ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL OF SCIENCE ENGINEERING AND TECHNOLOGY

ANALYSIS OF OCCUPATIONAL SAFETY AND HEALTH PRACTICES ON CONSTRUCTION SITES IN TURKEY: FIELD STUDY

M.Sc. THESIS

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Department of Civil Engineering

Construction Management Msc Programme

JANUARY 2013

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To my beloved family,

FOREWORD

I express sincere appreciation to my thesis advisor, Assoc. Prof. Dr. Gürkan Emre GÜRCANLI for his guidance and insight throughout the study.

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January 2013

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ABBREVIATIONS

OHS **:** Occuotional health and safety.
PPE **:** Personal protective equipment.
SFS **:** Safety Management System.
SGK **:** İş Sağlığı ve Güvenliği.
ILO **:** International Labor Organization.
HRM **:** Human Resource Management.
SMS **:** Safety Management System**.**

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ANALYSIS OF OCCUPATIONAL SAFETY AND HEALTH PRACTICES ON CONSTRUCTION SITES OF TURKEY: FIELD STUDY

SUMMARY

The construction industry is one of the most dangerous sectors. The incidence of fatalities, injuries and illnesses to construction workers are among the highest in most of the countries. Accidents have drastic effects in the economic costs of workplace. Costs can be associated with the time lost from work, human pain and suffering, and the subsequent loss of moral and decline in worker efficiency and productivity.

Occupational Health and Safety acts provide workers with a safe and healthy work environment. In order to effectively gain from safety programs, factors that affect its implementation need to be studied.

This thesis is consisting mainly of two parts. The first part, represented by the first three chapters, contains a brief review of fundamental concepts, terms, features and strategies in Occupational Health and Safety (OHS). The second part, represented by the last three chapters, deals with the specific objectives of this study, which are: (1) investigating the degree of influence of factors on a safety program implementation, as perceived by the respondents (OHS experts). (2) Evaluating the frequent reasons of the accidents on the construction site.

According to the literature review and the interview with OHS experts, 17 sub-factors have been considered and grouped into five dimensions: Resource factor, Personal factor, Management factor, HRM (incentive factor), Relationship factor. A face-to-face questionnaire and interview have been used to measure and analyze the needed response rate.

According to the participants of the study, it has been noticed that the resources factor is the most important implemented factor among all the considered factors in a safety management system.

From the surveys held, visiting and observing the construction sites and the interview with OHS experts, it has been found out that the workers awareness about the safety on the construction site is very low. Hence, the safety culture must be developed between the employees working at the construction sites.

TÜRKİYE'DE İNŞAAT ŞANTİYELERİNDE İŞCİ SAĞLIIĞI VE İŞ GÜVENLİĞİ UYGULAMALARININ ANALİZİ :BİR SAHA ARAŞTIRMASI

ÖZET

İnşaat sektörü dünyadaki birçok ülkede en büyük iş alanlarından birini oluşturmakta.İLO'dan alınan verilere göre inşaat sektöründe çalışan işçi sayısı 110 milyonu aşmakta, hatta birçok ülkede bu rakam direkt ya da dolaylı olarak değişime uğramakta ve bu sayının iki katına ulaşabilmektedir.

İçinde birçok tehlike ve risk barındıran inşaat sektöründe meydana gelen yaralanmalar,kazalar ve hastalıkların sayısı dikkat çekici derecelere ulaşabilmektedir.Maliyet, çalışma zamanı kaybı, kişinin sağlık durumunun iyileştirilmesi ve takiben manevi kayıpla birlikte oluşan üretkenlik ve aktifliğin azalmasıyla ilişkilendirilebilir.Sözü edilen yaralanmalar, kazalar ve hastalıkların meydana gelmesinde rol oynayan pek çok faktörden ve bu faktörlerin oluşmasına yol açan koşullardan bahsedilebilir.Çalışma koşulları, çalışma metaryalleri,farklı yükseklikteki dinamik inşaat alanları ve çevresel faktörler olarak sıralayabileceğimiz bu faktörler örnek olarak verilebilir.

Yapılan araştırmalar şunu açık olarak göstermiştir ki inşaat sektöründe endişe teşkil eden en büyük sorun çalışanların korunmasıdır.Bu kavrama daha genel bir söylemle yaklaşmak gerekirse işçi sağlığı ve güvenliği şeklinde ele alınabilir.İşçi sağlığı ve güvenliği kavramı ise çalışanlara yönelik güvenlik ekipmanlarının teminini sağlamak, şantiyelerdeki tehlikeli alanların ve potansiyel kaza durumlarının riskini azaltmak, bununla birlikte meslek hastalıkları ve iş kazalarının önüne geçmek adına işçi sağlığı ve güvenliğine koşut olarak yapılan bütün çalışmalar ile uygulamalalar şeklinde tanımlanabilir.

Güvenliği arttırmak ve şantiyelerdeki kazaları önlemek için verimli ve yüksek performens sağlayan ve yüksek güvenlik standartlarına sahip güvenlik yönetim programlarına ihtiyaç vardır.Aynı zamanda bu güvenlik programlarından etkili bir şekilde yararlanmak için, güvenliği etkileyen faktörler üzerinde çalışmak ve bu faktörleri biçimlendiren sebeplerlerle ilgili köklü çözüm yolları üretmek gerekmektedir.

Daha önce bu konuyla ilgili yappılmış çalışmalara, güvenlik araştırmaları literatürüne ve iş güvenliği uzmanlarıyla yapılan görüşmelere göre çıkarılan faktörler 5 ana faktör şeklinde toplanmış ve bu faktörlere bağlı 17 alt faktör hesaplanmıştır.Bu ana faktörler şu şekilde sıralanabilir;

-Kaynak faktörü

-Personel faktörü,

-İnsan kaynakları yönetimi faktörü,

-İletişim faktörü,

-Yönetim faktörü.

Bu çalışmanın amacı;

_İş sağlığı ve güvenliği uzmanlarının rehberliğinde hazırlanan, işçi sağlığı ve güvenliğiyle ilgili saptanan maddeler şeklindeki güvenlik hususlarının, Türkiye'deki inşaat alanları sahalarına uygulanıp uygulanmadığını, yine iş sağlığı ve güvenliği uzmanlarıyla yapılan değerlendirmelere bağlı kalınarak saptamaya çalışmak,

_İş güvenliği uzmanlarına göre, güvenlik programlarını etkileyen faktörleri ve bu faktörlerin güvenliği etkileme derecesini öğrenmek,

_İnşaat sektöründe meydana gelen kazaların ve bu kazalara yol açan faktörlerin gerçekleşme sıklığını açığa çıkarmak şeklinde yazılabilir.

Hazırladığım çalışma, İstanbul'un çeşitli bölgelerindeki orta ve büyük ölçekli 37 şantiyede uygulandı ve bu şantiyelerdeki iş güvenliği uzmanlarıyla birebir görüşmeler yapılarak anket yöntemi kullanıldı.

Birinci bölümde, inşaat yönetimi ve proje yönetimi kavramları tanımlanmış, konunun temel esasları açıklanarak iş güvenliği terimlerinin tanımı yapılmıştır.Yine aynı bölümde inşaat sektörüne yönelik yapılmış çalışmalar literatürüne bağlı kalarak bu sektörün belli başlı karakteri, Türkiye ve İngiltere'deki inşaat sektörüyle işçi sağlığı ve güvenliği istatistikleri, inşaat sektörü yöneticileri için stratejiler ve işçi sağlığı ve güvenliğinin öneminden bahsedilmiştir.

İkinci bölümde, yapılan araştırmalar baz alınarak oluşturulmuş işçi sağlığı ve güvenliğini etkileyen faktörlerin, farklı ülkelerdeki etkinliği ve uygulanma biçimleri karşılaştırılarak tablo şeklinde gösterilmiştir.

Üçüncü bölümde, bu çalışmada kullanılan metaryaller, uygulanan metodlar, çalışma araçları, gerekli verilerin analizinde kullanılan prosedür ve yöntemler konu alınmıştır.

Dördüncü bölümde ise yapılan çalışmanın ve anketlerin sonuçları sunulmuş, uygulanan testlerden çıkarılan sonuçlar tablolar yardımıyla gösterilmiş ve bu sonuçların ayrıntılı analizlerine yer verilmiştir.

Çalışmanın son bölümünde elde edilen bulgular yapılan çalışmaya göre sonuçlandırılmış, bu konudaki gelecek araştırmalar için ipuçları ve tavsiyelere yer verilerek bölüm sonlandırılmıştır.

Şantiyelere yapılan ziyaretler, inşaat sahaları üzerinde yapılan değerlendirmeler ve iş güvenliği uzmanlarıyla yapılan görüşmelere göre bütün inşaat alanlarında iş güvenliği programı vardır.Ancak işçi sağlığı ve güvenliği üzerine yapılan bu çalışmada kullanılan anketin üçüncü bölümündeki veriler, inşaat alanlarında bazı kazaların meydana geldiğini gösteriyor.Yine bu anket sonuçlarına göre çalışanların, inşaat alanlarındaki güvenlik kuralları, önlemleri ve iş güvenliği araçlarının kullanılması hususunda sahip oldukları bilincin yeterli olmadığı söylenebilir.Güvenlik programlarının düzenli ve tam verimli uygulanımı ise en yüksek seviyede değil.

İnşaat alanlarındaki çalışanlar arasında güvenlik kültürünün geliştirilmesi, çalışma alanındaki tüm personellerin iş güvenliği sorumlulukları konusunda, dikkatin arttırılmasına yönelik motive edici uygulama ve pratiklerin arttırılması, aynı zamanda düzenli uygulanması gerektiğine gönderme yapılabilir.Ayrıca uygulanan güvenlik programlarının risk ve başarı değerlendirmesinin yapılması, ortaya çıkan uygulama fırsatlarının değerlendirilmesi, personellerin güvenlik araçları ve

kullanımları hususlarında yetiştirilmesi ve yöneticilerin güvenlik uygulamaları konusundaki bilgilerinin genişletilmesi konularına dikkat çekilebilir.Bununla birlikte iş sağlığı ve güvenliğine yönelik gelişme ve iyileştirmelerin takibinin önemi vurgulanabilir.

1. INTRODUCTION

The construction industry is one of the biggest industrial employers in many countries of the world. The ILO estimates the number of construction workers in the world at more than 110 millions (usually between 5 to 10% of the world's workforce), but in many countries double that number depend, directly or indirectly, on the construction sector. The construction work is always dangerous and risky. Working conditions, working materials, the dynamic construction situation such as working at different heights, and other factors such as environmental conditions lead construction projects to face many challenges.

As is evident from the research reviews, one of the most important concerns of construction industry is labor protection. Labor protection means providing the workers with safety equipments and decreasing the risk of dangerous situations, occupational diseases and accidents.

In order to increase safety and prevent accidents on the construction sites, a good safety management program needs to be implemented to ensure high safety standards in order to achieve higher performance and productivity.

Furthermore, in order to effectively gain from safety programs, factors that affect its implementation need to be studied. This study identified 5 main factors and 17 sub factors from safety literature review and previous researches and these were thereafter validated by construction safety professionals.

The ultimate goal of this study is to:

(1) Make a frame work from OHS items and to check through questionnaire survey if those items are implemented on targeted construction sites in Turkey?

(2) Investigate the degree of influence of factors on a safety program implementation, as perceived by the respondents (OHS experts).

(3) Evaluate the frequent reasons of the accidents on a construction site according to the experts.

My study targeted only the OHS experts at each of the 37 construction sites. The study was conducted through a literature review and face to face questionnaire surveys with 37 respondents from medium to large-scale construction projects taking place at different locations in Istanbul.

The results showed the most influential factor resources. Furthermore, using factor analysis, the 17 SFs could be grouped into five dimensions: Recourse factor, Personal factor, Management factor, HRM (incentive factor), Relationship factor.

In the first chapter, construction management and project management will be defined, Fundamental concepts and terms in Occupational Health and Safety, Literature review on characteristics of construction industry, main features of the construction industry and its specific OSH features, Statistics in Construction Industry and Occupational Health and Safety in United kingdom and Turkey, Strategies for employing in construction industry and the Importance of Occupational Health and Safety.

The second chapter is Safety Management System literature review and table demonstrating the Safety factors adopted by various countries, factors influencing the implementation of a safety management system for construction sites.

Third chapter is dedicated to the materials and methods of the study that includes population and sampling, instruments of the study, procedure and methods used to analyze the data.

Fourth chapter is first presenting the results of the study. Subsequently statistical tests conducted on the gathered data are presented and discussed in the tables.

Final chapter is conclusions of the findings, limitations and recommendations for future research.

1.1 Construction Management And Project Management Definition

Project Management (PM): the management during most of the earlier phases of the life cycle, of the development of a construction project, from inception (including planning, design, procurement, where applicable and etc.) to the end of the execution phase and the commissioning/star-up and sometimes including the "period of warranty" (usually, 5 to 10 years from the completion of the execution phase, largely depending on the legislation of each country). For each construction project, the scope of the PM is clarified in the contract between the stake holder's involved (owner/client and project manager) (Dias, 2009).

Construction Management (CM): the management during only the execution phase, and sometimes also the contractor procurement phase (it does not usually include the conception/design phase). For each construction project, the scope of the CM is clarified in the contract between the stakeholder's involved (owner and construction manager) (Dias, 2009).

1.2 Fundamental Concepts And Terms In Occupational Health And Safety

In this section the basic management principle in Occupational Health and Safety will be covered briefly: World Health Organization (WHO) defines Health as "A state of complete physical, mental and social well-being and not merely the absence of disease and infirmity" (WHO,2006). "Safety is the protection of people from physical injury (Hughes & Ferrett, 2007). An accident is an incident plus its sequences and the end product of a sequence of events' actions resulting in an undesired consequence (injury, property damage, interruption, delay)" (Holt, 2005). "Injury or illness is an abnormal condition or disorder. Injuries include cases such as, but not limited to, a cut, fracture, sprain or amputation. Illnesses include both acute and chronic illnesses such as, but not limited to, a skin disease, respiratory disorder or poisoning." (OSHA, 2009) "Safety System is the name given to the effort to make things as safe as is practical by systematically using engineering and management tools to identify, analyze, and control hazards" (Url-2).

Employer (ILO-OSH 2001): “Any physical or legal person that employs one or more workers; the constructors, sub-constructors, contractors and subcontractors, while legal persons are also Employers” (Url-2).

1.3 Literature Review On Characteristics Of Construction Industry

Construction project: an investment program to carry out one or more construction works (facilities), where the social, economic, technological and administrative issues during the whole life cycle are taken into account.

The construction industry is one of the biggest industrial employers in many countries of the world. The ILO estimates the number of construction workers in the world at more than 110 millions (usually, between 5 to 10% of the world’s workforce), but in many countries double that number depend, directly or indirectly, on the construction sector.

The Confederation of International Contractors’ Associations (CICA) estimates the world production by the construction industry at 3 to 4 billion (1012) of Euros. The gross domestic product (GDP) varies, sometimes significantly among countries, but is usually between 5% to 15% (Dias, 2009).

Construction is a complex activity where various stake-holders are present working under constant challenge by demands of the job. Each job will have several of its safety and risk factors, requiring quality and safety management systems to be established as indicated (Mehta and Agnew, 2010).

The nature of construction has made it a challenging regime to handle risks, e.g. constant change on building environment, direct exposure to hazardous sources, high pressure on demanding schedules and costs, and increasing complexity on construction techniques (HSE, 2001).

Data from a number of industrialized countries show that construction workers are three to four times more likely than other workers to die from accidents at work (Url-2).

1.4 Main Features of Construction Industry and It's Sspecific OSH Measures

The continuous competition among construction companies always makes it necessary to pay attention to productivity issues in construction companies. The main objectives of any construction project are:

- Cost: to minimize costs of the projects.
- Time: to meet the deadline of the project.
- Quality: to care about quality and avoid defects.
- Safety and health: to ensure safety and health and avoid occupational accidents and diseases.
- Environment: to build a positive impact on the environment.

The inter-relationships among the above five main objects and the pressure of market with its favour in time, cost, quality and safety and health, usually make it very complicated to reach our purposes. However, we must always put in mind that occupational safety and health should never be compromised or affected in any circumstances, for social and human reasons but must follow some regular standards.

The recent changes in construction industry ensure that good occupational safety and health has clear positive effect on productivity. In other words, construction employers recognize that prevention measures are an investment rather than a cost. For example, studies in European Union countries and elsewhere have shown that the cost of occupational accidents is about double of the cost of measures, such as the action during the design, the planning and the execution of the construction project, that are necessary to prevent them (Dias, 2009).

The construction industry is full of various dangers. This is due to the probability of facing high number of accidents and professional diseases on the industrial sites. Meanwhile, the constructors have been starting to question the efficiency and the effectiveness of the existing systems for possible implementing and monitoring safety and health measures. However, generally they all agree that if an accident happens, it means that something has failed. On the other hand, industry hazards and their preventive measures are apparently known by construction professionals in many countries.

Even though, there is a clear reduction in fatal accidents in some countries in the last decades, but still onsite accidents continue to occur. This shows that, practically the prevention measures are not designed for the absolute cut of accidents as every human wishes. The existence of enough laws and regulations on OSH in construction industry does not guarantee the ideal absolute solution. This is due to the failure in implementing these laws and regulations. In most countries, there are sufficient laws and regulations on OSH in construction, yet there is a failure to apply these laws and regulations. As a result of this, the following two questions arise frequently:

- Why are the existing laws and regulations not implemented in many cases?
- Why prevention measures are not implemented in many cases?

Of course, there is no clear answer to the above two questions. Thus, many justification arguments have been used. Following justified points can be summarized as:

- The crowdedness of existing OSH laws, regulations and the fact that they are prescriptive rather than performance-based.
- The adjustment of the OSH laws and regulations in a way that they care about the peculiarities of the construction industry.
- The continuous change of the OSH laws and regulations and even in short period sometimes.
- The high cost of the initial costs of prevention measures which may lead to non profitable productivity.
- The need that labor inspectors have to be more proactive and even reactive which leads to the failure in recognizing that it is not possible to have an inspector for each construction site.

  Furthermore, the specific nature of the construction industry ensures that there is a need for tailor-made OSH laws and regulations. However, this can never lead to failure justification in implementing the national laws and regulations or in taking preventive measures. These specific features can be summarized by:

- Producing special unique products such as a building, a bridge, a road, etc., which turn out products in series usually making workplaces easier to control, although they are complex.
- While involving many parties in the different phases of a construction project, sometimes with different interests: owners (low cost, high quality); users (high quality of life, comfort); designers (aesthetics, structural safety); contractor and sub contractors (reduce costs, improve productivity); etc.
- Possibility of existence of a high number of subcontractors in construction projects, this make the enforcement and inspection of OSH legislation, as well as the running of OSH training programs very difficult.
- Construction companies are most likely in need of becoming management and coordination companies, and hence outsourcing all or most of the construction works.
- Subcontractors being the main employers (most of them are micro or small enterprises);
- The need of a labor-intensive activity in spite of highly mechanized industry;
- Labor only subcontracting and self-employment on short-term contracts being common practice;
- The need of making payments on the basis of work performed (rather than hourly-based) becomes the most frequent method of payment in many countries;
- Falling from height is the main cause of fatal accidents in most countries. In some cases, it reaches 50 percent.

In conclusion, the governments and social partners in each country should work very deeply on all of these features and, together, do their best to search for possible applicable solutions at both the legislative level and the implementation level. Also, it would be highly appreciated if the OSH legislation become as simple as possible, and be as performance-based as possible, so that it is easy to implement by contractors and to inspect by labor inspectors. Moreover, it is advised that the owners/clients of the construction projects should be more involved in OSH issues and observe it very carefully (Dias, 2009).

1.5 Strategies for Employing OSH (Occupational Safety and Health) in Construction Industry

As mentioned before, many countries and regions have been looking for ways to improve OSH in the construction industry. For instance, The European Union has followed two relevant events regarding these issues in recent years. These two events were taken place in 2004 and 2006 by the European Agency for Safety and Health at Work, based in Bilbao, Spain. The main conclusions of the European Construction Safety Summit held in 2004 can be summarized by:

Procurement - building in safety: OSH issues are integral to the construction project process. They are not only limited to the construction phase of a project but also takes place throughout the entire lifetime of the project including design, construction, maintenance and demolition.

Enforcement - improving compliance: Prevention is the guiding principle for OSH legislation in the European Union.

Guidelines - sharing good compliance practice: OSH legislation should be joined by guidelines to help in illustrating how the legal requirements can be implemented thereby sharing good compliance practice.

Designing safe and healthy construction work place by figuring out risk wherever reasonably possible and to highlight any remaining residual risk through-out any project.

Improving safety and health performance by using social partner commitment: Social dialogue and agreements on OSH improvements are considered to be the key tools to emphasize the indispensable commitment to real improvements in safety and health on construction sites.

The industry has made considerable efforts to improve occupational safety and health by cooperating with each other. For sure, further improvements can only be achieved by combining the contractors, large and small with the workers, architects, designers, engineers and surveyors. However, this may need help from outside.

In addition to what mentioned above, some countries and regions have made many changes to their OSH legislation for the sake of a search for continual improvement of the working conditions of construction workers and for fewer occupational accidents and less occupational diseases in a certain industry (Dias, 2009).

1.6 Statistics of Construction Industry and Occupational Health and Safety

The ILO estimates that each year about 2.3 million men and women die from work related accidents and diseases including close to 360,000 fatal accidents and an estimated 1.95 million fatal work related diseases.

In economic terms, it is estimated that roughly four per cent of the annual global Gross Domestic Product, or US$ 1.25 trillion, is siphoned off by direct and indirect costs of occupational accidents and diseases such as lost working time, workers' compensation, the interruption of production and medical expenses (Url-1).

The ILO estimates the number of fatal occupational accidents in the construction industry at about 60 000 every year with about 64% in the Asia and Pacific region, 17% in the Americas, 10% in Africa and 9% in Europe (Figure 1.1).

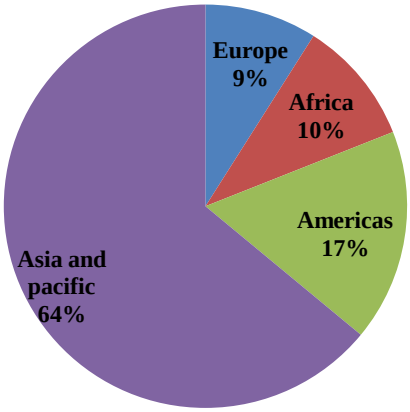

Figure 1.1 Distribution of the fatal accidents in the construction industry.

In many countries, there are twice as many occupational accidents leading to more than 3 days absence in the construction industry as the proportion of construction workers to all industrial workers would lead us to expect, and three times as many fatal accidents (Figure 1.2).

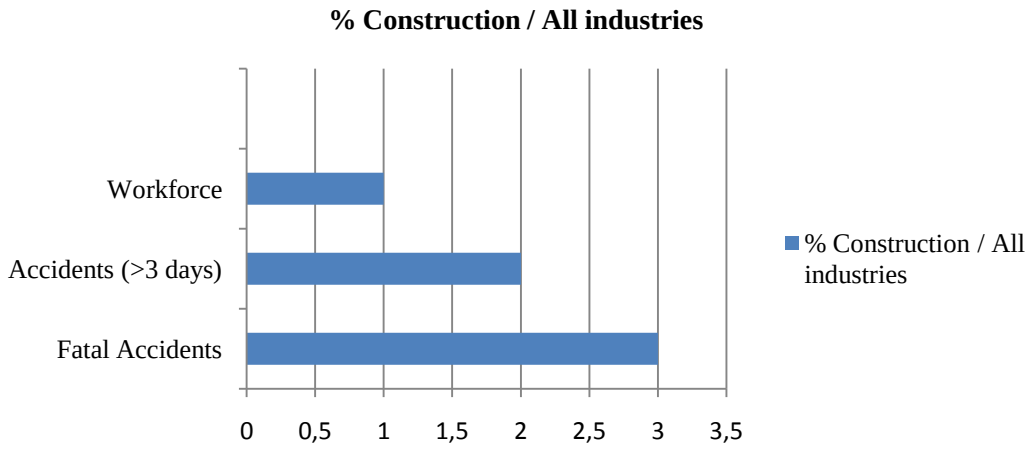

Figure1.2: Accidents in the construction industry versus all industries.

1.6.1 Statistics of construction industry and occupational health and safety in United Kingdom.

In the following tables,statistics is given about the construction related occupational injuries from UK (Url-5).

Table 1.1: Fatal Occupational Injuries by Construction Industry UK, 2004 – 2010.

	2004	2005	2006	2007	2008	2009	2010
TOTAL	69	60	79	72	52	41	50
EVENT or EXPOSURE							
Contact with moving machinery			1	3	1	2	-
Struck by moving, including flying/falling, object			17	10	6	2	6
Struck by moving vehicle			5	9	4	4	8
Strike against something fixed or stationary			1	1	2	1	1
Injured while handling, lifting or carrying			5	-	1	-	1
Slips, trips or falls on same level			-	-	1	-	-
Falls from a height			24	33	27	25	13
Trapped by something collapsing / overturning			7	6	4	2	13
Drowning or asphyxiation			5	3	2	-	2
Exposure to, or contact with, a harmful substance			1	1	-	-	-
Exposure to fire			1	-	-	-	-
Exposure to an explosion			-	-	1	-	-
Contact with electricity or electrical discharge			9	3	2	2	3

Injured by an animal			-	-	-	-	-
Acts of violence			-	-	-	-	-
Other kind of accident			-	2	-	3	1
Injuries not classified by kind			3	1	1	-	2

Table 1.2: Major Occupational Injuries by Construction Industry,UK, 2004 – 2010.

	2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
TOTAL	4529	4500	4474	4438	3950	3145	2857
EVENT or EXPOSURE							
Contact with moving machinery	-	-	210	195	171	135	125
Struck by moving, including flying/falling, object	-	-	777	713	624	491	405
Struck by moving vehicle	-	-	93	76	82	68	75
Strike against something fixed or stationary	-	-	121	128	114	68	80
Injured while handling, lifting or carrying	-	-	615	653	503	371	345
Slips, trips or falls on same level	-	-	1189	1209	940	789	757
Falls from a height	-	-	1217	1196	1244	1029	883
Trapped by something collapsing / overturning	-	-	684	663	686	618	515
Drowning or asphyxiation	-	-	433	425	350	253	274
Exposure to, or contact with, a harmful substance	-	-	100	108	208	158	94
Exposure to fire	-	-	33	29	31	19	20
Exposure to an explosion	-	-	1	2		3	
Contact with electricity or electrical Discharge	-	-	58	67	46	42	27
Injured by an animal	-	-	10	12	15	15	6
Acts of violence	-	-	8	8	10	5	4
Other kind of accident	-	-	46	27	35	35	34
Injuries not classified by kind	-	-	4	4	6	4	3

1.6.2 Occupational health and insurance in Turkey

Studies carried out by ILO present some concrete data about deaths and injuries arising from occupational accidents and professional diseases. Occupational accidents and professional diseases recorded by Social and insurance Institution (SGK) in Turkey present important data for us to see the situation in Turkey from this aspect even in an unclear manner.

Not only SGK statistics but also master's degree and doctorate studies carried out in this field, hold the non-governmental organizations responsible in occupational health and security field, and today media also provides the coverage for the comparison and the updates of the statistics in this field.

In that respect, controversies between related years of the statistics given in this section must be considered normal. It can be argued that the statistics in Turkey are uncertain due to reasons such as unsystematic registration of the statistics in Turkey.

Table 1.3: Occupational accident, continuous incapacity, and death statistics between (2002- 2010).

YEARS	OCCUPATIONAL ACCIDENT	CONTINUOUS INCAPACITY	DEATH
2002	72344	1820	872
2003	76668	1451	810
2004	83830	1421	841
2005	73923	1374	1072
2006	79027	1953	1592
2007	80602	1550	1043
2008	72963	1542	865
2009	64316	1668	1171
2010	62903	1976	144
TOTAL	**666576**	**14755**	**8410**

Only do the statistics of occupational accidents that are incurred by employees registered to the SGK and that could be recorded reveal the void in this field. Registered 8410 workers died as a result of occupational accidents in last eight years in Turkey. According to the statistics recorded in the last eight years, more than 100 workers in averaged die every year.

The most important one, among occupational accident results is whether working and life conditions of the workers are negatively affected or not. However, there is also a financial output of each occupational health. Material dimension of occupational accidents is larger than their apparent dimension. From this aspect, the tip of the iceberg metaphor is frequently made under this title. Indirect effect of material losses occurring as a result of occupational accidents is almost twofold their direct effects.

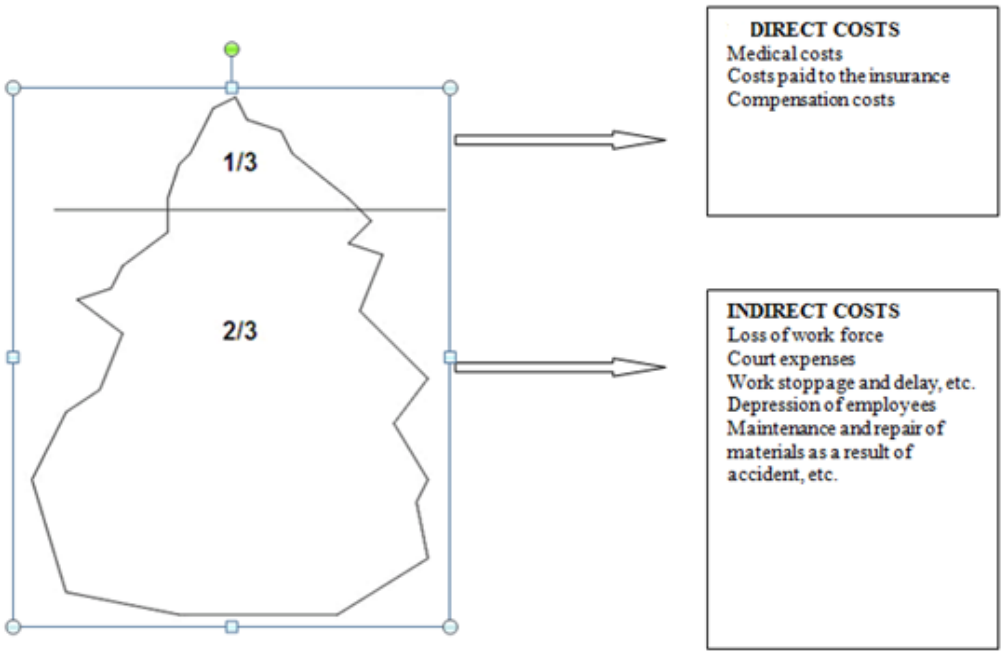

Figure 1.3: Direct and indirect cost of occupational accidents.

According to ILO criteria, it is estimated that a loss amounting 4% over the gross domestic product due to occupational accidents in Turkey. This amount also results in that a financial loss of billions of Turkish Lira occurs as a result of approximately one thousand occupational health involving death every year. As a result of this proportion, the equivalent of Turkish gross domestic product that was 953, 974 billion TL for the year 2009 is 38 billion TL (Ceylan, 2011).

1.6.3 Statistical values related to occupational accidents in construction sector in Turkey

SGK statistics formed by integration of finalized occupational accident files of previous year are published every year in Turkey. Although some improvements have been made in sector based classification of the statistics according to previous periods, it is difficult to say that they have sufficient amount of data.

Studies carried out in this field help in partial elimination of this deficiency. Doctorate study carried out by Müngen between the years 1968-1990 about occupational accidents takes an important place among these studies (MÜNGEN, 1993).

Statistics in this field form a relative integrity by the addition of the factors such as the fact that a more regular systematic have been followed in the classification and the publication of the statistics after the year 1990 when compared to previous years, the increase in the number of academic studies carried out in those years on these and similar studies carried out previously.

According to SGK statistics for the year 2010, 6437 occupational accidents happened in construction sector and 475 of them resulted in death. Once these numbers are evaluated superficially, occupational accidents of construction sector take the second place with a proportion of 10,23% in total after total number of occupational accidents in coal and lignite mining (12,96%), however, with a large proportion such as 33,42% it has a size approximately four times of the closest one, namely the accidents involving death in land transport and pipeline carriage works (9,21%) (Url-3).

Solely the data of the year 2010 are even sufficient for understanding the results caused by the accidents in the construction sector. This table shows that the constructions are the sector where the occupational accident is frequently encountered and approximately one third of the encountered occupational accidents result in death. Data in the table below reveal this explanation better (MÜNGEN, 2011).

Table 1.4: Number of occupational accidents happened in the period 2005-2009 in Turkey wide and construction sector.

Year	Total number		Continuous incapacity		Death	
	Turkey wide	Construction Sector	Turkey wide	Construction Sector	Turkey Wide	Construction Sector
2005	73923	6480	1374	322	1072	290
2006	79027	7143	1953	425	1592	397
2007	80602	7615	1550	359	1043	359
2008	7963	5574	1452	373	866	297
2009	64316	6891	1668	282	1171	156
Average	74166	6441	1599	352	1153	300

Number of accidents and their results according to years are also seen in the following Table comparing activity sub-groups recorded by the SGK between the years 2008-2010 under three separate codes but all of which can be easily accepted

as construction activity. An important note here is that there is a controversy between existing statistical information. This also stems from the type of recording by the SGK for the number of occupational accidents.

Table 1.5: Occupational accident statistics in Turkey between the years 2008-2010.

YEAR	CODE NO.	ACTIVITY SUB-GROUPS	NUMBER OF OCCUPATIONAL ACCIDENTS			CONTINUOUS INCAPACITY IN TOTAL			OCCUPATIONAL ACCIDENT IN TOTAL		
			MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL
YEAR 2008	41	BUILDING CONSTRUCTION	0	0	0	0	0		0	0	0
	42	CONSTRUCTION OF STRUCTURES OTHER THAN BUILDINGS	32	4518	4550	304	0	304	231	0	231
	43	SPECIAL CONSTRUCTION ACTIVITIES	11	1013	1024	73	0	73	66	0	66
			TOTAL		5574	TOTAL		377	TOTAL		297

YEAR	CODE NO.	ACTIVITY SUB-GROUPS	NUMBER OF OCCUPATIONAL ACCIDENTS			CONTINUOUS INCAPACITY IN TOTAL			OCCUPATIONAL ACCIDENT IN TOTAL		
			MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL
YEAR 2009	41	BUILDING CONSTRUCTION	3476	21	3497	0	0	0	0	0	0
	42	CONSTRUCTION OF STRUCTURES OTHER THAN BUILDINGS	1624	11	1635	241	0	241	128	0	128
	43	SPECIAL CONSTRUCTION ACTIVITIES	1729	16	1745	43	0	43	28	0	28
			TOTAL		6877	TOTAL		284	TOTAL		156

YEAR	CODE NO.	ACTIVITY SUB-GROUPS	NUMBER OF OCCUPATIONAL ACCIDENTS			CONTINUOUS INCAPACITY IN TOTAL			OCCUPATIONAL ACCIDENT IN TOTAL		
			MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL
YEAR 2010	41	BUILDING CONSTRUCTION	3023	33	3056	199	0	199	264	0	264
	42	CONSTRUCTION OF STRUCTURES OTHER THAN BUILDINGS	1578	5	1583	63	0	63	107	0	107
	43	SPECIAL CONSTRUCTION ACTIVITIES	1782	16	1798	56	1	57	104	0	104
			TOTAL		6437	TOTAL		319	TOTAL		475

Since the construction works are largely carried out at once and is a sector where the production continues in risky working conditions, working hours and style is longer

and more tiring when compared to other sectors, occupational accidents frequently occur in this sector. Besides additional factors such as flexible employment, untrained and inexperienced work force takes an importance place in the formation of occupational accidents (Ceylan, 2011; Url-3)

As a result of careful and cautious studies carried out on the records kept in construction sector related to encountered occupational accidents, the accidents could be classified in a certain order among them. The accidents resulting in either death or injury in the construction sector focus on 6-7 accident types. These accident types can be examined in 2 main groups. Accordingly, the first group consists of the accidents where the ratio of accidents resulting in death is more than 10% and the second group consists of the accidents where the accidents resulting in death is less than 10%.

Human fall (falling from elevation) takes the first place in the first group, followed by electric shock and material fall. The total of the accidents in the first group is 65.6 %. Briefly, if the accidents in the first group are prevented in the constructions, more than half of the accidents in total could be therefore prevented. However, in the second group, construction machine based accidents takes the first place with 8,6% followed by traffic accident in construction site and collapse of building section with 7,9% (Url-3).

1.7 The Importance of Occupational Health and Safety

The followings are some basis for handling the occupational health and safety:

- **Economics:** Both direct and indirect economic costs of workplace accidents, injuries and illnesses are of big importance. These are the costs that can lead to time loss at work, human pain and suffering, and gradually to the undermining of moral and workers' efficiency and productivity.

  In this connection, unsafe working conditions affect the industrial climate negatively and undermine or even damage workers' morale and motivation, as well as their relations with the owners and managers. This can force them to leave the firm, and hence the firm may face difficulties in substituting them by qualified workers, for more details see (Muñiz *et al*, 2009).

- **Legality:** Occupational Health and Safety Acts provide workers with a safe and healthy work environment. For example in order to protect workers employers must exercise due diligence. That is to take reasonable precautions suitable for the existing circumstances. In addition to that, the legal penalties that are possible for violations of health and safety legislation are very vital and can lead to civil lawsuits and criminal prosecutions (Muñiz *et al*, 2009).

- **Morality:** In the usual sense, it's accepted that employers are most likely to have a moral responsibility to provide their employees with a safe working environment. According to Society's standards of life or the ability to live must be worthy. For more investigations, we refer to (Hughes & Ferrett, 2007; Roger L, 2006).

- **Productivity and competitiveness:** Accidents have different effects in decreasing productivity and quality. In addition, they may cause the deterioration of the firm's public image or internal climate. For this reason a good occupational safety management must act positively not only on accident rates, but also on competitiveness variables and financial performance (Muñiz *et al*, 2009).

2. SAFETY MANAGEMENT SYSTEM

2.1 Safety Management System Literature Review

Anton (1989) defined a safety program as ‘‘the control of the working environment, equipment, processes, and the workers for the purpose of reducing accidental injuries and losses in the workplace.’’

Similarly, Oregon Occupational Safety and Health Division (2002) described a ‘‘workplace safety and health program’’ as ‘‘a term that describes what people (business owners, managers, and employees) do to control injuries and illnesses at their workplace. ’’

Safety management systems (SMS) are introduced into the construction industry as a formal system of managing site safety. Contractors are expected to manage site safety through formal SMS. It is important to evaluate how effective these systems are, so that deficiencies can be corrected.

Previous studies have discovered that the successful implementation of the SMS on construction sites can help to prevent accidents (Tam and Fung, 1998; Poon *et al*., 2000; Goldenhar *et al*., 2001; Hinze and Gambatese, 2003; Findley *et al*., 2004), it is essential to provide a comprehensive checklist of attributes that may affect the safety performance of worksites. Safety programs play a vital role in eliminating and reducing the work-related accidents and injuries.

According to Michaud (1995), a successful safety program can be measured in terms of no injury to people, no damage to equipment, machines and tools, no damage to environment, no loss of market competition and no damages to company image or brand-name but rather increasing the productivities.

According to Weber (1992a), Pierce (1995a), Safety programs can accomplish the desired results when safety goals have been clearly established. The safety goals should give a clear picture, direction and focus for performing day-to-day activities

in order to reach desired results. When realistic and achievable goals are set up, the progress towards accomplishing such goals can be easily measured.

Based on previous studies (Tam and Fung, 1998; Poon *et al*., 2000; Goldenhar *et al.*, 2001; Hinze and Gambatese, 2003; Findley *et al*., 2004), some effective safety programs were identified as follows: comprehensive safety policies, safety committees, safety inductions, safety trainings, jobsite inspections, accident investigations, first aid programs, in-house safety rules, safety incentives schemes, control of subcontractors, selection of employees, personal protection programs, emergency preparedness planning, safety related promotions, safety auditing, safety record keeping, and job hazard analysis.

Various studies related to construction safety asserted that most accidents on the site could have been reduced and prevented with the establishment of proper and consistent safety management process or program of planning, education/training and inspection. In particular, the safety management process should be well planned so that it enables site managers and trade workforces to not only easily identify and recognize safety risks but also communicate with each other during the construction process (Tam and Fung, 1998).

2.2 Safety Factors Adopted By Various Countries

A well-designed safety management system (SMS) can contribute to the success of implementing a safety management system in the workplace. National SMS for construction sites have been designed and implemented in several countries based on the standard practices for that country. The actual number of factors used in the development of the SMS differs from one country to another. This of course depends on the special needs of the domestic construction industry (Ismail *et al*, 2012).

There are several levels of factoral classifications depending on the degree of the desired details. For example, Table 2.1 gives the summary of first level safety adopted by many countries all over the world as mentioned by (Ismail *et al*, 2012)

Table 2.1: Gives the summary of first level safety adopted by many countries all over the world as mentioned by (Ismail *et al*, 2012).

Country	**Safety factors adopted**
Australia	• Project management committee (management support) • Hazard management (accident analysis, safety controlling) • Training, information and promotion • Implementation (equipment, safety environment, safety supervisor) • Recording, reporting and investigation (safety process factor) • Emergency procedures (safety organization) • Safety review (develop committee and responsibility)
China	• Safety meeting (management support) • Safety inspection (safety motivation) • Safety regulation enforcement (safety responsibility) • Safety training (safety training) • Safety communication (Personal Factors) • Safety cooperation (safety culture) • Management worker relationship (safety organization) • Safety resources (safety clear instruction)
Finland	• Training and Practice • Work involvement (process factor& environment, etc.) • Personal Factors • Responsibility (safety responsibility) • Clear and realistic goals (safety clear instruction) • Management Support

Jordan	• Safety policy (safety culture) • Training (safety training) • Safety meeting (management support) • Safety equipment (safety organization) • Safety inspection (safety motivation) • Workers attitude (Personal Factors) • Labor turnover rate (process factors) • Safety Motivation (safety motivation)
Malaysia	• Organization in construction management (safety organization) • Good communication (Personal Factors) • Clear goals (safety clear instruction) • Availability (safety culture) • Control of sub contractors (safety controlling) • Contractors satisfaction (safety motivation) • Codes and standards (safety code & standards) • Training (safety training) • Staff responsibility (safety responsibility) • Construction cost optimization (safety process factors) • Safety controlling • Management commitment (management support)
Netherland	• Safety standards (safety code & standards) • Safety responsibility (safety responsibility) • Training expert extra safety staffs (safety training) • Safety organization (safety organization) • Thematic approach (safety clear instruction) • Safety analysis (management support)
Singapore	• Incentive and punishment and recognition (Safety motivation) • SMS and Insurance policy and statutory requirement (Safety policy or Safety culture) • Safety framework (process factors) • Safety attitude • characteristics of Worker (Personal Factors)

Spain	• Safety policy (safety culture) • Incentive for participation (safety motivation) • Training (safety training) • Communication (Personal Factors) • Prevention planning (management support) • Emergency planning (safety organization) • Internal controlling (safety controlling) • Benchmarking (safety code and standards)
Thailand	• Personal attitude, positive group, communication, personal competency (Personal Factors) • Personal motivation, (safety motivation) • Teamwork, (safety training) • Equipment management, employee participation, Enforcement • Program evaluation (safety organization) • Sufficient resources, clear goals, (safety clear instruction) • Management commitment, supervision (management support) • Authority and responsibility, (safety responsibility)
USA	• Safety meeting (management support) • Safety inspection (safety motivation) • Safety regulation enforcement (safety responsibility) • Safety training (safety training) • Safety communication (Personal Factors) • Safety cooperation (safety culture) • Management worker relationship (safety organization) • Safety resources (safety clear instruction

2.3 Factors Influencing the Implementation of a Safety Management System for Construction Sites

The following summarizes and discusses the potential factors affecting the success of safety programs taken from various literatures.

1. **Resources Factor:**

   Includes hardware and software, safety equipment, personal protective equipment (PPE) must be given to the workers, any special requirements of the industry have to be sufficiently developed and provided to the worker. Also First Aid equipment is necessary, maintenance of the machines must be done periodically, and the following paragraph explains it briefly.

   Sufficient resource allocation: The goals of safety programs cannot be accomplished without adequate resources. An effective safety program results from the commitment of the top management to provide an appropriate level of resources. Management must consider and allocate sufficient resources to carry out day-to-day activities to accomplish both short-term and long-term goals. The resources required for effective safety program may include sufficient staff, time, money, information, methods used in safety works, facilities, tools, machines, etc. (Erikson, 1997; Rollenhagen and Kahlbom, 2001; Rechenthin, 2004; Abudayyeh *et al*.,2006).

   Personal protective equipment: the worker should use the PPE whenever the hazards/risks cannot be avoided. The OHS expert in the site must control the using of PPE by the worker .The PPE may be for permanent use or for temporary use. PPE for permanent use are those that all workers should wear during the work (e.g. hardhats, safety shoes). PPE for temporary use are those that depends on the tasks assigned (e.g. harnesses to prevent falls from height) and on the working environment (e.g. a noisy environment).

   Maintenance of the machines must be done periodically: We can reduce the risk of injuries by keeping the equipment and the machines in good condition and making periodic maintenance.

The workplace must be carefully assessed to determine possible hazards in order for proper selection of safety equipments. An effective safety program results in fewer injuries due to proper safety equipment acquisition and maintenance (Toole, 2002; Tam *et al*., 2004).

2. Management Factor :

Includes Safety meetings, risk assessment, contingency plan, Daily and weekly safety reports, Safety meetings, and the following paragraph explains it briefly.

Risk assessment (safety analysis): the key to reducing work related accidents and occupational diseases, risk assessment is the basis for successful safety and health management, if it is implemented well, it can improve workplace safety and health.

Risk assessment is the process of evaluating risks to workers safety and health from workplace hazards. It is a systematic examination of all aspects of work that considers:

- What could cause injury or harm
- Whether the hazards could be eliminated and, if not,
- What preventive or protective measures are, or should be, in place to control the risks (Url-4).

Contingency plan: emergency plan (including the evacuation of all those involved on the construction site, whenever a catastrophe or an occupational accident occurs) must be prepared and regularly updated (OSHA, 2009).

Policy factor: The safety legislation and policies have a great impact upon the safety level of a construction worksite. Legislations form a framework in which health and safety is regulated and controlled (Hughes & Ferrett, 2007). The site must be inspected by the authorities to ensure that the condition of safety and health rules are respected.

Good communication: When the lines of communications between management and workforce are open, workers can bring reports of unsafe working practices and hazardous environments to management's attention. Management in turn can also communicate their concerns and priorities of safety to gain employees' compliance

and awareness (Peyton & Rubio, 1991; Stranks, 1994; Vredenburgh, 2002; Fang *et al*., 2004; Abudayyeh *et al*., 2006).

Program Evaluation: Safety programs should be periodically evaluated to determine its success in meeting the set out goals and objectives. When the implementation of a safety program does not meet the defined goals, an evaluation process can facilitate in identifying the shortcomings of the program and thereafter, areas for improvements can be traced and reviewed accordingly. (Peyton and Rubio, 1991; Pierce, 1995b; Stranks, 2000; Abudayyeh *et al*., 2006)

Writing report: writing daily and weekly reports help in monitoring and inspections and make the arguments and conclusions persuasive (Hughes & Ferrett, 2007).

Meetings: Regular safety meetings are essential for communicating safety information to all parties.

3. Personal Factor

Includes awareness, good communication, personal attitude, positive groups, personal competency and the following paragraphs explains it briefly:

Personal competency: A successful safety program also results from placing the right person on the right job. The right person is defined as the person(s) who are physically and mentally capable for carrying out the assigned tasks with the right knowledge, experience and skills (Mohamed, 2002; Tam *et al*., 2004; Fang *et al*., 2006).

Positive group and Teamwork's: A safety program succeeds when all concerned parties from top to bottom hierarchical levels realize that preventing accidents is everyone's responsibility. In practice, members of a group conform to certain attitudes simply to avoid sanctions. If positive attitudes towards safety can be built and embedded within a group, safety can then be managed successfully. This is the basis of good safety culture. Every functional unit must cooperate in executing safe activities with the aim of achieving the goals set by the team such as planning and controlling their works, handling day-to-day safety problems (Krause, 1997; Ulloa and Adams, 2004; Petersen, 1984; Stranks, 2000; Johnson, 2003).

Personal attitude: Attitude is a tendency to respond positively and/or negatively to certain persons, objects or situations and is normally built up through experience. Individuals however differ in their perception of risks and willingness to take risks. Successful safety programs can be achieved if the positive attitudes of employees toward safety are reinforced (Levitt and Samelson, 1993; Stranks, 1994; Tam *et al*., 2001; Johnson, 2003; Schultz, 2004; Fang *et al*., 2006).

Personal Motivation: Although workers have adequate knowledge and skills to accomplish their jobs safely they will not, however work in such manner unless they are motivated to do so. To ensure commendable safety records, all personnel in the workplace must be motivated to carry out their job responsibilities safely, by the possibilities of achievement and recognition, opportunity for additional responsibilities, rewards, and personal growth (Petersen, 1984; Levitt and Samelson, 1993; Stranks, 1994; Neal and Griffin, 2002; Johnson, 2003).

4. Human recourse management/ Incentive Factor

Includes safety practice, training expert staff, teamwork, frequency of staff group meetings, safety promotion, campaigns, personal motivation, work place conditions, safety rules Welfare and the following paragraphs explains it briefly:

Appropriate safety education and training: A successful safety program can be achieved if all employees are given periodic educational and training programs in order to improve their knowledge and skills on safety at work. (Cooper and Cotton, 2000; Toole, 2002; Tam *et al*., 2004; Fang *et al*., 2006) all the worker must be trained about safety practices. In this regard, the workers need to possess the correct skills and knowledge for the nature of work.

The social insurance and the health certificate: According to the law of labor the employee in the construction site must have a health certificate and covered by social insurance.

***Welfare* :**The provision of facilities to maintain the health facilities include washing and sanitation arrangements, the provision of drinking water, heating, lighting, accommodation for clothing, seating (when required by the work activity or for rest), eating and rest rooms (Hughes & Ferrett, 2007).

5. Relationship Factor

Includes interfaces, personal relationship, Management support from the company.

Communication: open communication between management and the middle level and bottom-level staff to facilitate prompt report of and response to unsafe conditions and the good communication between the contractor and sub-contractors improve safety practices and it will help to maintain the safety practices of the sub-contractor (Fang, *et al*., 2004; Abudayyeh *et al*., 2006).

Management support: It is evident that management plays a very important role in an efficient and effective safety program. Management must fully and actively translate ideas into safety actions, including issuing a written comprehensive safety policy, allocating sufficient resources, suitable reacting to safety suggestions and complaints, attending regular safety meetings and training, regularly visiting the workplace, following the same safety rules as others (Pierce, 1995b; Stranks, 2000; Rowlinson, 2003; Rechenthin, 2004; Abudayyeh *et al*., 2006; Herrero *et al.*, 2006).

In this study based on previous safety researches, 5 main factors and 17 sub-factors were commonly proposed as essential to favorable outcomes of safety program implementation and the flowing table shows the main 5 factor and the sub factor that effect the safety management in construction site according to the applied survey.

Table 2.2: The factor that effecting the safety management program.

Recourse factor	Personal factor	Management factor	HRM(incentive factor)	Relationship factor
3- Personal protective equipments are given to the workers.	4- The worker use the given (PPE) and Workers' usage of the personal protective equipments (PPE) is controlled.	1- A contingency plan is prepared and regularly updated.	5- Workers are trained about safety practices.	10- Sub contractors safety practices are controlled.
7- Maintenance of the machines are periodically done.	14- Employees follow the safety rules when doing their jobs.	2-Risk assessment (safety analysis) is carried out.	8- Every worker in the site has an health certificate.	11- The company supports occupational health and safety department.
	15- The tasks assigned to the workers are suitable to workers' physical and personal abilities.	6- Daily and weekly safety reports are written.	9- Every worker is covered by social security.	
	16- Some health and safety procedures/instructions/rules are hard to follow.	13- Safety meetings are regularly held.	12- Workers that do not follow the safety rules are fined appropriately.	
		17- The site is inspected by the authorities about the health and safety rules.		

3. METHODOLOGY

3.1 Population And Sample

The experts on occupational health and safety in different Turkish industrial construction sites were identified as the target population for the study. The construction sites of the study were chosen randomly in Istanbul. Table 3.1 presents demographics of the occupational health and safety specialists that involved in the study.

Table 3.1: Demographics of the sample (N=37).

Variable	Group	f	%
Gender	Male	35	94.6
	Female	2	5.4
Age	<25 years old	5	13.5
	25-35 years old	24	64.9
	35-45 years old	4	10.8
	45> years old	4	10.8
Specialization	Civil Engineering	13	35.1
	Geology / Geophysics Engineering	1	2.7
	Environment Engineering	9	24.3
	Mining Engineering	2	5.4
	Mechanic Engineering	1	2.7
	Electrical Engineering	1	2.7
	Technical teacher	2	5.4
	OHS technician	6	16.2
	Chemistry Engineering	1	2.7
	Agriculture Engineering	1	2.7
Working experience	<2 years	11	29.7
	2-7 years	17	45.9
	7-15 years	4	10.8
	15> years	5	13.5

94.6% of the OHS specialists are male and just 5.4% of them are female. Majority of the specialists are between the 25 and 35 years old (64.9%). When asked about their graduation, it is found that most of them are graduated from a civil engineering program (35.1%) followed by environment program (24.3%).

The participants' working experience are mostly around <2 years (29.7%) and 2-7 years (45.9%) which is consistent with their age that reported above.

Table 3.2: Demographics related to the occupational health and safety (N=37).

Variable	Group	f	%
Experience as safety engineer	<2 years	20	54.1
	2-7 years	12	32.4
	7-15 years	2	5.4
	15> years	3	8.1
Field work (hours)	<1 hour	3	8.1
	1-2 hours	4	10.8
	2-4 hours	10	27.0
	4> hours	20	54.1
Certificate class	A class	3	8.1
	B class	2	5.4
	C class	29	78.4
	No certificate	3	8.1
Office work (hours) related to safety	<1 hour	3	8.1
	1-2 hours	9	24.3
	2-4 hours	17	45.9
	4> hours	8	21.6
How the certificate gained	Paid by myself	33	89.2
	Sent by a company I worked for	1	2.7
	Do not have one	3	8.1
Reading OHS act 6331 and knowing responsibilities	Read and know the responsibilities	34	91.9
	Do not read but know the responsibilities	3	8.1
Current position	Consultant	1	2.7
	OHS Specialist	24	64.9
	OHS team coordinator	11	29.7

54.1% of the participants of the study have less than 2 years of experience as a safety engineer. And 32.4% have between 2 to 7 years of experience while 5.4% have 7-15 years and 8.1% have more than 15 years of experience as a safety engineer.

54.1% of the participants use more than 4 hours of their working time in the field and 27.0% of them use between 2 to 4 hours.

While 8.1% of the participants (who are responsible for the occupational health and safety conduct) have no OHS certificate, 8.1% have an A Class, 5.4% have a B Class and 78.4% have a C Class certificate. 45.9% of the specialists use between 2 to 4 hours of their working time in the office. As can be seen from the table, most of the participants of the study had paid for their certificate themselves (89.2%).

91.9% of the specialists reported that they have read OHS Act 6331 and know their responsibilities while 8.1% reported that they have not read the act but know their responsibilities. One of the participants was employed as consultant, 24 (64.9%) employed as OHS specialist and 11 (29.7%) employed as OHS team coordinator.

3.2 Materials and Methods

To obtain data from the participants, in order to evaluate the status of construction safety management system in Turkey and the effective factors that influence the implementation of a safety management system for construction sites in Turkey, a questionnaire with three main parts have been developed by the researcher and was carried out accordingly.

All the conducted surveys have been carried out on the construction sites as it was important because the on-site surveys can also give a chance to observe the actual construction sites. Another advantage was that the respondents filled the questionere with more seriousness, and this made the results more reliable and limitted the inaccuracy of the quessionaire's desired outcome.

In the first part of the questionnaire demographics of the participants were being asked (including training and work experience).

In the second part of the questionnaire, participants' opinion were sought about 17 items related to OHS (which are clustered around 5 main factors: resources,

management, personal, HRM and relationship). The 17 items asked were constructed on a Liker-type 5 point scale (1=totally do not agree/never to 5=totally agree/always).

And in the last part of the questionnaire participants are asked to evaluate the frequency of reasons of the accidents on their construction site.

3.3 Analysis Of Data

The data obtained from the specialists were analyzed with SPSS 17.0 (Statistical Package for Social Sciences).

The below statistical techniques were used to summarize the findings:

1. Demographics of the sample summarized with frequency *(N)* and percentage *(%)*.

2. In order to see OHS specialists' perception of the status of construction safety management system in Turkey, mean scores ($\overline{X}$) and standard variations (*ss*) were calculated on 17 items that are clustered around 5 main factors.

4. RESULTS AND DISCUSSION

In this chapter, the results of the study are explained after the respective tables.

4.1 Descriptive Statistics Of The Construction Site

Table 4.1: Construction Sites' working area and the number of the workers.

	N	Min.	Max.	Mean	Std. Deviation
Construction area (m^2)	37	500.00	450,000.00	64,841.90	88,446.92
Number of workers at the site	---	40.00	2,000.00	449.39	465.91

As can be followed from the above table, minimum construction site area is 500.00 meters and the maximum area is 450,000.00 meters and the mean is 64,841.90 meters. Number of the workers at those sites is between 40 and 2,000 with a 449.39 mean.

4.2 Size Of The Conducted Construction Project

According to the European Union, Classification of construction enterprises by the number of workers employed is for medium project from 55 to 249 worker and large projects more than 250 workers so the size of construction project in this study is medium to large.

Table 4.2: Type of construction.

Variable	Group	f	%
Type of construction	Building	26	70.3
	Housing	4	10.8
	Infrastructure	2	5.4
	Infrastructure & Building	2	5.4
	Office & Residence	2	5.4
	Power grid	1	2.7
	Total	37	100,0

Most of the constructions involved in this study are buildings (70.3%). The rest consists of housing (10.8%), infrastructure (5.4%), infrastructure and building together (5.4%), office and residence together (5.4%) and a power grid (2.7%).

4.3 Results Of The Study

Table 4.3: Descriptive statistics for safety engineers' perception of the priority of the safety factors .

Factor	N	Min.	Max.	Mean ($\overline{X}$)	Std. Dev.
Resources	37	3	5	4.65	0.59
Management	37	2	5	3.84	0.70
Personal	37	2	5	3.70	0.57
HRM/Incentive	37	2	5	4.32	0.72
Relationship	37	2	5	4.05	1.03

OPTION	**SCORE RANGE**
Never	**1.00-1.80**
Sometimes	**1.81-2.60**
Often	**2.61-3.40**
Mostly	**3.41-4.20**
Always	**4.21-5.00**

The 17 items asked to safety engineers were constructed on a Likert-type 5 point scale (1=totally do not agree/never to 5=totally agree/always) and clustered around 5 factors that shown in the Table 4.3.

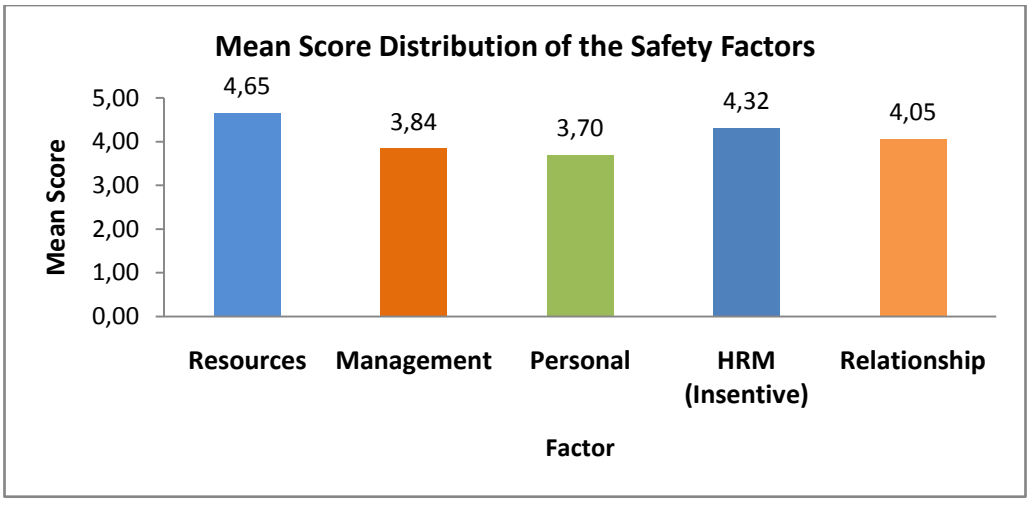

Figure 4.1: Mean Score Distribution of the safety factors.

For all the factors considered, resources are the most important factor in a safety management system according to the participants of the study (Table 4.3 and Figure 4. 1). It is scored the highest among the 5 factors ($\overline{X}_{\text{Resources}} = 4.65 \pm 0.59$). The safety engineers find resources 'always' the most important factor when implementing a safety management system.

The second most important factor is found to be HRM/Incentive factor which includes safety practices, training, insurance, safety rules ($\overline{X}_{\text{HRM/Incentive}} = 4.32 \pm 0.72$). HRM/Incentive factor rated 'always' important as the resources factor in a safety management system by the participants of the study.

The third most important factor is relationship factor ($\overline{X}_{\text{Relationship}} = 4.05 \pm 1.03$) and fourth factor is management ($\overline{X}_{\text{Management}} = 3.84 \pm 0.70$) followed by the personal factor ($\overline{X}_{\text{Personal}} = 3.70 \pm 0.57$). The safety engineers rated these factors 'mostly' important for a safety management system unlike the resources and HRM/Incentive factors which were rated as 'always' important.

The sub-factors of the 5 main factors that mentioned are detailed below in an order.

Table 4.4: Frequency table of the resources factor.

Sub factor		Never	Some times	Often	Mostly	Always
Sub03	f	0	1	2	4	30
	%	0,0	2,7	5,4	10,8	81,1
Sub07	f	0	0	4	7	26
	%	0,0	0,0	10,8	18,9	70,3

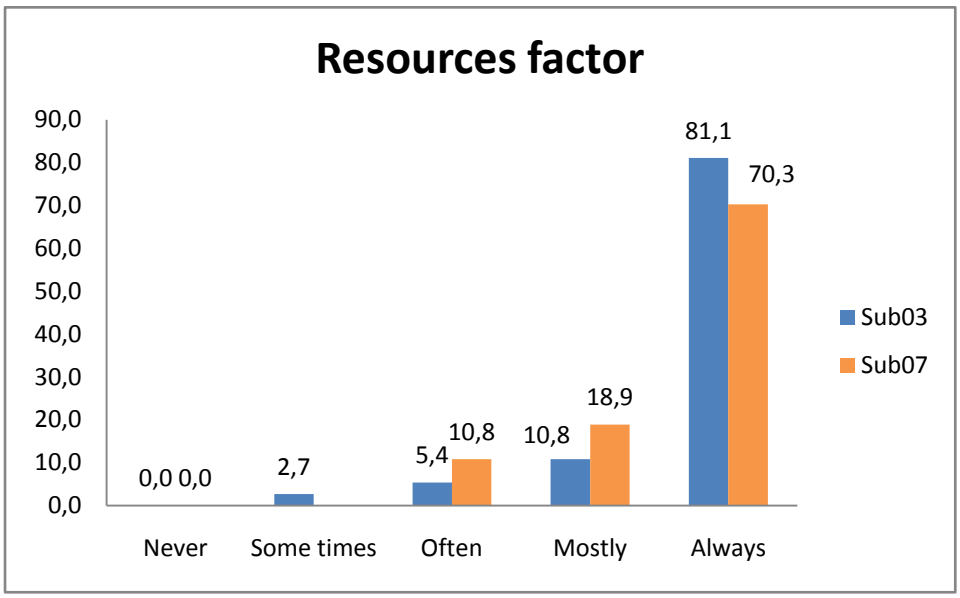

Figure 4.2: Frequency distribution for the resources factor.

Table 4.5: Descriptive statistics of the resources factor.

Sub factor/factor	N	Min.	Max.	Mean	Std. Dev.
Sub03	37	2	5	4,70	0,70
Sub07	37	3	5	4,59	0,69
Resources	37	3	5	4,65	0,59

As can be seen from the Table 4.4 and Figure 2, resources factor's sub-factors are scored very high by the safety engineers. Majority of the respondents gave answer for Sub03 ("*Personal protective equipments are given to the workers.*") and Sub07 ("*Maintenance of the machines is periodically done.*") factors marked as always, because they stated that both of these factor are very important in terms of resource allocation.

Most of the respondents put in 'always' territory. They find both of the sub factors very important in terms of resources. Mean scores of the factors found to be between 4.59 and 4.70 which mean the safety engineers think "*Personal protective equipments are given to the workers.*" ($\overline{X}_{Sub03}=4.70$) is slightly more important than the "*Maintenance of the machines is periodically done.*" ($\overline{X}_{Sub07}=4.59$).

Table 4.6: Frequency table of the management factor.

Sub factor		Never	Some times	Often	Mostly	Always
Sub01	f	0	5	4	10	18
	%	0,0	13,5	10,8	27,0	48,6
Sub02	f	0	2	6	7	22
	%	0,0	5,4	16,2	18,9	59,5
Sub06	f	1	2	5	12	17
	%	2,7	5,4	13,5	32,4	45,9
Sub13	f	1	1	5	4	26
	%	2,7	2,7	13,5	10,8	70,3
Sub17	f	13	13	4	5	2
	%	35,1	35,1	10,8	13,5	5,4

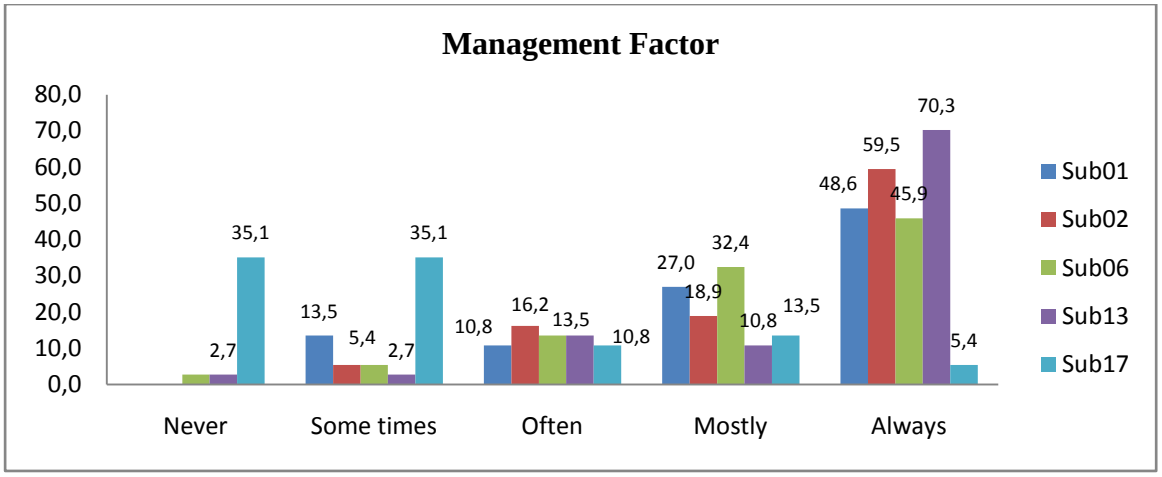

Figure 4.3: Frequency distribution for the management factor.

Table 4.7: Descriptive statistics of the management factor.

Sub factor/factor	N	Min.	Max.	Mean	Std. Dev.
Sub01	37	2	5	4,11	1,08
Sub02	37	2	5	4,32	0,94
Sub06	37	1	5	4,14	1,03
Sub13	37	1	5	4,43	1,02
Sub17	37	1	5	2,19	1,22
Management	37	1	5	3,84	0,70

In Table 4.6 and Figure 3, we can see how the management factor's sub-factors scores are distributed. While sub-factors of Sub01, Sub02, Sub06 and Sub13 were scored positively, Sub17 mostly scored negatively. So, the respondents put Sub13 ("*Safety meetings are regularly held.*") and Sub02 ("*Risk assessment (safety analysis) is carried out.*") factors in 'always', Sub01 ("*A contingency plan is prepared and regularly updated.*") and Sub 06 ("*Daily and weekly safety reports are written.*") factors in 'mostly' and Sub17 ("*The site is inspected by the authorities about the health and safety rules.*") factor in 'sometimes' territory.

Mean scores of the sub-factors found to be between 2.19 and 4.43 (Table 4.7). In terms of the management, the safety engineers think that "*Safety meetings are regularly held.*" ($\overline{X}_{Sub13}=4.43$) and "*Risk assessment (safety analysis) is carried out.*" ($\overline{X}_{Sub02}=4.32$) are the most important sub-factors. Then, in order, "*Daily and weekly safety reports are written.*" ($\overline{X}_{Sub06}=4.14$) and "*A contingency plan is prepared and regularly updated.*" ($\overline{X}_{Sub01}=4.11$) found to be important. "*The site is inspected by the authorities about the health and safety rules.*" ($\overline{X}_{Sub17}=2.19$) scored the lowest which means that whether to implement/monitor or not the health and safety rules in construction sites depends mostly on engineers' own decision with a little fear of governmental authorities.

Table 4.8: Frequency table of the personal factor.

Sub factor		Never	Some times	Often	Mostly	Always
Sub04	f	0	1	3	5	28
	%	0,0	2,7	8,1	13,5	75,7
Sub14	f	0	3	11	11	12
	%	0,0	8,1	29,7	29,7	32,4
Sub15	f	0	5	9	12	11
	%	0,0	13,5	24,3	32,4	29,7
Sub16	f	2	22	7	4	2
	%	5,4	59,5	18,9	10,8	5,4

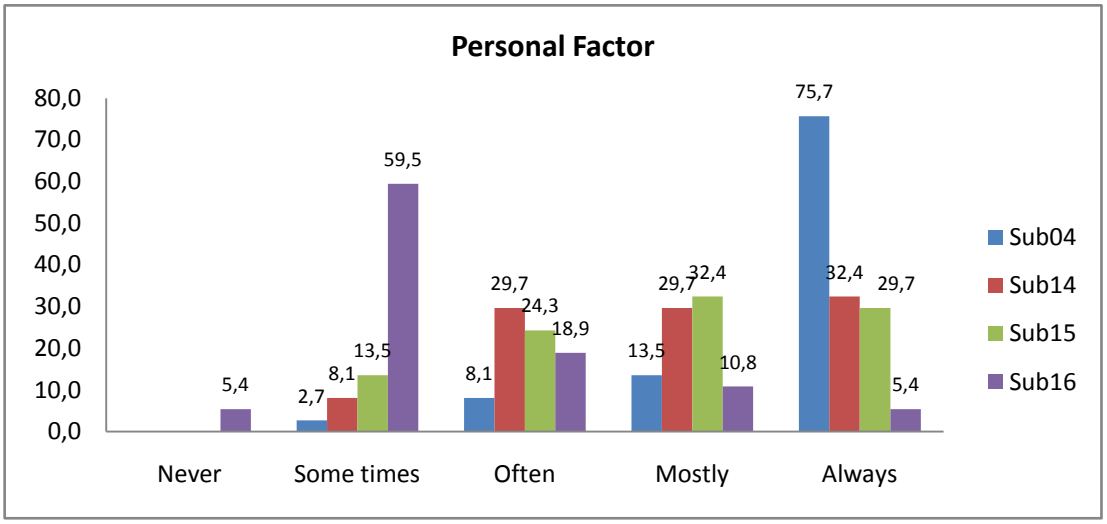

Figure 4.4: Frequency distribution for the personal factor.

Table 4.9: Descriptive statistics of the personal factor.

Sub factor/factor	N	Min.	Max.	Mean	Std. Dev.
Sub04	37	2	5	4,62	0,76
Sub14	37	2	5	3,86	0,98
Sub15	37	2	5	3,78	1,03
Sub16	37	1	5	2,51	0,96
Personal	37	2	5	3,70	0,57

Personal factor's sub-factors frequency distribution is given in Table 4.8 and Figure 4.4 the sub-factors are mostly distributed to the right side of the figure which means the safety engineers taking part in the study were generally giving credit for the personal factors for implementing a safety management system.

Mean scores of the sub-factors are between 2.51 and 4.62 (Table 4.9). Participants of the study believe that "*Workers' usage of the personal protective equipments (PPE) is controlled.*" ($\overline{X}_{Sub04}=4.62$) is the most important personal factor which was put in 'always' range. After Sub04, Sub14 "*Employees follow the safety rules when doing their jobs.*" ($\overline{X}_{Sub14}=3.86$) and Sub15 "*The tasks assigned to the workers are suitable to the workers' physical and personal abilities.*" ($\overline{X}_{Sub15}=3.78$) are found to be important sub-factors that were put in 'mostly' range. The safety engineer only 'sometimes' found "*Some health and safety procedures/instructions/rules are hard to follow.*" ($\overline{X}_{Sub16}=2.51$). In general, the safety engineers think that personal factors are important for implementing a safety management system.

Table 4.10: Frequency table of the HRM/ Incentive factor.

Sub factor		Never	Some times	Often	Mostly	Always
Sub05	f	1	2	2	6	26
	%	2,7	5,4	5,4	16,2	70,3
Sub08	f	0	1	2	8	26
	%	0,0	2,7	5,4	21,6	70,3
Sub09	f	0	0	3	2	32
	%	0,0	0,0	8,1	5,4	86,5
Sub12	f	3	8	6	10	10
	%	8,1	21,6	16,2	27,0	27,0

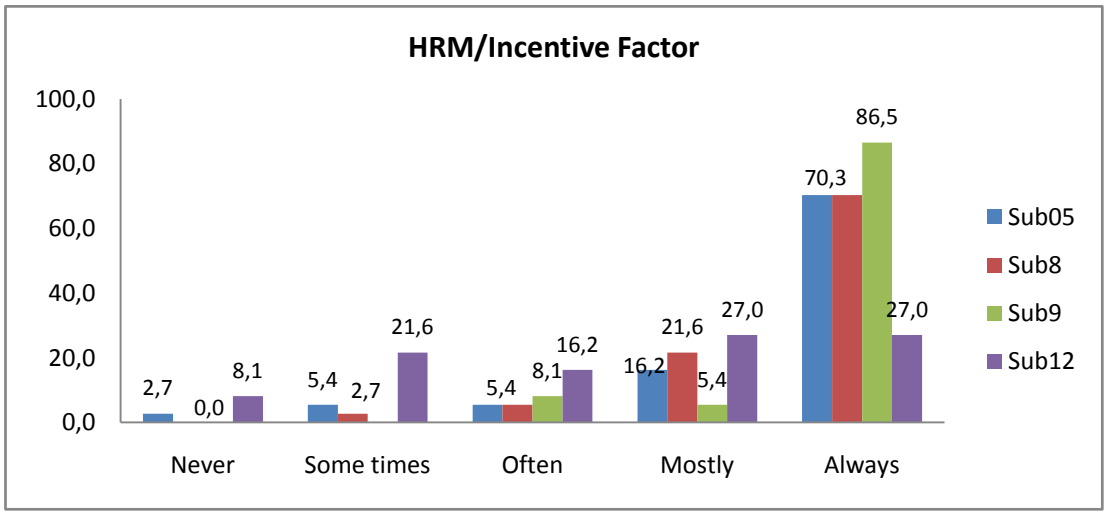

Figure 4.5: Frequency distribution for the HRM/incentive factor.

Table 4.11: Descriptive statistics of the HRM/Incentive factor.

Sub factor/factor	N	Min.	Max.	Mean	Std. Dev.
Sub05	37	1	5	4,46	1,02
Sub08	37	2	5	4,59	0,73
Sub09	37	3	5	4,78	0,58
Sub12	37	1	5	3,43	1,32
HRM/Incentive Factor	37	2	5	4,32	0,72

As can be seen from the Table 4.10 and Figure 5, HRM/Incentive factor's sub-factors are scored very high by the safety engineers. Apart from the Sub12 ("*Workers that*

do not follow the safety rules are fined appropriately."), other 3 sub-factors scored in 'always' range.

Calculated mean scores of the sub-factors found to be between 3.43 and 4.78 (Table 4.11). In terms of implementing a safety management system, the safety engineers think that "*Every worker is covered by social insurance.*" ($\overline{X}_{Sub09}$=*4.78*), "*Every worker in the site has a health certificate.*" ($\overline{X}_{Sub08}$=*4.59*) and "*Workers are trained about safety practices.*" ($\overline{X}_{Sub05}$=*4.46*) are very important sub-factors. The last sub-factor (Sub12), "*Workers that do not follow the safety rules are fined appropriately.*" ($\overline{X}_{Sub12}$=*3.43*) scored the lowest and is in 'mostly' level. It means that there is a problem about fining/penalizing workers who do not follow the safety rules.

Table 4.12: Frequency table of the relationship factor.

Sub factor		Never	Some times	Often	Mostly	Always
Sub10	f	1	3	4	6	23
	%	2,7	8,1	10,8	16,2	62,2
Sub11	f	1	8	4	7	17
	%	2,7	21,6	10,8	18,9	45,9

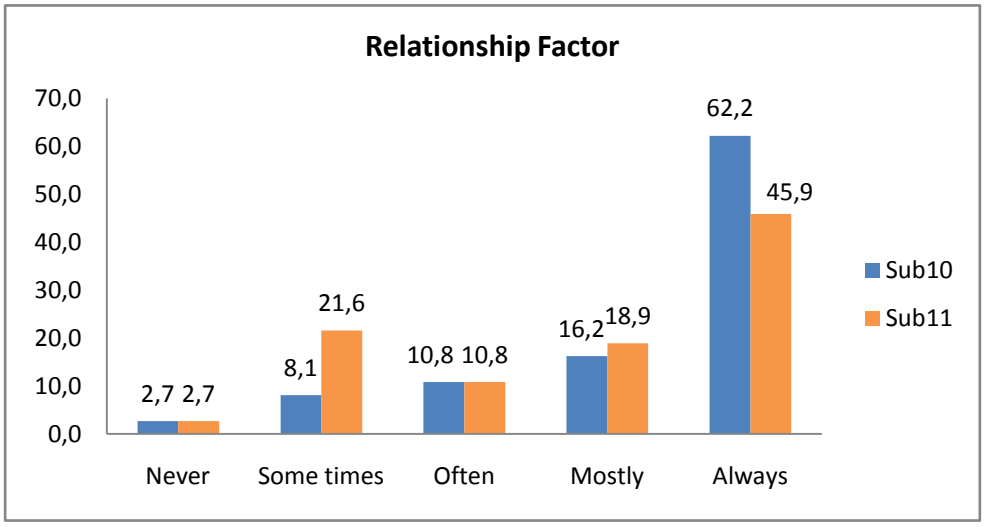

Figure 4.6: Frequency distribution for the relationship factor.

Table 4.13: Descriptive statistics of the relationship factor

Sub factor/factor	N	Min.	Max.	Mean	Std. Dev.
Sub10	37	1	5	4,27	1,12
Sub 11	37	1	5	3,84	1,30
Relationship	37	2	5	4,05	1,03

The fifth main factor relationship's sub factors were scored as in Table 4.12 and Figure 6. The frequency distribution shows that the safety engineers scored Sub10 ("*Sub contractors safety practices are controlled.*") in 'always' level and the Sub11 ("*The company supports occupational health and safety department.*") in 'mostly' level. It seems that they are not very happy about their companies support for occupational health and safety department. ($\overline{X}_{Sub11}=3.84$).

Alternatively, the nonparametric (Kruskal-Wallis test) test is applied to compare the safety factors according to the specialist.

Table 4.14: Safety factors analysis according to the specialist

	Special	n	Mean	Std. Deviation	Mean Rank	Chi-Square	Asymp. Sig.
Resources	Civil	13	4.5000	.73598	16.92	2.832	.418
	Environment	9	4.8333	.25000	21.00		
	OHS technician	8	4.5000	.70711	16.63		
	Other	7	4.8571	.37796	23.00		
	Total	37	4.6486	.58766			
Management	Civil	13	3.7077	.82710	16.77	2.707	.439
	Environment	9	3.7111	.73560	17.28		
	OHS technician	8	3.9000	.63246	19.69		
	Other	7	4.1714	.43861	24.57		
	Total	37	3.8378	.70054			
Personal	Civil	13	3.6346	.70427	17.62	6.030	.110
	Environment	9	3.8333	.55902	21.17		
	OHS technician	8	3.4063	.46170	12.88		
	Other	7	3.9643	.17252	25.79		
	Total	37	3.6959	.56561			
HRM (Insentive)	Civil	13	4.3462	.73978	19.12	1.117	.773
	Environment	9	4.3889	.63874	19.67		
	OHS technician	8	4.0625	.89393	15.88		
	Other	7	4.4643	.63621	21.50		
	Total	37	4.3176	.71843			
Relationship	Civil	13	3.9231	1.03775	17.38	7.090	.069
	Environment	9	4.0556	1.01379	18.56		
	OHS technician	8	3.5625	1.17830	14.31		
	Other	7	4.8571	.37796	27.93		
	Total	37	4.0541	1.03269			

In the above table, the comparisons of safety factors have been made according to area of specialist (civil engineering, environmental, OHS technician, and the other). Accordingly, all the factors have been calculated for p>0,05. For that reason, factors do not differ. This means that the answer for the question regarding work safety factors is simply that they do not change according to the specialist area.

Alternatively, the nonparametric (Kruskal-Wallis test) test is applied to compare the safety factors according to their experience: Moreover, for the factors with difference, the non-parametric Post-hoc double Mann-Whitney test is alternatively applied.

Table 4.15: Safety factor analysis according to the experience of safety engineer

	Working experience	**n**	**Mean**	**Std. Deviation**	**Mean Rank**	**Chi-Square**	**Asymp. Sig.**
Resources	<2 years	11	4.9545	.15076	24.64	9.484	.024*
	2-7 years	17	4.5588	.63449	16.76		
	7-15 years	4	4.0000	.81650	9.50		
	15> years	5	4.8000	.44721	21.80		
	Total	37	4.6486	.58766			
Management	<2 years	11	4.0000	.73212	22.27	5.472	.140
	2-7 years	17	3.6941	.73864	17.18		
	7-15 years	4	3.5000	.34641	10.50		
	15> years	5	4.2400	.57271	24.80		
	Total	37	3.8378	.70054			
Personal	<2 years	11	3.8182	.29772	21.64	6.323	.097
	2-7 years	17	3.5588	.65865	16.50		
	7-15 years	4	3.3750	.47871	12.00		
	15> years	5	4.1500	.51841	27.30		
	Total	37	3.6959	.56561			
HRM (Insentive)	<2 years	11	4.6136	.34212	22.27	6.912	.075
	2-7 years	17	4.0882	.84290	16.15		
	7-15 years	4	3.8750	.82916	12.00		
	15> years	5	4.8000	.20917	27.10		
	Total	37	4.3176	.71843			
Relationship	<2 years	11	4.3636	.80904	21.64	2.327	.507
	2-7 years	17	3.7941	1.18663	16.79		
	7-15 years	4	3.8750	1.03078	16.50		
	15> years	5	4.4000	.89443	22.70		
	Total	37	4.0541	1.03269			

p*<0,05

In the above table, the comparisons of safety factors have been made according to the experience of the specialist. Accordingly the resource factor p<0,05. That mean the respondent have a different answer to the resource factor to understand these different (mann-whitney test) is applied. The safety engineer which have <2 years experience give answer more high than the safety engineer with experience 7-15 years.

For the other factor all the factors have been calculated for p>0,05. For that reason, factors do not differ according to the experience.

4.4 Analysis of the Accidents on the Construction Site From the Conducted Questionnaire

It is reported that from 37 questioners 25 mentioned at least one accident happening during the operation time. The reported accidents reasons are given in Table 4.16 and Figure 7 (details of the accidents are added to the appendix section).

Table 4.16: Frequency distribution of the reasons of the accidents (N=37).

Variable	Accident	f	%
Unsafe behavior	Yes	21	56,8
	No	16	43,2
Unsafe situation	Yes	8	21,6
	No	29	78,4
Inevitable situation	Yes	4	10,8
	No	33	89,2

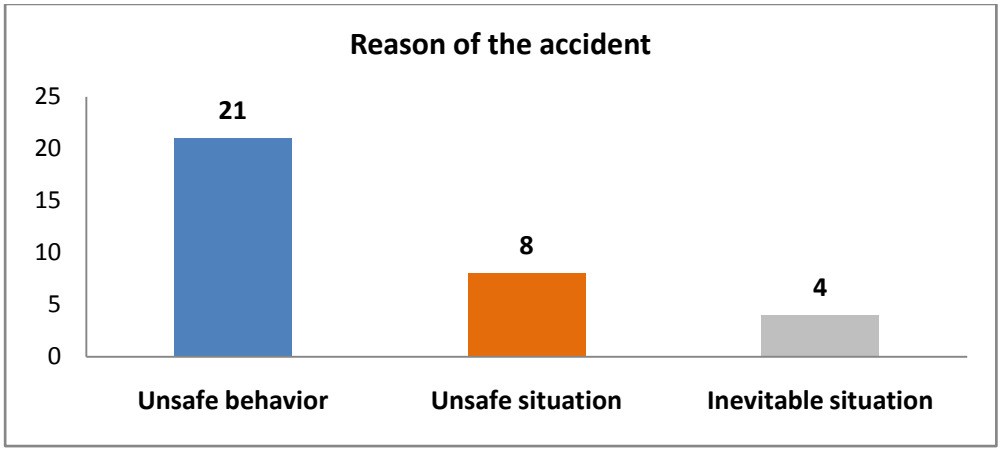

Figure 4.7: Causes of the accidents.

As can be seen from the table and the figure, most of the accidents occurred due to unsafe behaviors of the workers (21 cases). And the second most important reason of the accidents reported was unsafe situation. The last one was due to inevitable situation.

The questionnaire was given to 37 OHS experts on different construction sites. In the third part of the questioner, there was an open question to evaluate the frequency reasons of the accidents in their construction site which was ‘’until now what’s the biggest occupational accident in your construction site and what was the reason?’’. Surprisingly, the respond was about 25 from 37 OHS experts said that minimum one accident happened in their work site and the total number of accidents for third part of the questioner was 33 accidents.

The following table will show the accident that happened on the construction site from the conducted questioner result of accident, and the effective safety factor that must be taken in that case.

Table 4.17: Accident analysis.

#	Accident	Reason	Result	OHS factor that must be made in the case					The answer of the survey (*)				
				Resource	management	personal	HRM	Relationship	Resource	management	personal	HRM	Relationship
1	A worker of the company performing the external wall covering work has injured his hand tendons by a hammer. After making the first aid intervention in the infirmary of the workplace, he has been sent to the hospital.	Unsafe Behavior	The injury of the tendons of his hand.			14 4					5 `5		
2	Hand injury because of the misusage of the work tool given to him in an improper place.	Unsafe Behavior	Hand injury			14					5		
3	While a worker was working at a high place after he has finished his work, has fallen down and injured because he did not fasten the safety equipment (belt).	Unsafe Behavior	Injury			14 4					3 5		

#	**Accident**	**Reason**	**Result**	**OHS factor that must be made in the case**					**The answer of the survey (*)**				
4	A worker, during the cleaning of the floor of the workplace, has been injured when a rod iron has fallen down from the staircase and stroke him.	Unsafe Situation	Injury	**Resource**	**management**	**personal**	**HRM**	**Relationship**	**Resource**	**management**	**personal**	**HRM**	**Relationship**
					2	**14**				**4**	**5**		
5	Injuries that occur due to emergence of electric arc because of not performing energy control	Unsafe Situation	Injury	**7**					**5**				
6	A worker, who has the task of making the plaster repair, has preferred to perform the plaster work by climbing on a rambling folded parts and the parts have been overset and he has fallen down from an altitude of 80-90 cm and broke his foot.	Unsafe Behavior	Breaking of the ankle			**4** **14**					**5** **4**		
7	He has fallen down as he did not use his PPE (belt) during working at height.	Unsafe Behavior	Injury			**14** **4**					**5** **5**		

#	Accident	Reason	Result	OHS factor that must be made in the case					The answer of the survey (*)				
				Resource	management	personal	HRM	Relationship	Resource	management	personal	HRM	Relationship
8	A worker has fallen down when he stepped on unstable irons that the main reinforcement bars was not created by irons, and he crushed his chest and chin to the iron. His chest was a little bruised and his chin was slightly fractured.	Unsafe Situation	Injury		**2**					**4**			
9	1-Falling down because of not using the PPE(belt)	Unsafe Behavior	Injury			**4**					**5**		
	2- While other workers were carrying the planks, a worker was injured because of dropping a plank.	Unsafe Behavior	Injury			**14**					**5**		
	3- Injury because of working on the scaffold which has not been installed completely yet.	Unsafe Situation	Injury		**6**					**6**			

#	**Accident**	**Reason**	**Result**	**OHS factor that must be made in the case**					**The answer of the survey (*)**				
				Resource	**management**	**personal**	**HRM**	**Relationship**	**Resource**	**management**	**personal**	**HRM**	**Relationship**
10	During mold removing, some plywood's and planks were dropped on a worker and he gets injured	Unsafe Situation	Injury		**2**					**3**			
11	Falling down from the height: A worker has fallen from shaft space while he was working there because his blood pressure was drooped and he was not using PPE. His health condition is good and still working with us	Unsafe Behavior	Injury			**4** **14**					**5** **3**		
12	Falling down from the height: Occupational accident that leads to death. The worker did not use his safety belt even though he possess it, but has lost his balance and fell down.	Unsafe Behavior	1 death			**4** **14**					**4** **4**		

#	**Accident**	**Reason**	**Result**	**OHS factor that must be made in the case**					**The answer of the survey (*)**				
				Resource	**management**	**personal**	**HRM**	**Relationship**	**Resource**	**management**	**personal**	**HMR**	**Relationship**
13	Two occasions of falling down from the 2nd Floor at 7 m height. The security curtain has been displaced and could not be reinstalled and for that reason an occupational accident has occurred.	Unsafe Situation	Injury		**2** **6**					**5** **5**			
14	A small concrete particle has fallen on worker's head and he did not wear his helmet. He has been injured	Unsafe Behavior	Injury			**14** **4**					**3** **5**		
15	The plywood's of the floor are oiled before pouring concretes. As a result of this oiling one of our employers has fallen down from 2m height and muscle injury has been occurred in his right elbow. He has been given a 3-day rest.	Unsafe Situation	Injury		**2**	**14** **4**				**5**	**3** **5**		
16	Worker injuries resulted from not using PPE.	Unsafe Behavior	Injury			**4** **14**					**5** **3**		

#	Accident	Reason	Result	OHS factor that must be made in the case					The answer of the survey (*)				
				Resource	management	personal	HRM	Relationship	Resource	management	personal	HMR	Relationship
17	1- Falling down and slight injuries resulted by not using the PPE	Unsafe Behavior	Injury	4		14 4					5 5		
	2- While carrying materials drop some and cause to injure the workers in the team.	Unsafe Behavior	Injury			14					5		
	3- Falling down and breaking the right arm during working without taking the safety precautions while working on the edges of the operations storey.	Unsafe Situation	Break age of the right arm		2			11		5			5
18	Injuries by falling down of worker due to not using PPE safety belt during the pouring of concrete of high Colum(h>8,5 m)	Unsafe Behavior	Injury			4 14					5 5		

#	Accident	Reason	Result	OHS factor that must be made in the case					The answer of the survey (*)				
				Resource	management	personal	HRM	Relationship	Resource	management	personal	HMR	
19	1. Accident resulting from the misusage of the equipment. 2. Unsuitability of the hose connected to the equipment and the equipment in the working space.	Unsafe Behavior	Injury		**6**	**14**				**3**	**2**		
20	A slight injury on the foot that occurred when the worker has entered to the space of the structure because the door was left open.	Unsafe Situation	Injury		**6**			**11**		**3**			**4**
21	Concrete pumper who has been tasked too much has fall down and broke his arm when he entered the dismantling site for sleeping.	Unsafe Situation	Breakage of the arm			**15**		**11**			**5**		**5**
22	The overset of the truck resulting from the insufficient coordination between the crane operator and signaler and the truck driver has been injured.	Unsafe Behavior	Injury			**14**	**5**				**5**	**5**	

#	Accident	Reason	Result	OHS factor that must be made in the case					The answer of the survey (*)				
				Resource	management	personal	HRM	Relationship	Resource	management	personal	HMR	relationship
23	Arm breakage during jumping from the stairs. No guardrail on the stairs.	Unsafe Situation	Breakage of arm		**2**	**14**	**11**			**5**	**3**	**2**	
24	An accident has been occurred as the worker has fallen down from 2,5 meters height resulted by not using the PPE.	Unsafe Behavior	Tissue injury in arm and back			**14** **4**					**4** **4**		
25	Having no suitable stairs on the mobile platforms cause accidents.	Unsafe Situation	Injury		**2**			**11**		**4**			**3**

(*): The asnswer of survey as recived by the safety engineer, the tabele below show the grade for the answer

OPTION	SCORE RANGE
Never	**1.00**
Sometimes	**2.00**
Often	**3.00**
Mostly	**4.00**
Always	**5.00**

Table 4.18: Number and rate of major injuries to employees in construction sites from the conducted survey.

Accident	Number	Percentage
Falls	16	48%
Material fall	7	21%
Being hit by the equipment that he used	6	18%
Cave-ins (while or after excavation)	2	6%
Electrical Accidents	1	3%
Traffic accident on site	1	3%
total	33	100%

As it has been realized from the above analysis, the main reason of the occupational accidents in Turkey is unsafe behavior. The safety culture must be developed among the employees and give them a sufficient training about safety and motivate them to respect the safety rules to deal with their job safely.

From table 4.18 Human falls (falling from elevation) takes the first place from the total occupational accident, followed by material fall. The total of the accidents in the first group is 48%. Briefly, if the accidents in the first group are prevented on the construction sites, more than half of the accidents in total are prevented.

To prevent the fall accidents there are some suggestions extracted from the present study, which are as follows:

1-Fall Protection equipment: Protection against falls shall be implemented. Fall arresting systems like lifelines, body harnesses, and other equipments can be used when fall hazards cannot be addressed by employing railings, temporary floors and other means.

2-Focusing on proper working platforms/surfaces: Ladders, scaffolds, and working platforms and surfaces should be dry and stabilized.

3-Ergonomics of the worksite: Comfortable temperature, modest humidity are enough but not too much lighting/luminance level, low level of noise, are all expected to help with reducing falls or its impact.

4- ***Sufficient and timely safety training:*** along with close supervision and guidance, e.g. through safety consultants, safety checking, focusing on reducing the anxiety and rush to unsafe working speed.

5- Fitting the Job to the Worker: Be sure that the tasks assigned to the workers are suitable to workers' physical and personal abilities**.**

The safety engineer marked: ‘sometimes’ for “Some health and safety procedures/instructions/rules are hard to follow.” That means that if we can make the OHS manual clear and applicable it will help to implement it practically.

The safety experts marked: ‘sometimes’ for “The company supports occupational health and safety department.” The researcher observed that the construction company didn’t care much about health and safety management system and the employee assigned an OHS experts just to fulfill legal requirements. It can be suggested that all the constructors/higher authorities should be given lectures or training course to explain the benefit from implementing the safety rules on the construction sites and explain to them that this is a kind of investment to prevent the occupational accident/hazards and is better than adverse after effects in terms of capital/cost and productivity as is mentioned in literature review.

5. CONCLUSION

In this chapter a discussion on how this study can be utilized for increasing the occupational safety measures and the main research findings are given. Finally the chapter will be concluded by looking at the limitations of the study and recommending future researches.

5.1 Concluding Remarks

From this conducted survey we can conclude that the most important implemented factor in SMS in construction sites in turkey is the resources factor from OHS expert's point of view. The most common OHS expert answer was that they implemented most of the items of safety programs in the construction sites.

On the other hand from the third part of the survey occupational accident analysis we can notice the accident rate in the construction sites is high and about 48 % of occupational accident causes are falling from high .

Comparing the accident rate in this study, about 67.6 % from the respondent OHS experts says one accident or more was happened while working in construction sites with official occupational statistics; but the actual rate of the accident is more than the official statistics. As previous study by (Müngen and Gürcanli, 2005) suggests that the Social Insurance Institution General Directorate's official statistics only give the number of total injuries, fatalities or permanent disability cases by industries. Therefore, deriving the number of fatalities as well as non-fatal major injuries that occur on construction sites from the recording system of Turkey is very difficult.

From the surveys sized, visiting the construction sites and observations and the interview with OHS experts have found out that the workers awareness about the safety in the construction site is very low. They do not know how to take the necessary precautions during the work, how to use the personal protective equipment

during the work in a correct way, or apply the PPE when the technical staff present on sites and when the safety engineer asks them to wear the PPE during the work.

The safety culture must be developed among the employees that work on the construction sites. All personnel in the workplace must be motivated to carry out their job responsibilities safely, by the possibilities of achievement and recognition, opportunity for additional responsibilities, rewards, and personal growth, employee must be trained about safety practices.

Employers could also consider reducing manual work for future improvements in the safety and health of their employees. Also awareness on the right use of equipment or tools and wearing the PPE correctly could reduce risks among the workers.

The sample group .i.e., the experts were always positive and defending their company's OHS measures, but the results showed otherwise. There was OHS management system in every construction company but regularly following the rules was lacking.

5.2 Limitation Of The Study

There were some limitations to this study, with respect to the restricted time frame and getting permission to visit the construction sites. The number of case studies was limited to 37 OHS experts site in Istanbul, Majority of the specialists are between the 25 and 35 years old (64.9%), and the conducted research only included the OHS experts of each company. Workers were not included in the present study as most of them were reluctant to talk about the real situation.

5.3 Recommendation For The Future Research

For future researches, this study provides a compilation of the research that has been carried out on occupational health and safety management in construction industry. Further works, however might be of value to elaborate the questionnaire with more case studies conducted.

As suggested by the findings, the most accident was caused by personal factor, in the future researches we can concentrate how we can improve this factor to reduce the occupational accidents.

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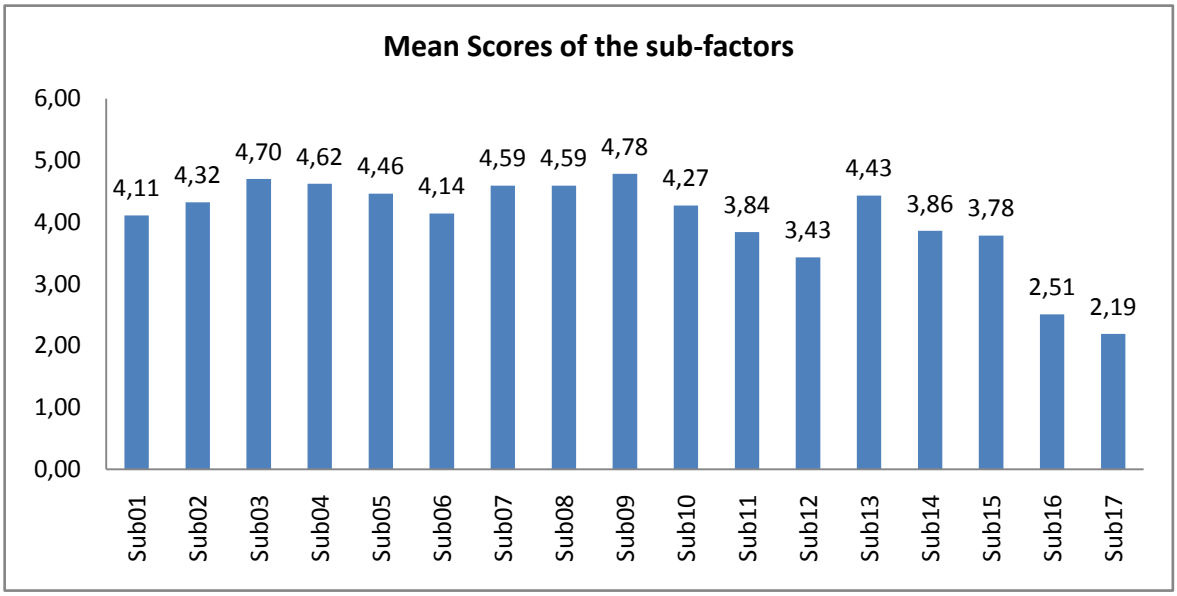
APPENDICES

APPENDIX A: Mean scores of the all sub-factors together.
APPENDIX B: Details of the Accidents Occurred in the Sites.
APPENDIX C: Questionnaire in English and Turkish.

Appendix A

Mean scores of the all sub-factors together

Sub factor	N	Min.	Max.	Mean	Std. Dev.
Sub01	37	2	5	4,11	1,08
Sub02	37	2	5	4,32	0,94
Sub03	37	2	5	4,70	0,70
Sub04	37	2	5	4,62	0,76
Sub05	37	1	5	4,46	1,02
Sub06	37	1	5	4,14	1,03
Sub07	37	3	5	4,59	0,69
Sub08	37	2	5	4,59	0,73
Sub09	37	3	5	4,78	0,58
Sub10	37	1	5	4,27	1,12
Sub11	37	1	5	3,84	1,30
Sub12	37	1	5	3,43	1,32
Sub13	37	1	5	4,43	1,02
Sub14	37	2	5	3,86	0,98
Sub15	37	2	5	3,78	1,03
Sub16	37	1	5	2,51	0,96
Sub17	37	1	5	2,19	1,22



Appendix B

Details of the Accidents Occurred in the Sites

1).(güvensiz davranış)Dış cephe kaplama işi yapan firmanın bir çalışanı, eline kekiç ile vurarak liflerini zedelemişti.İlk müdahale şantiye revirinde yapıldıktan sonar kazalı hastaneye sevk edilmiştir.

2-(güvensiz davranış)Kendisine verilen iş aletini doğru yerdedoğru şekilde kullanılmamasından kaynaklanan el yaralanması.

3-(güvensiz davranış)Yüksekte çalışma esnasında emniyet kemerini can halatına bağlamayan işçi işini bitirdiği esnada yüksekten düşerek yaralanmıştır.

4-(güvensiz davranış)bir işçi şantiye kat temizliği sırasında,merdiven açıklığından aşağı düşen bir tij demirinin ayak biileğine çarpması sonucu kazalanmıştır.İşçiye ilk müdahale şantiye sahasında ,sağlık personeli tarafından yapılmış,daha sonar ambulansla hastaneye sevk edilmiştir.

5-(güvensiz davranış)enerji kontrolünün yapılmamasından kaynaklanan elektrik arkının çıkması nedeniyle oluşan basit yaralanmalarla sonuçlanan iş kazaları.

6-(güvensiz davranış)Tamir sıvası yapacak olan bir işçinin,iskele kurmak ye80-90 cm yüksekten düşerek rine derme çatma istiflenmiş parçalar üzerine çıkarak sıva işini yapmayı tercih etmesi sonucu üzerine çıktığı parçalar devrilmiş,kendisi de yerden yaklaşık 80-90 cm yüksekten düşerek ayağını kırmıştır.

7-(güvensiz durum)temel donatı demirlerinin üzerinde yürüme yolu oluşturulmadığı için sabit olmayan demirlere kişinin basması sonucu,demirin hareket etmesiyle çalışan göğsünü ve çenesini demire vurmuştur.Göğsünde hafif ezilme ve çenesinde az hasarlı kırık oluşmuştur.

8-(güvensiz durum)kemer kullanmamak.Yüksekte çalışma yaparken kemer kullanmadığından dolayı düşmüştür.

9-(güvensiz davranış)emniyet kemerini kullanmaması sonucu düşme.

(güvensiz durum)kalas taşıma sırasında çalışan personelin kalası düşürmesi diğer personelin yaralanması.

(kaçınılmaz durum)iskele tam montaj yapılmadan.iskele üzerine çalışma sonucu yaralanma.

10—(güvensiz durum)kalıp sökümü sırasında plywoodların ve bazı kalasların işçi üzerine çökmesi ve yaralaması.

11-(güvensiz davranış)yüksekten düşme: Shaft boşluğundan düşen çalışan.işçi K.K.D(kişisel koruyucu donanım)kullanmadığından tansiyon düşmesi sonucu düştü.Sağlık durumu iyi ve hala bizimle çalışıyor.

- (güvensiz durum) shaftaki korkulukları yıkmışlardı.

12-(güvensiz davranış)Yüksekten düşme sonucu ölümlü iş kazası.personel,ekipmanı olmasına rağmen kullanmamış ve dengesini kaybederek düşmüştür.

13-(güvensiz davranış)2. Kat 7 m yükseklikten düşme iki kez vuku bulmuştur.Hafif yaralanma olmuştur.Güvenlik perdesi deplase edilmiş ve tekrar yerine monte edilmemiş ve bu yüzden iş kazası meydana gelmiştir.

14--(güvensiz davranış)baretini takmayan işçinin kafasına binanın üst katından ufak beton parçası düşmüştür.hafif yaralanmıştır.

15-(kaçınılmaz durum)Beton dökümü öncesinde döşeme kat playwoodları kalıp yağları ile yağlanmaktadır.bu yağlanma neticesinde ayağı kayan işçimizin yaklaşık 1 m yükseklikten düşmesi sonucu sağ dirsek kısmında kas zedelenmesi meydana geldi 3 günlük istirahat süresi verildi.

16-(güvensiz davranış)emniyet kemerini dikey yaşam halatına bağlamama ve kat içerisinde asma iskeleye binme gibi nedenlerden dolayı işçi yaralanmaları.

17-(güvensiz davranış) emniyet kemerinin kullanılmaması sonucu düşme ve hafif yaralanma

- (güvensiz durum)malzeme taşırken düşürmesi ve takım arkadaşlarını yaralaması
- (kaçınılmaz durum)operasyon katında kenardaki çalışmalarda güvenlik önlemini almadan çalışması sonucu düşme ve sağ kolunun kırılması.

18-(güvensiz davranış)Yüksek kolon(h>8,5 m) beton dökümü sırasında işçinin emniyet kemeri kullanmaması nedeniyle düşüp yaralanması.

19-(güvensiz davranış)Operatörün ekipmanı hatalı şekilde kullanmasından kaynaklanan kaza. 2 Bir ekipmana bağlı hortumun ve düzeninin yanlış olması.

20- (güvensiz durum Kapatılmayan yapı boşluğuna bir işçinin ayağının girmesi sonrası ayakta hafif zedelenme.

21-(güvensiz davranış) Fazla çalıştırılan beton pompacısının uyumak için söküm sahasına girmesi sonucu takılıp düşerek kolunu kırması.

22-(güvensiz davranış)Tırdan malzeme indirilirken vinç operatörü ve işaretçisinin koordinasyon eksikliğinden kaynaklanan tır devrilmesi ve sonucunda şoförün yaralanması.

23-(güvensiz davranış)Merdivenden atlarken kol kırılması. 2 Merdivende korkuluk olmaması.

24(güvensiz davranış)Emniyet kemeri takmayan bir işçinin 2,5 metreden düşmesi sonucu kol ve sırtta doku zedelenmesi.

25- (güvensiz durum Hareketli platformlarda uygun merdivenlerin bulunmaması kazalara neden olmaktadır.

APPENDIX C

Survey in the construction safety management system

This questionnaire was developed with respect to the master's thesis "**Analysis of occupational safety and health practices on construction sites in turkey: field study**", which is an on-going study at Graduate Program in Construction Management of Civil Department, Istanbul Technical University.

It is intended to provide a methodology to measure the effective factor in safety management system in construction site. By participating in this study, you will contribute to the validation and refinement of the questionnaire, and provide research data.

Initially, it is expected from you to fill out general information about you and your company. The main body of the questionnaire is composed of two parts, each with Sub-components.

Any information provided from participators on behalf of their companies will be confidential and used only for academic purposes. We would like to thank for your time and your contribution to our study.

Yosra TAMMAM
Thesis Supervisors: Assoc. Prof. Dr. Gürkan Emre GÜRCANLI

Date :

Istanbul Techniques University
Civil engineering faculty
Survey in the construction safety management system

Occupational Safety Management responsible Engineer particular

1-Gender

☐ Male ☐ Female

2- Age

☐ <25 ☐ 25-35 ☐ 35-45 ☐ 45>

3- Specialization

☐ Civil ☐ Architecture ☐Geology – geophysics ☐Environment ☐ Metal
☐ Mechanic ☐ Electric ☐ Technical teacher ☐OHS Technician ☐ Other

4- Experience years

☐ <2 ☐ 2-7 ☐ 7-15 ☐ 15>

5- Experience years as safety engineer

☐ <2 ☐ 2-7 ☐ 7-15 ☐15>

6- Daily hours for field work (monitoring)

☐ <1 ☐1-2 ☐ 2-4 ☐ 4>

7- Your certificate classification as a safety engineer

☐ A class ☐ B class ☐ C class ☐ Don't have

8. In the construction site how many hours did you spent in the office work ? (hours)

☐ <1 ☐ 1-2 ☐ 2-4 ☐ 4>

9- how did u achieve the occupational , safety training course certificate of the safty engineer?

☐ Myself ☐ company I worked there ☐ I didn't have certificate

10- Did you read New Occupational Health and Safety law (6331)? Responsibilities under this law, do you know it

☐ Yes, I read, I know my responsibility ☐No, I didn't read but I know my responsibility

☐ No, I didn't read, I don't know my responsibility

11- What is your position in the company you are working?

1- Construction area (m²) :

2- Contractor classification :

3- Number of worker at the construction site :

4- Type of construction (building ; infrastructure) :

5- Starting date of the project :

6- Ending date of the project :

7- Place :

Question no	THE QUESTION	always	mostly	often	Some times	Never
1	A contingency plan is prepared and regularly updated.					
2	Risk assessment (safety analysis) is carried out.					
3	Personal protective equipments are given to the workers.					
4	The worker use the given (PPE) and Workers' usage of the personal protective equipments (PPE) is controlled.					
5	Workers are trained about safety practices.					
6	Daily and weekly safety reports are written.					
7	Maintenance of the machines are periodically done.					
8	Every worker in the site has a health certificate.					
9	Every worker is covered by social insurance.					
10	Sub contractors safety practices are controlled.					
11	The company supports occupational health and safety department.					
12	Workers that do not follow the safety rules are fined appropriately.					
13	Safety meetings are regularly held.					
14	Employees follow the safety rules when doing their jobs.					
15	The tasks assigned to the workers are suitable to workers' physical and personal abilities.					
16	Some health and safety procedures/instructions/rules are hard to follow.					
17	The site is inspected by the authorities about the health and safety rules.					

Until now the biggest occupational accident in your construction site reason was

1- ☐ unsafe Behavior

*

2- ☐ unsafe Situation

*

3- ☐ an inevitable Situation

*

4- ☐ no accident happened

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Tarih :

İTÜ İnşaat Fakültesi Yapı İşletme Anabilim Dalı
İş Güvenliği Faktörleri Hakkında Bilgilendirme Anketi

İş Güvenliğinden Sorumlu Personele İlişkin Bilgiler

1-Cinsiyet

☐Erkek ☐ Kadın

2-Yaş

☐ <25 ☐ 25-35 ☐ 35-45 ☐ 45>

3-Uzmanlık alanı

☐ Inşaat ☐ Mimar ☐Jeoloji – Jeofizik ☐ Çevre ☐ Maden

☐ Makine ☐ Elektrik ☐ Teknik öğretmen ☐İSG Teknikeri ☐Diğer ……

4-İş deneyimi süresi (yıl)

☐ <2 ☐ 2-7 ☐ 7-15 ☐ 15>

5-İSG uzmanlık deneyim süresi(yıl)

☐ <2 ☐ 2-7 ☐ 7-15 ☐15>

6-Günlük saha denetim süresi (saat)

☐ <1 ☐1-2 ☐ 2-4 ☐ 4>

7- İSG uzmanlık derecesi

☐ A sınıfı ☐ B sınıfı ☐ C sınıfı ☐ Sertifikam yok

8. Şantiyede İSG ile ilgili masa başı mesaisi ne kadar ? (saat)

☐ <1 ☐ 1-2 ☐ 2-4 ☐ 4>

9- İSG sertifikasına hangi yolla sahip oldunuz?

☐ Kendim kursa gittim ☐ Şirket yolladı ☐ Sertifikam yok

10-Yeni İSG (6331) yasasını okudunuz mu?Bu yasaya göre sorumluluklarını biliyor musunuz?

☐ Evet okudum biliyorum ☐ Hayır okumadım ama sorumluluklarını biliyorum
☐ Hayır okumadım ,bilmiyorum

11- Çalıştığınız firmadaki göreviniz nedir ?

……

8- Çalışma alanı (m²) : _____

9- Yüklenici sınıfı : _____

10- Çalışma alanındaki işçi sayısı : _____

11- Çalışma tipi (bina ; altyapı:tünel) : _____

12- Proje başlama tarihi : _____

13- Proje teslim tarihi : _____

14- Bölge Müdürlüğü : _____

Soru no	Sorular	Her Zaman	Çoğunlukla	Sık Sık	Ara Sıra	Hiçbir Zaman
1	Acil eylem planı hazırlanıp, güncelleniyor mu ?					
2	Risk değerlendirmesi yapılıyor					
3	Kişisel koruyucu donanım işçilere veriliyor					
4	Çalışanlara kişisel koruyucu donanımların kullanımı denetleniyor					
5	Çalışanlara iş başı eğitimi veriliyor					
6	Haftalık ve günlük kontrol formları zamanında dolduruyor					
7	Makine ve vinçlerin periyodik kontrol muayeneleri zamanında yapılıyor					
8	İş başı yapan personellerinizin sağlık raporu yapılıyor					
9	İş başı yapan personellerinize,sosyal güvenlik kurumu sigortası yapılıyor					
10	Taşeron Firmaların iş güvenliği denetimi yapılıyor					
11	İş güvenliğine şirket yönetimi gerekli desteği veriyor					
12	İş güvenliği kurallarına uymayan personellerinize cezai işlem yapıyor					
13	İş güvenliği kurul toplantıları yapılıyor					
14	Çalışanlar, iş güvenlik kurallarına uyuyor					
15	Şantiyede işçilere verilen görevler, her birinin bünyesine uygun olarak dağıtılıyor					
16	Bazı sağlık ve güvenlik prosedürleri / talimatları / kuralları uygulamak zor oluyor					
17	Şantiyeniz Devlet tarafından denetlenmektedir					

İşyerinizde bugüne kadar meydana gelen en büyük iş kazasının nedeni nedir ve nasıl olmuştur ?

5- ☐ Güvensiz Davranış

*

6- ☐ Güvensiz Durum

*

7- ☐ Kaçınılmaz Durum

*

8- ☐ Kaza olmadı

CURRICULUM VITAE

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