Health and safety in construction

This chapter begins with a general discussion on the concept of safety before examining the modern concern with workplace health and safety, specifically in the construction industry. To better relate to the scope of this study, it will also review the current workplace safety and health situation in the Singapore’s construction industry. Subsequently, an overview of the safety legislations and policies undertaken in Singapore to improve construction safety will be investigated.

Introduction to Safety

Although the term “ safety” is very often used in our everyday life, the concept of “ safety” can have various meanings for different people. According to Oxford Dictionaries Online, safety is defined as “ the condition of being protected from or unlikely to cause danger, risk or injury”. Moreover, as safety is commonly viewed from the perspective of specific injury domains, some injury preventive researchers defined safety as the prevention of crime and violence whereas the others described it as a feeling of being out of danger or as a satisfaction of the basic human physiological needs.

Hence, due to the multitude of views on the definition of safety, the World Health Organisation (WHO) Collaborating Centres on Safety Promotion and Injury Prevention has developed an international consensus on the conceptual and operational aspects of safety in 1998 (Nilsen et al., 2004). They have defined safety as “ a state in which hazards and conditions leading to physical, psychological or material harm are controlled in order to preserve the health and well-being of individuals and the community”. This definition of safety contains two dimensions, of which one is objective and

can be assessed by measuring behavioural and environmental parameters whereas the other is subjective and can be evaluated according to the feeling of being safe (WHO, 1998).

In addition, safety is a resultant of a complex process which integrates humans' behaviour and interaction with their physical, social, cultural, technological, political, economic and organisational environment. According to Maurice et al. (2001), the optimum level of safety can only be attained with the presence of four conditions that proved beneficial in defining the domain of safety. Table 2. 1 indicates the four basic conditions for safety.

Table 2. 1 Four basic conditions that define the domain for safety

Four Conditions for Safety

1) A climate of social cohesion, peace and equity between groups that protects human rights and freedoms

2) The respect of the values of individual and their physical, material and psychological integrity

3) The prevention and control of injuries and other consequences or harm caused by accidents

4) The provision of effective measures to cope with undesirable traumatic events

Source: Maurice et al. (2001)

Workplace Safety and Health (WSH)

Before 1880s, there was little interest in work safety and minimal protection for the safety of workers in their workplaces because legislation, precedent and public opinion were all in favour of the management (Pearson, n. d.). Moreover, workplace accidents were perceived to be " cheap" and were often disregarded because there were no workers' compensation laws that protect the interest of workers. Thus, work-related accidents were common then.

However, in the late 1900s, workers' safety and health in the workplaces begun to receive increasing attention due to the rapid industrialisation of the United States (U. S.) and the establishment of unions that promote the need for safer working conditions. Hence, the high fatalities and injuries rate then compel the federal government to implement various acts to force the industries to reduce the occurrence of work-related accidents or illnesses so as to improve on the safety standards of their workplaces (Aldrich, 2001). Some initiatives of the federal government include passing of the Occupational Safety and Health Act (OSHA) in 1970 and the enactment of the workers' compensation laws.

Therefore, tighter employers' liability and the steep increase in the cost of accident due to the compensation laws have initiated the employers' interest and concern with work safety (Aldrich, 2001; Alton, n. d.). As a result, significant improvement in the workplace safety and health performance can be observed as fatalities rate in the U. S. declines from 27 deaths per 100, 000 workers in 1950 to 3. 5 in 2011 respectively (BLS, 2012; Kaufman, 1997). The safety performance in British industry had also improved

significantly since the introduction of the Health and Safety at Work Act (HSWA) in 1974 as the fatalities rate has decreased from 2. 9 per 100, 000 workers in 1974 to 0. 5 in 2011 (HSE, n. d.). Like OSHA, HSWA is the primary piece of legislation covering occupational health and safety in the United Kingdom (UK). Figure 2. 1 illustrates the work-related fatalities rate among different countries.

Safety in the Construction Industry

Safety has always been a major issue in the construction industry. In many developed and developing countries, the construction industry has constantly been ranked as one of the worst industries in terms of the frequency of fatalities and work-related injuries. Unlike the other industries where it mostly consists of a stationary fabrication setting with little changes in working procedures, equipment and labour force, the working environment in the construction industry is generally complex and ever-changing. This is due to the multidisciplinary and multitasked aspects of the parties involved in the project and also the use of sophisticated plants, equipment and construction methods (Teo, Ling, & Chong, 2005). Thus, this highly differentiated and unstructured nature of the construction industry makes safety management extremely challenging (Gambatese, Hinze, & Haas, 1997; Lingard, 2012; Zhang, Teizer, Lee, Eastman, & Venugopal, 2012). Many research and studies over the years have attempted to look into improving construction safety using various concepts such as designing for safety (Gangolells, Casals, Forcada, Roca, & Fuertes, 2010), HR practices (Lai, 2009; Lai, Liu, & Ling, 2011) and BIM technologies (Azhar, Nadeem,

Mok, & Leung, 2008; Kiviniemi, Sulankivi, Kähkönen, Mäkelä, & Merivirta, 2011; Qi, 2011; Zhang et al., 2012)

For instance, the Britain authorities have long recognised that safety should be addressed from the very start of a project and they are the first to introduce the Construction (Design and Management) Regulation in 1994 and revised in 2007 respectively. This regulation places duties on clients, designers and contractors for consideration of safety issues from design through the demolition stage of a project (Hecker & Gambatese, 2003). According to Gibb (2002), this regulation has lead to an increase in the profile of construction safety among designers in several European Union (EU) countries. Additionally, Australia has also introduced the Model WHS Regulation 2011 whereby have to provide a Safe Design Report that specify the hazards relating to the design of the structure to the person carrying out the construction work (Safe Design Australia, 2011).

Therefore, good safety planning and management throughout the project life cycle become an essential prerequisite for most construction projects because without a thorough understanding of safety issues on site, undesirable work-related accidents will occur. This will then incur additional costs, unnecessary project delays and in the worst situation, the loss of lives (Lai et al., 2011). Therefore, the next section will attempt to understand the different safety issues on sites by first identifying the various root causes of accidents.

Causes of Accidents

According to Teo (2009), accidents are unintentional and undesirable events that can cause pain, suffering, damage and injury to the affected person(s) or property, if not a combination of both. While not all work-related accidents will cause physical injuries or damages, the occurrence of any accidents on site will definitely challenge the quality of the construction site operation. Therefore, there is a need to understand the various causes influencing safety performance in the construction industry so as to better develop strategies to tackle this concerning issue.

A review of the literature on construction safety reveals that much research efforts have been directed to understand the factors and causes that can influence construction accidents (Abdelhamid & Everett, 2000; Hamid, Majid, & Singh, 2008; Hughes & Ferrett, 2008; Suraji, Duff, & Peckitt, 2001). Many types of theories have been developed throughout the decades to understand the accident causation factors. The earliest research can be traced back into the 1930s were Heinrich (1931) had pioneered the accident causation theories by developing the five-domino model of causation. The domino theory had been the foundation work of many other models that were developed by other researchers thereafter.

According to Ridley (1976), most of the accidents on site are either caused by unsafe acts, unsafe conditions or frequently a combination of both. An unsafe act refers to a violation of an accepted safety procedures which then permits the occurrence of an accident whereas an unsafe condition refers to a hazardous physical condition or circumstance that are in violation of contemporary safety standards. Table 2. 2 present the development of

different theories that were developed to understand the accident causation factors.

Table 2. 2 Development of different models to understand the accident causation factors

Types

Characteristic of Model

Model / Theory

Authors

Accident Causation Models

Understand the various accident causation factors

Develop tools for better accident prevention programme

Domino Theory

Henrich (1932)

Multiple Causation Model

Petersen (1971)

Stairstep Model

Adams (1976)

ARCTM: Construction Model

Abdelhamid & Everett (2000)

Behaviour Models

Studies the tendency of humans to make errors under various situation and environment conditions

Accidents are mainly a result of human unsafe characteristic only

Accident proneness theory

Accident (1983)

Goals freedom alertness theory

Kerr (1957)

Motivation reward satisfaction

Petersen (1975)

Sociological theory of accidents

Dwyer and Raftery (1991)

Human Factor Models

Holds human error the main cause of accidents

Unlike the behaviour model, the responsibility not only fall on human unsafe characteristic alone

The responsibility also fall on the design of workplace, which does not take into consideration the limitation of human

Ferrel theory

Ferrel (1977)

Human-error causation model

Petersen (1982)

McClay model

McClay (1989)

DeJoy model

DeJoy (1990)

Source: Abdelhamid and Everett (2000)

To tailor to the need of the construction industry in identifying the root cause of accidents, Abdelhamid and Everett (2000) had developed an Accident Root Causes Tracing Model (ARCTM) after further development and synthesis from various existing accident causation models. ARCTM proposed that unsafe conditions can occur before or after the start of an activity and they can either be caused by human-related or nonhuman-related factors. Table 2. 3 illustrates the different causes of unsafe conditions that might lead to accidents.

Similar to that proposed by Abdelhamid and Everett (2000) and Suraji et al. (2001), Toole (2002) has also tried to identify and attribute the basic root causes of construction accidents to factors such as lack of proper training, poor enforcement of safety, use of unsafe equipment, methods or sequencing, unsafe site conditions and a poor attitude towards safety. The aforementioned are just some of the many studies undertaken by researchers in an attempt to identify the root causes of work-related accidents so as to develop better preventive strategies (Hill, 2003). Even though there has been a significant improvement in the safety performance of the construction industry as compared to the past, more has to be done to further reduce the fatalities and work-related injuries frequency rate.

Table 2. 3 Main causes of unsafe conditions which can lead to accidents

Main Causes of Unsafe Conditions

Human Factors

Management action or inaction

Worker or co-workers unsafe acts

Fail to provide proper or adequate personal protective equipment

Violate workplace standards

Insufficient ventilation

Poor housekeeping

Poor design

Sabotaging equipment

Unauthorised operation of equipment

Insufficient rest while working

Removing safety device

Source: Abdelhamid and Everett (2000)

Construction Safety in Singapore

The construction industry in Singapore has been one of the fastest growing industries since Singapore embarked on her various industrialisation programme in the early 1960s. However, the safety situation in the industry then deteriorated so drastically that the government had to introduce the Factories Act in 1973 to regulate occupational safety and health in Singapore. Since then, Singapore's statutory OSH regime was governed by the Factories Act.

However, due to the high-profile and fatal accident that took place in Nicoll Highway in 2004, this had called attention to the need for a reform of the current legislative approach to OSH (Teh, 2006; Teo, 2009). This has therefore led to the unveiling of a new Workplace Safety and Health (WSH) framework in 2005 and the introduction of the WSH Act in 2006, which will repeal and replace the former Factories Act. The new WSH Act became the key legal instrument for the WSH framework and it aims to cultivate good safety and health practices among all individuals in their workplaces. Additionally, WSH 2015 Strategy was developed concurrently so as to complement with the new framework. This strategy aims to halve the

workplace fatality rate from 4. 9 fatalities per 100, 000 workers in 2004 to 2. 5 by 2015. As a result of the dynamic and changing WSH landscape, a full-fledged industry-led WSH Council was established in 2008 and a new national target was developed by identifying enhancements to the previous WSH 2015 Strategy. This new strategy, named WSH 2018 aims to achieve an even more challenging goal, which is to reduce the fatality rate to less than 1. 8 fatalities per 100, 000 employed workers by 2018 (WSH2018, 2009). With the introduction of WSH Council, WSH Council (Construction & Landscape) Committee was formed and ‘ Implementing WSH 2018 for Construction Industry’ was developed specifically to guide the efforts of the construction industry to achieve better WSH performance.

Following these efforts to increase the safety performance in the construction industry, it is noted that there is a remarkable improvement in the safety performance in 2011. According to the WSH Report 2011, construction industry was the only one that saw a drop in fatality numbers as the fatality rate decreased from 8. 1 per 100, 000 employed persons in 2010 to 5. 3 in 2011, as shown in the Figure 2. 2 (WSH, 2011). This is a significant improvement as the fatality rate of 5. 3 in 2011 is the lowest-ever since 2006. Furthermore, the number of work-related injuries has also fallen by 22% as compared to 2010 (channelnewsasia, 2012).

Despite the positive progression in the safety performance, it still remains as a serious concern as fatality rate continued to account for the highest among all industries in Singapore as shown in Table 2. 4. Thus, in order to achieve the targeted result set aside for the construction industry as seen in Figure 2. 3, all stakeholders will have “ to commit themselves to work towards a

safe and healthy workplace with a vibrant WSH culture and zero injury" (WSH2018Construction, 2010). In addition, more efforts have to be put to prevent falling from height because it remains as the major contributor to fatal accidents (see Figure 2. 4).

Till date, many studies have been conducted to look into improving construction safety in Singapore. For example, Ling, Ofori, and Teo (2004) have constructed a model to predict the safety level of a construction project site. Moreover, Ling and Teo (2006) have studied the intrinsic and external incentives on increasing worksite safety and found out that there are many personal factor that can affect site safety.

Safety Policies and Legislation

Ministry of Manpower (MOM) is the government regulatory body responsible for the enforcement of workplace safety and health legislations. Throughout the years, MOM, in collaboration with other government agencies and stakeholders have put in extensive efforts in achieving significant and sustained improvement in the WSH performance for the construction industry. In this section, various policies and legislations that have been introduced particularly to improve on the safety performance in the construction industry will be discussed.

Workplace Safety and Health (WSH) Act

In the past, Singapore's primary legislation in the construction safety regime was governed by Chapter 104 of the Factories Act and Section 68 and 77 of the Building Operations and Work of Engineering Construction (BOWEC) Regulations (Cheah, 2007). However, due to the spate of high-profile

accidents in 2004, MOM saw the need for a fundamental reform of the former safety policies and legislations in order to curb the rising numbers of work-related accidents on site. Hence, as part of the new WSH framework that was introduced in 2006, the Factories Act was repealed and replaced by the Workplace Safety and Health Act on 1 March 2006. As a result, the OSH regulation has evolved from a highly prescriptive (rule-based) system to a more descriptive (performance-based) approach.

Unlike the former Factories Act where industry players were expected to comply with a fixed set of safety guidelines, the new WSH Act is focused on three guiding principles – reduce risk at source, instil greater ownership of safety and health outcome by industry players, and impose higher penalties for poor safety management. This is a paradigm shift from the former Factories Act because it encourages every industry player to be more proactive rather than reactive to safety issues.

Workplace Injury Compensation Act (WICA)

The former Workmen's Compensation Act has been replaced by the Workplace Injury Compensation Act (WICA), which came into effect on the 1st April 2008. Unlike the former Act which only covers manual and non-manual workers earning $1, 600 or less per month, WICA is applicable for all employees regardless of their level of earnings. The enactment of WICA is essential because it safeguards the interest of all employees and employers as the former are now able to claim compensations for work-related injuries promptly without having to prove fault whereas the latter are protected against the fraudulent claims of errant employees (MOM & WSHC, 2008). At the same time, this new Act enhances the effectiveness and efficiency of the

compensation process and indirectly, influences the employers to pay more attention to workplace safety and health issues.

In order for WICA to stay updated with the current market situation, amendments have been to WICA and it will take effect from 1st June 2012. The key objectives of the recent changes are to maintain a fair balance between the pay-outs for the injured employees and the responsibilities that fall on the employers and also, to ensure that the WICA framework remains efficient so that injured employees can receive compensation promptly (MOM, 2012). Some of the major changes include increasing the compensation limits, prohibiting compensation due to work-related fights and work-related exclusion clauses and expanding the scope for compensable diseases. Table 2. 5 illustrates the recent amendments to the compensation limits.

Safety and Health Management System (SHMS)

Safety and Health Management System (SHMS) is a systematic process that is mandatory for all workplaces such as worksite, shipyard and factories in Singapore. It provides a platform for goal setting, performance measurement and clear management commitments and direction in order to manage human and organisational risks (MOM, n. d.-b). SHMS guides the efforts for an effective and proactive implementation of risk control measures to reduce work-related injuries, which will subsequently lead to a long-term reduction in operational costs (Baliyan, 2008). To build up an effective SHMS, it has to adhere to the relevant WSH legislation and guidelines set out for the construction industry, such as the SS 506 Part 1: 2009 Occupational safety and health (OSH) management system and CP 79: 1999 Safety management

system for construction worksites. In tandem with the SHMS, audits and reviews must also be carried out periodically on SHMS to ensure its continual performance (MOM, n. d.-a). Table 2. 6 shows the requirements for SHMS audit or review depending on the project's contract sum.

To make sure that SHMS is effective and relevant in addressing construction safety, Teo et al. (2005) have developed a model to measure the effectiveness of the SHMS of construction sites in Singapore.

Summary of Chapter

This chapter has looked into the concept of safety before focusing on workplace health and safety especially in the construction industry. It has also reviewed on the construction situation in Singapore and highlighted the various policies and legislations that are in place to improve the safety performance for the construction industry in Singapore.

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