

# Safety in high-rise building construction



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## **Chapter 1: Introduction**

### **1. 1 Background**

In previous decades since workers balanced themselves at dizzying heights above ground with little to prevent them from falling, high-rise construction has been layered in safety regulations and equipment. Construction can be referred as a relatively hazardous undertaking. There are significantly more injuries and lost workdays due to injuries or illnesses in construction as compared to any other industry. In contrast to most industrial accidents, innocent bystanders also get injured due to construction accidents. Several crane collapses from high rise buildings under construction have resulted in injuries to passersby.

Safety during a high-rise construction project is affected in large part by decisions made during the planning and design stage. Some designs or construction plans are inherently difficult and dangerous to put into practice, whereas other, similar plans may considerably reduce the possibility of dangerous accidents. Beyond these design decisions, safety also depends largely upon education, alertness and cooperation during the construction process. Workers should be always alert to the possibilities of accidents and avoid taken unnecessary risks.

### **1. 2 Related Problems**

The causes of injuries in high-rise construction are plentiful. The largest single category for both injuries and fatalities is individual falls. Handling of goods and transportation are also a major cause of injuries. An individual fall may be caused by a series of coincidences: inattentive worker or an insecure railing or slippery footing etc. Removing any one of these causes might serve

to stop any particular accident, but again each casualty may have multiple causes.

Many measures are available to improve jobsite safety in construction. These include design, choice of safety equipment, education and vigilance. By altering facility designs, particular structures can be safer or more hazardous to construct. Choice of different safety equipments plays an important role in overall safety of project. Educating workers and managers in proper procedures and hazards also has a direct impact on jobsite safety. During the construction process itself, the most important safety related measures are to insure proper vigilance and cooperation on the part of managers, inspectors and workers. Vigilance involves bearing in mind the risks of different working practices. In also involves maintaining temporary physical safeguards.

### **1.3 Aim**

To study and evaluate the Safety in High Rise Construction with special focus on safety at construction in Kuwait: issues, problems, procedures, and recommendations

### **1.4 Objectives**

- To study and understand the various risks involved, and the safety issues related to construction and analysis the previous work done in this field.
- To evaluate the existing safety procedures, policies, regulations and accident prevention methods with respect to construction industry in Kuwait.

- Development of questionnaire and conducting survey and interviews with the contractors and the consultants and safety engineers
- To identify the root of safety problems related to construction in Kuwait and recommend potential safety programs and solutions and estimating the likely effect on project progress and accident reduction
- Suggesting some recommendations for safety at construction based on the study at Kuwait

### **1. 5 Expected outcomes**

At the end of project, a reader will be able to understand the various risks involved in high rise construction and the various measures followed to reduce that risk. The practices followed and measures developed to make high-rise construction a safer job will be listed in report.

### **1. 6 Resources used**

The resources that will be used for this study will include various international papers and books regarding safety in high-rise construction. The papers and books will be generally taken from the university library and some of them will be taken from the internet, while the use of internet resources will be kept to a minimum.

### **1. 7 Gantt Chart**

Gantt Chart: Project on Safety in High Rise Construction

TASKS

Oct Nov Dec Jan Feb

Selection of the Topic

Submission of the Project Proposal

Literature survey on the Topic

Submission of the Interim Report

Main Research on the Topic

Conclusion and Recommendations

Final Report Submission

## **CHAPTER 2: LITERATURE REVIEW**

### **2. 1 Researches Done at International Level**

In most countries, the building and construction industry has a high rate of occupational accidents. In the EU15, the rate of construction injuries leading to over three days' absence from work exceeded 6, 000 per 100, 000 employees in 2005 (Arbetsmiljöverket, 2008). Although this is approximately three times the rate in the Swedish construction industry, Sweden's rate still places building and construction among the top 10 occupational sectors for occupational accidents in the country. Much effort has been made to reduce the rate of industrial accidents, mainly through technical solutions, rules, and regulation. In an interview study of the Australian construction industry, Holmes, Lingard, Yesilyurt, and De Munk (1999) found that risk was largely attributed to the nature of the work, poor individual work practices, ignorance, and work pressure due to budgetary and time constraints. To successfully approach these sources of risk there is a need to understand not only underlying structural and organizational conditions, but also psychological and social factors. Such a broadened and deepened

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perspective on safety should supplement rather than replace the engineering approach. The concepts of safety culture and safety climate are important contributions from the behavioral and social sciences to our understanding of occupational safety. Denison (1996) stated that the concepts of organizational culture and climate both suggest the existence of a shared, holistic, and collectively defined social context that emerges over time. The two concepts share many features, though organizational culture places greater emphasis on creating the social environment whereas organizational climate corresponds to how this social environment is experienced by the actors and thus is more external (Denison). Zohar (1980) defined organizational climate as “ a summary of molar perceptions that employees share about their work environments.” Neal and Griffin(2006) defined perceived safety climate. as “ individual perceptions of policies, procedures and practices relating to safety in the workplace” and suggested that group safety climate refers to perceptions shared within the group. According to organizational climate theory (Schneider, 1975), such shared perceptions will result in normative conclusions as to the correct way to behave in relation to safety in the organization. Climate serves to guide one’s own behavior and contributes to the predictability of the behavior of others (Guldenmund, 2000). Pidgeon (1991) suggested that organizational culture represents a shared meaning system (i. e., a system of symbols, ideas, rules, and cognitions, with certain observable behavioral consequences); furthermore, he defined safety culture as “ the set of beliefs, norms, attitudes, roles, and social and technical practices which are concerned with minimizing the exposure of employees, managers, customers, and members of the public to conditions considered dangerous or

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injurious.” Pidgeon stated that such construed meaning systems specify what is important and legitimate to the group, and that this culture is created and recreated as members of the group repeatedly behave in a way that seems natural and unquestionable to them, thus constructing a particular version of risk and safety. Pidgeon also suggested that it is misleading to consider only organizational or corporate culture, as the cultures of workgroups, departments, divisions, and organizations, as well as cultures at an even broader macro level (e. g., nations) are nested within one another as well as overlapping. Both safety climate and safety culture are socially construed phenomena and the importance of these concepts to occupational safety is generally accepted (e. g., Zohar 1980; Zohar, 2002; Donald & Canter, 1994; Pidgeon, 1998; Guldenmund, 2000; Lee & Harrison, 2000; Cooper & Phillips, 2004; Mearns, Whitaker, & Flin, 2003; Neal & Griffin, 2006; Clarke, 2006b; Pousette, Larsson, & Törner, 2008).

Gun (1993) investigated contractors’ safety performances at 98 different construction sites over 2 years. It was concluded that management training and good management practices are most likely to prevent injuries which are associated with the violation of regulations. Hinze and Raboud (1988) studied safety on large construction projects; the study discussed the relationships between company size, level safety policy, project level safety policy, project coordination, and economic pressure on worker safety. It was found that higher frequencies of construction accidents occurred on projects that were over budget and those that were competitively bid.

According to a Business Round Table report (Construction Industry Institute, 1988), the cost of an effective construction safety and health program in the

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USA is approximately 2.5% of direct labor costs. Successful safety programs have been developed by many construction companies and have shown remarkable results. Dupont's safety training and observation program achieved good results in reducing work-place accidents (Peyton and Rubio, 1991). Bechtel reported that 83% of their projects are meeting the zero goal after applying the 'Zero Accident Program'; this program reduced lost-time injuries in 1993 to less than half when compared with 1992 (Center to Protect Workers' Rights, 1993).

Hakkinen (1995), developed a training program called "one hour for safety management" to provide safety education and training for top management. The program was applied in 100 companies and showed success in attracting management's attention to safety issues. Ringdahl (1990) designed a simple model for cost benefit evaluation of improving safety measures at companies. Jaselskis et al. (1996) presented strategies for improving safety performance on both a company and a project level.

## **2. 2 Safety problems in Construction**

Construction sites tend to have several employers working on them simultaneously, making safety coordination in such a dynamic environment a very complex process. Temporary duration of work, together with the rapidly changing character of the site are in complete contrast to regular factory production and form a serious hazard to safety. These special features and problems arise from the following:

### **2. 2. 1. Competitive tendering**

Contractors often feel that their bids will be considered even if they do not make proper provisions for safety costs. In the case of hard-pressed local

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authorities, struggling with government-imposed spending cuts, and smaller firms on the brink of survival in a business recession, this problem is usually more acute and seldom comes to the surface. These problems affected Kuwait after the liberation, due to expenditure cuts and a large number of small construction firms. The extent of cost cuts by government and the low number of governmental projects have increased the competitive tendering between companies in the last 5 years. As a result, contractors have been forced to reduce their profits and costs to stay in the market and allow projects to sell to other companies or subcontractors to secure a profit margin. As shown earlier in the questionnaire distributed to construction firms, most contractors do not consider safety costs in their tenders unless it is recognized by the contract documents. Statistics show that lost-time accident frequency rates, which ranged from 2.5 to 6 per 100,000 man-hours worked on contracts where no provision for safety costs been made in tenders, could be reduced to a range of 0.2 to 1 per 100,000 man-hours worked on projects where proper safety planning and costing had been done and the costs accepted by the client (King and Hudson, 1985).

### **2.2.2. Lack of safety regulations**

The absence of a unified set of safety regulations adversely affects the enforcement of safety on the job site. The MPW has a safety chapter in its construction practices manual, KOC has its own manual, and no safety standard manual exists in KM. Projects constructed by American companies are ruled by OSHA and/or the US Army Corps of Engineers safety manual. International standards are not necessarily applicable to the Kuwaiti work environment since methods of practice in advanced and industrial countries

different from those used in Kuwait. Other national standards have not been updated to comply with the new technology and constructability methods; for example, the prohibition against using wooden scaffolding is not included in such standards.

### **2.2.3. Small size of most construction firms**

The open trade and commercial lease given to its citizens by the Kuwaiti government encourages many citizens to establish small businesses, which are especially concentrated in construction. Small construction firms with less than 10 employees account for about 60% of construction firms in Kuwait. This high proportion of small undertakings is a handicap to the spread and adoption of safe working practices. After the liberation, private housing businesses flourished, attracting many small firms and independent contractors with limited experience in building construction. These firms cannot afford the services of safety specialists or instructors, resulting in little opportunity for organized safety instructions either off- or on-site. Compared to large firms, the small firms are usually short of capital and under great pressure to cut costs at the expense of safety. Construction at this level is a competitive arena, where the saving of a few dinars means the difference between success and failure. In addition, most small firms use temporary labor and may not assure continuity of work, so investing money in training and equipment for them is considered an unnecessary cost. Also, it is more difficult for government safety inspectors to inspect the work and practices of a large number of small firms than a smaller number of medium-sized and large ones.

#### **2. 2. 4. Extensive use of subcontractors**

The specialization of activities on building sites has been a main factor leading to the extensive employment of subcontractors. Many companies in Kuwait look for safe and fast profit, selling their projects to subcontractors for a certain percentage of the profit. This causes many problems in coordination, safety planning, allocating safety responsibility, and communication. In practice the effective control of site-safety practices is difficult to enforce when a number of small subcontractors, especially those with fewer than five employees, are engaged on one site. The main responsibility is taken by the general contractor, who should insist that all necessary safety measures are written into the subcontractor's agreement. Unless proper provision is allowed for the subcontractors to consider safety in their bid, it is doubtful whether they will take safety seriously.

#### **2. 2. 5. Lack of relevant accident data**

If you cannot measure safety, then you certainly cannot manage it. The lack of official safety data and records of construction accidents at sites makes safety the last issue to be concerned by the contractor and owner. The people on-site and at management level are not aware of safety problems, since they are not informed by the statistics or figures of serious and fatal accidents that have occurred at sites, and the number of disabilities that resulted from such accidents.

#### **2. 2. 6. Extensive use of foreign labor**

Kuwait as a rich developing country attracts many investments and working labor. The employment of migrant labor has always been a special characteristic of construction sites in Kuwait. Different labor cultures and

traditions reflect on human relations, different work habits, and communication problems. Most construction workers in Kuwait are unskilled, untrained, and inexperienced, especially after the liberation. They come from poor communities of other countries and are ready to work in any job to establish a reasonable life for their families; many do not see their families for 2±3 years in order to save some money for the future. The workers are emotionally vulnerable and preoccupied with their problems since most of them are working in unsecured conditions and not on their sponsor's bail. All of these above conditions can affect the concentration and attention of the worker and may contribute to mistakes.

### **2. 3 Research methodology for Study in Kuwait**

Different research activities have been used to collect the necessary information and data related to this research. Among these are field visits, questionnaires, and interviews.

#### **2. 3. 1. Contractor's questionnaire**

To understand the problems associated with the implementation of safety programs in construction companies, questionnaires were mailed to technical managers, safety directors, and in some cases chief engineers. Key persons in companies were identified either by business contacts or by direct phone calls to the companies. Thirty-two questionnaires were mailed to various large, medium, and small-sized construction companies in Kuwait. The questionnaire covered a range of subjects related to safety, namely: (1) company's profile; (2) safety records; (3) accident statistics; (4) training; and (e) safety policy.

### **2. 3. 2. Consultant's questionnaire**

Another study was conducted to determine the extent to which designers recognize the need to address the safety of construction workers in project plans, contractors' selection criteria, contract clauses concerning safety, and procedures followed at job site supervision. Addresses of key consultants were identified from a bulletin distributed by the Kuwait Engineering Society.

### **2. 3. 3. Interviews**

A number of interviews were conducted with safety engineers, heads of safety departments in government ministries, and company superintendents. The interviews stressed the difficulties in implementing safety at job sites, government procedures and policies, safety standards, cause of most construction accidents, and methods of prevention. Interviews with contractor's superintendents covered safety programs, labor behavior and company's investment in safety. Visits were also made to two major insurance companies dealing with construction insurance in Kuwait. The questions covered insurance types, premiums, major accidents, companies commitment to safety procedures at the job site, labor compensation, accident records, accident investigation procedures, and insurance companies' role in safety in general.

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