



IMPROVING CONSTRUCTION SAFETY THROUGH SAFE WORKING CYCLE CONCEPT: A LITERATURE REVIEW

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Abstract: Safe Working Cycle (SWC), which is also known as Site Safe Cycle (SSC) or Safety Work Cycle is a concept which incorporates safety management into the construction management system to improve safety in construction. It enables an organisation to regulate its daily working process, provide a model for management to follow, and implement certain elements of the safety management system. Currently, SWC concept is effectively practiced in countries like Japan, China, Hong Kong, Singapore, United Kingdom etc. in their construction projects. As literature shows, after implementing the SWC, these countries have exhibited exceptional progress in construction safety and health, and the number of accidents have been decreased significantly. Though SWC is a novel concept to Sri Lanka, it is one of the best safety management tools which can be adopted to improve safety in construction industry in Sri Lanka. Therefore, this paper aims at reviewing the literature related to SWC concept which will assist the researcher to evaluate the applicability of SWC concept to the Sri Lankan construction industry, in the next phase of study.

Keywords: Safe Working Cycle (SWC) Concept; Construction accidents; Construction industry

1. Introduction

Generally the work environment of construction industry is considered as more hazardous comparing to other industries, mainly due to the potential nature for serious accidents and health hazards by heavy use of large equipment, dangerous tools, and hazardous materials. Evidently, the construction industry reported a higher percentage of accidents annually. Therefore, it is important to identify tools and procedures to mitigate the safety issues in the construction industry. In this context, Safe Work Cycle (SWC) has identified as a tool for safety management. Accordingly, this paper presents a summary of a comprehensive literature review carried out on SWC which can be used to mitigate the safety issues.

2. Construction Industry

The construction industry is a substantial contributor of economy in any country. As [1] stated construction industry is one of the major partners of the economic growth and development. Different type of definitions can be found related to construction industry within the literature. According to

[2], construction industry is “broad conglomeration of industries and sectors which add value in the creation and maintenance of fixed assets within the built environment”. Further [3] indicated that construction industry is “the sector of the economy which plans, designs, constructs, alters, maintains, repairs and eventually demolishes buildings of all kinds, civil engineering works, mechanical and electrical engineering structures and other similar works”. Similarly, the industry which is constructing, deconstructing, reconstructing, renovating, altering, demolishing, relocating, maintaining or repairing of any building or infrastructure facilities can be identified as construction [4]. According to [5] construction industry has the capability to convert the several types of resources in to social and economic infrastructures and facilities. Therefore, construction industry sustains a significant position among the major sectors in countries. The construction industry is an economic investment and its relationship with economic development is well posited [6].

3. Construction Safety

Workplace safety is a core consideration of all types of organisations which has accountability for optimising and protecting the human resource [7]. All humans' plans, projects and ideas involve with both risk and safety [8]. A construction site is a place accustomed to work accidents and it is the task of managers, workers and trade unions to balance the possible favourable outcome of given arrangement against their possible adverse consequences [9]. Furthermore, Occupational accidents in the construction industry cause economic and social problems in organisations, as well as in countries [10]. Therefore, ensuring the construction safety is not an easy task [7].

As [11] highlighted, approximately 350,000 people die around the world every year due to workplace accidents and around 60,000 of those deaths happened during the construction process [11]. As [7] revealed, the fatality rate of construction industry is appreciably high compared with other industries. Additionally, [12] highlighted that the ratio of fatal and non-fatal accidents in construction industry is 1:13 while, the ratio of fatal and non-fatal accidents in other industries is 1:115.

Lack of knowledge, training and supervision are contributing factors for workplace accidents [13]. [13] further added that the lack of a controlled working environment and the complexity and diversity of the sizes of organisations have an effect on safety performance in the industry. Additionally, [14] quoted that inadequate safety precautions, non-implementation of rules, limited funds, deficient knowledge and unqualified officers induce unexpected accidents in construction industry in Sri Lanka. Moreover, low educational level of workers who engaged with construction industry is another factor that leads to accidents in Sri Lankan construction industry [7].

4. Safe Working Cycle (SWC)

4.1 What is SWC?

SWC is a tool which draws all the important safety activities such as inspection, supervision, and safety committee meetings which are in fact the requirements come under public works contracts and the Factories and safety management regulation, together in a systematic manner [15]. SWC has originated in Japan which promoted by Japan Construction Safety and Health Association to construction companies in 1982 [16]. SWC provides a model to management to follow and implement certain elements of the safety management system [17].

SWC Handbook issued by the Occupational Safety and Health Council in Hong Kong, has emphasized basic concept of SWC which is to combine construction quality and construction safety. It stressed that through the implementation of a safety policy, safety initiatives and a safety management system, the company management can change the traditional enforcement on safety measures into a cooperative and coordinated method of dealing with safety issues [17].

This cycle clearly explains the responsibilities of each different worker/rank. The cycle encourages mutual trust between supervisors and workers at the construction sites and facilitates direct communication. In addition, the cycle enables workers to receive and accept relevant safety training and safety message, and ultimately generate a safety culture. The aim of SWC is to integrate quality and safety aspects of construction so that adequate considerations can be taken for each aspect to achieve a cost effective construction project. Moreover, [18] has revealed that there are several goals that expected to be achieved by implementing SWC.



- Collaboration of contractor's and sub contractor's safety activities. It aim to change "let's do it (safety activities) together" instead of "do it"
- Incorporate "safety" into "work"

It targets at carrying out the work safely, efficiently, quickly, and inexpensively. Namely, eliminate the idea which work and safety are different terms.

4.2 Operational mechanism of SWC

The SWC can be classified into daily, weekly and monthly SWC. The period is ascertained by the importance, and urgency of the construction activities. Daily cycle is comparatively, detailed and the coverage of the weekly and monthly cycle can be identified as more broadly.

4.2.1 Daily SWC

As it is shown in Figure 1, daily SWC basically includes eight items.

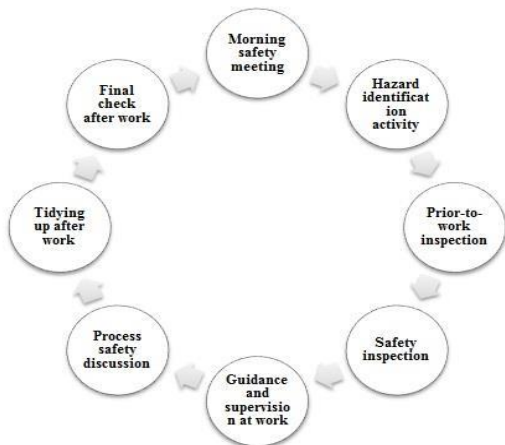


Figure 1: Daily SWC

These items are arranged according to the daily schedule of the project. This means that each person can carry out their responsibilities according to the schedule. Each organisation should set the working hours of each item according to its own conditions and the characteristics of the project [19].

4.2.1.1 Morning safety meeting

According to [20], morning safety meeting is identified as first step of the daily SWC. It includes:

- Announcing important matters such as project development, special safety information
- Morning exercises ex: stretching exercise
- Inspect the Personal Protective Equipment (PPE) and dressing

Table 1: Dominant aspects of morning safety meeting

| | |
|------------------|--|
| Participant s | All workers including workers of the subcontractors |
| Person in Charge | Project managers or Site agent |
| Equipment | Loudspeakers or other PA system, Demonstration equipment |
| Materials | Posters, Safety leaflets, Safety publications |

4.2.1.2 Hazard identification activity

This is the second step of daily SWC. In here team leaders or foremen lead team members to identify and find hazards in the day work before start their works and advice workers regarding the degree of risk and measures for precaution as well [21].

Table 2: Dominant aspects of hazard identification activity

| | |
|------------------|---|
| Participants | Every members of each group, every foremen from each trade |
| Person in Charge | Foremen |
| Equipment | White board (if needed) for illustrations |
| Materials | Operating manuals of the required working tools and equipment |

4.2.1.3 Prior to work inspection

As [17] expressed, a prior to work inspection is an essential activity which should be carried out immediately after the hazard identification activity. Inspecting all the tools, equipment, machinery and materials will ensure those are remaining safe and in proper condition before the start of work and usage of equipment [15].

Table 1: Dominant aspects of prior to work inspection

| | |
|------------------|--|
| Participants | All workers |
| Person in Charge | Individuals, plant operators, foremen, inspectors, maintenance group |
| Equipment | Measuring/testing tools and repairing tool |
| Materials | Opening manuals for machineries and equipment |

4.2.1.4 Guidance and supervision at work

As it is quoted in [15], guidance and supervision at work includes keeping track of implementation of the safety measures from the hazard identification activity, checking the compliance and solves problems that may happen during its implementation.

Table 2: Dominant aspects of guidance and supervision at work

| | |
|------------------|--|
| Participants | Team members |
| Person in Charge | Foremen, group leaders or person in charge |
| Equipment | Camera (if needed) |
| Materials | Hazard identification activity and Monitoring form |

4.2.1.5. Safety inspection

According to [20], safety inspection is carried out by senior management at

construction site at least once every day before the process of safety discussion. Whole site and surrounding areas affected by the construction is fallen in to the scope of safety inspection. Major safety inspection focuses are whether the construction procedures comply with the work plan and whether the installation process rise to unsafe condition.

Table 3: Dominant aspects of safety inspection

| | |
|------------------|--|
| Participants | Safety officers , Safety supervisors, foremen |
| Person in Charge | Project manager or site agent |
| Equipment | Camera (if needed) |
| Materials | Hazard identification activity and monitoring form |

4.2.1.6 Process safety discussion

Process safety discussion provides platform to discuss and solve problems which are identified during the safety inspection and hazards identification activities [22]. Moreover, safety discussion is arranged daily at fixed time and safety officer reviews safety performance of the day.

Table 4: Dominant aspects of process safety discussion

| | |
|------------------|---|
| Participants | Sub-contractor representatives, safety officers |
| Person in Charge | Project manager |
| Equipment | White board, projector, screen, camcorders |
| Materials | Record of process safety discussion |

4.2.1.7 Tidying up after work

This step is consisted to ensure that all the equipment, tools, instruments and environment of the workplace are tied up

after the end of day's work, in preparation for the next day's work. 5S concept is adopted for this daily SWC [20]. Therefore, all of the workers have clear understanding of 5S concept. According to 5S concept all equipment, tools and instrument are stowed and classified properly.

Table 5: Dominant aspects of tidying up after work

| | |
|------------------|--|
| Participants | All workers |
| Person in Charge | Foremen, Supervisors |
| Equipment | Brooms, shovels, garbage container, wheel burrow, storage containers |
| Materials | MSDS of cleaning agent |

4.2.1.8 Final check after work

Final check after work activity is carried out after the end of work. This is end of the daily SWC. The final check will ensure that no accident will happen at construction site after work, it can be a fire, flooding, scaffolding collapse, theft or trespassing [23]. Therefore, prevention of those accidents and losses is the main purpose of final check after work

Table 6: Dominant aspects of final check after work

| | |
|------------------|---|
| Participants | Foremen, Sub-contractor representatives |
| Person in Charge | Foremen or site agent |
| Equipment | Flashlights, keys of the all gates |
| Materials | Final inspection checklist |

4.2.2 Weekly SWC

Weekly SWC aims at making an interim review of the performance in the past week and making arrangements for the future. It includes 3 steps as follows;

- Inspection and check
- Process safety discussion
- Weekly tidying up [19]

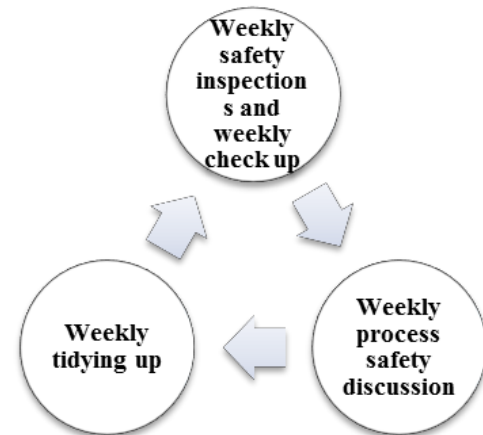


Figure 2: Weekly cycle

4.2.2.1 Weekly safety inspection and weekly check up

Both parties of contractor and sub-contractor are involved with this process [20]. In here, participants find out solution for safety problems and risk and try to eliminate those problems with collaboration of both parties. Throughout this process, it is possible to provide information for management regarding safety issues [15]. Moreover, contractor and sub-contractor also required to inspect their own machines, electrical installation and scaffolding.

Table 7: Dominant aspects of weekly safety inspection and weekly check up

| | |
|------------------|---|
| Participants | Project manager, Site agent, Safety officers, Representatives of sub-contractor, Plant operators, Electricians, Mechanics |
| Person in Charge | Project manager |
| Equipment | Camera (to record the inspection results), checking or repair tools |
| Materials | Safety inspection checklist, machinery inspection check list |

4.2.2.2 Weekly process safety discussion

Aim of the weekly process safety discussion is promoting the communication between people at various classes and sub-contractors and present the summary of the last week's safety performance and plan safety performance for the next week [21].

Table 8 : Dominant aspects of weekly process safety discussion

| | |
|------------------|---|
| Participants | Workers representatives. Representatives of sub-contractor |
| Person in Charge | Project manager |
| Equipment | Meeting equipment |
| Materials | Inspection records of past week and current week |

4.2.2.3 Weekly tidying up

Main purpose of this step is bodily tide up the site to prepare for work for next week [17].

Table 9: Dominant aspects of weekly tidying up

| | |
|------------------|--|
| Participants | All workers on site |
| Person in Charge | Foremen from the contractor and sub-contractor |
| Equipment | Tools required for the weekly tidying up |
| Materials | Inspection checklist |

4.2.3 Monthly SWC

Monthly SWC is carried out to review the site performance and progress, to improve the workers' safety awareness through training and reward schemes, and to recognise their commitment and cooperation [19]. Monthly SWC consists with four steps and they are illustrated in figure 3.



Figure 3: Monthly SWC

4.2.3.1 Monthly inspection

In the monthly inspection, inspect all the equipment, machines, tools and materials in order to ensure that they are comply with relevant rules and regulations [20].

Table 10 : Dominant aspects of monthly inspection

| | |
|------------------|---|
| Participants | Competent person appointed by the contractor and sub-contractor |
| Person in Charge | Electricians, Mechanics |
| Equipment | Testing meters |
| Materials | Maintenance manuals |

4.2.3.2 Monthly safety training

Awareness of safety, sharpen necessary skills, gain relevant knowledge and foster a correct attitude are afforded by monthly safety training. Further accidents can be avoided by eliminating the cause of accidents [17].

Table 13: Dominant aspects of monthly safety training

| | |
|------------------|---|
| Participants | All workers including workers of sub-contractor |
| Person in Charge | Safety officer |
| Equipment | All equipment required for training |
| Materials | Object required for training such as notes, materials for demonstration |

4.2.3.3 Monthly safety meeting

Monthly safety meeting are held together with daily morning safety meetings. The main objective of monthly safety meeting is to discuss safety issues than daily morning safety meetings and improve the worker's sense of safety awareness [22].

Table 14: Dominant aspects of monthly safety meeting

| | |
|------------------|--|
| Participants | All workers on site |
| Person in Charge | Project manager |
| Equipment | Loudspeakers or other PA system, Demonstration equipment |
| Materials | Daily morning safety meetings |

4.2.3.4 Safety Committee Meetings

Safety committee meeting focuses person on site such as safety officers, project manager, etc. [17]. Eliminating any misunderstandings or lack of coordination at work and reviewing the past safety records and planning for the coming month are done here. Safety committee meetings achieve reduction of accident and improve safety awareness among the employees [21].

5. Benefits of Implementing SWC Concept

The implementation of SWC has provided benefits for both the client and contractor. As [24] pointed out that SWC is an effective tool to improve construction safety by motivating contractors to perform safely on-site. The following section elaborates the perceived benefits which can be achieved by implementing SWC in construction industry.

5.1 Increased safety training

Safety training is considered as a main factor affecting safety performance [25]. Further, it is a provable to escalate the safety knowledge and awareness of construction workers [26]. Under SWC, contractors are supported to accomplish measurable safety

training to the workers by monthly safety training.

5.3 Stronger safety awareness and safety commitment

Increased safety awareness of frontline workers is concerned as one of the most considerable benefits of the SWC [21]. As [22] advocated that it is possible to instigate safety awareness of both site management personnel and construction workers through SWC.

5.4 Improved safety-related communication

Effective communication of safety concerns between different parties who involved with construction process is one of the prime segments to develop good site safety management [27]. According to [17], SWC encourages developing mutual trust between supervisor and workers and facilitates direct communication.

6. Barriers of Implementing SWC Concept

According to [28], common barriers in implementing safety management tools can be categorised under three major sectors such as challenges associated with workers, challenges associated with contractors and finally issues in prevailing subcontracting practice.

6.1 Challenges associated with workers

6.1.1 Low literacy level of workers

Based on the research by [29], majority of front-line workers on construction site are illiterate. Therefore, it is one of the barriers to progress good relationship among them and their immediate supervisors. Further, [30] highlighted that the absence of literacy level of workers is the key obstruction for safety training programme. Also, many small-scale contractors and their employees have not obtained sufficient correct education and thus it is very difficult to interpret contract documents and documents on safety incentive scheme.

6.1.2 Poor safety attitude of workers

Poor safety attitude of workers has been identified as a main reason for absent of safety performance [25]. Further, [29] indicated the attitude of employees towards health and safety as one of the primary cachets of the successful implementation of safety incentive scheme. The safety attitude of workers remains as the most critical factor in explaining safety activity [31].

6.1.3 High turnover rate of workers

The casual labour may not work frequently at one construction site, and they may find it difficult in adapting to contractors' safety incentive scheme. According to [28] findings, the higher turnover rates are associated with the higher injury rates.

6.2 Challenges associated with contractors

6.2.1 Limited budget, human resources and facilities on site safety

Limited resources were stated as factors which influenced negatively on safety performance. As [32] pointed out that the lack of resources is acted as the major reason for the lack of effective implementation of safety incentive. Therefore, adoption of extensive safety incentive scheme is difficult task in construction industry due to limited budget [33]. Further, [29] expressed that the benefits which result from an effective safety incentive scheme cannot be obtained without investing in health and safety issues thus, the cost of investing in safety incentives is a major problem.

6.2.2 Inadequate safety attitude of top managers

[13] have demonstrated the importance of the top management's role in dominating the effectiveness of safety incentive scheme. Furthermore, management negligence is contributed to many site accidents. According to [34], safety performance is directly integrated to the top management's perception on safety. Accident rate can be demoted by commitment and support from senior management. Therefore, top

management's commitment is really upon on success of any safety programme.

6.3 Challenges associated with Prevailing subcontracting practice

Sub-contractors are also expected as vital to better safety performance by contractors. [35] quoted that multi-level subcontracting is one of the key causes in adopting safety incentives for construction site.

Table 11 : Benefits and barriers for implementing SWC concept: literature and documentary review findings

| Benefits | Barriers |
|--|---|
| <ul style="list-style-type: none"> ▪ Reduced accident rate ▪ Increased safety training ▪ Stronger safety awareness and safety commitment ▪ Improved safety-related communication | <ul style="list-style-type: none"> ▪ Challenges associated with workers Low literacy level, poor safety attitude and high turnover rate of workers ▪ Prevailing subcontracting practice Limited budget, human resources and facilities on site safety, inadequate safety attitude of top managers ▪ Challenges associated with contractors |

7. Conclusion

Finding effective and efficient ways to mitigate safety issues in the construction industry in Sri Lanka is a deliberate need. The SWC is one of the safety tools which have contributed to reduce construction accidents and fatalities in Worldwide. Therefore, SWC is a good safety incentive which can be applied in Sri Lankan construction industry as well. The literature revealed that the benefits of implementing SWC include reduced accident rate, increased safety training, stronger safety awareness and safety commitment and improved safety-related communication. Moreover, as per the literature, the barriers for implementing SWC include low literacy level of workers, poor safety attitude of workers, high turnover rate of workers,

limited budget, human resources and facilities on site safety, inadequate safety attitude of top managers and prevailing subcontracting practices. The next steps of this research focused on validating the literature findings together with evaluation of the applicability of SWC concept to the Sri Lankan construction industry. The researcher believes that the mitigation of safety issues will help the organisations in many ways including improved productivity through healthy and satisfied employees, improved market through good organisational image and less compensation for the work related issues, etc.

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References

- [1]. Khan, R.A. (2008). Role of construction sector in economic growth: empirical evidence from Pakistan economy. In First International Conference on Construction in Developing Countries, (pp.279-290).
- [2]. Rameezdeen, R. (2006). Construction Sector in Sri Lanka, Galle. Retrieved from [http://cowam.tec.hh.net/060419construction sector SL.pdf](http://cowam.tec.hh.net/060419construction%20sector%20SL.pdf)
- [3]. Ofori, G. (1990). The construction industry: Aspects of its economics and management. Singapore: Singapore University.
- [4]. Construction Skills Queensland. (2012). Building and construction industry definitions. Retrieved from <http://csq.org.au/about-csq/building-and-construction-industry-definitions>
- [5]. Kirmani, S. S. (2003). The Construction Industry in Development Issues and Option. Washington: The World Bank.
- [6]. Olanrewaju, A. L., & Aziz, A.A. (2014). Sustainability Maintenance Initiatives. Building Maintenance Processes and Practices, 293-315. doi: 10.1007/978-981-287-263-0_10
- [7]. Karunasena, G., Priyadarshani, K., & Jayasuriya, S. (2013). Construction safety assessment framework for developing countries: A case study of Sri Lanka. *Journal of Construction in Developing Countries*, 18(1), 33-51.
- [8]. Priyadarshani, K. (2010). Developing Safety Management Assessment Model for Sri Lanka Construction Industry (unpublished BSc dissertation). Department of Building Economics, University of Moratuwa, Moratuwa.
- [9]. Gherardi, S., Nicolini, D. & Adella, F. (1998). conflicting perspectives in accident causation & safety management construction firm. *Journal of contingencies & crisis management*, 6(4), 202-213.
- [10]. Rubio, M. C., Menéndez, A., Rubio, J. C., & Martínez, G. (2005). Obligations and Responsibilities of Civil Engineers for the Prevention of Labor Risks: References to European Regulations. *Journal of Professional Issues in Engineering Education and Practice*, 131(1), 70-75. doi: 10.1061/(asce)1052-3928(2005)131:1(70)
- [11]. López-Valcárcel, A. (1996). Seguridad y salud en el trabajo en el Marco de la Globalización de la Economía. Ministerio de Trabajo y Seguridad Social de España, Proyecto Regional Seguridad y Salud en el Trabajo en los procesos de integración y globalización, Documento de Trabajo 26, OIT [in Spanish].
- [12]. Rameezdeen, R., Pathirage, C., & Weerasooriya, S. (2003). Study of construction accidents in Sri Lanka. *Built-Environment-Sri Lanka*, 4(1), 27-32
- [13]. Sawacha, E., Naoum, S. & Fong, D. (1999). Factors affecting safety performance on construction sites. *International Journal of Project Management*, 17(5): 309-315.
- [14]. De Silva, N., Rajakaruna, R.W.D.W.C.A.B. & Bandara, K.A.T.N. (2008). Challenges faced by the

- construction industry in Sri Lanka. Proceedings: CIB International Conference in Building Education and Research. Sri Lanka, 1023-1032.
- [15]. Lam, H. (2000) Implementation of Safe Working Cycle in Public Works, Symposium on Safe Working Cycle, Occupational Safety & Health Council, Hong Kong.
- [16]. Environment Transport and Works Bureau (2002) Implementation of Site Safety Cycle and Provision of Welfare Facilities for Workers at Construction Sites, Technical Circular (Works) No. 30/2002.
- [17]. Occupational Safety & Health Council (Hong Kong, China). (2002). "Safe working cycle" handbook. Hong Kong: Occupational Safety & Health Council.
- [18]. Ozaka, H. (2000) Safe Working Cycle Activities for Preventing Industrial Accidents in Construction, Symposium on Safe Working Cycle, Occupational Safety & Health Council, Hong Kong
- [19]. Occupational Safety & Health Council (2000) Symposium on Safe Working Cycle, Hong Kong
- [20]. Environment Transport and Works Bureau (2002) Implementation of Site Safety Cycle and Provision of Welfare Facilities for Workers at Construction Sites, Technical Circular (Works) No. 30/2002.
- [21]. Chan, D. W., & Choi, T. N. (2015). Critical analysis of the application of the Safe Working Cycle (SWC). *Journal of Facilities Management*, 13(3), 244-265.
- [22]. Tse, S. L. (2005). Study of the impact of site safety cycle on safety performance of contractors in Hong Kong, BSc (Hons) in Surveying Dissertation, Department of Real Estate and Construction, The University of Hong Kong, April.
- [23]. Hong Kong (China: Special Administrative Region). (2002). Code of practice on safety management. Hong Kong: Occupational Safety and Health Branch, Labour Dept.
- [24]. Ng, W. C. (2007). Evaluating the Effectiveness of Pay for Safety Scheme (PFSS) in Hong Kong Construction Industry. BSc (Hons) Dissertation in Construction Economics and Management, Department of Building and Real Estate, The Hong Kong Polytechnic University, April.
- [25]. Chan, A.P.C., Wong, F.K.W., Yam, M.C.H., Chan, D.W.M., Ng, J.W.S. and Tam, C.M. (2005). From Attitude to Culture - Effect of Safety Climate on Construction Safety. Research Monograph, Department of Building and Real Estate, The Hong Kong Polytechnic University.
- [26]. Hinze, J. & Gambatese, J. (2003). Factors that influence safety performance of specialty contractors. *Journal of Construction Engineering and Management*, 129(2), 159-164.
- [27]. Wong, K.W., Chan, P.C., Fox, P., Tse, T.C. & Ly, E. (2004). Identification of Critical Factors affecting the communication of safety-related information between main contractors and sub-contractors. Research monograph, department of building and real estate, the Hong Kong Polytechnic University.
- [28]. Choi, T. N., Chan, D. W., & Chan, A. P. (2012). Potential difficulties in applying the Pay for Safety Scheme (PFSS) in construction projects. *Accident Analysis & Prevention*, 48, 145-155. doi:10.1016/j.aap.2011.04.015
- [29]. Kheni, N.A. (2008). Impact of health and safety management on safety performance of small and medium-sized construction business in Ghana. PhD Theses, Department of Civil and Building Engineering, Loughborough University.
- [30]. Koehn, E.E., Kothari, R.K. & Pan, C.S. (1995). Safety in developing countries: professional and bureaucratic problems. *Journal of Construction Engineering and Management*, 121(3), 261-265.
- [31]. Cheyne, A., Cox, S., Oliver, A. & Tomas, J.M. (1998). Modelling safety climate in



- the prediction of level of safety activity. *Work Stress*, 12(3), 255-271.
- [32]. Ahassan, R. (2001). Legacy of implementing industrial health and safety in developing countries. *Journal of Physiological Anthropology and Applied Human Science*, 20(6), 311-319.
- [33]. Mayhew, C. (2000). Occupational Health and Safety Issues for Young Workers in the Fast food Industry, Sydney.
- [34]. Toole, T.M. (2002). Construction site safety roles. *Journal of Construction Engineering and Management*, 128(3), 203-210.
- [35]. Ahmed, S.M., Tang, S.L. and Poon, T.K. (1999). Problems of implementing safety program on construction sites and some possible solutions (Hong Kong experience). *Proceedings of the Second International Conference of CIB Working Commission W99 on Implementation of Safety and Health on Construction Sites* (edited by Singh, A., Hinze, J. and Coble, R.J.). A.A. Balkema, Honolulu, Hawaii, pp. 525-529.