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The Importance of Safety in Construction Sector: Costs of Occupational Accidents in Construction Sites

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Abstract: *Occupational accidents cause important social and economic problems by loss of life and physical injuries. Construction sector involves high risk due to its production processes and labor intensive characteristic and because of occupational accidents the sector brings up against financial loss in large scale. In developing countries, construction sector is one of the most important sectors that have a great contribution to economic development with its employment capacity and added-value to the economy. On the other hand, due to the lack of preventive measures, occupational accidents occur, frequently in construction in Turkey. Major occupational accidents are defined as the cause of serious injuries and a long-term disability; minor occupational accidents are defined as the cause of insignificant injuries and short-term disability. Minor occupational accidents are not considered sufficiently, they are even not kept as a record. It is known that minor occupational accidents, which are not considered sufficiently and even not registered, cause great financial loss in workplaces. The aim of this paper is to investigate the cost of workforce loss caused by the accidents in construction sites by using the statistics of three construction sites in Turkey and to compare the financial losses of minor and major occupational accidents. In this study, three construction project are investigated in Turkey in 2009 and it is obtained that the cost of workday loss caused by major occupational accidents is 19431.75 $ and minor occupational accidents cause a loss of 6924.25 $. The cost of workday loss caused by minor occupational accidents are almost 35 % of major workday losses'. These costs presents the importance of preventive measures for workers' health and safety in construction.*

Keywords: Construction, occupational accident, cost of occupational accident, accident analysis program.

JEL Classification: J81, J28, J10

1. Introduction

According to International Labor Organization (ILO), 337 million occupational accidents occur worldwide in every year and as a result of these accidents 2 million and 310 thousand people decease and 160 million people get injured. The financial loss caused by occupational accidents is estimated as 1.2 trillion $. There is an economic burden such as social security system and treatment costs on the back of society due to occupational accidents and diseases. Occupational accidents cause important financial loss in workplaces. However, occupational statistics are not recorded sufficiently in the developing countries and thus, the real cost of occupational accidents cannot be calculated. The heavy costs that the companies must face, prove the importance of occupational safety measurements (Andreoni, 1986; Larsson and Betts, 1996; ILO, 2004; Rikhardsson and Impgaard, 2004; Hamalainen, Takkala and Saarela, 2006).

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Costs caused by occupational accidents are well investigated in many different studies and they are subdivided into two categories as 'direct costs' and 'indirect costs'. Direct costs include first aid expenses, disability allowances, compensations, court expenses, the costs of penal provisions of the accidents involving death. Indirect costs include workday loss, working time loss in workplace, time loss for investigating the accident and legal processes, pausing the production after the accident, delay in workflow and program, damage in working machines or stopping to use these machines, low efficiency of workers, loss of reputation for the company, fine payments for late delivery. Thus, it is indicated that indirect costs are much higher than the direct costs in total (Rikhardsson, 2004; Waehrer,Leigh, Cassady and Miller, 2004; Lebeau and Duguay, 2013; Schulze, 2014; The American Society of Safety Engineers, 2014).

Although there are different classifications in the literature, the accidents that cause disability more than 3 days are generally defined as major occupational accident; accidents that cause minor injuries and disability less than 3 days are generally defined as minor occupational accidents. Major occupational accidents are generally put into legal transaction process and thus, the costs of the accidents can be calculated easily. On the other hand, minor occupational accidents cause difficult-to-calculate and indirect (hidden) costs. Minor occupational accidents aren't taken into account seriously enough in many companies since they cause minor costs and don't affect the workers' life severely. However, 29 out of 300 accidents result in major injuries and 1 out of 300 accidents results in death. Thus, it is clear that the costs of minor accidents must be considered as carefully as major accidents'(Heinrich, 1931; ILO, 1986; ILO, 1992; Glass, 1998).

Although many of the major occupational accidents consist of direct (apparent) costs, minor occupational accidents generally consist of indirect (hidden) costs. When the accident statistics records aren't kept in detail, it is impossible to determine the costs of minor accidents. The major part of the costs caused by minor occupational accidents is constituted by the workday loss. Workday losses can reach great amounts especially in big construction building sites, which have a great number of workers (Brody, Létourneau and Poirier, 1990; Fulwiler, 2002; Eurostat, 2004; Waehrer et al., 2004; Abiuso,2007; Aaltonen, 2012).

According to ILO, a great number of occupational accidents occur in construction sector, which takes an important place for employment in all over the world. In every year, 60,000 workers die in construction sector. Construction sector is a high risky sector as a result of its production processes and labor intensive characteristics. Great financial losses occur due to these accidents. Because the costs that caused by occupational accidents in construction sector aren't calculated, preventive measures cannot be taken at a sufficient level (ILO, 1992; Takala, 1999; Rubio et al., 2008).

When the statistics of Social Security Institution are analyzed, it can be seen that the numbers, which are related with occupational accidents in Turkish construction site, are alarming (see also Table 1). 6,000-9,000 occupational accidents occur in the sector annually and as a result of these accidents, approximately 400 workers die and another 400 workers become permanently disabled. % 34 of the deaths, which caused as a result of occupational accidents, occurs in construction sector. It is observed that occupational accidents and deaths have been increasing during recent years. While the total workday loss, which caused as a result of occupational accidents and diseases, reaches to 1,650,250 work-days, it is not known how much of these losses are related with construction sector. Financial losses caused by occupational accidents are underrated and they aren't calculated for both the sector and

enterprises. Accidents, which occur in construction sites, are heavy burdens for both enterprises and the state.

The aim of this paper is to investigate the cost of workforce loss caused by the accidents in construction building sites by using the statistics of three building sites in Turkey and to compare the financial losses of minor and major occupational accidents. Thus, the share of the occupational accidents within the operational costs and the importance of preventive measures will be emphasized. It will also be presented that the investments for occupational health and safety are not financial burdens; on the contrary, these investments can reduce the costs and increase the efficiency.

2. Material and Methods

Survey data is obtained from occupational accident statistics of year 2009 in three different construction projects in Turkey, by using “retrospective cohort” method. Accidents with serious and minor injuries and accidents resulted with the need of short-term rest in infirmary are considered. The total loss of time is recorded and by calculating this time with the hourly wage, the total cost of workday loss is calculated during one year period in building sites.

Retrospective Cohort Method is widely used in medical research and monitoring. In this type studies, cohort is created in a previous time. Exposure and diseases are observed based on records collected during this time. Retrospective cohort studies are based on records collected. Thus, the records must be accurate and reliable. Retrospective cohort method is widely used in the investigation of workplace accidents (Liddell, McDonald, Thomas and Cunliffe, 1977; Wild, Pierpoint, McKeigue and Jacobs, 2000; Krstev, Stewart, Rusiecki and Blair, 2007; Ascioglu, 2012; Tudor, Van der Walt, Margot, Dorman, Pan, Yenokyan and Farley, 2014).

Data collection was carried out with the permission of the construction enterprise. Survey data is recorded by occupational health and safety expert. A Visual Basic based software (Construction Accident Analysis Program) has been developed for analyzing detailed occupational accidents easy and fast. This software offers securing large amount of data about occupational accidents in the chosen sites. Additionally, the most important advantages of the software are ability of obtaining charts about accidents, making analysis based on the types of accidents, divisions where accidents happen etc.

The projects were run in three different cities and different wages were paid for different job titles. In order to standardize the cost calculation, the average wage paid to workers is calculated. The average wages are calculated as 52.25 $, 55.5 $ and 54.25 $ for projects A, B and C, respectively. The average wage for three projects is calculated as 54 $.

Labor wages and the costs of workday loss are classified into major and minor accidents and the ratio of these costs to the total cost of workday loss is calculated. Accidents resulted in disability more than 3 days are defined as ‘major accidents’; accidents resulted in disability less than 3 days are defined as ‘minor accidents’. In the survey, the causes and types of the accidents are recorded as well as various demographic characteristics of the workers.

The total workdays are 288, 295 and 292; monthly average number of workers are 286, 414 and 253; the total worked hours are 658,944, 977,040 and 591,008 for Project A, B and C, respectively for the year of 2009. The total workday is calculated as 278,374 (The total work-hours worked by all of the workers in 3 construction sites/one workday '8 hours'). The total workforce, which realized as a result of minor and major occupational accidents, is calculated by multiplying the total workforce loss caused by accidents and the average day wage ($ 54) (see also Table 3).

3. Theory/Literature Review

Construction sector is in the first place in terms of death rates in developing countries. In many studies, it is expressed that the construction sector is one of the most risky sectors and when comparing with the other sectors the workers of construction sector face with the risk of death 3 times and injury 2 times more (Waehrer et al., 2004; Brody et al., 1990; Mohamed, 2002; Levitt and Samelson, 1993; Rubio, et al., 2008; Rivara and Thompson, 2000; Saloniemi and Oksanen, 1998).

According to the statistics of Turkish Social Security Institution, construction sector is the first place among all sectors with 9,209 accidents and this number is the % 12.29 of all occupational accidents. % 34 of the deaths, which caused as a result of occupational accidents, occurs in construction sector (Social Security Administration, 2012).

Table 1. The Numbers of Occupational Accidents, Occupational Diseases, Death and Permanent Disability of Turkish Construction Sector (Turkish Statistical Institute Yearbooks)

Years	2005	2006	2007	2008	2009	2010	2011	2012
Occupational Accidents	6480	7143	7615	5574	6877	6437	7749	9209
Occupational Diseases	3	5	16	6	9	31	16	30
Permanent Disability	324	428	364	377	288	319	406	568
Death	290	397	359	297	156	475	570	256
Proportion in the Number of Total Death	26%	25%	34%	34%	13%	33%	33%	34%

In every workday, 22 occupational accidents occur, approximately 1.2 workers become permanently disable and 1 worker dies as a result of accidents in Turkey. Death rate in construction sector is 3-4 times higher than the other sectors. Variability in production methods and working types, using subcontractor companies intensively, wide and messy working fields, long and irregular daily working hours, worker circulation, great number of unskilled workers, using inadequate equipment, non-institutionalized and small firms are the main reasons of the occupational accidents in Turkish construction sector (Mungen, 2011; Tasdemir, 2010; Chamber of Civil Engineer, 2010; Ercan, 2010).

The most common accident types in Turkish construction sector are; falling, falling objects, splashing objects, landslide, collapsing building, electric shock, accidents in construction machines, organ trapping by machines and workbench, traffic accidents in construction site, respectively. The main reasons of these accidents are inadequate safety measures, which are accepted as burden by employers (Ercan, 2010; Tasdemir, 2010; Celik, 2011; Gürcanli, 2011; Mungen, 2011).

Workday losses caused by occupational accidents in Turkey are presented in Table 2. According to the statistics of Social Security Institution, the average workday loss of last 5 years is 1,678,681. Besides, social security costs caused by occupational accidents and diseases reach to $ 2 billion, annually. A great amount of money and source, which can be used to construct tens of hospitals and schools, is lost every year. In addition, these losses reduce the efficiency for both enterprises and country. A calculation method, which can be used for calculations of efficiency loss caused by occupational accidents, hasn't been developed yet. Due to the efficiency loss, which is an indirect cost, the losses caused by occupational accidents for country economy increase incrementally.

The workday losses and social security costs aren't presented separately for the sectors in the official statistics of Social Security Institution. Thus, because the certain workday loss is unknown in construction sector, it is impossible to make a comparative evaluation with other sectors. However, since it is known that 568 of 2209 permanent disability occur in construction sector in 2012, it can be estimated that at least % 26 of total security payments are originated from the occupational accidents and diseases occurred in the construction sector. This ratio means that $ 500 million financial loss occurs annually in construction sector due to the workday losses and treatment costs.

With the same method, this ratio is estimated as % 5.6, % 6.1 and % 3.3 for "Coal Mining", "Metal Products Manufacturing" and "Textile Products", respectively. The loss in construction sector is more than the sum of all of these sectors. Thus, reducing the occupational accidents to an acceptable level in construction sector has a great importance for country economy.

Table 2. The Number of Workday Loss as a Result of Occupational Accidents and Diseases in Turkey (Turkish Statistical Institute Yearbooks)

Years	Workday Loss[1, 2]
2008	1,865,115
2009	1,589,116
2010	1,516,024
2011	1,772,900
2012	1,650,250

[1]Temporary incapacity for work periods (day) (out-patient)
[2]Days of incapacity causing to in bed treatment in the hospital (in-bed

There are no comprehensive studies on the financial losses of occupational accidents for construction companies in Turkey. However, the studies focus on sectoral evaluations, generally. In a study that is published in 2008, it has been indicated that the occupational accident related added-value losses are 1.6 % of the total added-value in construction sector (Ofluoglu, 2011). In a study prepared in 1995, it is calculated that the death rate is 730 for 10 million working hours in whole sectors while the rate is 1430 in construction sector. For every 10 million $ gross national product contribution to the economy, one worker becomes 'disabled' (Arioglu, 2002).

It is well investigated in many different international studies that the insurance costs, workday losses and other costs, which are caused by occupational accidents, may reach to a great level and models are developed in order to calculate these costs. In two different

studies conducted in the USA in 1995, it is indicated that the calculation methods are not efficient in order to estimate the costs and the costs of one death or disability to the government and the employer are 780,000 $ and 27,000 $, respectively. Because the companies don't consider the hidden costs, they must face with a great amount extra costs except insurance and if they can calculate the real costs, it is obvious that the occupational safety performance can be increased (Everett, 1995; Everett and Thompson, 1995). In another study conducted in England in 2012, a method is developed by using cost-benefit analysis in order to calculate the costs in a realistic way. In the study, it is indicated that this ratio is much more in the smaller companies and defining the real costs before and after project is extremely important (Ikpe, Felix and David,2012).

Tang et al. developed a mathematical model for Hong Kong construction companies that can calculate the occupational safety costs by means of dividing the financial losses due to workday losses caused by occupational accidents to the total annual working hours. Tang et al. also developed a method for occupational safety cost optimization and calculated the correlative and percental ratio between occupational safety investment and occupational accidents costs. The same study indicates that each 1$ investment can prevent 2.27 $ cost (Tang et al., 2004).

Many different studies such as Leopold and Leonard (1987), Everett and Frank (1996), Tang, Lee, and Wong (1997),Santana, Araújo-Filho, Olivieraand Branco (2006), Mthalane, Othman and Pearl (2008), and Eugenio, Carvajal and Carmen(2010) models are also developed in order to calculate the money equivalent of the workday losses caused by occupational accidents. The studies also indicated that the accidents can cause considerable losses in terms of operation and social safety system and focused on the importance of preventive studies.

4. Results and Discussion

Among the 192 workers who had accidents, 11 % were women and 89 % were men. Since the construction sector is hard and dangerous, there are more men workers than women; thus, men face occupational accidents more. Besides, for women workers are generally appointed on subsidiary works such as office work, cleaning and cooking, they are exposed to lesser accident risk.

With reference to the accident distribution is obtained in terms of age, educational level and working hours; 25-39 and 18-24 age groups are exposed to occupational accidents with a ratio of 59 % and 25 %, respectively. 84 % of accidents have been occurred by the workers in 18-39 age group. In terms job experience, 0-5 months, 1-4 years, 5 months-1 year and 0-1 month experienced workers expose to accidents with ratios as 27 %, 24 %, 22 % and 21 %, respectively. 94 % of workers who expose to accidents work in the company less than 4 years. The accidents mostly occur among unskilled workers and primary school graduates with the percentage of 25.16 % and 73.65 %, respectively.

Undereducated, unskilled and young workers expose to accidents most in building sites. Although the majority of the workers are young, there is considerable difference in accident ratios according to the other age groups. For instance, workers who are in 40-66 age group forms 27 % of average (953) workers in building sites and the accident percentage among them is 12 % while the percentage is 23 % among the workers in 18-39 age.

26 % of accidents occur in the form of laceration. The most common accidents are foreign object in the eye, strain and temporal visual disability with percentages of 17 %, 15 % and 11 %, respectively. Because there are sheer number of sharp and drilling tools in building sites, there is a high ratio of accidents in the form of laceration. Foreign object in the eye and temporal visual disability cases are also occurred frequently due to the welding processes.

Eye, finger, foot and hand injuries are the most common results of the accidents. The majority of occupational accidents occur on Mondays, in summer months and between the hours 16.00-18.00. The most important reason of occupational accidents is 'unsafe behaivours' with a ratio of 62 %, which is defined as not to obey the rules although the necessary occupational safety measures are provided.

No severe injury or death occurred in the building site in the year of 2009. However, 14 serious accidents including five fractions, four lacerations, three burns, one sprain and one muscle rupture occurred that cause disability for ten or more days.

Table 3. Costs, Workday Losses and Occupational Accidents Occurred in the Building Sites in 2009 (Workday Loss x Average Daily Worker Wage)

	Minor Accidents			Major Accidents			Total Occupational Accidents	Total Workday Loss	Total Cost ($)
Building Sites	Number of Accidents	Lost Day	Cost ($)	Number of Accidents	Lost Day	Cost ($)			
Project A	44	33	1724.25	7	108	5643	51	141	7367.25
Project B	87	69	3829.5	17	181	10045.5	104	250	13875
Project C	32	26	1410.5	5	69	3743.25	37	95	5153.75
Total	**163**	**128**	**6964.5**	**29**	**358**	**19431.75**	**192**	**486**	**26369**

According to the study, the workday losses caused by the treatment in infirmaries or rest durations are 486 days and with a consideration of a workday includes 8 work hours, the total loss is calculated as 3888 hours (see also Table 3). The total cost of this loss is calculated as 26369 $ in 2009. The average workday loss per occupational accident is 2.53 days. Each accident resulted with a workday loss cause 136.62 $ cost.

Major occupational accidents cause 19431.75 $ loss while minor accidents cause 6964.25 $. Cost of minor accidents corresponds to 35 % of the cost caused by major accidents.

The most common work duration loss is 30 minutes (43.3 %) among the durations ranging between 30 minutes and 40 days during treatment and rest. 1-day-rest prevails among the others, most (26.56 %). 1-day-rests occurred 51 times at total and they cause 2754 $ cost, which corresponds the 10.5 % of total costs, to the employers. On the other hand, considering that the resting period exceeding 30 day in four workers cause 7020 $ cost, it can be seen that the expenses are directly proportionate to severity of accidents.

The total workforce cost is calculated as 15,032,196 $ by multiplying the daily wage of each worker (54 $) and the total workdays (278,374). The cost of workday loss is calculated as 26.369 $ which corresponds 0.17 % of total workforce cost. By considering the costs as a result of death and severe injuries, it can be seen how important the expenses caused by occupational accidents among all expenses.

On the other hand, average daily wage ($ 54), which is the gross wage that has no tax and insurance deduction, constitutes the basis for the calculation in enterprise. The calculations are made on the gross wages that constitute the basis for insurance deduction. It must be considered that the real wages can be a greater amount and thus, the costs caused by workday losses can be higher.

Workday losses are not the only reasons for the costs caused by occupational accidents. There are various expenses such as compensations, treatment costs, fines, court costs, loss of efficiency, training and insurance costs. It is well known that accidents resulting with death or permanent disability cause a great cost for employers in addition to various criminal sanctions. In a recent study, which published in 2001, it is presented that an accident resulting with death cause at least $ 72,000 cost to an employer in construction sector in Turkey (Tan, 2001).

However, it is not easy to follow the costs unless the enterprises stickle on this issue. Besides, the majority of these costs can be identified in a 3-years process. The total cost of an occupational accident can be determined only after the results of claim for compensation and recourse cases. In this study, the workforce losses, whose costs can be calculated easily, are emphasized in order to provide an idea on the final costs of occupational accidents.

The preventive occupational safety measures are taken in an adequate level in the construction site in which the investigation has been made. In spite of all the measures and controls, dangerous worker behaviours cannot be prevented. The workers are unaware on obeying the rules and lack of occupational safety culture. Workers have a low general and vocational education level. They generally are young, brave and excited. Fatalistic beliefs prevail among the workers in accordance with the national traditions of Turkish people. Therefore, the managers and engineers remain incapable to prevent the dangerous behaviours.

Hundreds of severe accidents occur in construction sites in Turkey due to lack of attention, dangerous behaviours, disregarding the occupational safety by employers, managers and workers, disapplying the rules of working at height, misusing of lifting and hand tools, which have a high potential for accidents, not maintaining and controlling the equipment, not employing sufficient amount of experts and technicians, lack of inspection, insufficient occupational safety education for workers. Approximately 400 workers die and another 400 workers become permanently disabled and approximately % 35 of deaths occur as a result of “falling from height”. However, due to the covering up the events, informality and excluding the some workers such as public servants, the statistics about occupational accidents in Turkey are far from the reality. Thus, the costs cannot be calculated in many enterprises.

5. Conclusions

According to the statistics published by Turkish Social Security Institution, construction sector takes the first place in terms of occupational accidents with the number of 9209 which corresponds the 12.29 % of total accidents. In every day, 22 occupational accidents occur, approximately 1.2 people become disabled and 1 worker dies in Turkey. Due to its dangerous production processes and labor intensive characteristics, construction sector takes place near the top in terms of accidents involving both death and personal injury. Occupational accidents cause significant financial losses especially in construction works which is a labor intensive and includes high risk of accidents. Majority of the Turkish construction sector companies don’t consider the occupational accident related workday losses in cost calculation.

Workday losses caused by accidents are seemed negligible among accident costs; however, they are important factors that can reach significant values for the companies and

government, in the long term. There are no comprehensive studies that focused on workday loss caused by occupational accidents. Preventing and decreasing these losses are also important in order to increase labor performance and productivity.

There is no certain information about the costs caused by occupational accidents in Turkish construction sector. On the other hand, considering that % 26 of annual disabilities occur in construction sector, it can be estimated social security spending and workday losses reach to a great amount. It is understood that the benefits of expenses for preventing occupational accidents have a great importance.

According to the study, the workday losses caused by the accidents are 486 days and the total loss is calculated as 3,888 hours (see also Table 1). The total cost of this loss is calculated as 26,369 $ in 2009. Each accident resulted with a workday loss cause 136.62 $ cost. The cost of workday loss is calculated as 26.369 $ which corresponds 0.17 % of total workforce cost. If these losses can be reduced to half, extra 227 workers, whose daily wage is 54 $, can be employed with a 15,000 $ earning. Likewise, an important machine or engine can be bought. Although any accident that resulted with permanent disability or death hasn't been occurred, the workday losses caused by minor and major accidents reached an important number.

Minor occupational accidents can cause financial loss as important as major accidents. According to research results, workforce losses caused by minor accidents reach 35 % of major accidents'. Register of the minor accidents precisely, calculating the costs, taking measures by investigating the causes of the accidents are importantly needed. Preventive expenses and studies can provide more benefits and contribute to labor peace and social welfare.

Although it seems that the accidents are caused by disusing of personal protective equipment, the real cause of accidents are organizational and executive mistakes. As it can be seen in many previous studies, subcontractor firms are frequently used in the sector. Because subcontractor firms don't have enough financial capability, adequate knowledge and experience in order to provide work safety measures, the number of occupational accidents increases. Their fast, longtime and unsecured working style also increases the accidents (Arioglu and Arioglu, 1997; Safak, 2007; Ercan, 2010; Mungen, 2011). As a matter of fact, 173 of 192 workers (% 90) who had accident were the subcontractor firms' worker in this study.

Disusing personal protective equipment (e.g. hand incisions as a result of disusing gloves, exposure to metal burrs as a result of disusing eyeglasses, nail stinging to foot as a result of disusing steel-soled work shoes, falling from height as a result of disusing safety belts and object falling to head as a result of disusing safety helmet etc.) is the primary reasons for accidents. However, personal protective equipment must be used in the conditions when a collective protection cannot be provided.

It seems that the general opinion about the highest risk group includes young and unskilled workers, especially molders who work at high and who don't have enough knowledge about the work and workplace (Mohamed, 2002; Sorock et al., 1993; Rivara and Thompson, 2000). However, it is known that the experienced workers expose to bigger and more dangerous accidents because of overconfidence and not to take any notice of work safety. These workers must be educated continuously.

Although 'dangerous behaviour of workers' is determined as the primary cause of occupational accidents, it is well known that 'managerial faults' have an important effect on dangerous behaviours. In brief, the necessary measures must be taken in order to investigate and minimize the causes of dangerous behaviours, such as ignorance, disregarding, lack of equipment. On the other hand, workers must inform the managers about deficiencies, obey the occupational safety rules and warn the managers for taking measures. All employees have to pay attention on using of PPE. Educational, instructional and informative occupational safety seminars, which cover all topics and risks, should be conducted. Necessary steps should be taken to avoid from mistakes after examining the occupational safety reports that are prepared by both company and whole sector. Trainings should be given continuously until the workers interiorize the usage of personal protective equipment as an obligation.

Alerts and warning signs must be prepared and placed in accordance with the work type and all workers must pay attention to these signs. Necessary controls should be applied permanently in all electricity areas. It is well understood that occupational safety related studies in construction sites should be carried out within the frame of a management system and detailed report of occupational accidents occurred in the sites should be kept. Risk assessment studies should be focused and revised in the light of examination of causes and results of accidents in detail.

Due to the great amount of financial losses caused by occupational accidents in sites and the economic and social effects of accidents on employers, state and workers, some measures, which can enhance working conditions, must be taken; the working hours shouldn't be protracted and a sufficient, preventive healthcare service must be provided for workers. Preventing the occupational accidents is strongly depend on enhancing the working conditions and the quality of preventive healthcare service and training the workers appropriately and periodically. Preventing accidents in building sites must be provided by improving physical conditions in the site, increasing the preventive health service quality and educating the workers periodically and expediently. Although employers are the main responsible on this issue, the government through inspections and the workers by the way of the responsibility to obey the rules are also in charge.

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