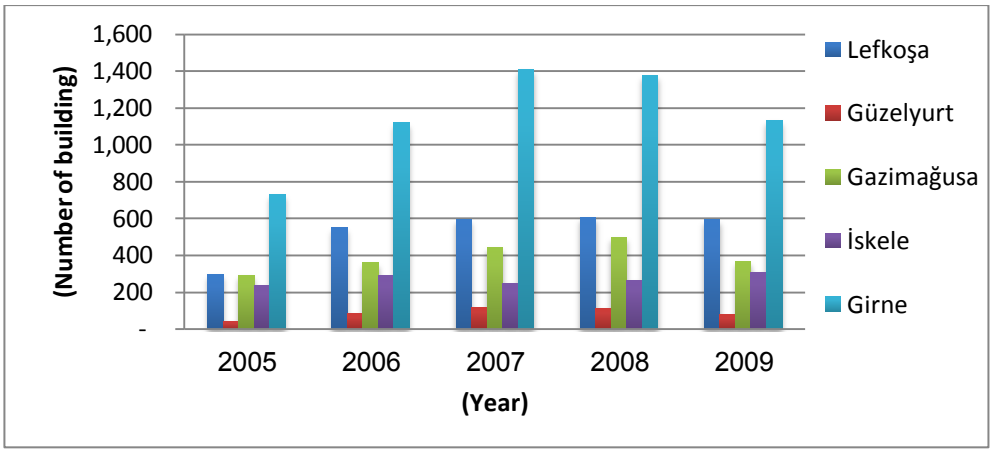

Figure 3.2. The number of construction projects in different cities of North Cyprus during (2005-2009) [3]

The number of workers of different age groups is an important factor that should be taken into account when analyzing the relation between accidents and the age of the worker. Table 3.1 summarizes the list of construction workers by age between the years of 2005 and 2011. The number of construction workers of ages ranging from 20-39 is the highest in comparison to other age groups. Between the years 2005-2011, the average number of construction workers was 8874 in North Cyprus [3].

Table 3.1. Categorization of the different ages of the workers between 2005 and 2011[3]

Age Group	2005	2006	2007	2008	2009	2010	2011	Total
15-19	316	501	252	380	199	93	309	2050
20-24	1306	1191	924	1095	580	567	597	6260
25-29	1629	1802	1707	1770	1750	1625	952	11235
30-34	1497	1692	1869	1855	1748	1540	1681	11882
35-39	899	1185	1871	1614	1359	1172	989	9089
40-44	1093	1078	1220	1464	1156	907	750	7668
45-49	891	992	857	935	1072	802	792	6341
50-54	440	744	629	802	905	710	577	4807
55-59	288	299	205	401	343	300	293	2129
60-64	16	66	80	135	79	29	86	491
65+	0	41	50	41	13	0	22	167
SUM	8375	9591	9664	10492	9204	7745	7048	62119
All Industries	85583	91,815	89,787	91,223	91,550	93,498	97,103	640559

3.3 Accidents in Construction Industry of North Cyprus

Since the focus of this study is on occupational health and safety in the construction industry, the number of accidents in industry and construction should be noted. The total number of accidents in industry and construction during the years 2006-2013 is presented in Figure 3.3 which was obtained from the Labor Department in North Cyprus according to monthly reports. In Conformity with the reports, most of the occupational accidents in these years occurred in 2007. Also, between the years of

2006-2012, the average number of occupational accidents in industry was 260 and was 71 in construction. Figure 3.3 shows significant improvement or fall in the number of accidents after 2007 in the construction industry.

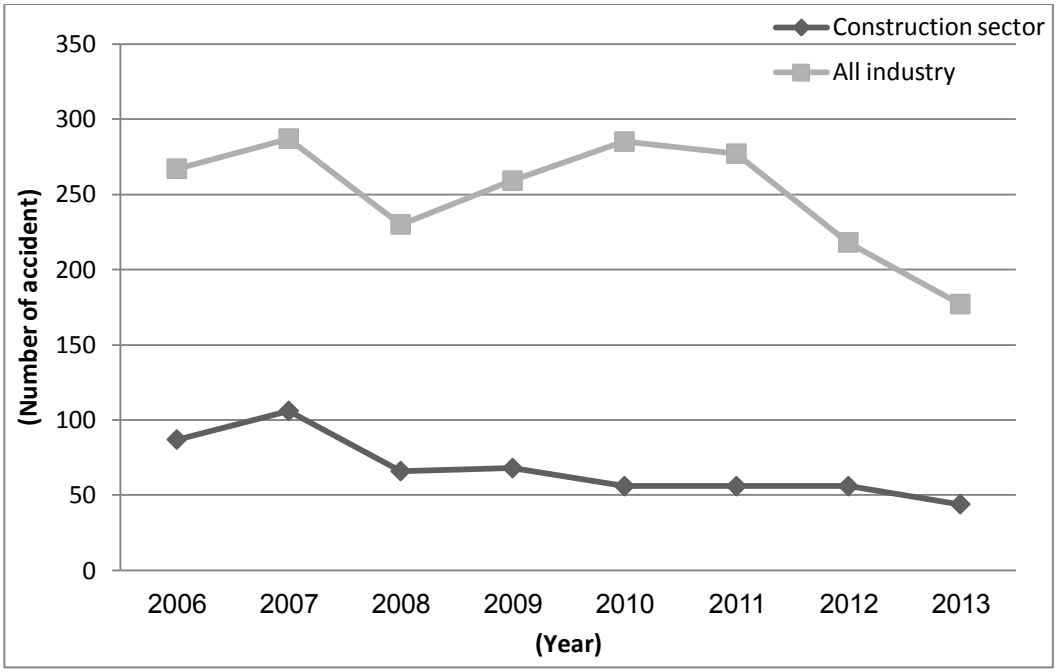

Figure 3.3. Number of accidents in both industry and construction industry [36]

Figure 3.4 shows the number of accidents in different types of the industries during eight years (2006-2013). The construction industry has had the highest rate of accidents during the mentioned years; which somehow supports the objectives of this study. Details of the accidents' percentages during the years 2006-2013 are given in appendix A that shows industry accident alterations.

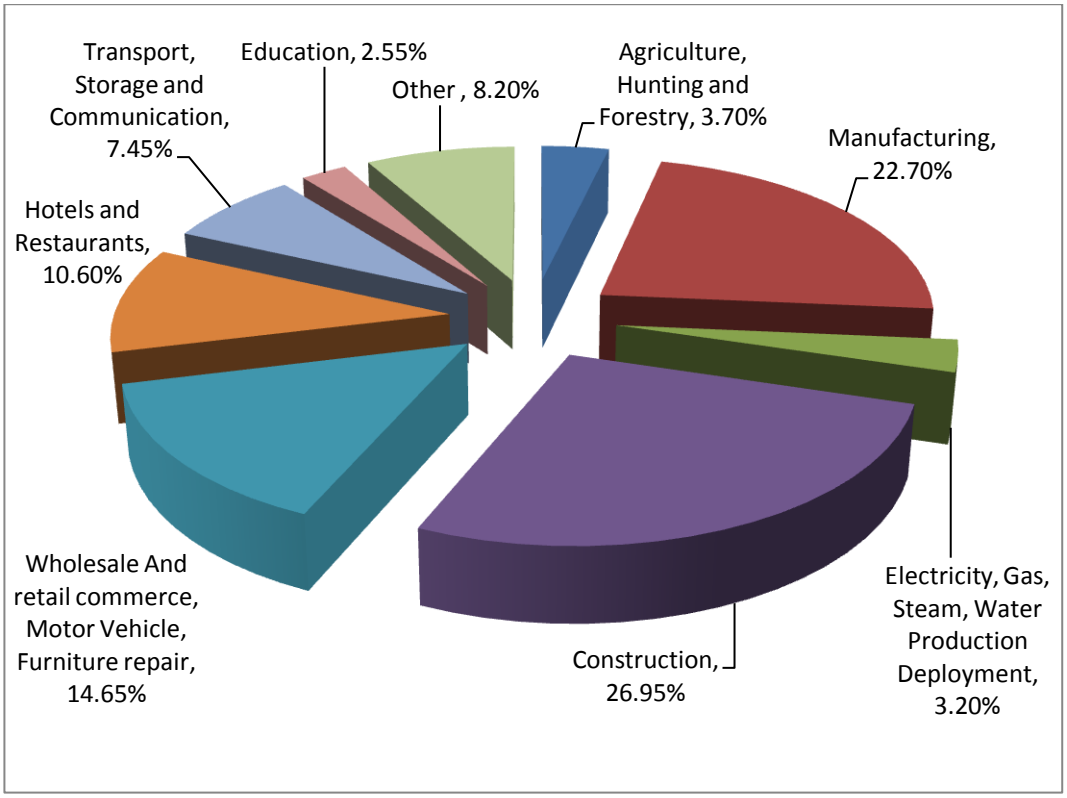

Figure 3.4. Number of accidents in different industries (2006-2013) [36]

The analysis of occupational health and safety needs precise statistics of accidents which include different accident types. Figure 3.5 categorizes different types of accidents in construction industry during the years 2006-2013. It is clear that falling from height was the most common out of all accidents; it amounted to almost one third of all construction accidents. Similarly, other types held responsible for high numbers of accidents are; being struck by objects, trapped by something, hit by moving objects or machinery, and traffic accidents on construction sites.

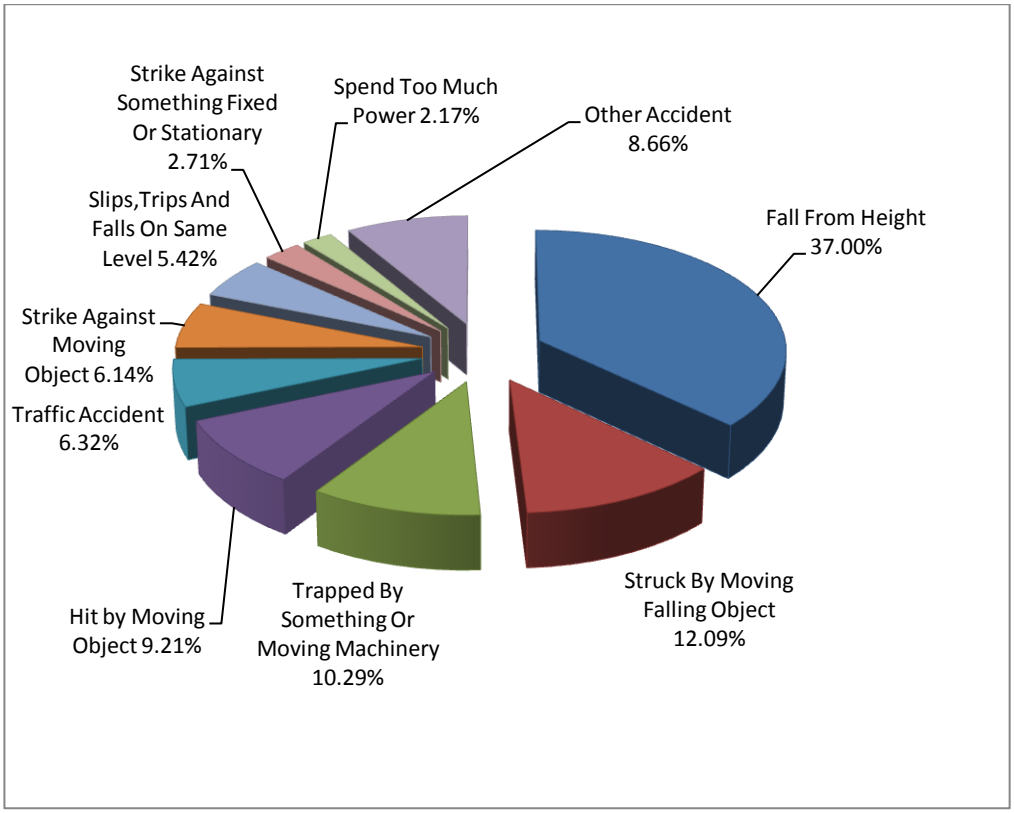

Figure 3.5. Different types of accidents in the construction industry (2006-2013) [36]

Table 3.2 presents the number of accidents in different age groups of workers in the construction industry. Tables 3.1 and 3.2 are in high agreement, which shows that the number of accidents has a direct relation with the number of workers.

Table 3.2. Number of accidents in different age groups of workers [36]

No	Age group	2006	2007	2008	2009	2010	2011	2012	2013
1	**<15**	0	1	0	0	0	0	0	0
2	**15-17**	0	1	0	0	0	1	0	0
3	**18-30**	40	51	30	17	20	17	15	13
4	**31-45**	31	41	26	44	35	34	26	17
5	**46-60**	9	8	7	9	8	6	6	6
6	**60 +**	1	0	1	0	0	0	0	0

In the age range of 18-30 and 31-45, the number of accidents is higher compared to other ranges and it varies each year.

Some of the data were not recorded in the Labor Department of North Cyprus due to the lack of registered documents. In approximately thirty three of the accidents, the age of the injured laborer was not recorded.

Figure 3.6 shows the amount of work days lost between 2006 and 2013. In accordance with the number of accidents, maximum days of worker absence were observed in 2007.

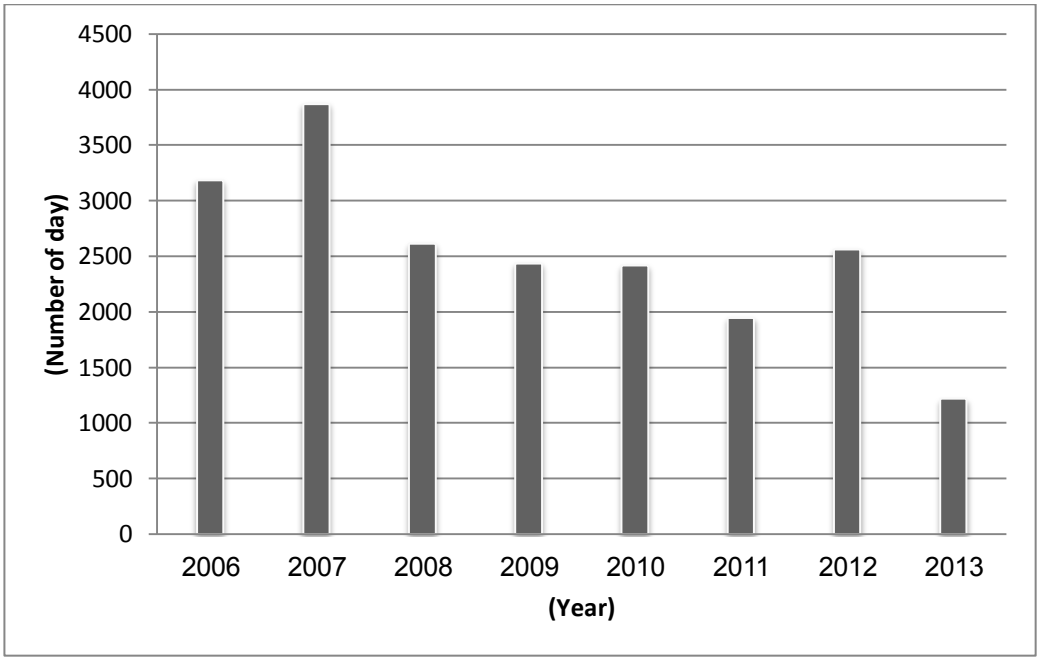

Figure 3.6. Annual days of worker absence in the construction industry due to work accidents [36]

In 2007, due to the explosion of the construction sector, the number of accidents was highest; where as in 2013, it was least because the information did not include the

last 3 months of the year which might have been the reason behind the maximum and minimum number of accidents in the mentioned years.

In the following chapter, the main statistics and information about the construction and accidents in North Cyprus is presented. These statistics contain information such as the different types of variables in the construction accidents. A comprehensive analysis and discussion is also made for presented information.

Chapter 4

ANALYSIS OF OCCUPATIONAL CONSTRUCTION ACCIDENTS IN NORTH CYPRUS

Occupational injuries and fatalities among construction workers have been a great concern to the construction industry. Researchers have analyzed the reports and information to categorize the most common types of accidents so their researches contain detailed information about the accidents [31].

Throughout recent decades, in response to rising growth of the construction industry, the occupational injuries and fatalities among construction workers have been a great concern to the construction industry. Many researchers used the existing reports for categorizing the most occurring types of the accidents in addition to detailed specifications of the accidents.

In this chapter, all categorizations, information, and statistics about the accidents during the years 2006-2013 will be presented and a complete discussion about the statistics will be made as well.

4.1 Variables Analysis

All accidents deal with different causes and variables. There are 57 variables in occupational accidents which can be classified into different categories such as personal, business, material, temporal, and spatial or geographic [11]. Having access to quite limited information, this study analyzed only a few of the stated variables.

The personal variables are the characteristics of the workers involved in the accidents such as age, gender, and the social security category. This information defines the worker's qualifications at the time of the accident [37].

The business variables include the type of contract, length of service offered by the worker involved in the accident, the number of workers in the company to which he/she belongs, as well as the construction activity it carries out [37].

The material variables involve the corresponding factors which are unique to each accident like the way in which it happened and the material agent that caused it. The temporal variables refer to the timing of the accident. While the spatial or geographic variables include the regional location of the accident within the country which is going to be studied [37].

4.1.1 Personal variables

As mentioned earlier, the personal variables include the personal information and related characteristics of the worker. Knowing this information enables us to analyze some important variables relevant to the workers.

4.1.1.1 Age

Figure 4.1 shows the number of workers of different ages and accidents during the years 2006 to 2013. The ages of the workers are divided into 8 different ranges and the minimum and maximum ages of the workers are 15 and 65, respectively. It can be seen that the maximum number of workers and accidents is within the age range of 30-39.

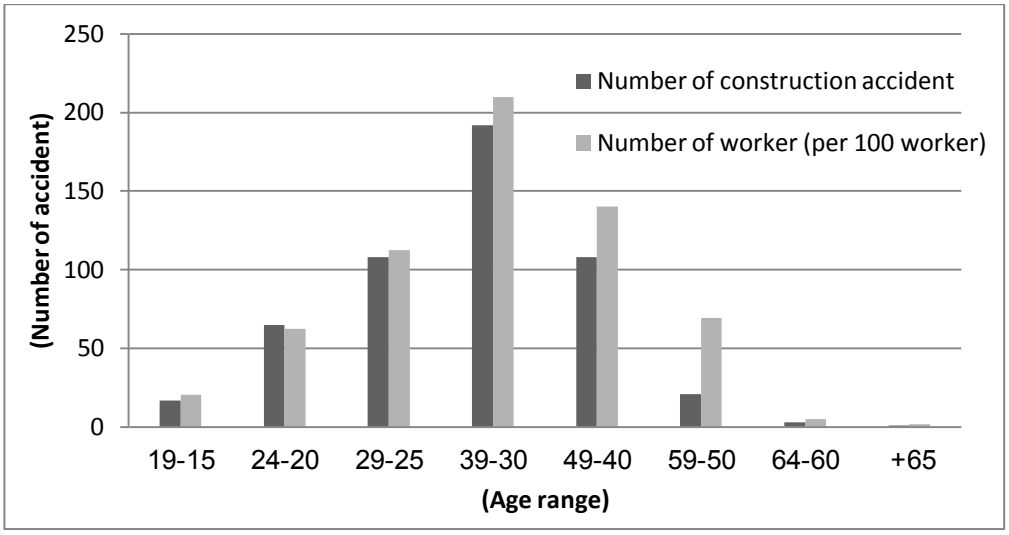

Figure 4.1. Number of occupational construction accidents and workers per age range in North Cyprus (2006-2013) [36]

According to Figure 4.1, it can be deduced that the rate of accidents; which is defined as a proportion of the number of accidents to the number of the workers (per 100 workers), is comparatively higher in some ranges than others. It is shown that; although the number of accidents in the age range 30-39 is higher than in other ranges, the rate of accidents in the age range 20-24 is more than that of other ranges, and is significantly low in the range of 50+. The likely reason for this difference in the rate of accidents between the stated ranges is experience. As mentioned, workers of older ages have more experience in construction and are therefore more careful with their jobs. Provided, the tasks assigned to or dealt with by older workers are usually simple and safe, unlike those handled by younger workers.

Figure 4.2 presents the percentage of accidents to the number of workers in ten different age groups for North Cyprus during 2006-2013, and for Spain during 2003-2008 [11]. Since table 4.2 is in high agreement with Table 4.1, it is seen that 30-39 is the range with the highest number of accidents.

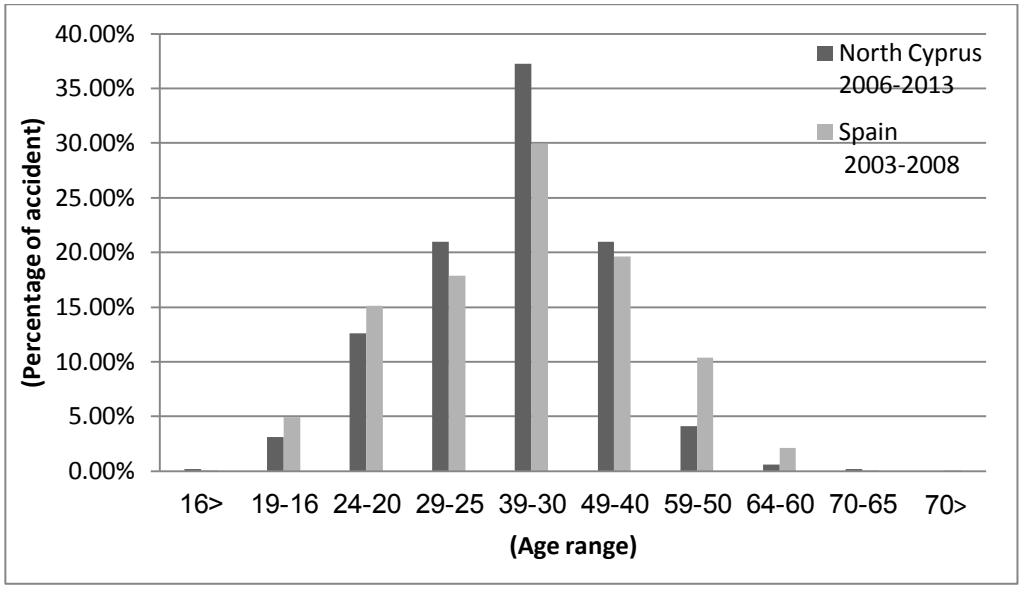

Figure 4.2. Percentage of accidents in different age groups for North Cyprus and Spain[36, 37]

According to Figure 4.2, in the ranges of 25-29, 30-39, and 40-49, the number of accidents in North Cyprus is higher than that in Spain. It might either be the lack of experience among the workers within these ranges, or the higher number of workers that is responsible for this difference.

4.1.2 Business variables

The business variables deal with construction activities such as [37]:

• Construction preparation: This includes activities like demolition, excavation, earth moving, perforation and drilling, as well as the rental of construction or demolition equipment with an operator.

• Building construction and civil works: This encompasses general building construction and individual civil engineering projects, setting up electrical and telecommunication line construction, construction of freeways, highways, landing fields, railways, sports centers, and hydraulic works.

• Installation and completion of construction work: It involves Electrical and insulation facilities, plumbing and air conditioning installation, windows and paint, installation of woodwork and plastic materials, floor and wall coverage, along with other finishing jobs on buildings and construction work.

4.1.2.1 National Classification of Economic Activities (CNAE)

Different kinds of professions deal with accidents, and in most research studies an analysis was made based on the profession of the injured worker. In North Cyprus, most of the accidents occurred for carpenters, steel workers, isolation workers, and plasterers [36]. If occupation accidents were recorded with exact detail in accident reports in North Cyprus, it would have been possible to show the results of CNAE in this country and compare it with other countries. Imprecision of information caused some limitation in this part.

4.1.2.2 Company staff (Workplace)

In most of the studies, the size of the companies was categorized into different types and some analysis was made about the size of the companies and the number of accidents. The size of the company staff was not recorded for North Cyprus, so the analysis of this part was altered to the region of construction.

According to information from the State Planning Organization in North Cyprus, Figure 4.3 shows the total number of constructed buildings, which consisted of rural and urban, during the years 1990 to 2009. A huge increment occurred in building construction from 2003.

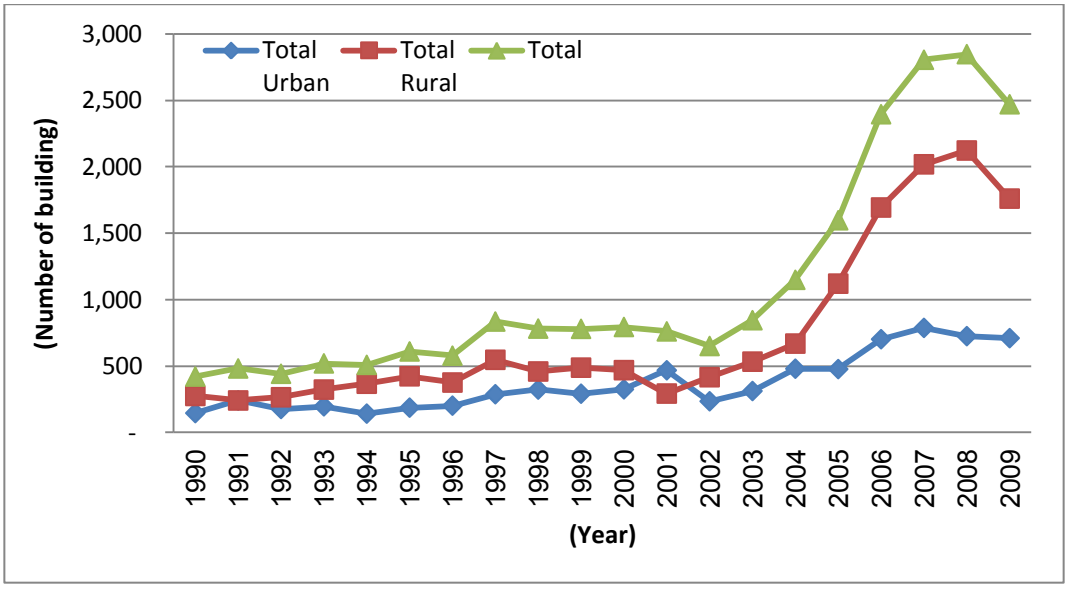

Figure 4.3. Number of buildings in North Cyprus (2006-2013) [3]

Based on Figure 4.4, due to the high increment in constructed buildings, the number of accidents was increased, and it reached its peak during these years.

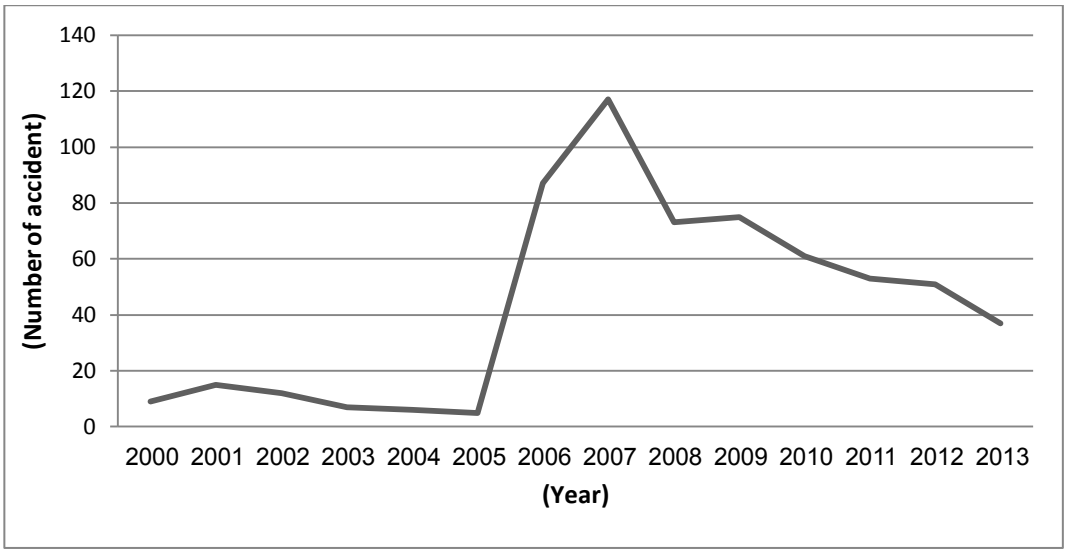

Figure 4.4. Number of construction industry accidents in North Cyprus [36]

Before 2005, the number of accidents in North Cyprus was low. After 2005 though, which was known as the explosion of the construction sector stage, the rate of accidents increased highly and reached its maximum by 2007.

4.1.2.3 The involved location and equipment of the accident

Table 4.1 presents the number of accidents and the equipment which caused the accidents in the construction industry during the years 2006 to 2013.

Table 4.1. Causes of construction accidents in North Cyprus (2006-2013) [36]

Cause of accident	Number
Scaffolding	79
Staircase and ladder	51
Wood work machine	45
Traffic accident in construction site	42
Heavy vehicles	27
Working surface (same level)	26
Electrical machinery	23

Based on the raw information from the Labor Department of North Cyprus, the locations of accidents were classified into 173 main categories (Appendix C). And after analyzing the raw statistics, Table 4.1 was prepared to summarize the main accident locations. According to Table 4.1, about 42% of the accidents' causes are related to 4 types which are "Scaffolding", "Machine", "Traffic accident in construction sites", and "Stair and ladder". Scaffolding, which has direct relation with fall accidents, caused %15 of construction accidents in this period. In total, fall accidents are divided into the following different types:

1. Fall when assembling scaffolding,
2. Fall when working on the scaffold,
3. Fracture of an element of the scaffolding,

4. Fall when disassembling the scaffolding,

5. Fall when working on formwork scaffolding,

6. Fracture of an element of the formwork scaffolding,

7. Falls from other types of scaffoldings, and

8. Collapse of the scaffold.

4.1.3 Temporal variables

A temporal variable, which deals with the timing of accidents, is an important variable for analyzing the occupational health and safety in the construction industry.

4.1.3.1 Day of the week

Figure 4.5 shows the number of accidents in different days of the week during the years 2006 to 2013.

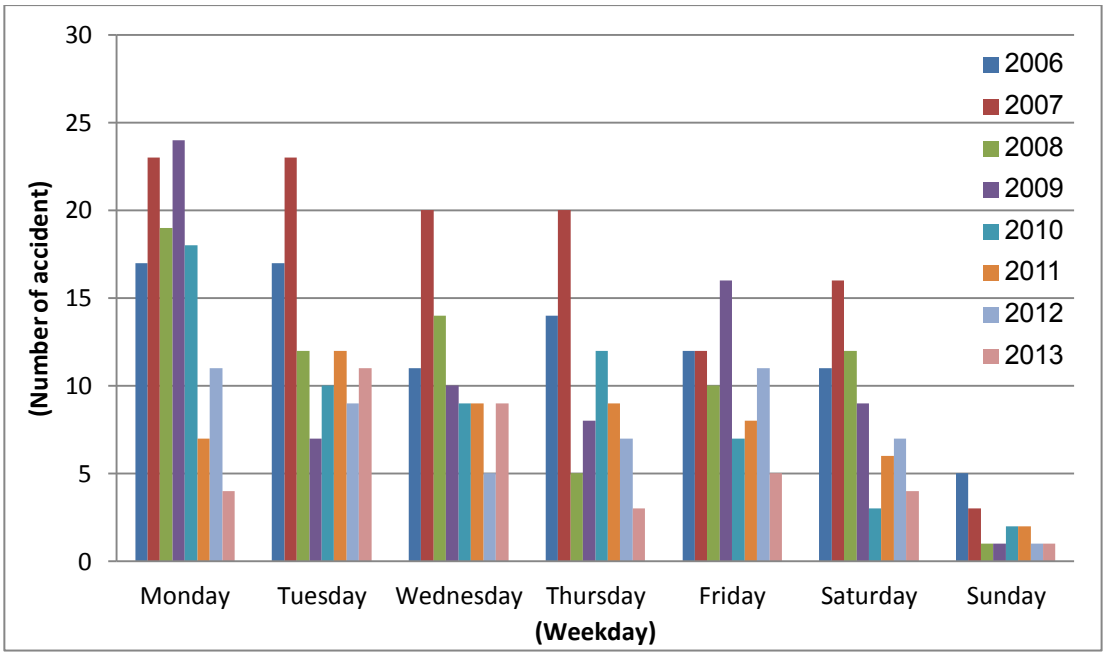

Figure 4.5. Number of construction accidents for each day of the week in North Cyprus(2006-2013) [36]

According to Figure 4.5, the scope of casualties in weekend is low due to the work permission. Generally in every year, Mondays include most of the weekly accidents.

After 2010, the construction accidents of Mondays were reduced. Mondays of 2009 had the most accidents with 24 numbers that summed up to %32 of construction accidents in that year.

In relation to the number of accidents in the different days of the week, Figure 4.6 shows the total number of accidents per day for 8 years (2006-2013). A descending number can be seen from Monday to Sunday.

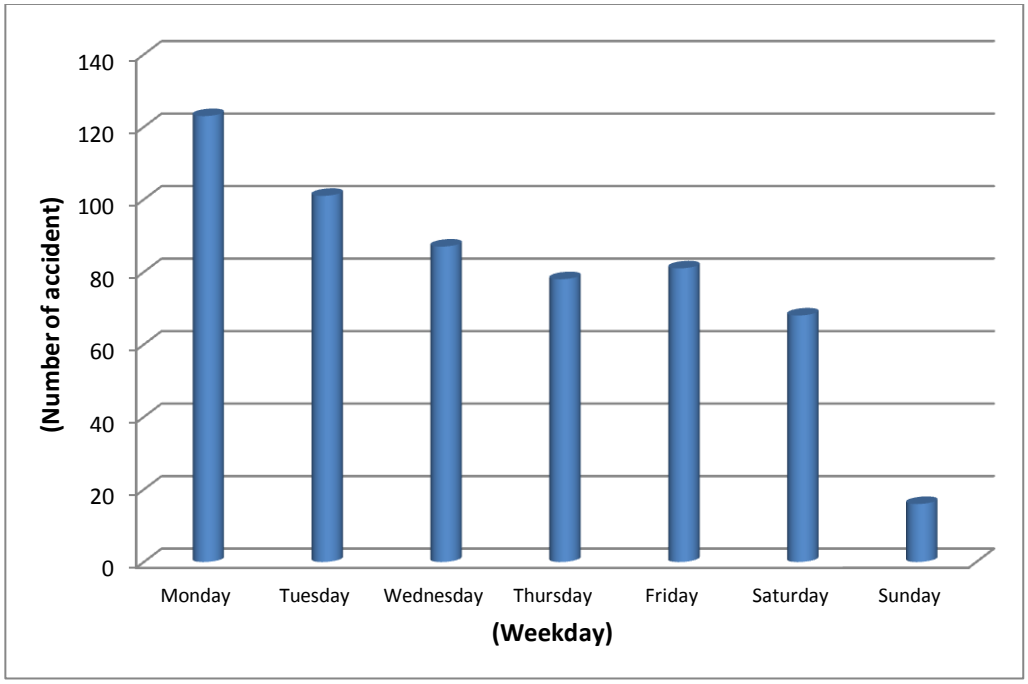

Figure 4.6. Occupational construction accidents according to each day of the week in North Cyprus (2006-2013) [36]

It can be seen that most of the accidents occurred on Mondays of each week between the years 2006-2013 in North Cyprus. This criterion is called the "Monday Effect," [38] and it assumes that some of the injuries reported on Monday actually occurred on the weekend, but were not reported on the real day of the accident. One reason for this is that social benefits from the insurance company would change with more

compensation paid for work-related injuries than for those incurred during leisure activities.

Figure 4.7 shows the percentage of accidents over the number of the workers in different days of the week in North Cyprus during 2006-2013, and in Spain during the years 1990-2000 [6]. Both the countries show the same trend for different days of the week.

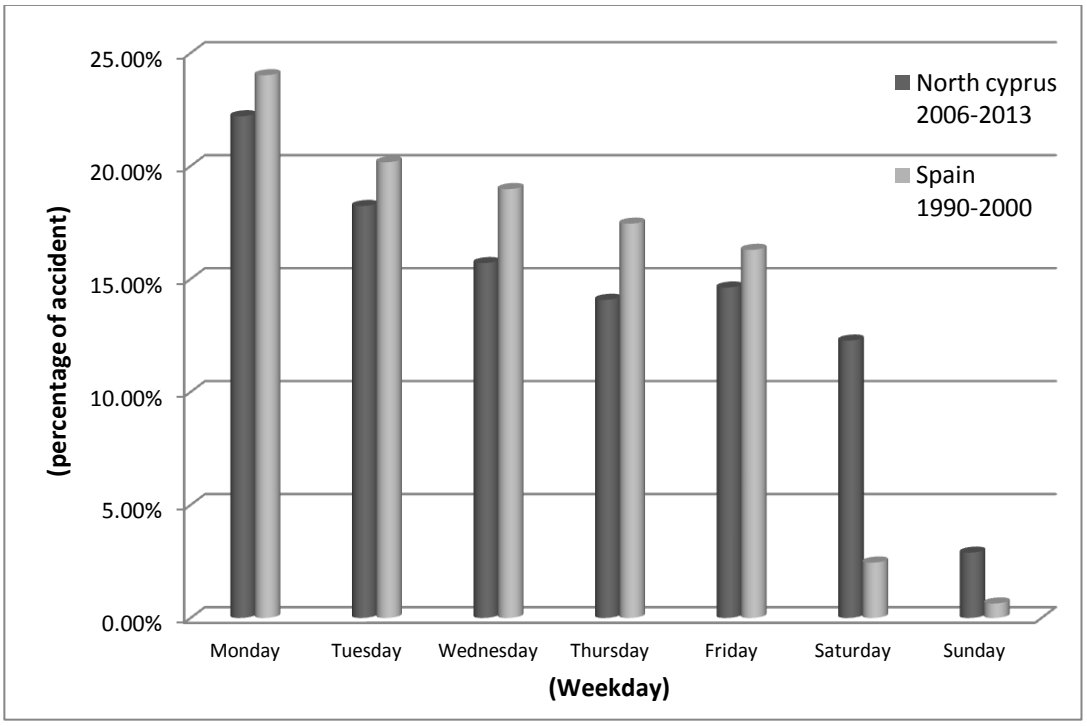

Figure 4.7. Comparison of the percentage of construction accidents over worker numbers in North Cyprus and Spain[36, 37]

According to the North Cyprus regulation, workers can work in construction sites on Sundays and the Labor Department gives permission to the contractors for this purpose. But there is no restriction for working on Saturdays. There are different percentages of construction accidents in week days because of construction site opening on weekends.

4.1.3.2 Days of absence

When an accident occurs to a person, it brings forth some days of absence for him/her to recover from the injury. Figure 4.8 shows the total number of absence days for the workers during the years 2006 to 2013. During the last 8 years, a total number of 20,237 days were recorded as work absence. In average, for each accident incurred, a worker loses 38 days of work. By comparing Figures 4.8 and 3.3, it can be concluded that the amount of work days lost does not depend on the number of accidents, but on the severity of the accidents which can increase the loss of work days. For example; in 2012, the number of accidents decreased, but the loss of work days increased compared to previous years.

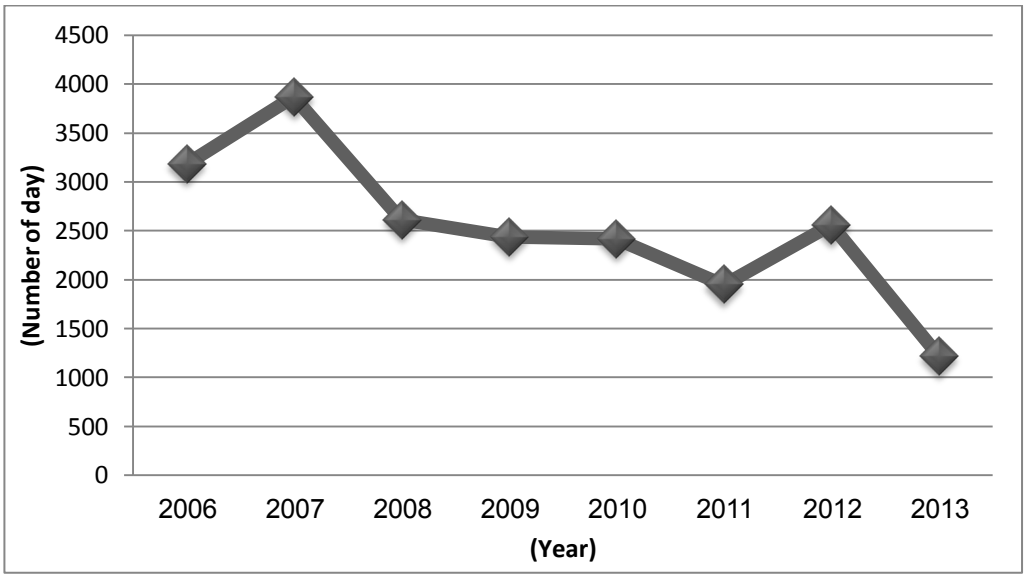

Figure 4.8. Loss of work days due to occupational construction accidents [36]

According to Figure 4.8, the days of work loss in 2007 amounted to the maximum among these years. During the last year, the days of absence decreased by 68% compared to 2007 which is a good improvement for the construction industry in North Cyprus. Yet on the other hand, decreasing the number of construction workers could have been a reason for this improvement.

4.1.4 Material variables

4.1.4.1 Injury

Figure 4.9 shows the total number of accidents in construction leading to injuries of workers in each year from 2006 to 2013. This Figure is in coherence with Figure 4.3 which shows that a higher number of constructed buildings lead to a higher number of accidents. Due to low numbers of fatal accidents (2-3%), the difference between the Figures 4.9 and 3.3 is minor.

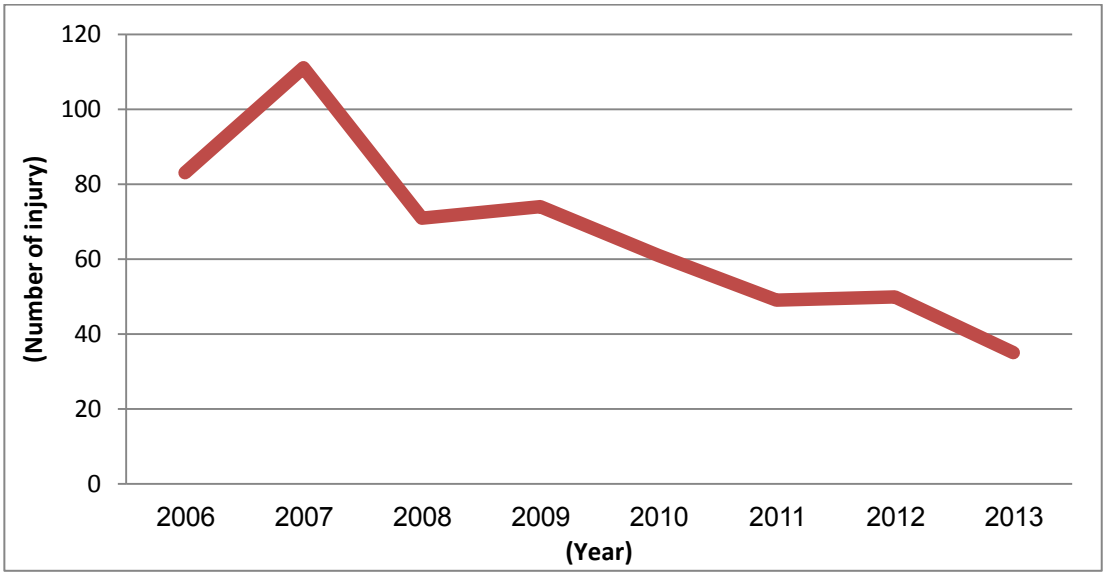

Figure 4.9. Number of injuries as a result of construction accidents in North Cyprus (2006-2013) [36]

Decreasing the number of workers during the recent years and improving occupational health and safety in North Cyprus has affected the decreasing number of accidents in the last years, especially after 2007.

Knowing which part of workers' bodies was injured in accidents over the years can provide some indications on preventing the accidents or their fatality. Table 4.2 shows different types of injuries in construction site accident. Nearly half of the

injuries were related to “Fractures”. Also, 78% of the accidents included fractures and amputations that mainly relate to hand, arm, and fingers. This means that these parts of the body are exposed to more danger than others. About 8% of these accidents however, are unidentified (unrecorded) and not stated in this table.

Table 4.2. Injury types in accidents in North Cyprus (2006-2013) [36]

Type injury of accident	**Number**
Fracture	250
Amputation	146
Superficial Injuries	31
Dislocation	31
Concuss	15
Burn	11
Bruise	10
Electric shock	8
Multiple	7
Unrecorded	45

Figure 4.10 shows the percentage of different parts of the body injured in accidents. Fingers have the highest percentage amongst the other body parts. About 23% of construction site accidents are related to toes. Also, 229 out of 499 recorded documents were about injuries of arms, hands, and fingers. It should be noted that Fig. 4.10 shows the important parts of the body with higher risks of accidents and neglects some parts because of low chances of injury**.**

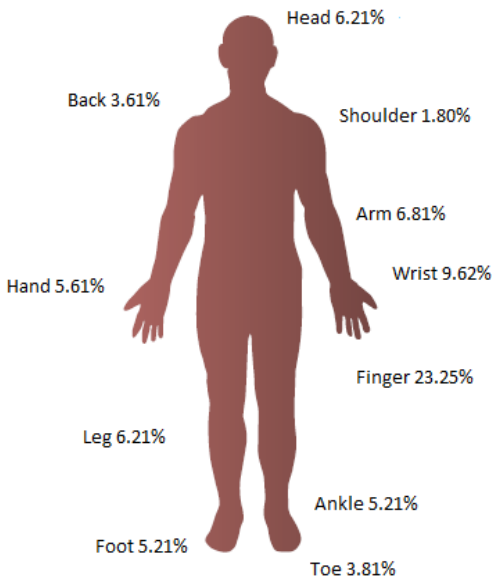

Figure 4.10. Percentages of body injuries in North Cyprus (2006-2013) [36]

4.1.5 Spatial or geographic variables

4.1.5.1 Climatic zones

Cyprus has an intense Mediterranean climate with the typical seasonal rhythm strongly marked in respect of temperature, rainfall, and weather. Hot dry summers from mid-May to mid-September and rainy, rather changeable winters, from November to mid-March are separated by short autumn and spring seasons of rapid change in weather conditions.

Figure 4.11 illustrates the number of accidents in different months of the year during 2006-2013. Each month of the year has its own type of weather conditions which can have an impact on the number of the accidents.

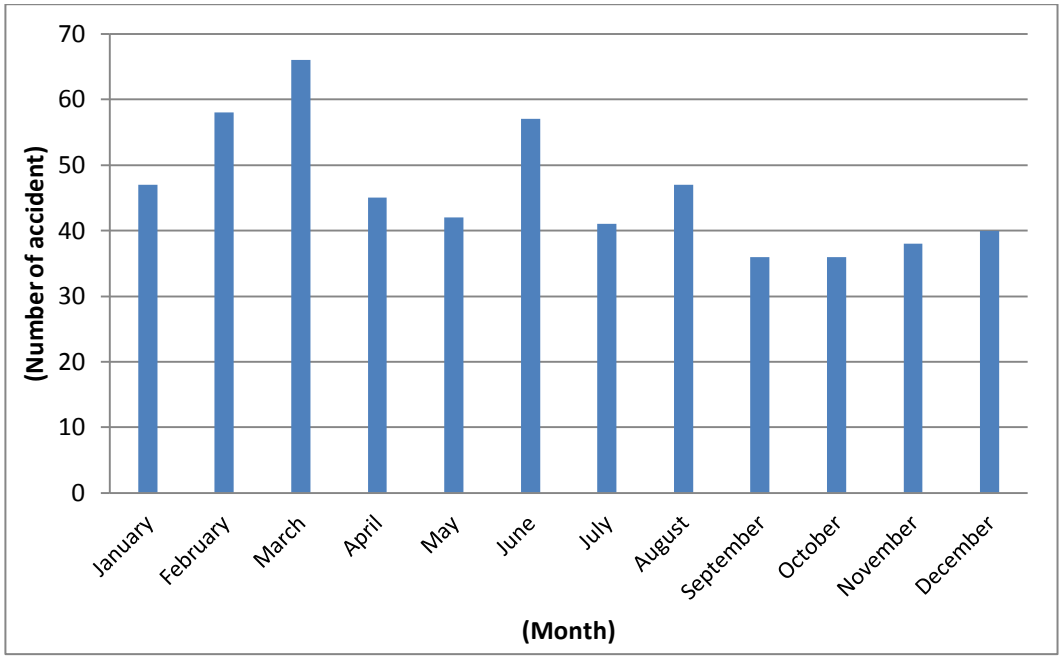

Figure 4.11. Occupational construction accidents in different months (2006-2013) [36]

Most accidents during the years 2006-2013 occurred in March. The number of accidents in September is about half those of March. Within the first three months of the year, the number of accidents is remarkably high due to the inappropraite climate conditions. The wind speed, average humidity, and rainy days are highest while the average temperature and hours of sun per day are lowest in these months when compared to other months of the year which show bad climate conditions.

Table 4.3 presents the typical climatic factors of North Cyprus such as temperature, humidty, and rainfall [39].

Table 4.3. Typical average climatic factors in each month of the year in North Cyprus

Months	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Max temp of day	15	16	18	22	27	31	34	34	31	27	21	17
Min temp of day	7	7	8	10	14	18	21	22	19	15	12	8
wind Speed (mm/sec)	3.0	3.1	2.9	3.0	2.9	2.9	2.8	2.8	2.8	2.6	2.7	2.9
Hours of sun per day	5.5	6.5	7	8.5	10.5	12	12	11	10	8	7	5
Average humidity	71	71	70	65	61	59	59	61	62	64	69	71
Rainy days	9	8	7	3	2	1	1	1	1	3	6	9
Average temperature	18	19	21	23	27	30	36	36	32	28	24	17

Figure 4.12 summarizes the number of accidents in construction in different seasons of the year.

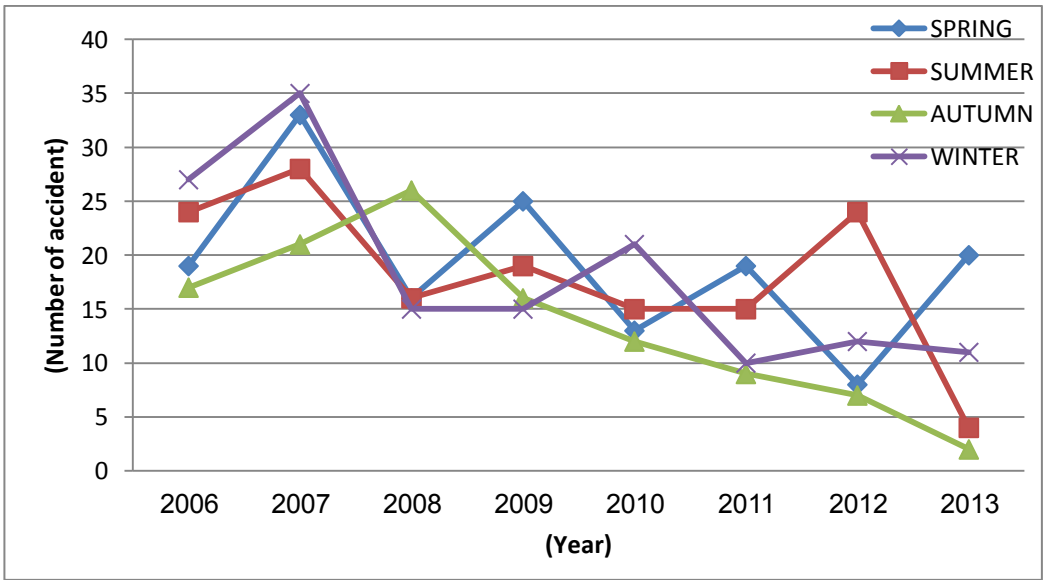

Figure 4.12. Construction accidents in different seasons (2006-2013) [36]

The alternating behavior of accidents and the decreasing rate of accidents in autumn can be seen in Figure 4.12. As mentioned earlier, 2007 had the highest number of accidents; this figure shows that winter and spring contain the majority of them. Based on Figure 4.12, it cannot be concluded that a special season is more dangerous in terms of working condition because it is varying over different years.

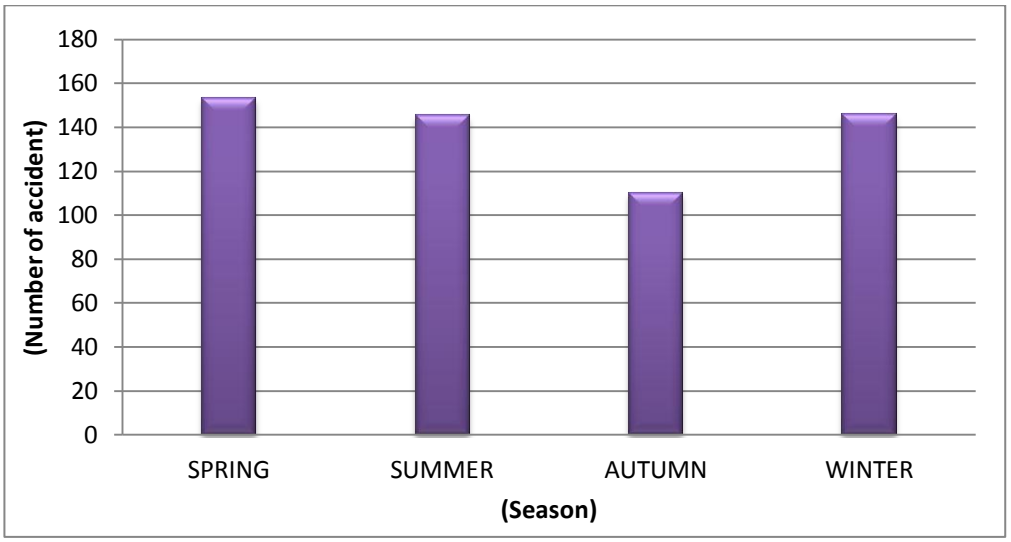

Figure 4.13. Occupational construction accidents in each season (2006-2013) [36]

According to Figure 4.13, the number of accidents in autumn is about 6-7%; which is less than the other seasons. Based on the data in Table 4.3, the desirable climate conditions in autumn could be the main reason for lower accident numbers where as the numbers of accidents in other seasons are close to each other.

4.1.5.2 Geographical

North Cyprus is divided into five main cities which are Lefkoşa, Girne, Gazimağusa, İskele, and Güzelyurt. The total number of constructed buildings and accidents during the years 2006-2013 is presented in Figures 4.14 and 4.15 respectively.

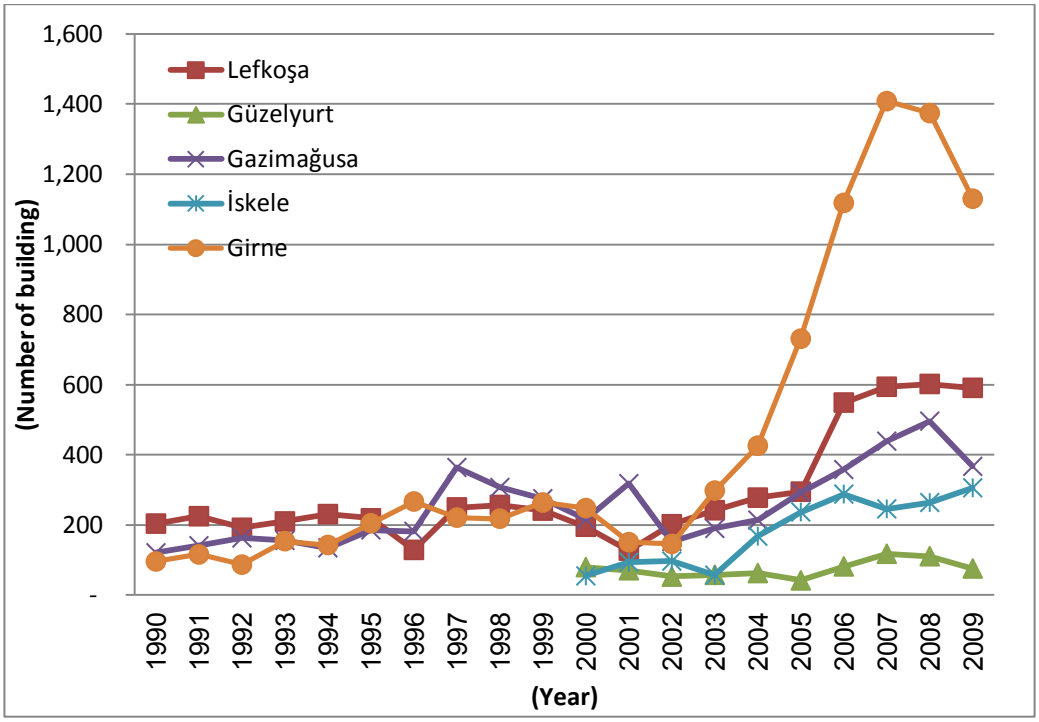

Figure 4.14. Number of buildings in different cities of North Cyprus (2006-2013) [3]

According to Figure 4.14, the number of construction projects in Girne after the explosion of construction sector phenomenon was increased drastically and reached 1408 in 2007.

In Gazimağusa, İskele, and Lefkoşa, the number of constructed buildings was gradually increased. The trend of the number of constructed buildings was almost constant in Güzelyurt.

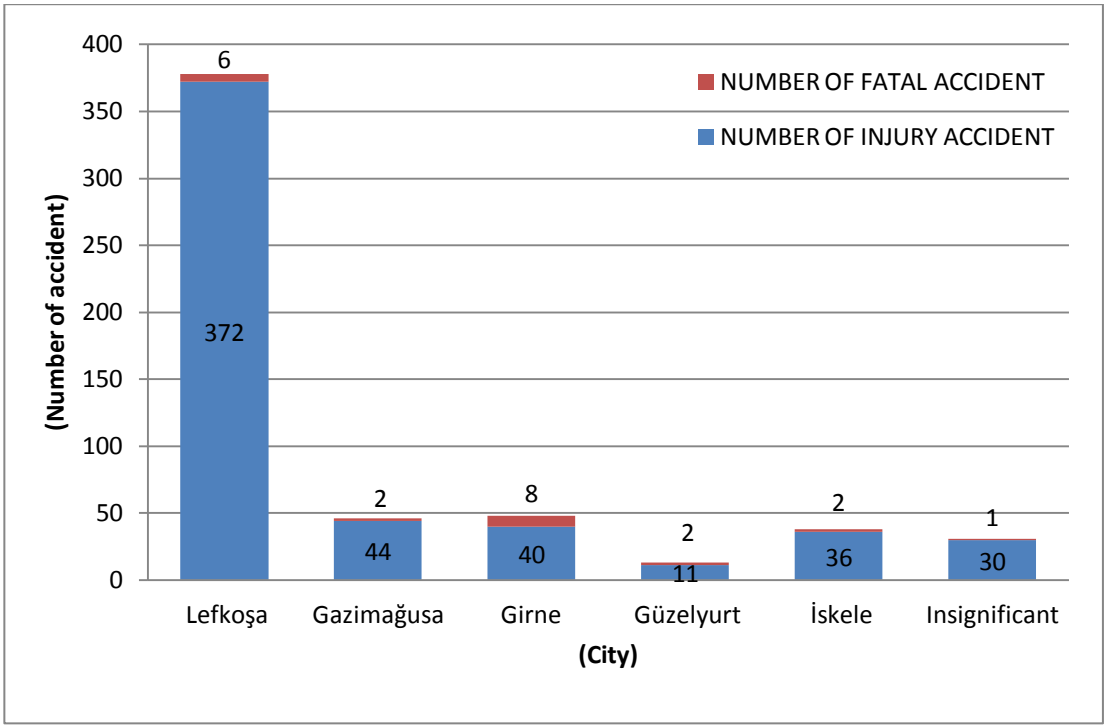

Figure 4.15. Number of construction accidents in different cities of North Cyprus (2006-2013) [36]

Considering Figure 4.15, about 68% percent of the total accidents happened in Lefkoşa in the last 8 years, noticing that in the recent years, Girne had the most number of construction projects. Also, during last 8 years, the number of accidents in Gazimağusa and Girne was slightly the same despite the huge difference in the number of construction projects. Girne has the highest number of fatality among other cities. Eight fatal accidents, which is about 16% of the total accidents, were recorded in Girne; which is a high rate when compared to Lefkoşa (0.015 % rate of fatality). It should be stated though that some of the accidents that had occurred in different cities of North Cyprus were recorded especially in Lefkoşa due to the fact that the central office for the recording of accidents' reports is located in Lefkoşa.

4.2 Fall from Height

Fall accidents are of the leading causes of industrial workplace injuries in North Cyprus. By increasing the complexity of the current construction projects,

occurrences of accidents are somehow inevitable. These accidents potentially cause serious damage to workers and prevent them from returning to work. Falling from height is a major cause of death and injuries in the construction industry.

Based on the US department of Labor [40], there are 11 categories of falls. These categories are as follows:

1. Falls from stairs or steps,
2. Falls through existing floor openings,
3. Falls from ladders,
4. Falls through roof surfaces (including existing roof openings and skylights),
5. Falls from roof edges,
6. Falls from scaffolds or staging,
7. Falls from building girders or other structural steel,
8. Falls while jumping to a lower level,
9. Falls through existing roof openings
10. Falls from floors, docks, or ground level, and
11. Other non-classified falls to lower levels.

Table 4.4. Summarized information about falls from height [36]

	2006	2007	2008	2009	2010	2011	2012	2013	Total accident	Fall from height	Rate of fall from height (%)
Age											
14-19	0	2	0	0	1	0	0	1	17	4	23.5
20-24	4	5	3	2	2	1	1	1	65	15	23.1
25-29	9	9	3	5	5	2	4	1	108	29	26.8
30-34	0	9	5	5	3	5	3	1	95	31	32.6
35-39	5	6	4	7	4	4	5	1	97	31	32
40-44	2	5	4	3	6	5	4	2	72	29	40.3
45-49	0	3	2	2	3	2	3	1	36	17	47.2
50-54	0	2	0	1	0	1	0	0	15	4	26.6
55-59	0	0	1	0	0	0	0	1	6	2	33.3
60-64	1	0	1	0	0	0	1	0	3	3	100
+65	1	0	0	0	0	0	0	0	1	1	100
Day of week											
Monday	4	9	8	6	6	3	5	0	123	41	33.3
Tuesday	3	12	4	5	3	6	3	2	101	38	37.6
Wednesday	4	7	4	4	2	4	2	3	87	30	34.5
Thursday	6	4	2	1	7	4	6	2	78	32	41
Friday	3	7	6	5	4	1	2	2	81	30	37
Saturday	4	8	4	6	1	3	4	1	68	31	44.5
Sunday	0	1	1	0	1	0	0	0	16	3	18.7
Loss of work days (per day)											
Less than 3 day	0	3	3	0	0	0	3	0	47	9	19.1
More than 3 day	1406	1817	1157	1245	1101	1065	1498	347	20190	9636	47.7
fatal	1	1	2	1	0	2	0	2	20	9	45
Loss of work days (per person)											
Less than 3 day	0	1	1	0	0	0	1	0	21	3	14.3
3-30 day	10	16	9	8	9	7	6	3	262	68	25.9
31-90	9	23	15	15	13	8	9	5	204	97	47.5
+91	3	1	0	1	1	3	5	0	20	14	70
unrecorded	1	6	2	2	1	1	1	0	27	14	51.8
fatal	1	1	2	1	0	2	0	2	20	9	45
Location and cause of accident											
Scaffolding	11	22	7	10	5	4	8	2	79	69	83.3
Staircase and ladder	5	6	7	9	6	8	5	3	51	49	96.1
Working surface	2	4	3	0	2	1	0	1	26	13	50
Heavy vehicles	0	4	2	0	4	0	0	0	27	10	37
Formwork	0	0	0	1	2	0	2	1	9	6	66.6
Demolition of ceiling	0	4	0	0	0	0	0	0	4	4	100

Fall accidents threaten those employees who work at heights during construction. Unless preventive actions or measures are effectively applied, there can be serious safety problems and hazards. If fall protection safety practices are not observed at the work site, workers would be in high risk of fall accidents

Falls from height amount highest within the age ranges of 60-64 and +65 which is because old workers have inappropriate body physics and weak potentials. The highest number of accidents is within the range of 45-49; which is about 47.2% of the total accidents. The maximum and minimum number of accidents occurred on weekend days (Saturday 44.5%, Sunday 18.7%). This is due to the fact that all the accumulated tiredness of the weak can add up to this high amount on Saturday. Mental reasons can also be another cause for this phenomenon. The low number on Sundays can be because those contractors warn all the workers and ban them from dangerous duties. They are required to get permission from several departments before working on this day.

About 83% of the scaffolding accidents were related to fall accidents and about all the accidents of stairs and ladders were related to fall accidents. This table also shows that those workers who have had fall accidents usually lost around 30-39 days of work.

In this chapter, the information was completely analayzed based on different variable categories such as personal, buisiness, material, temporal, and geographical. We derived many results from Tables and Figures which will be mentioned in the concluding chapter. Moving on with to the next chapter, the health and safety

discussion of a case study in North Cyprus by the name of Lara Park Hotel will be analyzed in continuation.

Chapter 5

CASE STUDY

5.1 Introduction

The purpose of this chapter is to identify and recognize dangerous areas at the Lara Park Hotel construction site (LPH) since the probabilty of occupational accidents in these project types is high. The identification of dangerous locations helps us find solutions in order to prevent those types of accidents which cause fatality such as falls from height. Falling from a height is one of the major cause of injuries and fatalities in the construction industry. The goal of this chapter is to present the results of a survey and discuss an incident to reach reasons for fall accidents in order to reduce the rate of accidents among workers at the Lara Park Hotel construction site. This chapter will outline this construction site, process, and plan for controlling incidents and reports of accidents.

5.1.1 Objectives of the chapter

- Showing the number of accidents during the project.
- Clarifying the causes of the accidents.
- Indentifying the health and safety situation.
- Providing some actions in order to prevent more accidents.

5.2 Introducing the Case Study

The specification of the case study is as below:

The construction of the Lara Park Hotel started in 2012. It is located 12 kilometers from the Girne city center. The main building area of the hotel is about 80,000 square

meters and the total area of its land is 130,000 square meters. The main specification of the hotel include 931 balconies, 202 windows, 6 elevator openings, 16 staircases and 945 floor openings of different sizes which can increase the risk of fall accidents. The hotel consisted of different divisions such as the main building, casino, restaurants, Aqua Park, swimming pool, sports club and apartments provided for employees.

The average number of the workers in this project was about 76 persons per day until the end of 2013. The construction of the hotel involves heavy equipment including tower cranes, cranes, excavators, bulldozers, and trucks.

5.2.1 Types of staircases in project

Staircases are very necessary components of construction projects which workers are often bound to accomplish. Figures 5.1 and 5.2 show the different types of staircases used in the Lara Park Hotel construction site. It can be observed that these stairs differ in numerous ways. The free space gaps between the staircases of type-B are more than those of other types. Two accidents within the time interval of 20 days occurred in the making of the type-B staircases, both resulting in fatality. The design of the staircases was not wrong but it had a primary role in the fatal accidents. Also, the wrong method of carrying the wheel barrow, lack of guardrail, and carelessness of workers were important reasons for the accidents that took place on staircase B.

In the second case, the carpenter went back to his job during the lunch period. Because everyone was eating lunch, and no one was at the working site, the details of the accident's happening were not clear. But again like the previous case, the lack of guardrail and control are the probable reasons behind it.

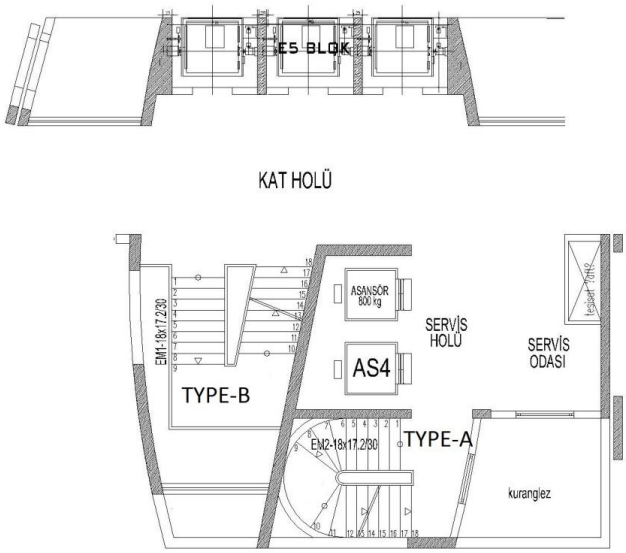

Figure 5.1. Type of staircase in the LPH construction site (A&B)

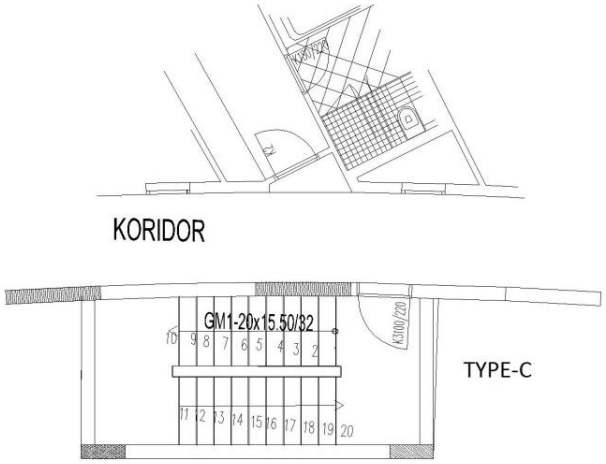

Figure 5.2. Type of staircase in the LPH construction site (C)

5.2.2 Number of workers

Figure 5.3 summarizes the average number of workers in each month. Also, different types of professions are categorized within the figure with the average number during different months.

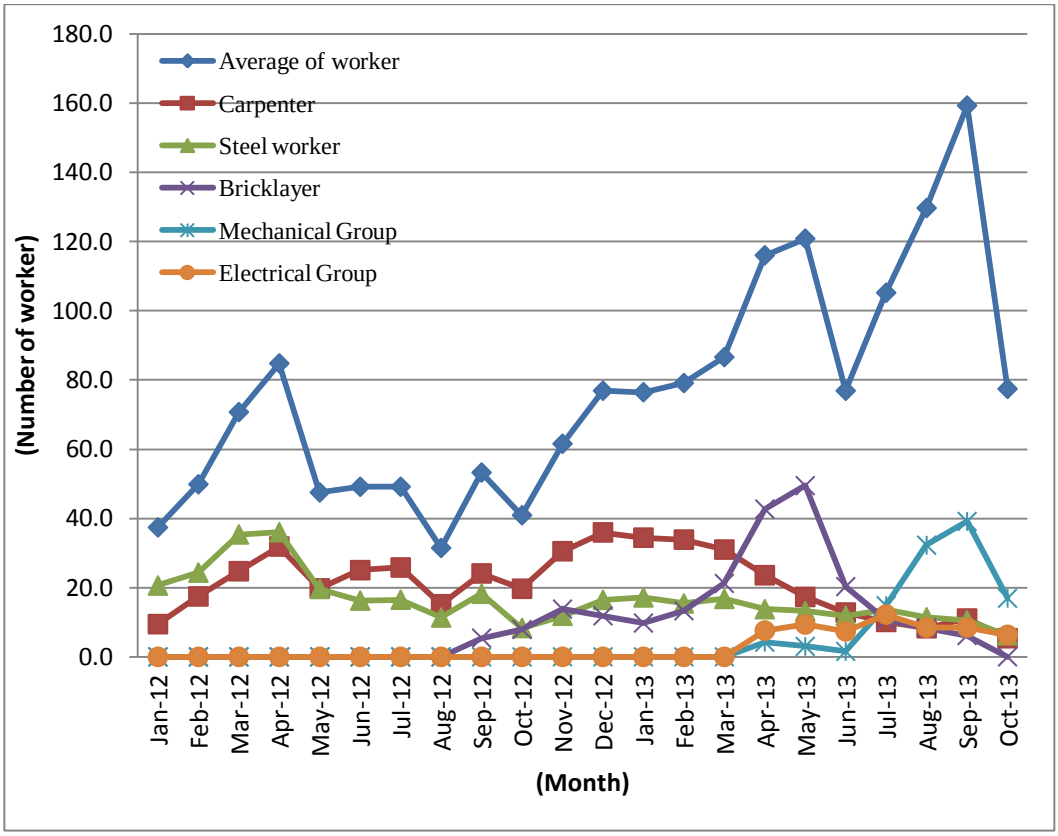

Figure 5.3. The average number of workers in each month

It is clear that the carpenters and steel workers have been working from the start of the project and were of higher numbers compared to other professions. The tasks done by carpenters and steel workers are vital in construction and a large portion of the laborers performing them are unskilled and have higher chances of being involved in accidents. Mechanical, Electrical, and Bricklaying groups are mostly dealing with low risk jobs and the accidents of their work are superficial injuries.

5.3 Report on Accident Statistics and Analyses for LPH

In a construction project, there are lots of hazardous situations which can result in accidents and injuries. Most of these hazard matters were resolved easily during the work through good work potential of the workers. Another issue was the fear of the secondary effects such as the police and labor department reports which led to some problems for the contractor.

Table 5.1 summarizes the description and detailed information of the occurred accidents in the case study from the start of the project until the end of 2013. It can be seen that since 2012, fifteen accidents occurred in the case study which caused workers to lose more than 2 days of work. There were also some minor accidents which were not mentioned in the table such as suffering from heatstroke, dizziness etc.

There were different types of accidents which threatened the workers. Table 5.1 indicated that about 50 percent of them were falling from height. Falling from height is a dangerous accident which can be identified in table 5.1 as a cause of fatality or high losses in work days for the workers. The loss of 81 work days, 2 fatal accidents aside from other secondary effects such as warnings of banning from the continuation of the work were some of the negative encounters of this case. Doctors could control the health situation of the injured workers till they have arrived at the hospital. One of the main disadvantages of the case study is that there was no doctor at the site. Controlling the health and diet of the workers could have a direct impact on the rate of accidents.

Table 5.1. Report of accidents for the case study

No	Month of accident	Year	NCAE	Cause of accident	Equipment involved	Location of accident	Age	Time of accident	Type of injury	Part of body	Loss of work days
1	June	2013	Carpenter	Fall from height	Lever arm	Staircase 5th floor	56	12 p.m.	Fracture	Skull and body	Fatal accident
2	May	2013	Electronic technician	Fall from height	Wheelbarrow	Staircase 3th floor	34	4 p.m.	Fracture	Skull and body	Fatal accident
3	May	2012	Carpenter	Fall from height	Scaffolding	Fall from 2 meter	54	10 a.m.	amputation	Back	15
4	September	2012	Carpenter	Touching sharp object	Spiral machine	Under ground	33	9 a.m.	amputation	Finger	7
5	October	2012	Bricklayer	Fall from height	Sweeper	Balcony 2th floor	28	6 p.m.	superficial	Back	2
6	August	2013	Carpenter	Fall from height	Scaffolding	Fall from 3 meter	41	9 a.m.	Fracture	Arm	30
7	July	2013	Carpenter	Hit by moving object	Lever arm	Under ground	37	2 p.m.	superficial	Head	4
8	October	2013	Carpenter	Fall from height	Formwork	Fall from 4 meter	26	11 a.m.	superficial	Foot	4
9	May	2013	Carpenter	Trapped by moving machinery	Spiral machine	Foundation	45	11 a.m.	superficial	Hand	2
10	July	2013	Plasterer	Touching sharp object	Nail	Interior of building	25	9 a.m.	superficial	Foot	3
11	August	2013	Steel worker	Fall from height	Truck	Fall from 2 meter	35	9a.m.	Bruise	Face	3
12	June	2013	Isolation worker	Touching sharp object	Nail	Wall shear	22	2 p.m.	amputation	Toe	2
13	May	2013	Masonry	Struck by falling object	Barrel	Interior of building	24	10 a.m.	superficial	Foot	5
14	July	2012	Carpenter	Struck By Flying Object	Hammer	Formwork	27	1 p.m.	Bruise	Foot	2
15	August	2013	Steel worker	Struck By Flying Object	Steel	Cut of steel machine	46	11p.m	Bruise	Eye	2

5.4 Fall Protection Methods for Construction Industry

Since half of the recorded accidents were falls from height, some fall protection method should be introduced, so we mentioned all the fall protection methods in the LPH. Several methods were suggested by the OSHA (1998) for controlling fall hazards. The methodologies used some procedures with the aim of elimination and substitution of those acts resulting in accidents. The procedures were to be carried out through warnings and administrative controls such as training and inspection, and the appropriate use of personal protective equipment (PPE) [41].

This section introduces some fall protection systems and figures implying the outcome before and after the installation of the fall protection equipments.

5.4.1 Guardrail Systems

A guardrail system is a “barrier erected to prevent employees from falling to lower levels”. Guardrail systems are vital for those workers who have to work on elevations of 6 feet (1.8 m) or more above ground level. OSHA regulated guardrails to be constructed from 2 inches (5 cm) x 4 inches (15 cm) lumbers and can range between 39 inches (1 m) and 45 inches (1.14 m) above the working level [41]. Guardrails can be established with different methods such as counterweighing, mounting on the roof as joists, or attaching to the wall or roof of the building. A sample of guardrails for floors and staircases in the case study can be viewed in Figures 5.4, 5.6, 5.7 and 5.8.

Figure 5.4. Guardrails in LPH project

Figure 5.5 Guardrails in staircases (1)

Figure 5.6. Guardrails in staircases (2)

Figure 5.7. Guardrails in staircases (3)

5.4.2 Safety Net Systems

“A safety net system is a meshed netted structure located under the surface where employees are working which prevents them from making contact with the surfaces at lower levels during a fall. Net system can be used when working on high elevations, the systems should be installed no more than 9.1 m (30 ft) below the working surface and should have sufficient clearance to avoid contact with surfaces at lower levels on lower elevations. Mesh sizes are limited to 15 cm (6 in) by 15 cm (6 in) and should be properly secured to prevent enlargement of mesh openings during a fall [41]”. Figures 5.8 and 5.9 show a net system fall protection in the case study.

Figure 5.8. Safety net system in LPH project (1)

Figure 5.9. Safety net system in LPH project (2)

5.4.3 Personal Fall Arrest and Fall Restraint Systems

“Personal fall arrests are used to protect workers under situations where falls can be potentially very harmful and will prevent the employee from making contact with a potentially dangerous surface below through deceleration. Personal fall arrest systems should be carefully inspected for wear damage and other types of deterioration before being used by employees [41]”. In Figure 5.10 it can be seen that workers during concrete casting used a personal fall arrest system in the image on the right side. The risk of a worker falling while assembling the formwork is observable in the image on the left.

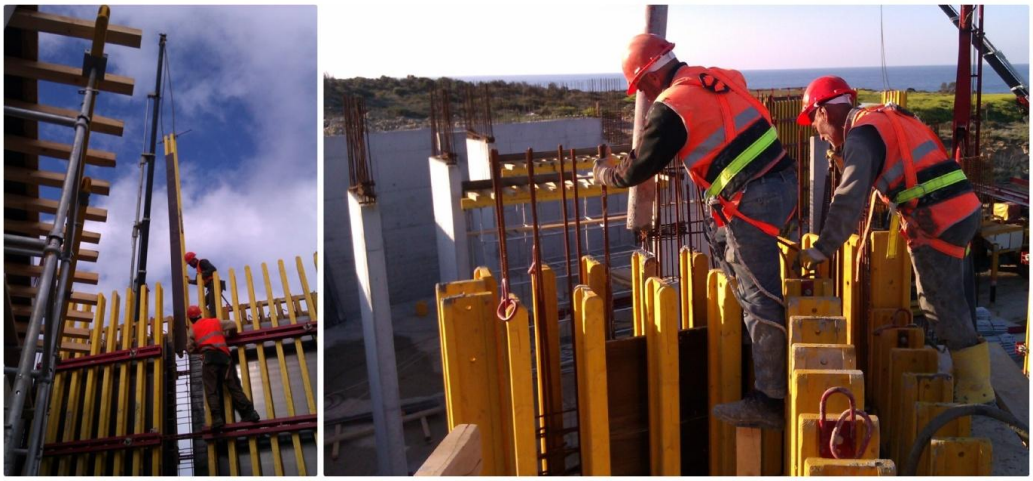

Figure 5.10. Utilizing a harness

5.4.4 Warning Line Systems

“A warning line is a barrier system on a roof used to warn employees that they are approaching an unprotected roof side or edge. Warning line systems are composed of stanchions and rope or wire, rigged and supported so as to comply with OSHA regulations. The systems are usually used on flat roof work. OSHA regulates that warning line systems be erected no less than 6 feet (1.8 meters) from the roof edge to

prevent falls [41]. Figure 5.11 shows the warning line system which informed and warned workers about the danger of falling from height.”

Figure 5.11. Warning line systems

5.4.5 Floor Cover System

Since a considerable amount of falls occur through openings in floors, it is important to provide procedures to prevent those types of falls by properly covering floor openings [41]. Figure 5.12 depicts that the worker is covering the floor opening.

Figure 5.12. Floor covers for openings

5.5 Other Safety Equipments in LPH

Besides falling from height, other kinds of accidents could be avoided by employing some of the equipment presented in this part.

Consideration of safety measures in construction sites is neccasary for all stages of work. In this section, some other safety equipment are introduced . The following figures show images of the existance and lack of some safety equipments.

Figure 5.13 shows the appropriate and inappropriate form of using equipment for reaching higher height points of a wall. Using equipment on which the worker does not have any balanace, is extremely dangerous.

Figure 5.13. Work at height level

Paying attention to the electricity cable is an important factor in the construction site. In Figure 5.14 the lack and existence of electricity cable caution on the foundation which can conduct electricity can be observed. Also, applying appropriate and

inappropriate forms of electricity plugging is shown in Figures 5.14 and 5.15. The lack of standard sockets can result in dangerous consequences.

Figure 5.14. Electric cable

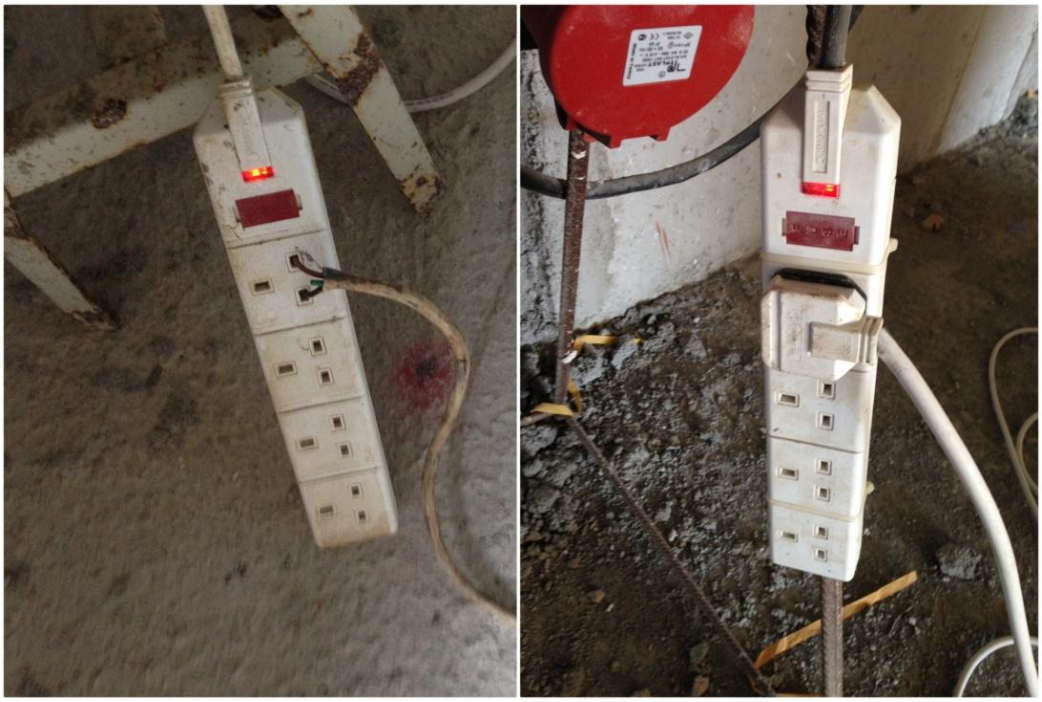

Figure 5.15. Electric extension and socket

Workers should wear helmets and steel toe work shoes in the construction sites. In the Lara Park Hotel construction site, some accidents were reported due to the

ignorance of wearing safety work gear like stepping on nails. Using appropriate shoes can also prevent from electrocuting (Figures 5.16 and 5.17).

Figure 5.16. Hard hat and work shoes

Figure 5.17. Nail and sharp object

Figures 5.18 and 5.19 show the usage and lack of work gloves and protective glasses in the LPH for the workers. Using masks and ear muffs can also help prevent them harm.

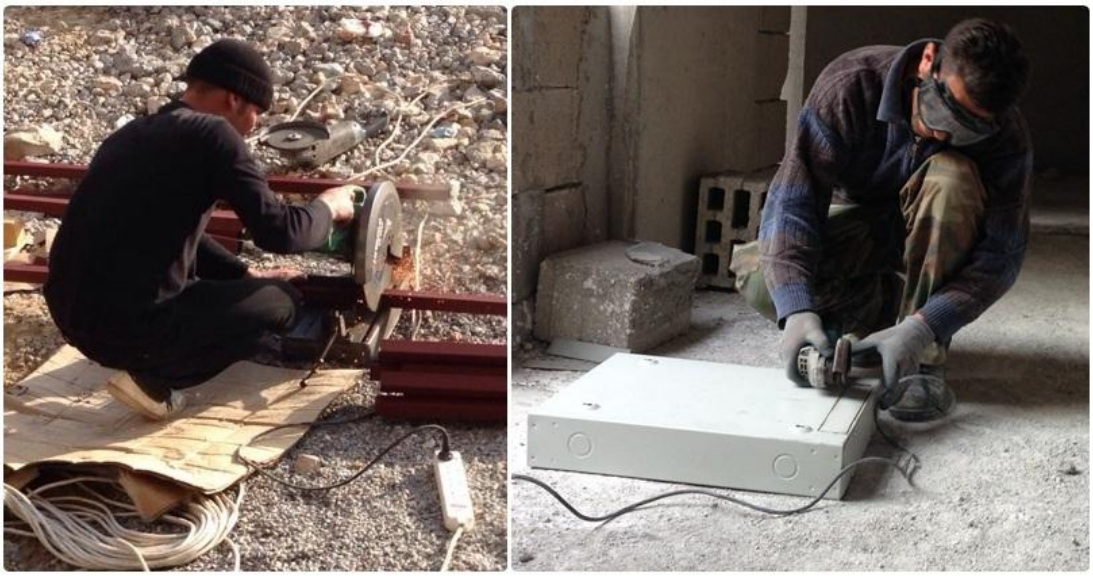

Figure 5.18. Work glasses

Figure 5.19. Work gloves

5.6 Lara Park Hotel (LPH) Construction Site Global Construction Safety Level

Table 5.2 presents all the information of accidents in the case study and compares them to the overall North Cyprus accident statistics. It should be noted that majority of the injured workers were not hospitalized due to the uncritical status of the

accident (6 superficial injuries during these 2 years were not recorded in the total accidents of North Cyprus). In LPH, the age range of 30-49 had the highest number of accidents which is the same as that of North Cyprus's information. Also, equipment such as scaffolding and nails were found to be the most dangerous among others. Feet are the most vulnerable parts of the body and the reason is being struck by objects. There are 6 shallow injuries in this case study which could have resulted from low caution of the workers at the work scene.

Eighty one days have been lost for the workers which means that the whole construction was off for one day. Due to the low number of accidents, the information of North Cyprus and the case study cannot be fully compared to each other but all the information is presented in Table 5.2.

Table 5.2. Summary of the accidents in the case study compared to the total accidents of North Cyprus

		Case Study		North Cyprus	
		2012	**2013**	**2012**	**2013**
1	**Number of accident**	4	11	51	37
2	**Fatal accident**	0	2	1	2
3	**Fall from height**	2	5	22	10
4	**Age Group**				
	15-19	0	0	1	2
	20-24	0	2	4	6
	25-29	2	2	12	5
	30-39	1	3	18	8
	40-49	0	3	14	11
	50-59	1	1	0	4
	60-64	0	0	1	0
	65+	0	0	0	0
5	**Involving location and equipment of accident**				
	Scaffolding	1	1	8	3
	Staircase & Ladder	0	2	3	3
	Height Vehicles	0	1	2	0
	Electrical Machinery	1	1	3	3
	Formwork	0	1	2	1
	Hammer	1	0	2	0
	Nail	0	2	0	1
	Lever arm	0	2	0	2
6	**Type of injury**				
	Superficial Injuries	1	5	2	0
	fracture	0	3	27	13
	amputation	2	1	14	16
	bruise	1	2	0	0
7	**Part of body**				
	Rib	0	2	0	2
	Back	2	0	0	0
	Finger	1	0	6	8
	Arm	0	1	4	0
	Head	0	1	1	1
	Foot	1	3	3	3
	Hand	0	1	3	2
	Face	0	1	0	0
	Toe	0	1	4	2
	Eye	0	1	2	1
8	**Loss of work days**	**2012-2013**		**2012-2013**	
		81		3777	

5.7 Summary of Survey

The safety situation of the Lara Park Hotel was evaluated in this chapter with complete explanation of the information and statistics of the occurred accidents in the past two years. Some conclusions drawn from the studied case are as follows:

- Fixed guardrails in staircases and floor openings should be installed immediately after removing the formwork.
- The presence of a doctor at the construction site for maintaining the health and offering first aid after an accident is a crucial issue.
- Sharp objects such as nails, steel, pieces of formwork, etc. should be collected after finishing each phase of the work.
- Workers should be motivated to wear some safety items such as work shoes, hardhats, work gloves, etc.

Chapter 6

CONCLUSION AND RECOMMENDATION

6.1 Conclusion

A parametric analysis of occupational accidents in the construction industry of North Cyprus has been conducted during the years 2006-2013. The study aimed to identify the effects of variables such as personal, business, material, temporal, and spatial or geographic factors on the occurrence of accidents. A comparison was further made between the statistics of North Cyprus and other countries. Also, occupational accidents' information and statistics of a case study performed in North Cyprus were compared to the total information of North Cyprus. Based on the discussions of the analysis, the following conclusions are drawn:

- Workers in the age range of 20-29 work carelessly with high risks which results in a high number of accidents compared to the workers of other age ranges.
- Falling from height has the highest number of recorded accidents in North Cyprus and scaffolding, which deals directly with falls from height, is most dangerous position in construction sites.
- Old and inexperienced workers are at higher risk of suffering fatal falls compared to others.

- Due to the incomplete recording of the accidents' information on the last day of the week and the mental state of the workers, on Mondays, the highest number of accidents was recorded.
- Saturday has the highest number of fall accidents due to the accumulative mental and physical exhaustion of 5 previous days.
- Approximately, half of the injuries were related to "Fractures". Also, 78% of accidents include fractures and amputations that targeted hands, arms and fingers.
- Absence of doctors from construction sites leads to increasing the probability of injuries and fatality happening in accidents.
- During the collection of information from the Labor Department of North Cyprus, it was realized that there are some limitations and missing data in the recorded information about the accidents such as timings of accidents, sizes of companies, professions of the injured people, experience of workers, occurrence days, and hospital expenses.

6.2 Recommendation

These conclusions show different outputs and causes of accidents which can be reduced by providing some proper protective actions. It is recommended that:

- Some training and appropriate penalty systems for inexperienced and careless workers are followed.
- Crucial factors like correct operations of scaffolding are controlled for preventing fall accidents from scaffoldings.

- Workers use working devices and safety equipment such as work gloves, hard hat, and work shoes, cautiously and appropriately since they can prevent damages to body parts, especially minor injuries.
- A doctor is present on construction sites for necessary controlling of the health and diet of workers and offering appropriate first aid for injured workers.
- Official members from the Labor Department record the important and exact information of accidents.

6.3 Recommendation for Further Studies

The future of our work is as follow:

1. A comprehensive comparison between the statistics and results of our study with numerical information of different countries.
2. Inspection of the Occupational Health and Safety Regulations in North Cyprus, determination of the lack and shortage of them, and the suggestion and implementation of regulations with the aim of reducing the rate of accidents.
3. Calculating the incurred costs of accidents such as the costs of hospital expenses, work loss, and the consequences of accidents then performing an economical analysis if the safety operations were utilized in the construction sites.

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APPENDICES

Appendix A: Industry Accidents

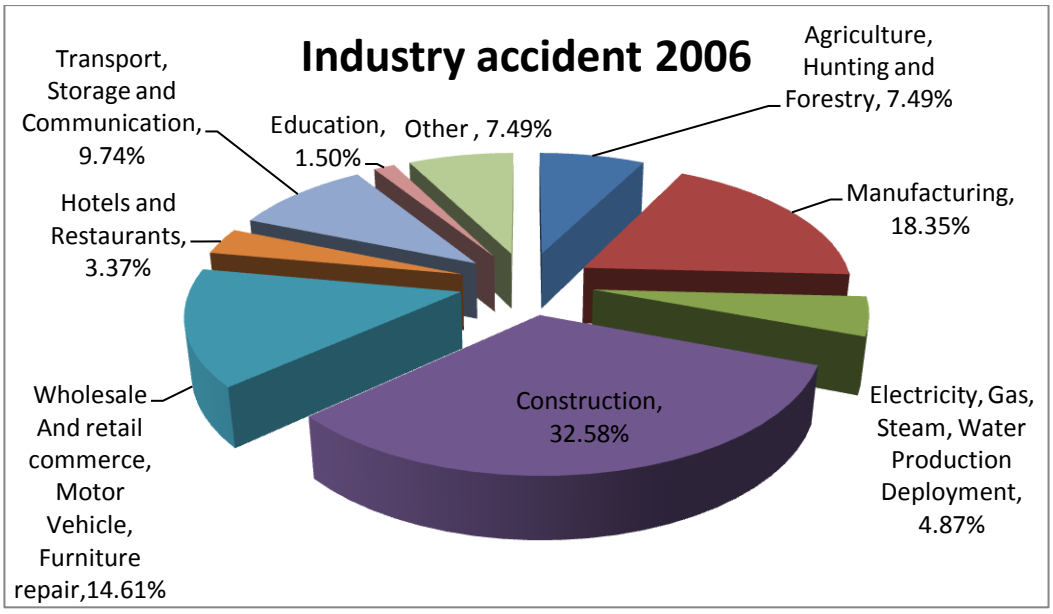


Figure A.1. Number of accidents in different industries (2006)

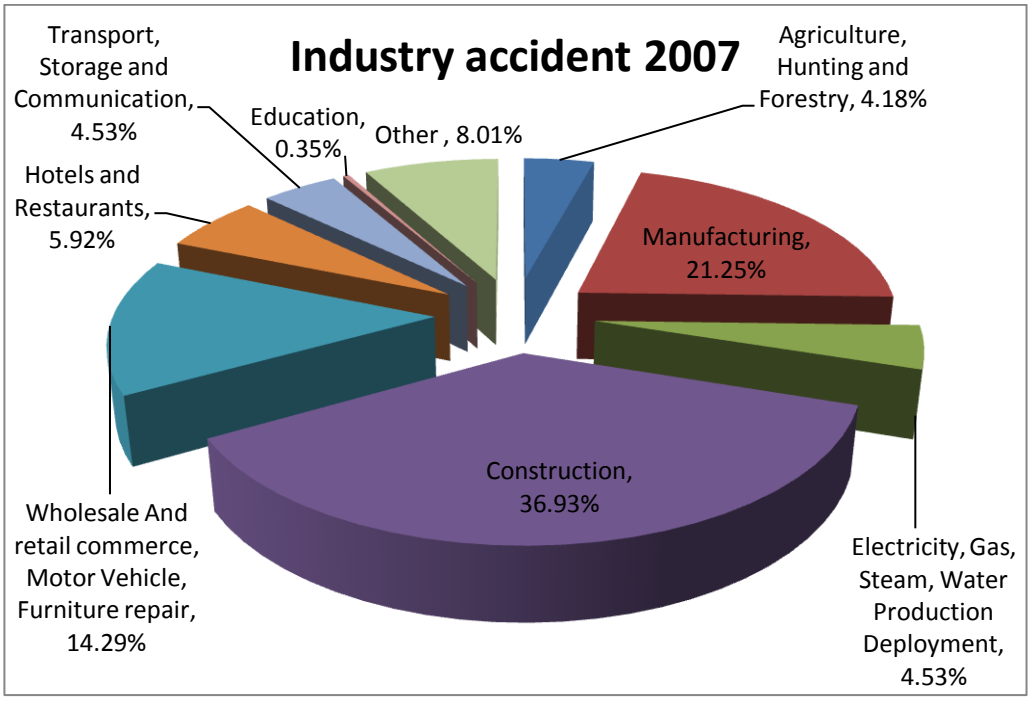


Figure A.2. Number of accidents in different industries (2007)

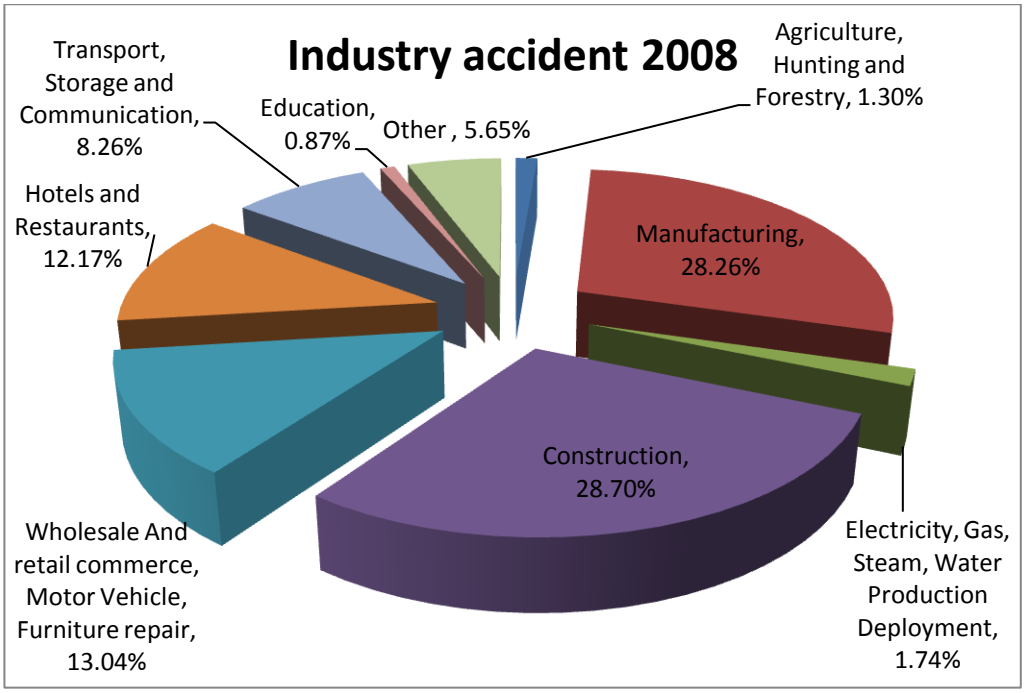


Figure A.3. Number of accidents in different industries (2008)

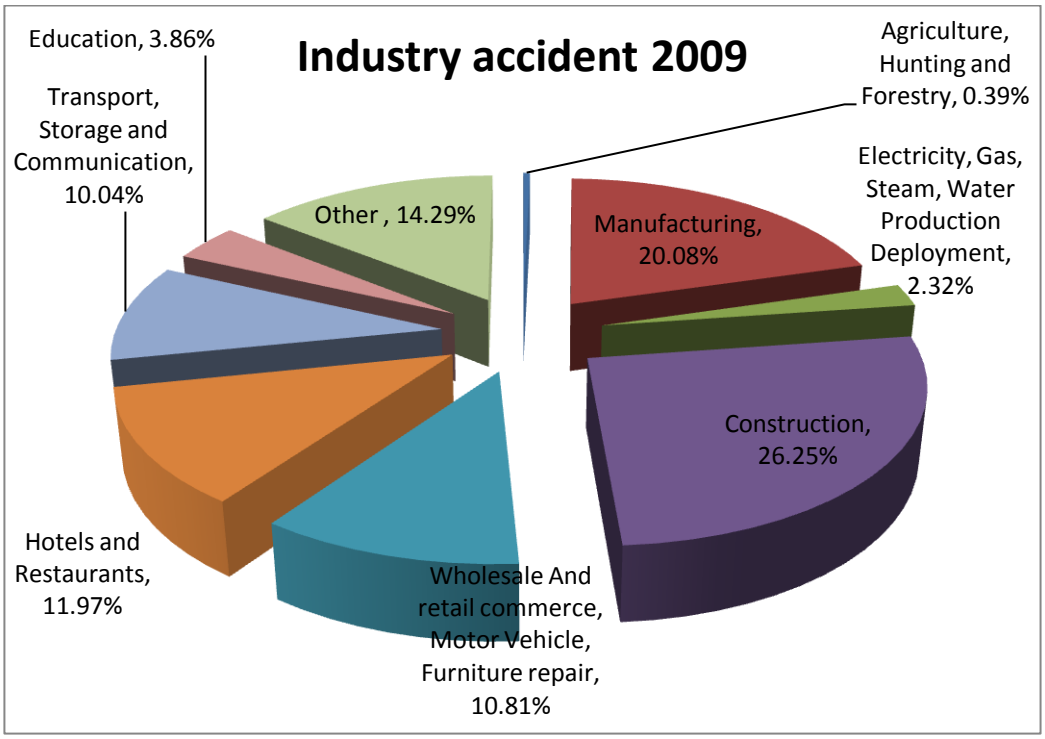


Figure A.4. Number of accidents in different industries (2009)

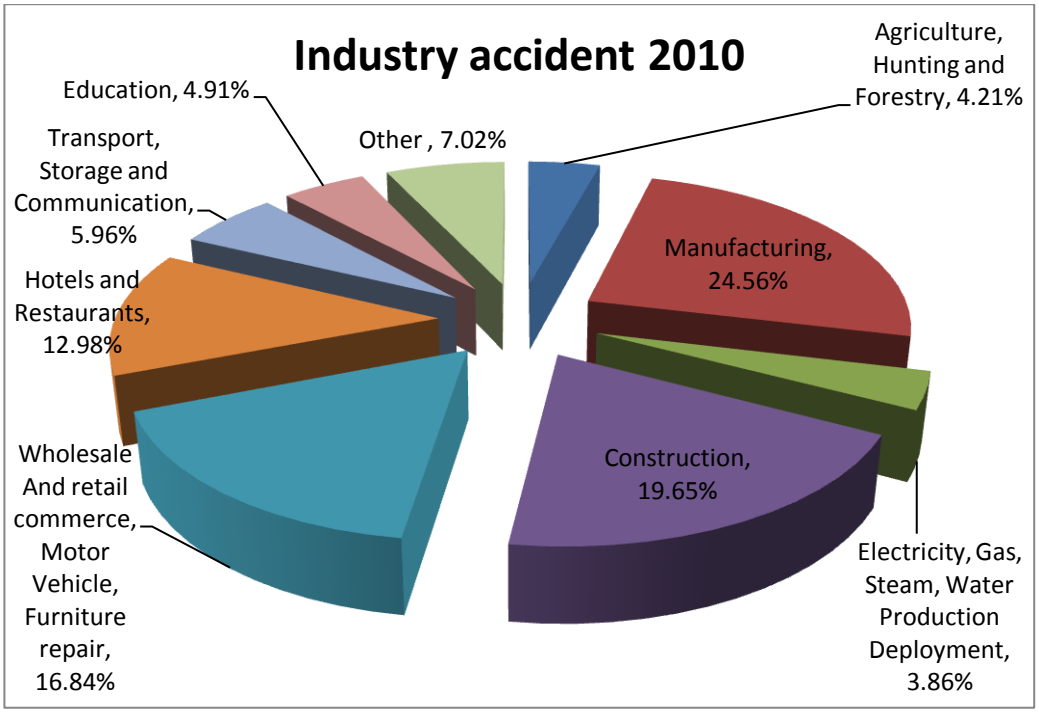


Figure A.5. Number of accidents in different industries (2010)

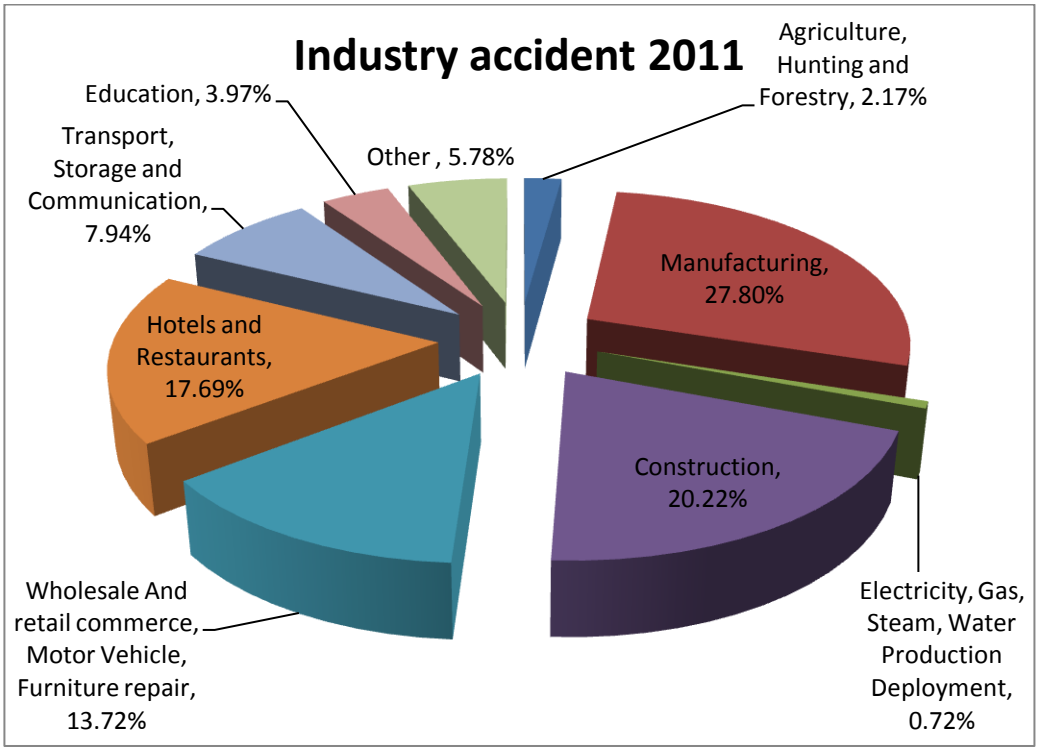


Figure A.6. Number of accidents in different industries (2011)

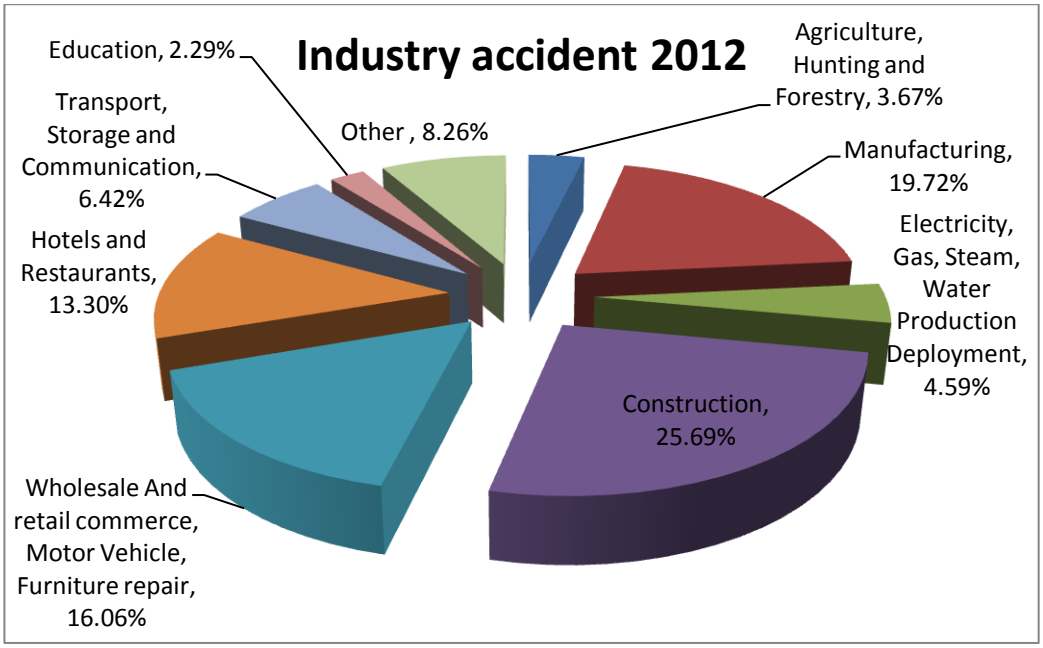


Figure A.7. Number of accidents in different industries (2012)

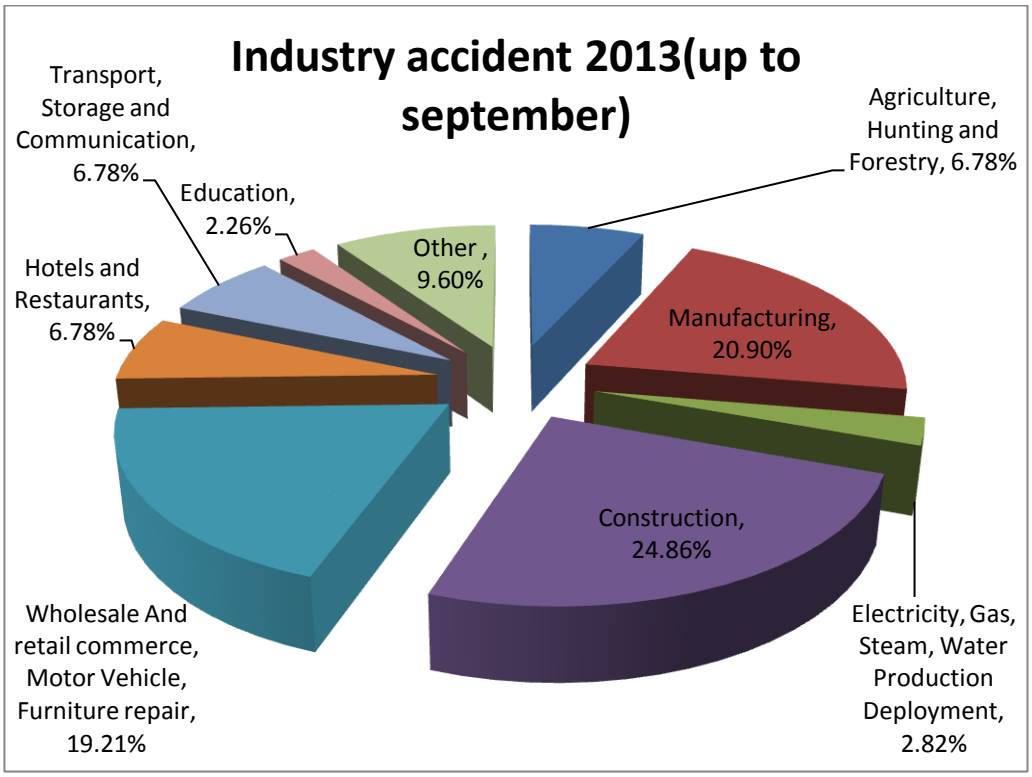
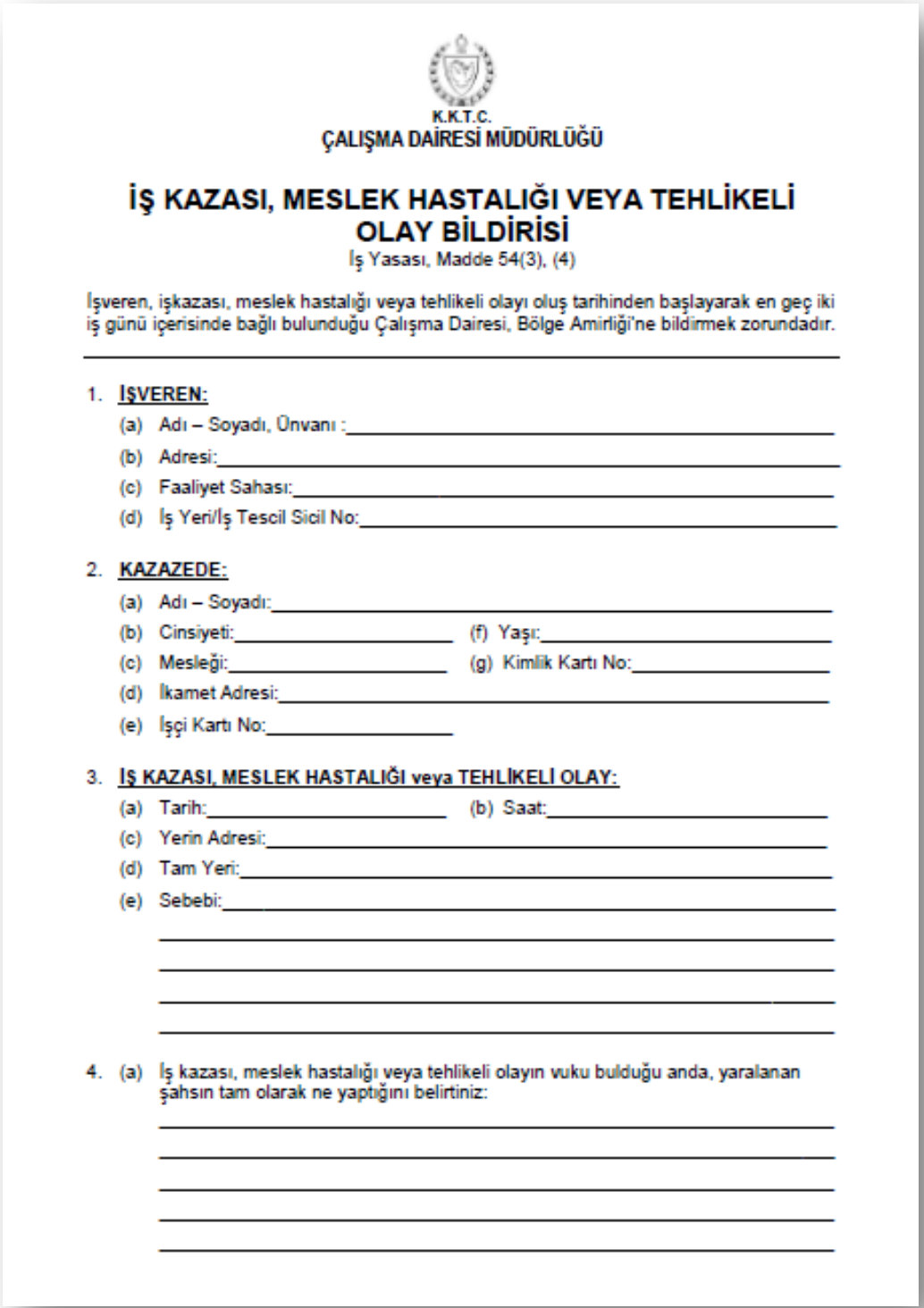


Figure A.8. Number of accidents in different industries (2013)

Appendix B: Form of Occupational Accident in North Cyprus



K.K.T.C.
ÇALIŞMA DAİRESİ MÜDÜRLÜĞÜ

İŞ KAZASI, MESLEK HASTALIĞI VEYA TEHLİKELİ OLAY BİLDİRİSİ

İş Yasası, Madde 54(3), (4)

İşveren, işkazası, meslek hastalığı veya tehlikeli olayı oluş tarihinden başlayarak en geç iki iş günü içerisinde bağlı bulunduğu Çalışma Dairesi, Bölge Amirliği'ne bildirmek zorundadır.

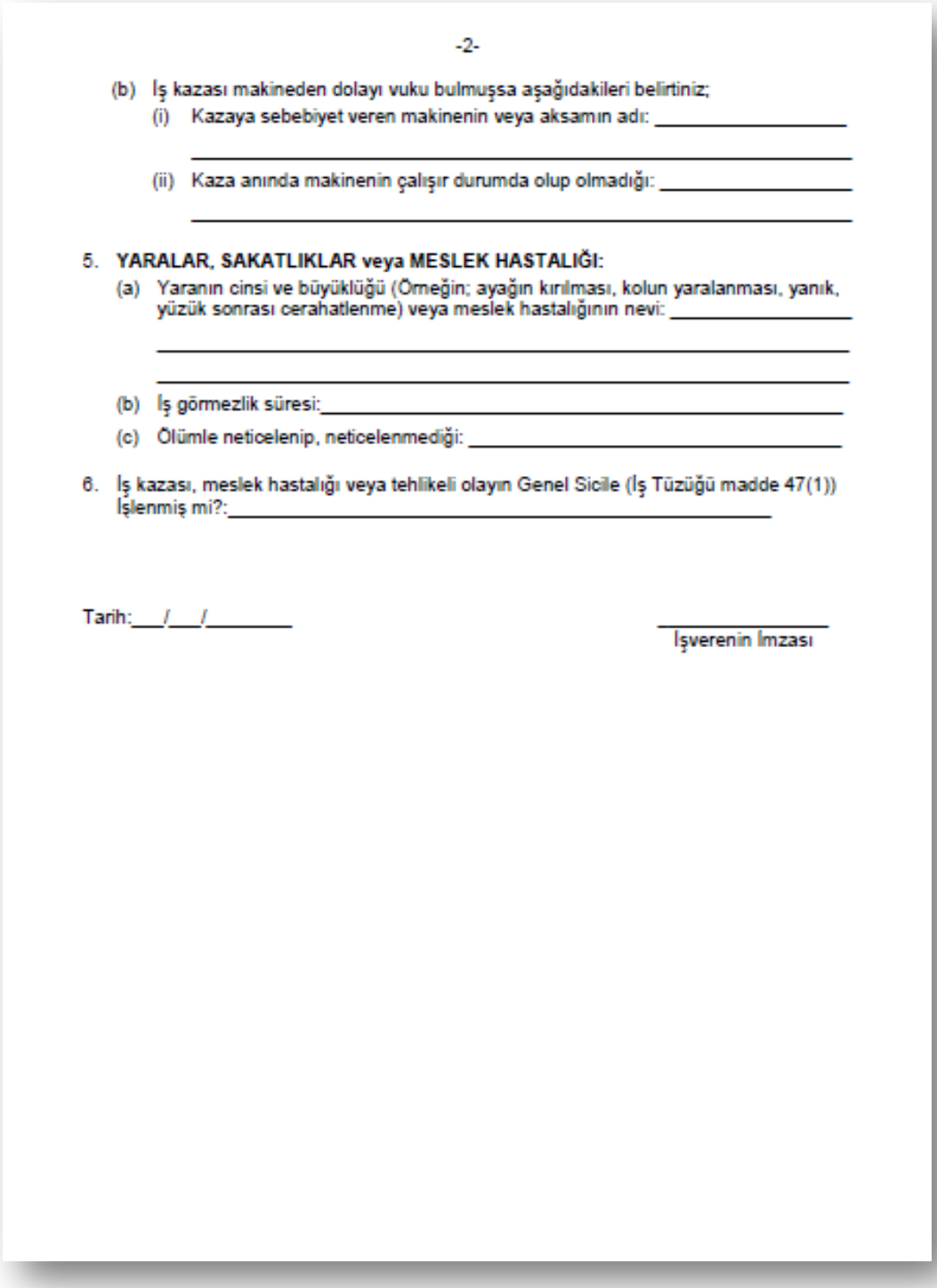
1. **İŞVEREN:**
   (a) Adı – Soyadı, Ünvanı :_____
   (b) Adresi:_____
   (c) Faaliyet Sahası:_____
   (d) İş Yeri/İş Tescil Sicil No:_____

2. **KAZAZEDE:**
   (a) Adı – Soyadı:_____
   (b) Cinsiyeti:_____ (f) Yaşı:_____
   (c) Mesleği:_____ (g) Kimlik Kartı No:_____
   (d) İkamet Adresi:_____
   (e) İşçi Kartı No:_____

3. **İŞ KAZASI, MESLEK HASTALIĞI veya TEHLİKELİ OLAY:**
   (a) Tarih:_____ (b) Saat:_____
   (c) Yerin Adresi:_____
   (d) Tam Yeri:_____
   (e) Sebebi:_____

4. (a) İş kazası, meslek hastalığı veya tehlikeli olayın vuku bulduğu anda, yaralanan şahsın tam olarak ne yaptığını belirtiniz:

Figure B.1. Occupational accident form (1)



-2-

(b) İş kazası makineden dolayı vuku bulmuşsa aşağıdakileri belirtiniz;

(i) Kazaya sebebiyet veren makinenin veya aksamın adı: _____

_____

(ii) Kaza anında makinenin çalışır durumda olup olmadığı: _____

_____

5. **YARALAR, SAKATLIKLAR veya MESLEK HASTALIĞI:**

(a) Yaranın cinsi ve büyüklüğü (Örneğin; ayağın kırılması, kolun yaralanması, yanık, yüzük sonrası cerahatlenme) veya meslek hastalığının nevi: _____

_____

_____

(b) İş görmezlik süresi:_____

(c) Ölümle neticelenip, neticelenmediği: _____

6. İş kazası, meslek hastalığı veya tehlikeli olayın Genel Sicile (İş Tüzüğü madde 47(1)) İşlenmiş mi?:_____

Tarih:___/___/_____

_____

İşverenin İmzası

Figure B.2. Occupational accident form (2)

Appendix C: Location of accident (2006-2013)

	Kaza Nevi	2006	2007	2008	2009	2010	2011	2012	2013	
1	Ağaç İşleme Makinesi	2	1	2	0	0	0	0	0	5
2	Ahşap Dolap	0	0	0	0	0	0	0	1	1
3	Alçı Torbası	1	0	0	0	0	0	0	0	1
4	Alüminyum Çubuk	0	1	0	0	0	0	0	0	1
5	Anavador	1	1	0	0	0	0	1	0	3
6	Araç	2	0	0	0	0	0	0	0	2
7	Asansör	1	1	0	0	0	0	0	0	2
8	Asansör Boşluğu	0	0	0	0	0	1	0	0	1
9	Asansör Kepçesi	0	0	0	1	0	0	0	0	1
10	Asma Tavan	0	0	0	1	0	0	0	0	1
11	Azot Gazı	0	0	0	0	0	0	1	0	1
12	B.Y.S Araçlar	1	3	0	0	0	0	0	0	4
13	B.Y.S. Malzemeler	0	0	0	0	0	1	0	0	1
14	Bahçe Duvarı	0	0	0	0	1	0	0	0	1
15	Balkon Korkuluğu	0	0	0	1	0	0	0	0	1
16	Balyoz	0	0	0	0	0	1	1	1	3
17	Beton Delme Makinesi	0	0	0	0	0	0	1	0	1
18	Beton Makinesi	0	0	0	0	0	0	0	1	1
19	Beton Rögar Kapağı	0	1	1	0	0	2	1	0	5

20	Bijon Anahtarı	0	0	0	1	0	0	0	0	1
21	Bina İçinde(Diğerleri)	1	0	0	0	0	0	0	0	1
22	Blok Mozaik	0	0	0	0	0	1	0	0	1
23	Boru Tıpası	1	0	0	0	0	0	0	0	1
24	Büz	0	0	0	0	0	0	0	1	1
25	Cam	0	1	2	0	0	0	1	0	4
26	Cıvata	1	0	0	0	0	0	0	0	1
27	Çalışma Çevresi	2	5	1	1	0	1	0	0	10
28	Çalışma yüzeyi	1	6	2	2	4	0	0	1	16
29	Çamur Makinesi	0	1	0	0	1	0	1	0	3
30	Çatı	0	0	0	0	1	0	0	0	1
31	Çatı Malzemesi	0	0	0	1	0	0	0	0	1
32	Çatıda Islak Zemin	0	0	0	0	0	0	0	1	1
33	Çekiç	0	1	1	1	1	0	2	0	6
34	Çelik Halat	0	0	0	0	0	0	1	0	1
35	Çelik Kalıp	0	0	1	0	1	0	0	0	2
36	Çivi	1	1	1	0	0	0	0	1	4
37	Daire Testere	1	2	2	0	1	1	3	1	11
38	Demir	0	0	1	1	0	0	0	0	2
39	Demir Bükme Aleti	0	0	1	0	2	0	0	1	4
40	Demir Çarpması	0	0	1	0	0	0	0	0	1
41	Demir Direk	0	1	0	0	0	0	0	0	1
42	Demir Kelepçe	0	0	0	0	0	0	0	1	1
43	Demir Kesme Mak.	1	0	0	0	0	0	0	0	1

44	Demir Kiriş	0	0	0	0	0	1	0	0	1
45	Demir Kova	0	0	0	1	0	0	0	0	1
46	Demir Levye	0	0	0	0	0	0	0	1	1
47	Demir Makas	0	0	0	1	0	0	0	0	1
48	Demir Parçası	0	1	1	0	0	0	0	0	2
49	Denizlik	0	0	0	0	0	0	1	0	1
50	Depo	0	1	0	1	0	0	0	0	2
51	Destere	0	0	0	0	0	0	0	1	1
52	Diğer	1	1	0	0	0	0	0	0	2
53	Diğer Destereler	2	0	1	1	0	1	0	0	5
54	Dorse Kapağı	0	0	0	0	1	0	0	0	1
55	Döşeme ve Duvar Boşluğu	0	0	2	0	0	0	0	0	2
56	Dozer	0	0	1	0	0	0	0	0	1
57	Döşeme	0	0	1	1	1	0	1	0	4
58	Döşeme ve Duvar Boşluğu	1	0	0	0	0	0	0	0	1
59	Duvar	0	1	0	1	0	1	0	0	3
60	Ekskavatör	0	0	0	0	3	0	0	0	3
61	El Aletleri	5	2	2	0	0	0	0	0	9
62	El Arabası	0	0	0	0	0	0	0	1	1
63	Elektrik	0	0	0	0	0	1	0	0	1
64	Elektrik Kablosu	0	0	0	0	0	2	0	0	2
65	Elektrik Malzemesi	0	0	1	0	0	0	0	0	1
66	Elektrik Panosu	0	0	0	0	0	0	1	0	1
67	Elektrik Tesisat	0	0	1	1	1	0	0	0	3

68	Elektrikli El Aletleri	4	1	1	0	2	0	1	0	9
69	Elektrikli Testere	1	0	0	1	1	0	0	0	3
70	Farsa Makinası	0	0	0	0	0	1	0	0	1
71	Fırlayan Parçalar	2	1	0	0	0	0	0	0	3
72	Forklift	2	2	0	0	0	0	0	0	4
73	Freze Tezgâhları	0	0	1	2	0	0	0	0	3
74	Gaz	0	1	0	0	0	0	0	0	1
75	Gerilim Hattı	0	1	0	0	0	0	0	0	1
76	Güç Üreten Makine	1	0	0	0	0	0	0	0	1
77	Harç Makinesi	1	3	0	0	1	0	1	0	6
78	Harç Makinesi Kayışı	0	0	0	0	1	0	0	0	1
79	Harç Teknesi	0	0	0	0	0	1	0	0	1
80	Hava Şartları	0	0	0	0	1	0	0	0	1
81	Havalandırma Boşluğu	0	0	0	1	0	0	0	0	1
82	Islak Zemin	1	0	0	0	0	0	0	1	2
83	İletim Kayışları	3	0	0	0	0	0	0	0	3
84	İnşaat Balkonu	0	0	1	0	0	0	0	0	1
85	İnşaat Demiri	0	1	0	0	0	0	0	2	3
86	İnşaat Kalıbı	0	0	0	1	0	0	0	0	1
87	İnşaat Malzemeleri	0	0	0	0	0	1	0	0	1
88	İnşaat Molozu	0	0	1	0	0	0	0	0	1
89	İp	0	0	0	0	1	0	0	0	1
90	İp Kopması	0	0	0	0	1	0	0	0	1

91	İş Makinesi	0	1	0	0	0	0	0	0	1
92	İzmirillo Makinesi	1	0	0	0	0	1	0	0	2
93	İzolasyon Makinesi	1	0	0	0	0	0	0	0	1
94	Kablo	0	0	0	2	0	0	0	0	2
95	Kalas	1	1	0	0	0	1	0	0	3
96	Kaldırma Makinesi	0	1	0	0	0	0	0	0	1
97	Kalıp Demiri	1	0	0	0	0	0	0	0	1
98	Kalıp Panosu	0	0	0	0	0	1	0	0	1
99	Kalıp Tahtası	0	0	1	1	2	1	2	1	8
100	Kamyon	1	2	0	0	3	0	1	0	7
101	Kanal Duvarı	0	0	0	0	0	1	0	0	1
102	Kango Makinesi	0	1	0	0	0	0	0	0	1
103	Kapalı Odalar	0	2	0	0	0	0	0	0	2
104	Kapı	0	1	0	0	0	0	0	0	1
105	Kaygan Yüzey	0	1	0	0	0	0	0	0	1
106	Kaygan Zemin	2	0	0	0	1	0	0	0	3
107	Kazı Makinesi	0	0	0	0	0	0	1	0	1
108	Kazma	0	0	0	0	0	0	1	0	1
109	Kepçe Demiri	0	1	0	0	0	0	0	0	1
110	Kerpiç Duvar	0	0	0	0	0	1	1	0	2
111	Keser	0	0	0	0	0	0	1	0	1
112	Keski Demiri	0	0	1	0	0	0	0	0	1
113	Kimyasal Maddeler	0	0	0	0	0	1	0	0	1
114	Kolon	0	0	1	0	0	0	1	0	2

115	Küçük Yük Arabası	0	1	2	0	0	0	0	0	3
116	Kürek	0	0	0	0	0	0	0	1	1
117	Levye	0	0	0	0	0	1	0	0	1
118	Makara Tertibat	2	0	1	1	0	0	0	0	4
119	Maket Bıçağı	0	1	0	0	0	0	0	0	1
120	Makine(Diğerleri)	0	0	0	1	0	0	1	1	3
121	Masa	0	0	0	1	0	0	0	0	1
122	Mekanik Makaslar	0	0	1	0	0	0	0	0	1
123	Merdiven	4	6	7	8	5	6	2	1	39
124	Merdiven Sahanlığı	0	0	0	0	0	0	0	2	2
125	Mermer	1	0	2	0	0	1	0	1	5
126	Metal (diğerleri)	0	0	1	0	0	0	0	0	1
127	Metal Saç	0	0	1	0	0	0	0	0	1
128	Motorlu Araç	0	0	0	0	1	0	0	0	1
129	Motorlu Pres	0	0	0	0	0	0	0	1	1
130	Motosiklet	1	0	0	0	0	0	0	0	1
131	Mutfak Dolabı	0	0	0	0	0	1	0	0	1
132	Oyma Makinası	0	4	1	0	0	0	0	0	5
133	Palet	0	0	0	0	0	1	0	0	1
134	Pano	0	0	0	0	0	0	1	0	1
135	Pencere	0	0	0	0	0	0	1	0	1
136	Pencere Pervazı	0	0	1	0	0	0	0	0	1
137	Perde Duvarı	0	0	0	0	1	0	0	0	1
138	Planya Makineleri	1	1	3	0	1	2	1	0	9

139	Plastik Sandalye	0	0	0	0	0	0	1	0	1
140	Poliüretan(Kimyasal Madde)	0	0	0	0	0	2	0	0	2
141	Profil Boru	0	0	0	0	0	1	0	0	1
142	Profil Demir	0	0	0	0	1	0	0	0	1
143	Sabit Merdiven	1	1	2	1	1	1	1	0	8
144	Sac Pano	1	0	0	0	0	0	0	0	1
145	Saç Levha	0	0	0	1	0	0	0	0	1
146	Sende	0	0	0	0	0	1	0	0	1
147	Seyyar Merdiven	0	0	0	0	0	1	1	0	2
148	Seyyar Rampa	0	0	2	1	0	0	0	0	3
149	Sıva	1	0	0	0	0	0	0	0	1
150	Silinti Çakıllar	0	0	0	0	0	0	0	1	1
151	Spiral Makinesi	0	0	0	1	3	0	2	3	9
152	Su	0	1	0	0	0	0	0	0	1
153	Su Tankeri	0	1	0	0	0	0	0	0	1
154	Tahta sunta	0	0	0	0	0	0	0	1	1
155	Taş Blok	1	1	0	0	0	1	0	1	4
156	Taş Kırma Makinesi	0	0	0	0	0	0	0	1	1
157	Taşlama Makinesi	0	0	0	1	0	0	0	0	1
158	Tavan Çökmesi	0	4	0	0	0	0	0	0	4
159	Tesisat Anahtarı	0	0	0	0	0	0	0	1	1
160	Testereler	0	0	0	1	0	0	0	0	1
161	Toprak	0	0	0	0	1	0	0	0	1
162	Toprak Zemin	0	1	0	0	0	0	0	0	1
163	Trafik Kazası	2	8	5	16	10	0	0	1	42

164	Tuğla	1	1	0	0	0	1	1	1	5
165	Van Araç	0	0	1	0	0	0	0	0	1
166	Varil	1	0	1	1	0	0	1	0	4
167	Vinç	2	2	0	0	0	0	0	0	4
168	Yapı İskelesi	12	23	7	12	9	5	8	3	79
169	Yatar Tepsi	0	0	0	0	0	1	0	0	1
170	Yatay Daire	0	0	0	0	0	0	1	0	1
171	Yük Asansörü	1	0	1	1	1	0	0	0	4
172	Yük Eşyası	0	1	0	0	0	0	0	0	1
173	Zemin	0	2	0	1	0	0	2	0	5