CHAPTER TOW

LITERATURE REVIEW

This chapter will discuss the nature of accidents, the global construction safety performance scenario, construction safety performance in developing countries, and methods used to improve safety performance in the constructions industry.

2.1 Introduction

The safety performance of the construction industry has been improving. Health and safety has been recognized as an important business performance subject (Myers, 2003; Wilson and Koehn, 2000). The factors causing construction site accidents have been addressed by several researchers. Toole (2002) listed the main causes of construction accidents. These are lack of proper training, deficient enforcement of safety, lack of safety equipment, unsafe methods or sequencing, unsafe site conditions, not using provided safety equipment, poor attitude toward safety, and isolated, sudden deviation from prescribed behavior. The state of the safety in the construction industry in Khartoum is poor. In the past five years, the numbers of people injured or even died in the construction projects has been increasing. This is due to the fact that in Khartoum, there has been a tremendous infrastructure building projects. After the lifting of the economic sanction from the West, Sudan has enjoyed a rapid economic growth supported mainly by its oil wealth. Thus the Sudan government initiated a major infrastructure building projects.

The authority, however, has not been able to keep up with the huge increase in number of construction projects. Many safety issues in the construction projects were overlooked by the authority due to ignorance. This is because the main concern for the authority there has been how to finish as many projects possible to make up for the lost time the country suffered as results of the economic sanctions. Other factor for the negligence of safety in the Sudan construction industry is the fact that most construction workers are foreign nationals from other countries, hence there is little pressure from the local population on the government to address this issue.

The state of the construction industry in a country is symptomatic of the state of its national economy. Put another way, the fate of any national economy cannot be separated from that of the construction industry. This is a consequence of the forward and backward linkages the construction sector forges with the rest of the economy (Drewer, 1980; Ahmad and Yan, 1996). The backward linkages refer, for instance, to the construction materials and services sectors of the economy. The forward linkages refer to the economic activities that result from the use of constructed buildings and facilities.

2.2 Importance of the Construction Sector

The construction sector plays an important role in the economies of countries throughout the world. The role of the construction industry in economic development has been validated by several studies (Strassman, 1975; Turin, 1969; Wells, 1986; Ofori,1988). In these studies, a strong statistical relationship has been

established between thestate of the construction industry and economic growth. Turin (1969) analyzed the data for 87 countries (developed and underdeveloped) between 1955 and 1965. He concluded that a positive correlation existed between the value added by construction and the Gross Domestic Product (GDP) of the country. Strassman (1975), who argued that the construction industry mirrored a pattern of structural change that reflected a country's level of economic development, echoes this conclusion. It has further been established that where economic growth has been significant, the growth of construction output has been even more dramatic (Wells, 1986). For example, in the UK, the construction industry was projected to have an economic output of some £58 billion ($87 billion) in 1998, which constitutes approximately 10% of theGDP (Construction Task Force, 1998). In China, while the GDP was growing rapidly since 1979, the share of the construction industry as a percentage of GDP increased as well (Ahmad and Yan, 1996).

Generally speaking, the assessment of the total value of construction output in any economy is difficult to determine and usually understated. Nowhere in the national accounts of any country is there a comprehensive picture of the total output of construction (Wells, 1986). Wells, who has worked in the area of development economics as it relates to the construction industry, cites as one of the reasons for this scenario the fact that the value added by construction to GDP is the difference between the value of sales at market prices, and the market value of all current purchases. It therefore excludes the value of purchased building materials

and components, fuel,transport, professional services, insurance and legal fees. Additionally, the value of capital formation in construction, which is a measure of the gross output of the construction sector, excludes the value of repairs and maintenance work. Further, a large percentage of construction activity, especially in developing countries, is carried out in the 'informal sector.'6 This contribution is not included in national statistics.

The construction industry is a major employer of labor. This claim is confirmed by the data from selected countries in Table 2-1. Of all industrial workers, the construction sector employed between 4.9% (33.4 million) in the People's Republic of China and 16.2% (5.7 million) in Mexico from 1994 through 1997. In the United States, the average was 6.2% (7.9 million) for the same period. In the United Kingdom, the average was 7.1% (1.8 million) for the same period. In Germany the average was 14.0% (2.9 million) for the same period. The data in Table 2-1 should not be surprising since many construction activities, tasks and operations are labor-intensive. The data in Table 2-1 confirm that construction employment in developing countries such as those in Africa follows a similar trend. As a percentage of total employment, employment in the construction sector ranged from 4.8% (313,600 workers) in South Africa in 1997 to 11.8% (41,000 workers) in Botswana in 1995.

While caution must be exercised in the use of employment statistics, particularly in developing countries, Turin (1969) found that regular construction employment contributed between 40 and 80 workers per1000 where the industry

plays a lesser role,and between 300 and 400 workers per1000 where construction plays a more significant role as an economic sector in the national employment statistics.

Similarly, in most developing countries, the construction sector contributed between 2% and 6% of total employment (Low and Christopher, 1992).

Table 2.1 construction Employment in developed countries:

Country[7]	1994	1995	1996	1997	Average
Egypt	15,241.4 1,019.4 (6.7%)	15,344.2 967.6 (6.3%)	N/A	N/A	15,292.8 993.5 (6.5%)
South Africa[8]	N/A	6,576.6 359.1 (5.5%)	9,113.8 555.1 (6.1%)	6,556.9 313.6 (4.8%)	7,118.8 409.3 (5.7%)
Argentina	10,529.0 900.9 (8.6%)	10,348.0 821.3 (7.9%)	10,542.0 852.3 (8.1%)	N/A	10,473.0 858.2 (8.2%)
Brazil	N/A	69,629.0 4,229.0 (6.1%)	67,920.0 4,337.0 (6.4%)	69,332.0 4,583.0 (6.6%)	68,960.3 4383.0 (6.4%)
Venezuela	7,265.9 602,9 (8.3%)	7,667.0 624,7 (8.1%)	7,819.2 600.1 (7.7%)	8,286.8 694.4 (8.4%)	7,759.7 630.5 (8.1%)
Mexico	N/A	33,881.1 5,168.4 (15.3%)	35,226.0 5,778.8 (16.4%)	37,359.8 6,264.9 (16.8%)	35,489.0 5,737.4 (16.2%)
Canada	13,291.7 743.8 (5.6%)	13,505.5 715.0 (5.3%)	13,676.2 705.4 (5.2%)	13,940.6 730.7 (5.2%)	13,603.5 723.7 (5.3%)
United States	123,060.0 7,493.0 (6.1%)	124,900.0 7,668.0 (6.1%)	126,708.0 7,943.0 (6.3%)	129,558.0 8,302.0 (6.4%)	126,056.5 7,851.5 (6.2%)
China	671,990.0 31,880.0 (4.7%)	679,470.0 33,220.0 (4.9%)	688,500.0 34,080.0 (4.9%)	696,000.0 34,479.0 (5.0%)	683,990.0 33,414.8 (4.9%)

Country	1994	1995	1996	1997	Average
Japan	64,530.0 6,550.0 (10.2%)	64,570.0 6,630.0 (10.3%)	64,860.0 6,700.0 (10.3%)	65,570.0 6,850.0 (10.4%)	64,882.5 6,682.5 (10.3%)
Hong Kong	2,872.8 220.5 (7.7%)	2,905.1 229.3 (7.9%)	3,007.7 269.6 (9.0%)	3,144.7 306.2 (9.7%)	2,982.6 256.4 (8.6%)
Israel	1,871.4 118.0 (6.3%)	1,965.0 140.6 (7.1%)	2,012.7 150.0 (7.5%)	2,040.2 146.2 (7.2%)	1,972.3 138.7 (7.0%)
Denmark	2,554.9 158.5 (6.2%)	2,609.8 163.2 (6.3%)	2,627.3 170.2 (6.5%)	2,682.0 176.1 (6.6%)	2,618.5 167.0 (6.4%)
Finland	2,080.0 109.0 (5.2%)	2,128.0 115.0 (5.4%)	2,158.0 118.0 (5.5%)	2,194.0 130.0 (5.9%)	2,140.0 118.0 (5.5%)
Germany	20,987.0 2,753.0 (13.1%)	20,939.0 2,973.0 (14.2%)	20,706.0 3,042.0 (14.7%)	20,549.0 2,873.0 (14.0%)	20,795.3 2,910.3 (14.0%)
Turkey	20,396.0 1,231.0 (6.0%)	21,378.0 1,228.0 (5.7%)	21,698.0 1,356.0 (6.2%)	20,815.0 1,323.0 (6.4%)	21,071.8 1,284.5 (6.1%)
United Kingdom	25,697.0 1,863.5 (7.3%)	25,972.7 1,835.5 (7.1%)	26,218.8 1,818.7 (6.9%)	26,681.6 1,864.8 (7.0%)	26,142.5 1,845.6 (7.1%)
Australia	7,885.5 568.8 (7.2%)	8,218.2 601.1 (7.3%)	8,324.2 596.2 (7.2%)	8,386.6 580.3 (6.9%)	8,203.6 586.6 (7.2%)
New Zealand	1,559.5 92.4 (5.9%)	1,632.6 99.7 (6.1%)	1,687.5 110.4 (6.5%)	1,735.9 115.1 (6.6%)	1,653.9 104.4 (6.3%)

The significant contribution of construction employment is confirmed by the data in Table 2-1where the range is between 4.9% and 16.2% of total employment.

In labor surplus economies where employment is scarce and seasonal, labor-intensive industries like construction remain invaluable sources of employment andincome. Thus, the construction employment contribution to the countries shown in the Tables 2.1 and is vital to the economies of these countries. Such contributions are likely to rise as the economy grows, industry develops, and per-capita income increases (Edmonds and Miles, 1984). Per capita income refers to

the average annual income per individual citizen Therefore, as economic growth accelerates, construction output will not only expand but will also be a clear linkage to the rest of the economy (Wells, 1986; Ahmad and Yan, 1996).

Table 2.2 construction Employment and total employments :

Country	Year	Total Employment (000s)	Construction Employment (000s)	Share Of Construction Sector (%)
Botswana	1995	345.4	41.0	11.8%
Egypt	1995	15,344.2	967.6	6.3%
Morocco	1992	3,494.3	281.9	8.1%
Mauritius	1995	436.3	41.9	9.6%
South Africa	1997	6,556.9	313.6	4.8%

2.3 Nature of the Construction Industry

The construction industry is characteristically one in which most of its products are unique for substance, form, size and purpose (Berger, 2000; Porteous, 1999). Each building or facility may, therefore, be described as being custom-made. Buildings cannot be isolated from the environment in which they are situated. From another perspective, Wells (1986) cites that the products of construction differ widely in terms of location, materials and production techniques, and the standards of the finished product regarding space, quality, durability, and aesthetic consideration. It is less well recognized that theyvary from each other, even when built to identical plans and specifications (Porteous,1999). For example, ground conditions may require different foundation depths or systems for two otherwise apparently identical buildings.

A further consideration is that the completed products are generally not mobile in that they are permanently fixed in specific locations. This consideration implies that even if components are prefabricated and/or pre-assembled elsewhere, the final assembly process remains site-specific. Where they are not unique, work operations that are similar and repetitive are executed in work environments that change from hour to hour due to changes in the environment such as weather conditions, location, physical conditions, and height (Porteous, 1999).

The physical working environment in construction varies with seasons and job site conditions. Site conditions conceivably vary between work done below natural ground level, at ground level, at elevated heights, and sometimes even over and under water. This changing working environment results in potentially hazardous situations.

Construction workers are required, therefore, to familiarize themselves constantly with these new situations. Unlike manufacturing, continuity of production is not always possible, since each product of construction is usually unique.

Construction sites are subject to local conditions (Berger, 2000). The availabilityof materials and plant equipment may vary, requiring substitution with materials and plant with which the labor force might be unfamiliar. Moreover, each building siterepresents in effect the creation of a production site where new workplaces are set up.

The term 'mobile factories' could be used to describe this phenomenon. At the end of each construction project the 'factory' is disassembled and relocated to the site

of a new or different project. However, the conditions at the new site might be completely different to the previous project site.

The construction industry has often been described as an industry characterized by fragmentation (Center to Protect Workers' Rights, 1993; Helledi, 1999). This description has arisen due to the number of stakeholders and participants in the construction process from project inception through project completion and beyond each with divergent roles, goals, expertise and skills. This fragmentation has resulted in the following:

- Increased construction costs;
- Low productivity;
- Poor communication between all participants;
- Increased, and often, unnecessary, confusing and contradictory documentation;
- Ineffective and inefficient project management;
- Unnecessary delays;
- Unsatisfactory quality performance;
- Rework;
- Poor safety performance; and
- Costly and lengthy disputes .

Additionally, the composition of construction project teams responsible for the design, project management and project execution, changes from project to project,resulting in a lack of continuity and consistency. Traditionally, design is separated from the actual construction process with resultant problems in

communication, coordination and interpretation. Significant professional, legal and institutional barriers have accompanied this separation, which has created continuity problems between the various members of the project team, constructors and subcontractors.

The divorce of design from production in the construction process is reinforced by the rigid compartmentalization of training in the various design and construction professions (Wells, 1986). A consequence of this compartmentalized approach has been the isolation of professionals from technical developments in the industry due to a corporate approach to construction activities that disallows innovation and technologicaldevelopment in the industry. The effect of this isolation results in little consideration being given to alternative construction materials and techniques. Even more fundamental, is the consequent and apparent lack of concern for worker safety. It is rarely central to the thinking of owners, designers, contractors and unions (Center to Protect Workers' Rights, 1993).

Under the traditional building procurement system,9there is little incentive to investigate alternative materials, methods and safety options as a result of professional fees being linked to the final cost of the project (Wells, 1986). The cost of the time spent in investigating alternatives not be recovered from the client under such procurement and contractual arrangements.

Further, this separation of design from production provides the ideal breedingground for disputes between the various participants in the construction process. Apart from the separation of design from production, contracting by its

very nature is adversarial. The objectives of the different contracting parties are different (Binnington, 1999). The objectives of the major contracting parties, namely, the client and constructor are divergent regarding the traditional project parameters of time, cost, and quality. For example, constructors are constantly under pressure from clients to submit highly competitive bids and reduce the cost of construction. Competitive tendering usually results in the selection of the contractor who is prepared to take the biggest risk or who has made the biggest mistake (Binnington, 1999). This tension contributes to the climateof disputes. Consequently, safety is one of the first areas to be sacrificed in the effort to reconcile the divergent objectives.

2.4 Safety Performance of the Construction Industry

In the industrialized nations of the world, accidents12, now cause more deaths than all infectious diseases and more than any single illness13 except those related to heart disease and cancer (Brittannica Online, 1998). The construction industrial sector is a dangerous or highly hazardous one (The Business Roundtable, 1983; Churcher and Alwani-Starr, 1996; Khalid, 1996;). It has earned itself this unfortunate and unenviable reputation due to the disproportionately high incidence of accidents and fatalities which continue to occur on construction sites around the globe. For instance, in New Zealand, construction workersare three times more likely to be killed and twice as likely to be seriously injured than thegeneral workforce . Internationally, construction workers are two to three times

more likely to die on the job than workers in other industries while the risk of serious injuryis almost 3 times higher (Site Safe, 2000).

The construction industry in the United Kingdom, for example, has for many years consistently had the highest incident rate for fatal accidents and serious injuries14 when compared with all other industrial sectors (Joyce, 1995). In New Zealand during 1998 more than 3,000 workers had injuries serious enough to prevent them from working for more than five days (Site Safe, 2000). The number of fatalities in construction represents only a fractional part of the problem, with thousands of major injuries, and even more minor ones, resulting in lost time.

In the United States of America, for example, the construction industry employs in the region of 6% of the entire industrial workforce (Table 2-1). However, the construction sector has generally accounted for nearly 20% of all industrial worker deaths.

In Europe, the situation is more serious with the construction industry employing on average between 5% of the industrial workforce in Finland and 14% in Germany (Table 2-1). Construction accounts for on average between 7.5% of all accidents andinjuries in the United Kingdom and 12.6% in Finland as evidenced in Table 2-3. The sector is responsible for 30% of all fatalities (Berger, 2000).

2.5 Construction Accidents

The importance of the use of plant and equipment in construction works seems to beincreasing on daily basis. Manual methods are fast giving way to mechanical methods in theeffort to increase productivity, meet increasing complex

specifications, construct or actualizethe growing complexity of modern designs, utilize the numerous new construction materialsthat are being introduced into the industry, meet the tight schedules and targets placed byclients' demands, implement control measures required to bring projects on track and ensureeffective and efficient utilization of the numerous resources involved in the construction ofprojects. New plant and equipment are being developed and produced regularly in response tothe needs of the industry. Seeley. Asserts that increasesmechanization of construction work can speed up construction and reduce the overall cost ofconstruction. In appreciation of the important role that plant and equipment play in achievingproject objectives, clients are placing greater emphasis on the use plant and equipment eventhat before by identifying possession of plant and equipment of prospective contractors as amajor criterion for the award of contracts. In response to this development, contractors oftenembark on efforts to own construction plant and equipment in order to be able to competefavorably with their counterparts during tendering. They do not stop there; hay also stipulatemechanized methods in their production methods statement during tendering. They are alsocompeted to implement the methods stipulated in their tenders when eventually contracts arewon and have to be executed.Mechanization goes with hazards as the use of plant and equipment is prone toaccidents and injuries. Research studies have confirmed that the construction industry is one ofthe most hazardous industries all over the world, in Godwin (2011). In mostcountries, the rates of accident and injury prevailing in the

industry are higher that whatprevail in other industries. For developed countries, loushine et al. (2003), in Godwin (2011).

Discovered that the United States construction industry currently accounts for over 22% of alloccupational fatalities in the entire United States even though it employs less than 7% of thecountry's workforce, HSE (2009), in Godwin (2011). reports that Britain's constructionindustry, which is one of the biggest industries as it provides employment for 2.2 millionpeople, is also one of the most dangerous recording over 2,800 deaths from injuries received atwork in the last 25 years. The situation in developing countries is worst because researchstudies discover that accident and injury rates in many of the developing countries such asNigeria (Idoro, 2004 and 2007), in Godwin (2011). Thailand (International Labourorganization, 2005), in Godwin (2011).And Tanzania are considerably higher than inEuropean countries. Mbuya and Lema (2003), in Godwin (2011). Opine that in mostdeveloping countries, safety consideration in construction projects delivery is not given apriority and the employment of safety measures during construction is considered a burden.Enhassi et al. (2008), in Godwin (2011). Also discover that in many developing countries, thelegislation governing OHS is significantly limited when compared with UK. They reportfurther that there are rarely any special provisions for construction on workers' safety and thegeneral conditions for workers are often not addressed. Lee and Halpin (2003), in Godwin(2011). Earlier discovered that in many of the countries where safety legislation exists, theregulatory authority is weak and non-existent and employers

'pay lip service 'to regulations.Koehn et al. (2003), in Godwin (2011). Further discover that in developing countries, injuriesare often not reported and the employer only provides some form of cash compensation for aninjury to the employee. This phenomenon has several implications on the constructionindustries of developing countries. Rowlinson (2003), in Godwin (2011). Observes that thecost of accidents accounts for 8.5% of the total tender price in the Chinese constructionindustry. The Nigerian construction industry shows almost all the features discovered aboutdeveloping countries. The industry has no legislation governing OHS, on regulatory authorityon OHS, accident and injuries are not reported and clients, consultants and contractors givelittle or no attention OHS. The resulting implication is high incidences of accidents andinjuries (Godwin 2011).

2.6 Global Construction Safety Performance Scenario:

In developed countries, recent advancement in technology, on one hand, hascontributed positively to industry productivity, but on the other hand, has created a morechallenging and unsafe work environment (Farooqui et al.,2007), in Farooqui (2008).

According to research findings, those who spend their working lives on construction sites have1 in 300 chance of being killed at work. The chance of being disabled by injury or seriousillness is much greater than in most other industrial fields. Every construction worker is likelyto be temporarily unfit for work at some time as a result of a minor injury or a health problemafter working

on a construction site (Ahmed et al., 2000, in Farooqui (2008).Stated that being struck by an object, falling atground level, and being hit by falling objects were the most common reason of accidentsleading to injuries in Egypt, and a study of Zeng et al. (2008) has pointed out that someaccidents such as falling from height and hit by falling materials were the most commonreason of accidents leading to injuries in Chinese.Rowlinson (2003), in Farooqui (2008).Reported that between 1989 and 1992, 256people were fatally injured in the Australian construction industry. Statistics revealed that thefatality rate was 10.4 per 100,000 workers, which was similar to the fatality rate for roadaccidents. In 2000, a study was conducted in China Huang et al. (2000), in Farooqui (2008).Revealed that 3,000 construction workers are killed in work related accidents each year. InHong Kong, 275 reportable accidents per 1,000 workers per year were recorded in 1994; thisfigure stood at around 150 in 2000 (Rowlinson, 2003), in Farooqui (2008). In comparison, 10construction workers in every 1,000 suffer an injury in a year in Japan, and the figure isaround 50 for the United Kingdom (Rowlinson, 2003), in Farooqui (2008). A study of theEgyptian construction industry concluded that safety programs applied by contractorsoperating in Egypt were less formal and the accident insurance costs were fixed irrespective ofthe contractors' safety performance (Farooqi et.al 2008).

Table 2.3 compares the fatality rates in global scenario of all industries to that ofindustry in 2002.The table clearly indicates the unsafe nature of the construction

Table 2.3 Fatality rates in selected countries in 2002 (Death/100,000 employees).

Country	All industry	Construction
Australia	2.0	5.0
Canada	6.1	20.9
Hong Kong	8.6	64.2
Sweden	1.4	5.0
United Kingdom	0.7	4.4

2.7 Construction Safety performances Scenario in developing countries:

Construction in developing countries, such as Pakistan and India, is more laborintensive that in the developed areas of the globe, involving 2.5-10 times as many workers peractivity (Koehn and Regmi 1991), in Farooqui (2008). Typically workers tend to be unskilledand migrate in a group, with or without their families, throughout the country in search ofemployment. In fact, they are usually divided into various factions. Communication problemsrelated to difference in language, relation and culture tend to inhibit safety on the work site.

In Pakistan, there is a significant difference between large and small contractors. Mostlarge firms do have a safety policy, on paper, but employees in general are not aware ofexistence. Nevertheless, a number of major constructions exhibit a concern for safety and haveestablished various safety procedures. They also provide training for workers and maintainsafety personnel on the jobsite. For the majority of contractors, however, maximizing profit isthe prime concern. Unsafe conditions exist on many sites, both large and small, and laborersare subjected to numerous hazards.

On many sites, no training programs for the staff and workers exist; therefore noorientation for new staff or workers is conducted, hazards are not pointed out, and no safetymeetings are held. Employees are required to learn from their own mistake or experience. Inaddition, lack of medical facilities, shanty housing, and substandard sanitation tend to exist onremote projects. Workers undertake a risk while at work and the following problem areas arecommon:

While excavating in deep trenches (with no proper shoring or bracing), accidents dueto cave-ins often occur.

Concreting is done mainly by laborer, and cements burns due to the unavailability ofprotective gloves and boots are common.Workers fall from heights due to weak scaffolding and the unavailability of safetybelts.

Workers sustain injuries on the head, fingers, eyes, feet, and face due to absence ofpersonal protection equipment.There is improper housekeeping.

Lack of understanding of the job and poor equipment maintenance are also major causes ofaccidents.

Injuries generally are unreported; however, if necessary, a laborer might receive firstaid or preliminary medical care. In most cases, specialized medical treatment or compensationis unavailable. Workers themselves consider accidents as due to their own negligence, andaccept that construction is a dangerous occupation. Nevertheless major accidents involving thedeath of a worker may be reported due to the financial expenses and litigation that could beinvolved.

Maintenance and inspection schedules often are not followed, and only after abreakdown is equipment repaired. This approach leads to loss of time, idle workers, andprojects delays. It may also cause damage to property. Breakdown of concrete mixers,vibrators, water pumps, and tractors are common. Electrocution is also a major hazard, due touse of substandard electrical equipment and underground cables. Workers, especially youngones, take chances, and often do not follow safety norms or use personal protective equipment.

Also laborers and staff are sometime are under the influence of alcohol and drugs. Unfortunately, crew members are not checked for drugs and alcohol before the start of andduring work.

One of the impeding factors that prevent Pakistan from developing a constructionsafety program is pervasive corruption, a by –product of the system of bureaucratic controls.As an example, for any accident that takes place on-site due to lack of safety practices, the particular low-level activity supervisor (engineer/technician), not the construction manager, istheoretically held responsible and may, in exceptional cases, be subject to physical abuse harmfrom the victim's group of friends. In extreme circumstance, the supervisor may also becharged with a criminal offence. However, cash payments are usually accepted in lieu ofpressing charges. In addition, because workers are usually non-residents of the local area andare often unaware of their rights, accidents are often not reported to the proper authorities or, ifreported, are lost in the local bureaucracy.

Owners and consultants do stress safety before work commences, but as the workprogresses their concerns for deadlines becomes a priority and they tend to pay less attentionto safety. On large projects, the owners may provide medical facilities at the site, butultimately safety is the contractors' responsibility.

According to the survey conducted by Farooqui et al. (2007), in Farooqui (2008). Themajor injuries faced by contracting firms in Pakistan on their projects site, in descending orderof occurrence, were given as follows:

- Fall injuries.
- Struck by wastage and raw materials.
- Heat stroke.
- Head injuries.
- Eye injuries.
- Burning cases.

In the same study, some informal assessments identified a few major reasons for safetynon-performance which included:

Lack of development of construction sector in the shape of mechanization andindustrialization.Lack of professional construction management practice, inadequate safety provisionslaid by the existing regulatory environment which has failed establish safety a s majorindustry objective ,insufficient and incentive –less insurance mechanisms which havefailed to establish safety as a business survival issue, and unfavorable businessenvironment which has led to adversarial business relationship among stakeholdersresulting in controversies, conflicts, claims and

litigation and hence diverting the focusfrom issues like safety (Farooqui et.al 2008).

2.8 Safety Management:

Management and planning is one way to avoid unplanned events. Since accidents areunplanned events, an effective safety management can help avoid job injuries. Safetymanagement must be through, and it must be applicable to all aspects of the job, from theestimating phase of the project until the last worker has left the premise at the completion ofthe project. All parties to a construction project must be included in some way in the safetyprogram every party is responsible.

In Australia, almost all respondents agreed with the statement "safety is theresponsibility of both management and the worker together" Williamson, et.al (1997), inHassouna (2005). Kartam, et.al (2000), in Hassouna (2005).Concluded in their study thatowners, as part of his safety responsibly, must ensure that the designs safe projects. He alsoensures that the contractor has a safety program. The owner should include the safety programas an element of the bidding technicalities.

Tam, et. Al, (2004), in Hassouna (2005).Identified that poor safety awareness offirm's top leaders and poor safety awareness of projects managers were the main factorsaffecting construction safety performance in China. Jannadi et.al,(1998) in Saudi Arabiastated that the responsibility for safety on any construction projects should be shared betweenall the parties involved in the projects, namely, the owners, the designer or architect and thecontractor.

Tam et al (2004), in Abdul Rehim (2008). Did a study in China and noticed that thecauses of accidents were due to poor safety awareness from top leaders; lack of training; poorsafety awareness of managers; reluctance to input resources for safety; reckless operation; lackof certified skill labor; poor equipment; lack of first aid measures; lack of rigorousenforcement of safety regulation; lack of organizational commitment; low education level ofworkers; poor safety conscientiousness of workers (Abdul Rehim et.al 2008).

2.9 Safety Program:

Sawacha et al. (1999), in Aksorn (2009). uncovered that a safety program that has themost effect on site safety consist of management talks on safety, provision that has the mosteffect on site safety consists of management talks on safety, provision of safety booklets,provision of safety equipment, providing a safe environment and appointing a trained safetyrepresentative on site (Aksorn et al.2009).

Hinze and Harrison (1981), in Hassanien (2007). Surveyed the nature of safetyprograms in the largest 100 construction firms in the USA, and concluded that larger firms hadmore formal safety programs. They also had the safest performance. Lower injury rates werein companies that provided workers with formal safety orientation; companies that gaveincentives to workers and foremen and companies that employed full time safetyrepresentatives. Safer performance was noted to occur when safety representatives were hiredand trained by safety directors (Hassanein et al. 2007).

The studies conducted by Tam et al. (1998), in Aksorn (2009). And Poon et al., (2000),in Aksorn (2009). To evaluate the influence of safety program on improved constructionsafety performance revealed that successful safety program, however, do not need extensiveelements, but should at least include the critical elements including safety policy, safetycommittees, safety inductions, safety training, and safety inspections (Aksorn et al. 2009).

2.10 Safety Policy

Evelyn, Florence and Adrian (2005), in Hassanein (2007). Presented the results of a postal survey of contractors in Singapore. The findings revealed that site accidents are morelikely to happen when there are inadequate company policies (Hassanein2007).The health and safety policy statement should contain the aims which are notmeasurable, and objectives which are measurable of the organization or company. Aims willprobably remain unchanged during policy revisions, whereas objectives will be reviewed andmodified or changed each year. The statement should be written in clear and simple languageso that it is easily understandable (Phi Hughes et.al 2001).The following points should be included or considered when a health and safety policystatement is being drafted:

• The aims should cover health and safety, welfare and relevant environmental issues.

• The position of the senior person in the organization or company who is responsible forhealth and safety (normally the chief executive).

• The names of the health and safety adviser and any safety representatives.

• A commitment to the basic requirements of the health and safety at work Act (accessegress, risk assessments, safe plant and systems of work, use handing, transport andhanding of articles and substances, information, training and supervision).

• Using a safety committee or plant council.

• Specific policies of the organization (violence to staff).

2.11 Safety Training:

A study by Hinze and Gambatese (2003), in Hassanein (2007).concluded thatspecialty contractors' safety performance was consistently influenced in part by a number offactors. The factors show to improve safety performance include: minimizing worker turnover;implementing employee drug testing and training of workers Hassanein (2007). Huang andFang (2003) believed that in the safety programs, for each projects of many contractors, it is arequirement that anyone working on site should receive at least eight hours of safety trainingor for refresher safety training.Langford et al. (2000) identified the critical factors that influence the attitudes ofconstruction workers towards safe behavior on construction sites. According to the results oftheir study, training of operative and safety supervisors is important to safety awareness andimproved performance .The importance of safety training to improve the safety performancein the construction industry has been addressed by many researchers Huang et al. (2003)Aksonrn et al. (2008). Effective training of construction workers can be one of the best waysin improving site safety performance. Chinese construction industry had

received limitededucation about safety issues Zeng et al. (2008). Similarly; in the study by Dingsdag et al.(2008) construction workers identified training as a necessary element of safety performance.In Gaza Strip Hassouna (2005) found that 24% of the respondents were receivingtraining courses and all of them achieved a good benefit from it, the main course which wasreceived included the first aid courses, causes of accidents, ways to prevent accidents, the safetechnique of scaffolding, and using safety tools. It was also found that part of respondentsreceived safety training abroad such as in Saudi Arabia and the United Arab Emirates (UAE)and other part received training courses in the Syndicate of engineering and in the contractorunion. For organized safety training courses for managers, engineer, and labors Ahmed (2005)found 10% (8) of the respondents, from a total of 83 respondents, have training on how to useequipment and how to perform the danger activity safety, but the other respondents 90% (75)did not have any training for their workers, engineers and labors.

2.12 Accident Investigations:

A subsequent study by Hinze and Raboud (1988), in Hassanein (2007). On largebuilding construction projects in Canada has shown that larger firms generally had bettersafety records (Hassanein, 2007). The investigation of an accident can provide meaningfulinformation that can be used effectively to reduce or even eliminate foreseeable hazards(Hinze and Wilson, 1996), in Hassouna (2005). Hinze and Wilson (1996), in Hassouna (2005).In their research found that in USA, the majority of respondents in their survey to record andinvestigate

construction injuries agreed that accident investigations were vital to improvedsafety performance. In Hong Kong, accident reporting and investigation program was found tobe most significant contributor to reducing site accident frequency rate (Poon, Ma and Ho,2003), in Hassouna (2005). Respondents in Hong Kong also believed that reporting andinvestigating injury provides useful information to prevent similar accident in recurring. Theinformation gathered from accident/incident investigation is also useful and effectivemechanism to formulate the corrective actions (Poon Ma and Ho, 2003), in Hassouna (2005).In Kuwait, Kartam, et al. (2000), in Hassouna (2005). Found that most of contractors inKuwait did not have a safety record.

2.13 Safety Regulations:

In the studies of Kartam, in Kuwait (2000), in Hassouna (2005).And Hassouna(2005),in Gaza Strip respectively. Found out that there was a consensus between the respondents oftheir surveys that safety regulation is significant to reduce accidents in the construction site.The study of Tam, et al (2004), in Hassouna(2005). In China found that there was a consensusbetween the respondents of their surveys that safety regulation is significant to reduceaccidents in the construction site.In the study of Hassouna (2005), it was found that 75% respondents, from a total of(83) respondents had accidents in their construction projects during the last five years; 10% (5)of the respondents had death cases, while 14% (7) of them had injuries that caused permanentinability and more than 40% (20) of them had temporary injuries as the majority of contractorshad a very

high number of light injuries. This study also found that 92% (46) of consultantsand 75% (15) of owners believed that safety is not confined only to those working in the field,but it extends to any party who could affect the safety performance in sites such asgovernment. The majority of respondents agreed that workers have bad safety culture whichcontributes to increase accidents rates in construction, and the majority of participants agreedthat consultants have the power and authority to force all employees in sites. On the role ofdesigners, 49% (41) of the respondents agreed and 40% (33) of them strongly agreed thatdesigners should be responsible for build ability and safe construction working and they haveregular site visits to ensure safe construction as specified and record mistakes and notes whichcould be avoided in the next designs. Also, the majority of consultants and owners agreed tostop the contractors in preceding the work when they made safety violation. The majority ofthe respondents believed that the current regulations are inadequate. 37% (31) of therespondents believed that the current regulations were practical and could not be applicable inconstruction industry. On the role of insurance companies and ministry of labor, Ahmed foundthat the insurance companies care more than the ministry of labor in following safety issues inthe construction sites. 30% (25) of the respondents agreed that the insurance companiesarrange safety site visits and 14% (12) of them only agreed that the ministry of labor arrangesuch visits. The majority of respondents agreed that the implementation of total qualitymanagement in the construction industry can reduce accidents. For the contract made byowners on safety

conditions, the study found that 53% (44) of respondents believed that fewowners institutions care more in safety conditions in its own contracts, such as UNDP andUNRWA, which include strong provisions and sometimes a penalties against contractors whomade safety violation. On the penalties against contractors, 25% (21) of the respondents foundthat stopping the work when an injury or safety violation happened, were considered as apenalty because stopping the execution causes loss in the overhead, productivity and maydelay the projects. On safety and using safety tools the study found that the majority of therespondents mentioned using hard hats with score (2.90) as the most important safetyprocedure, followed by having the first aid bag with score (2.85), emergency telephonenumber, and safety footwear are in the next degree (Hassouna ,2005).

2.14 Role of the Government towards safety:

Kartam et al. (2000), in Hassouna (2005).Found that all the respondents for theirsurvey agreed that Kuwait government should play an important role in safety management inthe construction industry. In Kuwait, every contractor is required to contact the safetydepartment of the Kuwait municipality when starting new projects and submit necessarydocuments such as building permit, area location. The safety department provides safetyinformation regarding the proposed job or activity, and a safety representative conducts a sitevisit to ensure safe places for storage, temporary site offices, and services. Safety posters withmajor instructions are given to the contractor to be hung at the job site, in addition to safetyinteraction procedures and accident prevention methods for each activity

related to theproposed job. The municipality charges a certain fee as insurance for safety and workcompletion. This amount is returned to the contractor at the completion date of the projectalong with a clearance certificate (Kartam, et al, 2000), in Hassouna (2005).The situation in Saudi Arabia seemed worse than in Kuwait because the practice ofsafety in Saudi Arabia is not regulated by any government agency Jannadi et.al (1998). Thepractice of safety in construction in the USA is regulated by governmental agencies such asthe occupational safety and health administration (OSHA), which provides strict rules andregulations to enforce safety and health standards on job sites.

2.15 Advantages of Applying Safety on construction sites.

Applying safety on the construction projects has many advantages, as summarized below:

- Reduce the accidents on the construction sites.
- Help end projects in the early time.
- Increase employee morals
- Increased productivity.
- Decreased the number of compensation.