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Classification of Construction Accidents in Northern Cyprus

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ABSTRACT

This study, carried out in northern Cyprus, encompasses construction accidents occurred between the years 1994 and 2004 and recorded in the archives of the Ministry of Labor and Social Security. Within the scope of the study, victims were classified according to their industrial brunches firstly and it was established that 793 (26.40%) of total 3004 victims worked in the Construction industry. These 793 construction accidents were classified according to date, hour of the accident, type of accident, result of accident, loss of workday, type and place of injury, age, profession, experience and so on. Results reveal that fall from height (37.70%), crashed by an object (10.97%) and struck by an object (10.84%) are most frequent accident types. However, in case of fatal accidents falls again rank first but electrocutions rank second and crashed, jammed in or between objects and traffic accidents share third place. The results are compared with accidents occurred in Turkey and similarities are observed. Unskilled workers are the most frequent victims (34.40%) of these accidents. At observing the frequency of accidents throughout the year, spring and summer appeared to be the periods in which accidents, and deaths resulting from accidents, were most frequent. It is considered that research findings will provide a broad and beneficiary source for the occupational health and safety studies and would aid policy makers in developing countries especially in Turkey and northern Cyprus.

Keywords: Construction industry, occupational health and safety, classification of occupational accidents, Turkey and Northern Cyprus.

1. INTRODUCTION

Construction industry is one of the largest industry globally in providing employment capacity, productivity, and contributing to the economy (ILO, 2015). At the same time, it is

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among those industries in which occupational accidents occur most frequently, in almost every country (EASHW, 2003; Eurostat, 2009; HSE, 2009; Reyes et al., 2014). Around 30% of occupational accidents worldwide, resulting in death, take place in construction works (Fang et al., 2004; Gürcanlı & Müngen, 2013). Construction industry is a project based industry, different job activities exist, each activity creates different risks and each project has its own characteristics as well as risks. Moreover, contingent forms of contracting exist and coordination of subcontractors as well as main contractors is usually difficult (Çelik & Tözer, 2014; HSE, 2005). According to International Labour Organisation (ILO) data, it can be seen that the probability of fatal accidents of construction workers is 3-4 times higher than other industries in many coutries (ILO, 2015).

In the USA, 20% of fatal accidents and 9% of occupational injuries take place in the construction industry where its share in total employment is between 6 to 7% (Gürcanlı & Müngen, 2013). It was observed that 32% of occupational deaths in the UK, during 2013-2014 period were in the construction industry (HSE, 2014). About 25% of all occupational accidents in Finland are in the construction industry (Nenonen, 2013). Looking at Singapore, it can be seen that construction industry offers employment to 29% of the work force of the country, meanwhile being the cause of 40% of occupational accidents (Chua & Goh, 2004; Feng et al., 2015).

Prevalent construction types, construction methods and techniques, the work force and their culture in construction industry are almost the same in both Turkey and Northern Cyprus (Kıvrak et al., 2014). Therefore, there are similarities in construction works accidents as well. When Turkey is examined for occupational accidents, it shows similarities with the Northern part of Cyprus. 30.5% of all occupational deaths in Turkey are in the Construction industry (Gürcanlı & Müngen, 2013; Çelik & Tözer, 2014; Gürcanlı, 2013; Akboğa & Baradan, 2015; Baradan et al., 2016).

As in all other fields, the existence of statistical data provides strong evidence in Occupational Health and Safety, and works as a guiding tool (Doguwa, 2010). Occupational accidents are being archived in the Northern Cyprus for the last 20 years by the Labor Directorate disorderly. First, the whole archive was transferred to a digital environment, and all of the data was classified to be used effectively to develop countrywide O&H policies.

2. AIM OF THE STUDY

As mentioned above, the presence and quality of statistical data – as in all other fields – presents very strong evidence to experts in the Occupational Health and Safety field, and serves as a tool of direction (Doguwa, 2010). Thus, the aim of this study carried out in the northern part of Cyprus, is to provide a scientific basis to the investigations on occupational accidents and diseases, carried out by the Labor Directorate, and aid to record them in the literature.

In addition, the main goal of this study is to,

- Provide data on past accidents to the technical personnel, working at construction sites, who are responsible for work safety, ,
- Present data to labor inspectors to guide them for a sound inspection,

- Provide the data needed for creating severity indexes and construction accident likelihood for the risk analysis, which will be established through scientific approacheses

by making a detailed analysis of the recorded accidents in the northern part of Cyprus.

3. METHODOLOGY

Firstly, industrial distribution of occupational accidents was established, working on the digital environment. After that, the study focused on accidents in the Construction Industry. During the study, it became essential to re-arrange accident records compatible with the International Classification of Diseases (ICD-10) format.

In the final stage of the study, findings were interpreted and statistical data on occupational accidents, which took place in the Construction Industry, were presented for the use of the industry and experts. In addition to this, suggestions for technical and administrative arrangements towards controlling occupational accidents in the Construction industry and achieving a sustainable improvement were made, and expert views were also provided.

4. RESULTS

In the year 2013, the ratio of workers subjected to occupational accidents in the south of Cyprus was 985.2 out of 100,000 workers (Bruch, 2014). Having a ratio of 6.6 deaths for 100,000 workers in the EU in general, the Construction industry is the most fatal one after the mining and quarrying industry, which has a 10.9 ratio. Moreover, looking into EU countries, it can be seen that South Cyprus is at the top of the scale with the rate of 4.9 deaths out of 100,000 workers (Eurostat, 2013). However, 10-year data of the South of Cyprus shows that, due to gaining of EU membership, a considerable decrease occurred in occupational accidents in the Construction industry (Eurostat, 2014). However, there was a decline in the economy of South Cyprus, which was directly affected by the economic crisis in Greece. As a result of this decline, a decrease of employment was seen in the narrowing Construction Industry, therefore, a more significant decrease in occupational accidents was also observed.

Looking at the Northern part of Cyprus, it can be seen that the population is around 313,000, and 12.6% of the employment is in the Construction Industry (SPO, 2015). The industry is by far leading in occupational deaths. 48% of occupational deaths in the country take place in the construction sites (Çelik & Tözer, 2014).

4.1. Accident Data according to the Industrials

One of the first findings reached through studies on records is about the industrial distribution of occupational accidents. It can be seen that 793 occupational injuries and deaths of a total of 3004 accidents, investigated by the Directorate of Labor for the twenty-year period 1994-2014, took place in the Construction industry. This figure shows that almost a quarter of all casualties are construction workers, or those from or around constructions. The Construction industry is followed by the Manufacturing industry, with 444 casualties (Table 1). A total of

722 accidents, of which 12 are deaths and 710 are injuries, are provided under the heading of 'other industries', which include agriculture & plantation, financial services, education, public services and hotel, tourism & catering services.

Each industry is also examined for the ratio of deaths originating from work, and the Construction industry was found to have the highest death rate after the mining (quarrying) industry (Table 1).

4.2. Construction Industry and Occupational Accidents in this Industry

4.2.1. Economic Development, Industrial Development, and Occupational Accident Relationship:

Northern Cyprus Construction industry is at the top of the industries considerably contributing to economic growth of the country, and according to the data by SPO, it affects 27 sub industries, thus the state of the economy, directly. Therefore, developments in the Construction industry run parallel with economic growth. While the average growth of the industry was 6.8% during the years 2000-2012, general economic growth average was around 4.9%. The Construction industry grew above the general growth rate during the years of economic development, and showed a sharp decline during periods of economic shrinkage. While the industrial growth peaked during the 2004-2005 period, it went into a sharp decline right after those years (SPO, 2012).

Construction industry is a field in which labor is used intensely. Although various construction methods are used, it is estimated that cost of labor for the most widely used construction methods in the country is 40-50% of the total cost (SPO, 2012). With this aspect, the Construction industry is one that creates most of the employment opportunities. The ratio of employment the industry creates among overall employment shows variations in time. The construction employment rate that was 5-6% in the 70's rose up to 19-20% after 2003. However, in parallel with economic fluctuations, the shrinkage in the industry brought this rate under 10% again (SPO, 2015; SPO, 2012).

Unable to achieve a planned and sustainable growth from the point of employment and economic growth, the industry went through sharp declines because of the dead - ends. Parallel to this, unplanned development there resulted Occupational Health and Safety problems which were growing exponentially. This made the Occupational Health and Safety field a problem increasingly difficult to manage. This situation can be observed clearly, when the number of occupational accidents and employment rate are compared year by year. Analysing results of the study, reveals the changing employment capacity of the construction industry throughout years. Moreover, the industry achieved a very rapid growth and development during the 2004-2005 period, right after the years 2001, 2002, and 2003, during which the state economy was revitalized. In parallel, the Construction industry reached its highest levels of employment. The employment rate of Construction industry, which was around 14% during the 90's, rose up to 18% in early 2000's, when an economic and industrial revival was seen. As stated above, this unplanned development in the Construction industry and unusual increase in employment capacity also caused a rise in occupational accidents.

Table 1. Distribution of occupational accidents in the Northern Cyprus during 1994-2014, distribution of the number of deaths and injuries, death rates within industries.

Industry	Death	Injured	Total	(%)	Death Rate Within the Industry (%)
Construction	42	751	793	26.40	5.30
Carpentry	1	190	191	6.36	0.52
Manufacturing	7	437	444	14.78	1.58
Public Service	7	350	357	11.88	1.96
Finance	5	238	243	8.09	2.06
Costal & harbor works	5	117	122	4.06	4.10
Transportation	2	84	86	2.86	2.33
Mining (Quarries)	5	41	46	1.53	10.87
Other industries	12	710	722	24.03	1.66
Total	86	2918	3004	100.00	2.86

Table 2. Employment capacity of the Construction industry in the northern part of Cyprus, its share in total employment, and distribution of fatal accidents in the Construction industry through years, and the comparison of this with South Cyprus and Turkey.

Years	Northern Part of Cyprus			Rep. of Cyprus (Southern Part of Cyprus)			Turkey		
	1	2	3	1	2	3	1	2	3
2000	6199	16.46	50.00	27400	8.52	21.22	761452	3.50	32.30
2001	6038	17.54	80.00	28800	8.72	21.81	681882	3.20	33.80
2002	6521	18.62	0.00	30400	9.04	22.20	713629	3.30	36.60
2003	7071	19.70	33.30	32400	9.43	22.68	685902	3.20	33.80
2004	6953	17.78	37.50	34100	9.63	23.36	752136	3.80	31.30
2005	7467	15.86	66.67	35700	9.88	23.85	933498	4.70	27.10
2006	9157	13.94	57.14	37300	10.11	24.35	1185728	5.80	24.90
2007	8701	12.02	85.71	39400	10.39	25.02	1247970	6.00	34.40
2008	7367	10.10	50.00	40500	10.41	25.68	1238888	5.80	34.30
2009	6356	9.54	16.67	38600	9.99	25.50	1227698	5.80	13.30
2010	6316	8.98	0.00	36300	9.38	25.56	1431000	6.30	33.10

1-Employment in Construction industry (registered)
2-Share (%) of Const Employ. in Total
3-Share (%) of Fatal Const. Accidents

The economic crisis during 2005-2006, and the decline in the Construction industry in the following years, resulted in a decline in the industrial employment capacity. As the employment capacity average of the industry went down to 8.34% during the 10-year period after the economic crisis, the number of occupational accidents also declined.

Comparing Northern Cyprus to the EU member Republic of Cyprus and to Turkey, the first thing that is noticed is that employment capacity of the Construction industry in Northern Cyprus is much higher (in percentage) that South Cyprus and Turkey. Table 2 examines the data of the three neighboring countries during the years 2000-2010. According to the data, Northern Cyprus is far ahead in fatal accidents in the Construction industry. However, the levels of the other two countries are also considerably high.

4.2.2. Distribution of Accidents According to Time of Day:

Examining through time, it can be seen that the number of annual investigations between 1994 and 2004 is quite low. For the first 11-year period of the 20 years under study, average annual investigations were found to be 9.36. The main result of this is that most of the occupational accidents during those years were not reported to the Labor Directorate. For the second half of the 20-year period, however, the average annual investigation figure rose up to 68.6. It is assumed that this increase is the result of coordination between the Labor Directorate and Social Security Office and Department of Health. In addition to this, it is also thought that another reason for the rising number of accidents can be the fact that there was a serious growth in the Construction industry during that period, resulting in an increase in the number of constructions and workers.

A decline is seen in construction works in the Northern Cyprus during summer and winter months because of the effect of the climate (Department Of Meteorology, Republic of Cyprus). Spring and autumn months, on the other hand, are perfectly suitable to carry out construction works. However, autumn being towards the end of the year, usually discourages investors. Therefore, autumn months (September, October, and November), or in other words, last months of the year, are the months with the least activity in construction works, hence the lowest number of occupational accidents. Spring months, being the beginning of the new year, and having suitable weather conditions are preferred by both investors and other stakeholders. Therefore, during the spring months of March, April, and May, more construction works, and more occupational accidents are observed. The weather being very hot in summer months leads to a decrease in construction works, but at the same time, unusual climatic conditions push the limits of workers and increase the risk of accidents. Especially people working in open air, directly subjected to the effects of the sun, can suffer of loss of concentration, difficulty in breathing, dizziness, extreme loss of body fluids, and similar ailments, and consequently face the risk of accidents. Data obtained through the study shows that although construction works are less in summer, the number of accidents comes second after spring. The summer period is followed by autumn, and finally by winter, which is at the end of the year.

In their study, Akboğa and Baradan (2015) focused on the 94 fatal construction accidents in the city of İzmir, in Turkey, during the years 2007-2011. Through their analyses, they established a concentration of fatal accidents on Mondays and Thursdays. Pointing to the fact that workers could have a difficulty in focusing on work during the first day of the week,

and this lack of attention being the cause of accidents on Mondays, however they could not point to any cause for accidents happening on Thursdays. This study established that construction accidents mostly happened at the start of the week, on Mondays and Tuesdays, and the number dwindled towards the end of the week.

Gürcanlı and Müngen (2013), in the study they carried out in Turkey, pointed to the fact that most accidents in constructions took place between 15:00-17:00 hours (right before the end of work), between 10:00-12:00 (right before lunch time), and between 13:00-14:00 (right after lunch), and they interpreted this as hunger, weakness after a meal, and end of day fatigue being the reason for accidents. Findings obtained as a result of this study showed that accidents mostly took place right before and after lunch break, which is in parallel with the findings of Gürcanlı and Müngen. This fact points out that hunger and after meal fatigue can trigger2 accidents (Table 3).

Table 3. Distribution of work-based injuries and deaths in the construction industry by time of the day.

Time Interval	**Death**		**Injured**		**Total**	
	No.	%	No.	%	No	%
4.00 and 7.00	0	0.00 (0.6%)*	3	0.40 (0.4%)	3	0.38 (0.5%)
07:00<t≤08:00	4	9.52 (1.2%)	41	5.46 (0.6%)	45	5.67 (0.8%)
08:00<t≤09:00	4	9.52 (9.3%)	66	8.79 (13.1%)	70	8.83 (11.6%)
09:00<t≤10:00	1	2.38 (11.1%)	71	9.45 (12.5%)	72	9.08 (12.0%)
10:00<t≤11:00	2	4.76 (12.2%)	66	8.79 (13.7%)	68	8.58 (13.1%)
11:00<t≤12:00	1	2.38 (12.3%)	47	6.26 (12.7%)	48	6.05 (12.6%)
12:00<t≤13:00	1	2.38 (2.3%)	30	3.99 (1.4%)	31	3.91 (1.7%)
13:00<t≤14:00	4	9.52 (8.5%)	60	7.99 (8.4%)	64	8.07 (8.4%)
14:00<t≤15:00	5	11.90 (10.5%)	63	8.39 (11.2%)	68	8.58 (10.9%)
15:00<t≤16:00	5	11.90 (12.7%)	71	9.45 (10.4%)	76	9.58 (11.3%)
16:00<t≤17:00	1	2.38 (13.3%)	32	4.26 (12.1%)	33	4.16 (12.6%)
17:00<t≤18:00	3	7.14 (2.5%)	17	2.26 (1.6%)	20	2.52 (1.9%)
18:00<t≤19:00	0	0.00 (1.3%)	12	1.60 (0.6%)	12	1.51 (0.9%)
19:00<t≤20:00	0	0.00 (0.6%)	6	0.80 (0.4%)	6	0.76 (0.5%)
After 8.00 PM	0	0.00 (1.6%)	10	1.33 (0.8%)	10	1.26 (1.1%)
Unknown	11	26.19	156	20.77	167	21.06
Total	42	100,00	751	100,00	793	100,00

*Numbers in the parentheses reveal percentages for Turkey from Gurcanli and Mungen, (2013)

4.2.3. Classification of Construction Accidents:

First of all, as stated earlier, accident records in the study were converted to ICD-10 format, and classified per causes of accidents. According to this, 'falls' type of accidents take the

first place in terms of frequency, and those resulting in death and injury. Looking at accidents resulting in injuries, 'falls' is followed by 'struck by thrown objects'or by a 'projected object', 'crashed, jammed in or between objects', 'sharp object injury', 'falls on the same level', 'injured by falling objects', 'traffic accidents', 'contact with heat or with hot substances', and 'exposure to electricity' type accidents, similar to the study by Akboğa and Baradan (2015). In fatal accidents, 'falls' is followed by 'exposure to electricity', 'crashed, jammed in or between objects', 'traffic accident', 'falling objects', and 'building and construction collapse' type accidents, in that order (Table 4).

Table 4. Causes of Construction accidents with ICD-10 Codes

Causes	Death		Injured		Total	
	No.	%	No.	%	No.	%
Falls (W12, W13)	21	50 (43.7)*	278	37.02 (33.3)	299	37.7
Exposure to electricity (W85, W86)	10	23.81 (11.8)	9	1.2 (2.9)	19	2.4
Crashed, jammed in or between objects (W23)	3	7.14	84	11.19	87	10.97
Trafic Accidents (V00 - V60)	3	7.14 (6.7)	54	7.19 (1.4)	57	7.19
Falling objects (W20)	2	4.76	57	7.59	59	7.44
Building or Construction Collapse (W20)	2	4.76 (6.8)	4	0.53 (3.1)	6	0.76
Cave-ins (while or after excavation) (W20)	1	2.38 (5.5)	5	0.67 (1.9)	6	0.76
Struck by thrown, projected object (W20)	0	0	86	11.45	86	10.84
Sharp object injury (W24 - W29)	0	0 (8.9)	63	8.39 (3.9)	63	7.94
Fall on same level (W01, W03, W10)	0	0	62	8.26	62	7.82
Contact with heat or hot substances (X10 - X19)	0	0 (2.1)	23	3.06 (2.9)	23	2.9
Stricking against or struck by objects (W22)	0	0 (10.5)	8	1.07 (10.7)	8	1.01
Explosins (W36 - W40)	0	0	6	0.8	6	0.76
Contact with chemical Substances (T52 - T59)	0	0	4	0.53	4	0.5
Other	0	0	4	0.53	4	0.5
Unidentified	0	0	4	0.53	4	0.5
Total	42	100	751	100	793	100

*Numbers in the parentheses reveal percentages for Turkey from Gurcanli and Mungen, (2013)

Gürcanlı and Müngen (2013) in the study they carried out in Turkey, rerached similar results. Their findings have been given in parantheses in Table 4. Data in Tablo 4 has been sorted out according to number of fatalities. As the labor office and all other responsible parties have followed and recorded all fatal accidents meticulously, one cannot claim the same same for non-fatal accidents. In Table 5, falls type accidents are examined in detail and divided into three groups such as, 'falls from scaffolds', 'falls from structural elements' and 'other type of falls'. A total of 86 accidents of falls from scaffoldings (of which 5 died) have been recorded. 59 accidents of falls from structural elements have been recorded with 7 deaths. In addition, it was observed that 58 accidents due to falls from movable ladders, or others group, were recorded, with 4 deaths. These facts show that the most frequent type of fall are falls from scaffoldings, but the most fatal fall type are falls from structural elements.

Table 5. Detailed classification of falls

Type of Falls (W12, W13)	Death	Injured	Total
Falls from scaffoldings			
Scaffold failing-breaking-falling	3	24	27
On the scaffold (loosing footing)	1	9	10
On the scaffold (while going up-down)	0	7	7
On the scaffold (erecting-dismantling)	0	5	5
On the scaffold (slipping, loss of balance etc.)	1	36	37
Sub. Total	5	81	86
Falls from structural elements			
Falls from structural element (from the roof)	0	10	10
Falls from structural element (from edges of the slabs)	3	28	31
Falls from structural element (flight of stairs)	1	6	7
Falls from structural element giving in	1	1	2
Falling down through opening on the floor	2	7	9
Sub. Total	7	52	59
Other type of falls			
Moving ladder	4	54	58
From the molds	2	18	20
Into a canal, hole etc.	0	13	13
From a vehicle, machine	2	35	37
Going up on unsuitable object	1	14	15
Other	0	11	11
Sub. Total	9	145	154
Total	21	278	299

Table 6 examines other fatal accident types besides falls, in detail. As shown in the table, exposure to electricity accidents were recorded 19 times, and 10 of these resulted in deaths. These point to the fact that electrical accidents are more deadly than falls from structural elements. Again, in Table 6, 'crashed, jammed in or between' type of accidents are grouped under five sub-headings, and 5 of the 145 victims lost their lives.

Table 6. Detailed classification of other type of accidents

Type of other Fatal Accidents	Death	Injured	Total
Exposure to Electric (W85, W86)			
Contact with live electricity	4	3	7
Contacting aerial electric cable	2	3	5
Contacting electric cable in the open	1	2	3
Contacting cable placed in the wall-floor	1	1	2
Electric shock of other types	2	0	2
Sub.Total	10	9	19
Other type of fatal accidents			
Crushed between a stationary and a moving object (W23)	2	48	50
Crushed under a fallen object (W20)	2	60	62
Crushed between moving objects (W23)	0	4	4
An organ getting jammed in a machine (W23)	0	15	15
Crushed under a load (W23)	1	13	14
Traffic Accidents (V00-V60)	3	54	57
Building & Construction Collapse (W20)	2	4	6
cave-ins (W20)	1	5	6
Other	0	1	1
Sub.Total	11	204	215
Total	21	213	234

4.2.4. Facts About Victims:

In this study, construction workers, who suffered an accident, are divided into groups according to the kind of work they were doing on the construction site. In other words, they are divided into groups based on their vocation. As it can easily be understood, the group mostly affected by accidents is the group of 'unskilled workers' (Table 7). It is assumed that, this arises from the fact that a great number in the work force in the Construction industry is made up of 'unskilled workers'. Another reason is the fact that the 'unskilled workers' group

has the least work experience and training in the industry (Çelik et al. 2012). In underdeveloped countries, and in developing countries, like in Northern part of Cyprus, most of the employers refrain from providing vocational training to new workers.

Instead of giving them vocational training, inexperienced workers are forced to start from the lowest level of work at the site, and expected to learn the job by themselves in time and without help or supervision. Inexperienced workers pay for this faulty attitude of employers – which has become habitual due to the local conditions – by getting injured, and sometimes even by losing their lives. New and untrained workers in the Construction industry go through their training process in the field, as 'unskilled workers'. Given the situation as it is, 'unskilled workers' turn out to be the group suffering from most accidents, with 30.09% injury, and 28.57% death rates. 'Unskilled workers' group is followed by 'formwork skilled workers', with 14.29% death and 11.58% injury rate, and 'paint/plaster skilled workers' with 10.29% death and 11.58% injury rate. Rates regarding 'Operators', 'welders', 'electricians', and 'steel fixers' job type groups are shown in Table 7.

Accident victims were later examined by dividing them into 7 groups according to their field titles, and their ages. After establishing 6 age groups, as shown in Table 8, the number of victims in each group was figured out. According to this, a total of 23 victims (of which 4 were deaths) were collected in 7 different title groups within the under 20 year old designation. In the 20+ group, a total of 275 victims were established, of which 9 lost their lives. These figures place the 20+ group in the first place regarding their exposure to accidents, but behind the 30+ group in deaths. While at least 1 death or injury was registered in the 20's group, except for the 'employer' designation. 'Unskilled worker' designation group had the most death and injury incidents recorded within the 20's group. The age group with the highest number of deaths (13) is the 30's age group, with a total of 271 accident victims. At least 1 death or injury was recorded in the other 6 groups within the 30's designation, except for the '3rd party' and 'secretary' groups. 'Unskilled worker' group is again at the top for deaths and injuries, within the 30's age group. 40's age group is in the 3rd place with a total of 154 victims, 6 of which are deaths. While at least 1 death or injury was recorded in the 40's age group except for the 'employer' and 'secretary' title designations, 'unskilled worker' group is again at the top of the count regarding deaths and injuries. A total of 51 accidents were recorded for the 50's age group, of which 6 were deaths, and 1 death and 4 injuries were recorded for the 60's age group. As stated above, the 'unskilled worker' group for all age ranges rank at the top in terms of accidents.

Later, it was attempted to establish how often each job type group encountered any type of accident. According to this, as it is shown in Table 9, the most frequent accident type, which is the 'falls' type, is a great risk for almost all job type groups. As for the 'unskilled workers', who encounter the highest number of accidents, it can be seen that they are prone to all types of accidents. It is assumed that this arises from the fact that 'unskilled workers' are used in all activities and levels of the construction. Another reason is that 'unskilled workers' group is frequent in the field. It is also observed that 'paint/plaster skilled workers' are affected from 'falls' type of accidents most frequently, and they encounter more often the 'fall on same level' and 'falling object' type of accident risks in that order. Looking at 'steel fixers', it can be seen that after 'falls' accidents, they encounter 'crashed, jammed between objects' accidents more frequently.

Table 7. Distribution of fatal and non-fatal accidents according to job types

Job Types	Death	Injured	Total
	No.	No.	No.
3rd Party	1	3	4
Alum. PVC Skilled Worker	0	15	15
Asphalt Skilled Workers	1	5	6
Assembly Personnel	0	17	17
Carpenter	0	21	21
Ceramic Skilled Worker	2	23	25
Concrete Skilled Worker	0	9	9
Electrician	3	31	34
Employer	2	4	6
Eng. / Arch. / Mng.	1	5	6
Foreman	0	18	18
Formwork Skilled Workers	6	87	93
Gatekeeper	0	4	4
Insulation Works	0	11	11
Mechanics	0	11	11
Operators	3	68	71
Paint/Plaster Skilled Worker	6	82	88
Plumber / Pipe Fitter	1	21	22
Roofer	0	5	5
Secretary	0	2	2
Steel Fixer	2	31	33
Unskilled Workers	12	226	238
Wall Works Skilled Worker	0	9	9
Welders	1	39	40
Unknown	1	4	5
Total	42	751	793

The reason for this is that, besides working at heights, they do works like hand, carrying of objects, shaping materials by applying power, or using powerful mechanical tools. This increases the risk of getting jammed between the material and the power tool . 'Electricians' working at construction sites also suffer 'falls' type accidents because they work at heights (Table 9). However, another increased risk for 'electricians' is their working with electricity,

which is reflected in the consequences. After the 'unskilled workers' group, 'formwork skilled workers' encounter the most accidents at construction sites. Besides being victims of 'falls' type accidents often, because they work at heights and mostly close vicinity to the edges, they also face accidents like 'fall on same level' and 'falling object'. 'Operators' use vehicles, and therefore work at ground level; but operators who use large work machines can also suffer injuries from 'falls' (from machine) while servicing the machines and doing maintenance work. However, the most frequent accidents facing operators are 'falls, 'traffic accidents, and 'crashed, jammed between objects', in that order.

At a later stage, it was examined whether workers who encounter accidents had received any training about the work they did or not. This examination showed that a great number of accident victims did not receive any occupational training (Table 10). As stated previously, most of the employers in Northern Cyprus refrain from providing occupational training to new workers, and they leave them to learn the work on the site by themselves. Moreover, at the beginning of this study, no licensed institution was found in the Northern Cyprus providing Occupational Health and Safety training. The only educational work done for the industry in the field of Occupational Health and Safety in Northern Cyprus was the Occupational Health and Safety Expertise education, which was initiated in 2014 by the Labor Office.

Figures given in Table 10 show the graveness of the problem with the training status of the employees. According to these figures, only 21 out of 793 victims, that is 2.6% had training prior to beginning work. A survey by Çelik et al. (2012) on the training level of Construction industry workers in northern part of Cyprus, arrived at a similar conclusion. Again, in Table 11, it can be seen that the job type group with the least vocational training is 'unskilled laborers'.

First thing that is noticeable in Table 10 is that a large part of the victims (16.9%), especially those losing their lives, is the ones whose vocational experience were not established, or somehow not registered. In addition, it was established that 27.59% of accident victims were injured during their first month at work, and 5.93% lost their lives during the 1-6 months at work. On the other hand, the death rate of all accidents was 5.3%. Hence, the conclusion that accidents resulting in deaths are related to experience at work.

Analysis of the place of injuries on bodies of the accident victims are given in detail in Table 11. Looking at the analysis results, place of wounds on the body parts of most of the victims registered (98.36%) have been recorded. According to this, 40.86% of the victims received wounds in 'hands and arms', but these wounds did not cause deaths. Similarly, 24.97% of the victims received wounds in 'legs and feet', and these also were not deadly. 'Innards and torso' wounds were seen in 3.40% of injuries and these also did not cause deaths. On the other hand, injuries in the 'waist, neck, and spinal column' region made up 4.04% of accidents and 3.13% of these resulted in deaths. Similarly, injuries in the 'face, head, and skull' region amounted to 10.34% of the accidents, and 8.54% of these caused deaths. In some accidents, victims were injured in more than one part of the body. This type of injuries (different parts of the body) made up 9.46% of all accidents, and 4% of these resulted in deaths. The most dramatic result noticeable in Table 11 is that a great part of those victims who lost their lives received wounds comprising the whole of the body (all body). While almost all of such accidents are referred to as serious accidents, and make up 5.30% of all accidents, the death rate of these was established as 69.05%.

Table 8. Distribution of Victims in the Construction industry among Age Groups and Job Types

	≤19		20≤x≤29		30≤x≤39		40≤x≤49		50≤x≤59		≥60		Unknown		Total		
Job Types	Death	Injured	Death	Injured	Death	Injured	Death	Injured	Death	Injured	Death	Injured	Death	Injured	Death	Injured	Total
3rd Party	1			1		1						1			1	3	4
Alum. PVC Skilled Worker		2		5		2		4		1				1		15	15
Asphalt Skilled Workers				2		2	1			1					1	5	6
Assem bly Perso nnel				8		8		1								17	17
Carpe nter				5		9		3		4						21	21
Ceramic Skilled Worker	1	2		11		6	1	2						2	2	23	25
Concrete Skilled Worker				4		3		2								9	9
Electri cian			1	12	2	12		4		1		1		1	3	31	34
Employ er							1	2	1	2					2	4	6
Eng. / Arch. / Mng.				3	1	1		1							1	5	6
Foreman				2		6		5		4		1				18	18
Formwo rk Skilled Workers		3	2	29	1	33	1	15	2	5				2	6	87	93
Gatekee per				1		1		2								4	4
Insulati on Works				4		5		1		1						11	11
Mecha nics				6		5										11	11
Opera tors			2	14		25		25	1	4					3	68	71
Paint/ Plaster Skilled Worker	1		1	29	1	31		18	2	3	1			1	6	82	88
Plumber / Pipe Fitter				9	1	7		3		2					1	21	22
Roofer				2		3										5	5
Secretary				2												2	2
Steel Fixer		2		10	2	11		5		2				1	2	31	33
Un- skilled Workers	1	8	3	91	4	66	2	48		11		1	2	1	12	226	238
Wall Works Skilled Worker				2		3		3		1						9	9
Welders		2		13	1	17		4		3					1	39	40
Un- known				1		1							1	2	1	4	5
Total	4	19	9	266	13	258	6	148	6	45	1	4	3	11	42	751	793

All the details of analyses carried out in relation to the type of injuries that victims received are shown in Table 12. Looking at analysis results, injury types of most of the victims registered (98.61%) have been established. According to this, 1.64% of the victims had 'trauma', 2.90% 'loss of limbs', and 0.25% 'contact with chemicals' type of injuries, but these did not cause death. The ratio of victims who received 'fracture' type wounds is 41.87%, and such injuries caused deaths at the rate of 0.30%. Although causing deaths at a rather low ratio, 'fracture' type injuries have been the most frequently encountered injuries. It was established that 'burn' type injuries were seen in 3.15% of accidents, and they caused deaths at the rate of 4.00%.

Table 9. Distribution of Accidents according to Job Type versus Accident Type

Job Type	Building & Construction Collapse	Cave-in	Contact with Chemical Substances	Contact with heat or hot substances	Crashed, Jammed Between Objects	Explosives	Exposure to Electricity	Fall on Same Level	Falling Objects	Falls	Sharp Object İnjury	Striking against or struck by objects	Struck by thrown, projected object	Traffic Accident	Unknown
3rd Party		1								3					
Alum. PVC Skilled Wo.								2	1	5	5		2		
Asphalt Skilled Wor.				2	2					1				1	
Asse mbly Perso nnel					1			2	1	10	2		1		
Carp enter								3	1	8	7	1	1		
Ceramic Skilled Wor.					3		2	1	2	7	4		6		
Concrete Skilled Wor.	4									2				3	
Electri cian				1	5		5	3	2	7	4		4	2	1
Emp loyer					1		1			4					
Eng. / Arch. / Mng.					1	1				3	1				
Foreman					2	1		2	1	7	2		1	2	
Form work Skilled Wor.		2			5		1	9	5	49	7		12	3	
Gate keeper								1	1	1				1	
Insul ation Works					1	1		1	1	6	1				
Mecha nics			1	1	1	1		1	3	1	2				
Opera tors		1		7	9		1	2	3	19		3	8	18	
Paint/ Plaster Skilled W.				1	2		1	10	6	54	3	1	4	2	4

Table 9. Distribution of Accidents according to Job Type versus Accident Type (continue)

Job Type	Building & Construction Collapse	Cave-in	Contact with Chemical Substances	Contact with heat or hot substances	Crashed, Jammed Between Objects	Explosives	Exposure to Electricity	Fall on Same Level	Falling Objects	Falls	Sharp Object İnjury	Striking against or struck by objects	Struck by thrown, projected object	Traffic Accident	Unknown
Plumb er / Pipe Fitter					1				3	13	3		2		
Roofer										3			2		
Secretary								1						1	
Steel Fixer					9		1	1	2	10	1		4	5	
Un-skilled Wor kers	2	2	2	9	37	1	5	19	22	68	16	3	32	18	2
Wall Works Skilled W.					3			2	1	1	1		1		
Wel ders			1	1	4	1	2	1	4	16	4		6		
Un-known				1				1		1				1	1
Total	6	6	4	23	87	6	19	62	59	299	63	8	86	57	8

Table 10. Experience and Vocational Training Status of Workers according to Job Types

Job Type	**Working Experience (Months)**									**Training**			
	0	**1<x<6**	**7<x<12**	**13<x<36**	**37<x<72**	**73<x<108**	**>108**	**Unknown**	**Total**	**Unknown**	**Trained**	**Not Trained**	**Total**
3rd Party	4								4	2		2	4
Alum. PVC Skilled Wor.		3	3	1	2	1		5	15	4		11	15
Asphalt Skilled Workers				1	1		4		6	2		4	6
Assembly Personnel	1	2	1	4	1	2	1	5	17	6	1	10	17
Carpenter			6	6		1	4	4	21	5		16	21
Ceramic Skilled Worker	1	2	7	2	2	4	1	6	25	11		14	25
Concrete Skilled Worker		2	2	3		1	1		9	3		6	9
Electrician	1	6	7	4	5	3	3	5	34	8	8	18	34
Employer				1	2		1	2	6	1		5	6
Eng. / Arch. / Mng.	1	1		2		1	1		6		6		6
Foreman		3	2	3	3	3	4		18	4	1	13	18

Table 10. Experience and Vocational Training Status of Workers according to Job Types (continue)

Job Type	Working Experience (Months)									Training			
	0	1<x<6	7<x<12	13<x<36	37<x<72	73<x<108	>108	Unknown	Total	Unknown	Trained	Not Trained	Total
Formwork Skilled Wor.	3	13	26	9	7	5	4	26	93	28		65	93
Gatekeeper		1			2		1		4	1		3	4
Insulation Works		2	1	2	2	1		3	11	3		8	11
Mechanics				8	1		1	1	11	3		8	11
Operators		15	14	14	5	3	13	7	71	17	3	51	71
Paint/ Plaster Skilled Wo.	2	16	17	18	10	8	7	10	88	24		64	88
Plumber / Pipe Fitter		3	2	8	4		3	2	22	8		14	22
Roofer		2	1	1				1	5	3		2	5
Secretary		1	1						2		1	1	2
Steel Fixer	2	4	6	6	2		1	12	33	8		25	33
Unskilled Workers	13	40	57	45	27	3	17	36	238	79		159	238
Wall Works Skilled Wor.			5	2			1	1	9	2		7	9
Welders	1	2	2	9	11	4	6	5	40	12	1	27	40
Unknown			1		1			3	5	5			5
Total	29	118	161	149	88	40	74	134	793	239	21	533	793

Table 11. Job types vs. place of injuries on the body

Injured Part of the Body									
Job Type	**All Body**	**Different Parts**	**Face, Head & Skull**	**Hands and Arms**	**Innards and Torso**	**Legs and feet**	**Unknown**	**Waist, Neck & S.Column**	**Total**
3rd Party	1					2	1		4
Alum. PVC Skilled Wor.		3		9		3			15
Asphalt Skilled Workers	1	1		2		2			6
Assembly Personnel		2	1	9		5			17
Carpenter			2	12	1	5		1	21
Ceramic Skilled Worker	2		1	13		7		2	25
Concrete Skilled Worker		2		1	1	5			9

Table 11. Job types vs. place of injuries on the body (continue)

Injured Part of the Body									
Job Type	**All Body**	**Different Parts**	**Face, Head & Skull**	**Hands and Arms**	**Innards and Torso**	**Legs and feet**	**Unknown**	**Waist, Neck & S.Column**	**Total**
Electrician	3	3	2	16	1	7		2	34
Employer	1	1	1	1	1	1			6
Eng. / Arch. / Mng.	1	2		3					6
Foreman		3	1	8	2	4			18
Formwork Skilled Wor.	5	15	7	42	6	13		5	93
Gatekeeper		1				3			4
Insulation Works	1	1		3	1	4		1	11
Mechanics	1	2		6		1		1	11
Operators	4	7	9	25	3	16	3	4	71
Paint/Plaster Skilled Wo.	5	3	12	30	2	23	4	9	88
Plumber / Pipe Fitter	1	2	3	9	1	6			22
Roofer		1	2	1		1			5
Secretary		1						1	2
Steel Fixer	2	3	3	15	3	5	1	1	33
Unskilled Workers	12	19	30	97	3	72	2	3	238
Wall Works Skilled Wor.			2	3		4			9
Welders	1	3	6	19	2	8		1	40
Unknown	1					1	2	1	5
Total	42	75	82	324	27	198	13	32	793

It was also seen that ‘interior organs’ type injuries made up 16.02% of the accidents and 7.87% of those resulted in deaths. On the other hand, ‘open wound injury’ type accidents made up 21.56% of all accidents, and 0.58% of these resulted in deaths. It was also seen that these types of injuries (different types of injuries) are 11.22% of all accidents, but 32.58% of them caused deaths. This situation shows that in accidents, where different types of injuries are seen at the same time, count at the top of fatal incidents.

Table 12. job types vs type of the injuries

Type of the injuries										
Job Type	**Burns**	**Closed Iniury**	**Contact with Chemicals**	**Diferent type of iniures**	**Fracture**	**Loss of limbs**	**Open İnjury**	**Trauma**	**Unknown**	**Total**
3rd Party				1	2				1	4
Alum. PVC Skilled Wor.		2		1	4		8			15
Asphalt Skilled Workers	2	1		1	2					6
Assembly Personnel		5			7		4	1		17
Carpenter		2			8	2	7	2		21
Ceramic Skilled Worker		4		2	10		9			25
Concrete Skilled Worker		3		2	2		2			9
Electrician	3	6		2	13	1	8	1		34
Employer		1		2	3					6
Eng. / Arch. / Mng.				2	2	1	1			6
Foreman				3	9		6			18
Formwork Skilled Wor.		22		14	38	2	17			93
Gatekeeper		2			2					4
Insulation Works	1	2			6		1	1		11
Mechanics	1	2		1	2	1	4			11
Operators	7	9		8	32	2	11		2	71
Paint/Plaster Skilled Wo.	1	15		9	43	2	13	1	4	88
Plumber / Pipe Fitter		1		2	15		4			22
Roofer		1		1	1		1	1		5
Secretary				1				1		2
Steel Fixer		5		9	7	1	11			33
Unskilled Workers	8	37	1	24	103	10	51	2	2	238
Wall Works Skilled Wor.		1			4		4			9
Welders	2	6	1	3	15	1	9	3		40
Unknown				1	2				2	5
Total	25	127	2	89	332	23	171	13	11	793

5. CONCLUSION

Detailed analysis of the construction accidents occurred in Northern Cyprus between 1994 and 2014, reveals the alarming situation of the industry. As stated at the beginning of this study, high risks present in the nature of this industry. However, employers have not realized the importance of safety management as well as implementing very basic preventive measures yet. Of course the secondary factors may be stated as the unconsciousness of workers and employers, who have to work face to face with these risks. As it is clearly pointed out in the study, training level of workers in the Construction industry, and their awareness of Occupational Health and Safety are quite low. Additionally, a great number of construction companies did not provide any training for their employees in the field of Occupational Health and Safety. This is another element contributing to the dramatic situation of the industry.

Learning from past experience, in other words historical records that include types of accident, work type, activity at time of accident, and so on is important for accident prevention because every construction projects may have some similarities with the past projects. For establishment and implementation of safety management on the construction site, these kinds of past data may provide necessary background knowledge. If we focus on the accidents in the industry, it can be seen that falls type accidents leads first and these accidents, mostly resulting in deaths, which generally took place in multi-story buildings, and on scaffoldings. In addition, the work type that is most prone to accidents, injuries, and deaths, is the unskilled workers group.

Projects run by the EU on the island, recently, and support programs, have paved the way for some serious developments in the field of Occupational Health and Safety. However, the works and encouragements of the EU in the field are not sufficient for needed improvements by themselves. The economic, political, and legal problems in the field of Occupational Health and Safety in the country need to be taken into consideration systematically by the political and legal institutions of the country.

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