

SAFETY MANAGEMENT ON CONSTRUCTION MANAGEMENT: A CASE STUDY REVIEW

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ABSTRACT: Poor safety management in construction management may adversely affect cost, schedule and quality of a project. Heavy fines upon safety offence becomes a burden to the budget; losing working hours as a result of safety incident impacts on the schedule, and compromising quality is always an indirect consequence when workers perform duties in an unsafe site environment. Therefore, promotion of safety management becomes the top priority in any construction manager's agenda.

Working safely will benefit construction project and lead to a "real" success. This paper is a case study, based upon "Geller's 10 principles for achieving a total safety culture", reviewing how a Hong Kong leading construction company fosters the safety culture and possesses a pleasant safety record over years. Its safety performance is not only well ahead the local industry, but also ranges top within the Asia Pacific region and comparable to those mature Western industries. The review concluded that safety culture is one of the major components in construction management and collaboration is the essence to realize this positive culture within an organization. Safety management is not merely a "top down" approach, but requires the positive "bottom up" actions from the other end. The successful story of this company can demonstrate the contribution of safety management in construction management.

Keywords: Construction Management, Safety Management

1. INTRODUCTION

Construction management focuses on successfully delivering construction projects which can be viewed as a three legged stools, with the legs defined as cost, schedule and quality [1]. The success level of project delivery may well be measured by a contained budget, a timely completion date and the best workmanship. However, poor safety consideration may adversely affect cost, schedule and quality of a construction project. Heavy fines upon safety offence becomes a burden to the budget; losing working hours as a result of safety incident impacts on the schedule, and compromising quality is always an indirect consequence when workers perform duties in an unsafe site environment. Most importantly, there were many serious incidents leading to casualty. For example, the construction industry accounts for one third of all work fatalities in UK [2], and construction is Australia's third most dangerous industry. On average, 49 workers have been killed at work each year since 1997–1998, this represented almost one per week [3]. Obviously, there is a need for the construction management team to act positively to avoid such unpleasant happenings. Therefore, promotion of health and safety becomes the top priority in any construction manager's agenda and there are many researches in the recent years about how and why to promote safety management [4-8].

Working safely will benefit construction project and lead to a success. One of the effective ways is to foster

the corporate culture. According to a safety study in 2002, a company can change certain cultural characteristics to create a safer working environment. Evidence suggests that if these characteristics are improved, a higher level of safety culture and performance will result. The authors studied construction organizations in Denver areas and concluded that there is a strong correlation exists between corporate culture and good safety performance. Their findings also reveal that the company with the best safety record also had the most consistent safety culture. However, by comparing the opinions of upper management, middle management and field personnel, the authors also found the discrepancies between the beliefs, values and behaviors of employees. These discrepancies can result in a weak company safety culture [9]. Therefore, the aim of this paper is to demonstrate how a corporate safety culture is fostered?

The way that the author has chosen to answer this research question is to briefly establish a theoretical framework pertaining to safety culture, at first, and follows by triangulation of a case study.

The scope of the paper is based upon the safety management practice of a Hong Kong leading construction firm which possesses pleasant safety track record over years. The paper is organized as follows: having provided a brief introduction and reviewing various literatures, methodology of this research is discussed. The backgrounds of the case study are then presented which follows by the analysis of those safety practices of the studied organization. Finally, a discussion,

limitation of this paper and conclusions, including suggestion to construction management are provided.

2. THEORETICAL ISSUES

Reviewing the past theories always helps shaping the research; this section introduces past researches and relevant theories related to construction and safety management. This review also forms the framework to assist analyzing the case which is presented latter in the paper.

Construction management approach should not just focus on its own issues of building or infrastructure areas but needs to understand and appreciate the other disciplines, like hygiene, and incorporate it into the management system. Such hygiene factors are the product of successful safety management which aims at managing all aspects of safety throughout the whole organization [10]. Safety management provides a systematic way to identify hazards and control risks while maintaining assurance that these risk controls are effective. However, most safety management system, which is based upon safety standards and rules, may be ineffective [6]; one of the effective ways for efficient safety management is creating safety culture within the organization [8].

Bodley stated that culture involves what people think, what they do, and what they produce [11]. In order to provide a safe working environment, one of the best ways is to create a safety culture within the organization, because organizational-cultural factors can play an important role in safety management. Geller stated that in a total safety culture, everyone feels responsible for safety and pursues it on a daily basis [12]. There is a also Chinese idiom from the “The Art of War” - “同舟共濟 (*tóng zhōu gòng jì*)” which means when people are crossing a river in the same boat and are caught by a storm, they will come to each other's assistance just as the left hand helps the right. When everyone in the organization feels “safety is their matter”, they will contribute positively to the safety policy.

An organization's safety culture impacts on work methods, absenteeism, product quality, productivity, commitment, loyalty and satisfaction [13], and the key indicators of the corporate safety culture are people, process and values [14]. Therefore, safety culture is most likely to take hold when the safety concept is reinforced through positive means, and not just punitive actions [15].

In order to create the safety culture within an organization, Geller categorized 10 principles for achieving a “Total Safety Culture” [12]:

1. Organizational culture drives the safety process: Ownership, commitment and proactive behaviors are more likely to achieve outcomes than by working to meet goals set by others. Therefore, corporate safety culture should be referred to as a mission owned and achieved by the very people's benefits.
2. Behavior-based and person-based factors determine success: Behavioral and personal approaches to

safety can decrease undesirable behaviors and increase desirable behaviors within organizations.

3. Focus on process not outcomes: When organizations only rank projects according to injury rate, attention will be diverted from processes designed to reduce injuries, not outcomes. However, when employees are held accountable for ongoing work practices that continue to the organization's safety, process improve and injury rate eventually reduced.
4. Behavior is directed by activators and motivated by consequences: Behaviors followed by pleasant consequences are more likely to be repeated and safety desire will be motivated.
5. Focus on achieving success but not avoiding failure: Productivity and quality goals receive more continuous, proactive attention than safety goals.
6. Good observation and feedback lead to safe behavior: An effective observation and feedback process requires substantial employee's contribution that holds individuals and teams accountable for conducting regular behavioral observation and feedback.
7. Follow COACH approach: The five letters COACH are a mnemonic reminder of key aspects of optimal safety coaching (C=communication, O=observation, A=analysis, C=change; H=help).
8. Promote observation and coaching are key actively care process: Workers can learn and observe safety-related work practices of others, and then they can readily learn to offer behavior-specific feedback as an actively coach.
9. Importance of self-esteem, belonging and empowerment: The sense of “every worker is valuable; they all belong to the team; and they are empowered to make safety different” is essential for safety culture. Safety happens when worker feels that they can contribute.
10. Safety is value not priority: Values are deep-seated personal beliefs that are never compromised. Priorities often change depending upon the situations; but values remain constant.

In this paper, the safety culture of the case studied organization was examined based upon Geller's research.

3. RESEARCH METHODOLOGY

A case study strategy is suitable for a research about “how” [16]. This study is to examine “how” an organization to create safety culture. Case study research is therefore a viable choice.

The case study methodology is also useful to test theory [17] which also suits the theme of testing if the studied organization meets the “Geller's 10 principles for achieving a total safety culture”.

Yin suggested six commonly used sources of case study evidence, which include:

- documentations,
- arrival records,
- interview,

- direct observations,
- participants-observation, and
- physical artefacts [16].

Yin also reminded the proper procedures for collecting each type of evidence and distinguished the individual strengths and weakness of each source of evidence [16]. The safety report, safety manual and other archives were obtained from the publications of the studied organization which is not only stable for repeated reviewed, but also contains relevant details of safety management practices. Therefore, “documentation” and “archival records” are the main source of evidence in this case study, and informal interviews to one of their safety personnel have been conducted to verify some of the details.

4. THE CASE STUDY: SAFETY MANAGEMENT

Understand the background of the organization helps to interpret the case, this section provides the rationale of choosing the organization for this study which follows by the context of case study.

4.1 Safety Performance Comparison

With references to the relevant statistics¹, the snapshot of reportable construction accidents in 2005-2006 of some selected countries/cities, are presented as Table 2.

Table 2. Comparison of Safety Statistics of Selected Country/City for 2005/06

Description	Country / City				
	USA	U.K.	Australia	Hong Kong	Singapore
No. of reportable accident	414,900	8,384	75,700	3,548	1,300
Total no. of Workers	7,166,600	5,261,800	877,000	59,266	184,400
per one hundred person employed	5.79	6.28	8.63	5.99	9.45

It is worth to notice that the accident rate of Hong Kong is lower than those reputable and mature countries U.K., Australia and Singapore, and is just marginal below the USA. Its safety performance is not only in the top range within the Asia Pacific region, but it is also comparable to those mature Western industries.

In Table 3, a comparison of incident rates of Hong Kong versus the studied organization from 2006 to 2009 is tabulated. The accident rate of G-Force was only in the

¹The following information is accessed via internet on 20 February 2010:
 USA - <http://www.bls.gov/iif/oshwc/osh/os/ostb1621.pdf>
 UK - <http://www.hse.gov.uk/statistics/industry/construction/data.htm>
 Australia - <http://www.safeworkaustralia.gov.au/NR/rdonlyres/EF2B952A-3299-4CC1-AD0B-FDE8D92643C6/0/Construction.pdf>
 Hong Kong - http://www.labour.gov.hk/eng/osh/pdf/OSH_Statistics_2008.pdf
 Singapore - http://www.mom.gov.sg/publish/momportal/en/communities/workplace_safety_and_health/reports_and_statistics/workplace_injuries.html

range of 5.7 to 6.4, a single digit result, while the industry was from 54.6 to 64.3, this is almost ten times higher in average.

Table 3. Comparison of Safety Statistics of the Industry and Studied Organization from 2006 to 2009

Item	Field	2006	2007	2008	2009
Accident Rate	Industry	64.3	60.6	61.4	54.6
	G-Force	8.2	8.3	5.7	6.4
Fatal	Industry	16	19	20	19
	G-Force	0	4	2	1
Fatal Rate	Industry	0.303	0.379	0.405	0.376
	G-Force	0.000	0.482	0.351	0.156

Therefore, the safety practice of this leading Hong Kong construction company is selected to demonstrate good safety management.

4.2 Safety Background of Studied Organization

The studied organization (pseudonym = G-Force) maintains steadily approximately 11% of the market share out of the average US\$8 billion in the past few years. In 2010, the organization celebrates its 53 years anniversary. As one of the leading construction companies in Asia, G-Force’s activities span the entire spectrum of building, civil engineering, foundation work, electrical and mechanical works. This organization employs approximately 2,000 full-time staff, and has built a wide range of construction projects in Hong Kong.

The organization’s culture indicates that it values the importance of construction safety, and shows its concern for its staff and believes a good market leader always protects their followers. The most telling message, as repeatedly emphases by its top management, from G-Force is doing in leadership is that those who take safety leadership seriously and excel it in all aspects of their works.

This organization commits absolutely to striving for an accident-free working environment, because it believes that quality, technical excellence, progress and attractive financial returns are all outcomes of good safety management. While construction projects are by nature high-risk activities; workers operate in dangerous working environments in which all participants, whether at senior leadership level, project operational level or front-line working level, need to place safety at the very top of their agendas. It has put much effort into safety program by promoting “see and act”, which the top management is convinced is the right track to success. Therefore, staff always maintain their focus on fully implementing, at all levels within the projects. All staff members must therefore offer maximum effort and assistance to one another, constantly stressing the importance of safety and that it is everyone’s responsibility.

In order to share the mission of safety leadership, workshops were also held annually since 2005. Business partners, representatives from clients, government officials and academics from UK and Singapore, have been invited to attend, and different good practices and procedures were shared.

4.3 Case Study Analysis

Geller stated that it is every safety professional's ultimate goal to achieve a total safety culture within his/her organization. In the following context, the research for the case study is analyzed under the same ten headings as categorized by the author [12].

Organizational culture

G-Force's culture drives the safety process because its corporate policy is to place health and safety as the number one priority over all business considerations. The organization's mission is "to build for a better quality of life and living environment in a safe and sustainable manner". G-Force believes that quality, technical excellence, progress and attractive financial returns are all outcomes of good safety management.

Behavioral and personal base

G-Force's behavior-based and person-based factors pull its success. G-Force believes that employee must understand relevant behavioral science principles and feel comfortable using them to prevent work injuries. Therefore, G-Force makes safety personal and meaningful and has put much effort into safety and promoted the "Safety Step Change" program since 2007. The responsibility for implementing "safety policy" is rested on each and every employee as it is their well being. All staff are taught to "see and act"; and always maintain their focus on fully implementing safety at all levels. Certain dispositions or moods influence an individual's propensity to help other workers.

Safety process

G-Force focuses on safety process but not the outcomes. Staff are responsible to identify and address those significant new safety risks during site inspections or when preparing new method statements, such risks were then captured and transferred into the project safety registers to ensure awareness, communication and thorough reviews. When staff are held accountable for ongoing work practices that continue to the organization's safety, process improved and eventually injury rate is reduced.

Activators, motivators and consequences

G-Force believes safety behavior is directed by activators and motivated by consequences. Safety signs, memos, good practices, lesson learnt and safety alert statements are always introduced to the workplace in order to prompt safe work practices. These activators announce consequences for unsafe behaviors which can help to

imitate and maintain safe work practices.

Emphasis safety success

G-Force focuses on its safety success but not failure. Not only significant poor safety outcomes are posted in the monthly safety newsletter, but pleasant and encouraging news will also be frequently updated. For example, the safety newsletter in December 2007 reported, "Occupational Health Promotion Campaign Award presentation held on 22 Jan 2008, four G-force projects have entered to the finalists." Their organization publication in June 2010 have also concluded and published the awards received by the organization within 2009.

Observation of safety practices and feedback

G-Force values observation and feedback which lead to safe behavior. These include the feedback and observation of safety improvement needs as identified by the top management after periodical site safety walk; constructive safety comment as provided by subcontractors and workers via regular project safety meetings. All safety participants, whether at senior leadership level, project operational level or front-line working level place safety who can supply safe working practices and processes, the observations and feedback on generic hazard identification are welcome. Analyzed and selected feedback will then be posted on the intranet.

COACH approach

Communication – G-force has established and maintains information, in paper and/or electronic form to describe the core elements of the safety practices. This safety information is posted on office / site / depot notice boards, as well as the intranet and company website.

Observation – Any significant safety risks observed and identified during routine site inspections by safety personnel will be reverted to the project immediately to ensure positive remedial reactions.

Analysis – Should there be any serious safety incident, G-Force's first thought and actions are with the victims, it follows by analysis of the root cause. "Panel of Enquiry" will be formed to ensure similar accidents will never happen again.

Change – G-Force developed a series of "Step Change in Safety" actions and key performance indicators for good changing progress is set and reviewed by top management periodically. This "Step Change" challenged the project teams and required them for a steady improvement.

Help – G-Force helps employee with updated safety information and knowledge, by maintaining central database of all safety information including those of external origin, required by its safety management system. Those current revisions are identified; and current versions of relevant documents are available at all locations which helps operations functioning effectively.

Active care process

G-Force promotes active care process. There are various safety awards to uphold safety performance: monthly project “Safe Subcontractor Award”, “Safe Worker Award” and also annual “Safe Foreman Award”, “Safe Subcontractor Award”, “Safe Worker Award”. Workers will be inspired by safety-related work practices when they observe the reward of actively caring behavior.

Self-esteem, belonging and empowerment

G-Force believes employees and workers need to feel good about themselves before they will act for the safety by adopting the following strategies to build up self-esteem:

- solicit and follow up employee suggestion in safety;
- provide opportunities for personal learning; and
- increase and encourage management attention to the occurrence of safe behaviors.

G-Force believes employees and workers will feel as part of a cohesive group and then will actively care on safety by adopting the following strategies to build up sense of belonging:

- sponsor celebrations for safety events held by reserving appropriate project’s budget for safety;
- use self-managed work team by continuing with the “one team approach” to implement safety; project team is accountable for safety as an integral part of effective and efficient construction management.

G-Force believes employees and workers should be empowered to the safety process and then can positively contribute to safety outcomes by adopting the one team approach to implement safety in projects. Every project is empowered to:

- pay attention to process measures;
- resolve risk and make it easy to build safety;
- define subcontractor safety deliverables.

Organizational safety value

G-Force’s ultimate goal is to deliver a high level of quality to their customers and the quality of the way in which projects are delivered, reliably, safely and responsibly. G-Force believe that they can best deliver the level of quality to which they aspire by concentrating on three core values “safety, integrity and excellence”. The organization places safety as it core values throughout a corporate culture. In a conflict of interest, safety always comes first.

5. DISCUSSION

To ensure the organization’s growth, G-Force places “safety” as one of the integral parts of their business model which is demonstrated by Figure 1 as presented and affirmed during their Top management conference in September 2009.



Figure 1. Safety as one of the core business strategies

Under such positive safety leadership, G-Force has produced a number of successes including a project in Singapore which has, as at May 2007, a record of over 2.5 million man-hours without a reportable accident. There were 53% accident-free project in 2009 and the average accident rate is 6.4, which was significantly lower than the industry average. All these confirm that exemplary levels of safety performance can be achieved by appropriate “Safety Management”.

The final results of safety reward are well beyond the time limit of this paper, and it may not be feasible to quantify the results in financial terms within a short time span. However, the following significantly positive outcomes have been observed up to January 2010:

- Winning the landmark project
- Being invited to an international safety conference
- Receiving the safety dividends

5.1 Winning the Landmark Project

In February 2008, G-Force allied with another contractor and G-Force was the head of the joint venture, won a \$5 billion design and build project for the government headquarters. The marking scheme for that tender weighted 60% of the scores to bidders’ “Quality Aspects”, this includes design and aesthetics; planning, sustainability and environmental aspects; function, quality assurance, safety and technical factors etc. Price accounted for the other 40% of the weighting.

In allocating a score for the “Quality Aspects”, one of the foci was “Quality Assurance and Safety”. Tenderers were asked to prepare a specific quality plan, including quality policy and quality system. The organization’s safety initiatives demonstrated their commitment for safe working environment. The marking scheme also required tenderers to provide a specific safety plan including a policy statement, risk assessment procedures and proposals to address the risks identified. The organization’s outstanding record in safety leadership and performance was certainly an advantage. Such good safety management practices did contribute positively to

the final score of the tender evaluation.

5.2 Being Invited To The International Safety Conference

The organization's commitment to, and continual development of, safety issues is reflected by its holding of Safety Workshops and Safety Conferences since 2005. These ongoing efforts have not only been enthusiastically supported by the local profession and experts, but also recognized by safety associations in other cities.

The Chief Executive and safety representatives of G-Force were invited to Singapore's National Workplace Health and Safety Conference to present a keynote address and paper presentation in May 2007, which was a great honor for the company. This represented an acknowledgement of the company's leading position in the importance of design work in safe construction.

5.3 Receiving the Safety Dividends

The organization's record reveals that the following safety awards were received appraising and rewarding the efforts of G-Force in driving the safety working environment:

International Awards

- Four major projects in Singapore received the awards from the Royal Society for the Prevention of Accidents, in recognition for their excellence in occupational health and safety management. Among them, three were gold and one was silver.
- In Dongguan, the organization was awarded a certificate as a "Pioneer in Safe Production and Fire Prevention" at the 2009. G-Force was one of two corporations (the other being a French company) among seven finalists to receive this prestigious award.

Hong Kong

- 6 awards at the Occupational Safety & Health Council of Hong Kong (OSHC)'s Occupational Health Award Scheme 09/10 in different personal protection categories.
- 17 awards at the Construction Safety Forum and Award Presentation Ceremony organised by the OSHC, among them three were gold awards.
- Its Batching Plant won a Merit Award in the Good Housekeeping Awards 2009/2010 organised by the OSHC in February 2009.
- At the Construction Industry Safety (CIS) Award Scheme 2009/10, earning a total of 17 awards, the organization won by their project teams. Among them, there was a gold award in the "Safety Team" category.
- At the 2009 Considerate Contractors Site Award Scheme, G-Force won an impressive total of five awards, including two gold awards.

6. LIMITATION

Although the safety outcome of the case studied organization was satisfactory, there was still room for improvement. For example, G-Force still recorded a fatal accident in 2009.

There are some limitations of this research and the result of the research cannot be generalized. Firstly, levels of influence by trade unions of different countries are different, which may affect the safety culture differently. These differences should be reviewed, addressed and reflected in the national-organizational safety culture.

Secondly, national cultures of different countries may impact on leadership and followership to the safety perception. Consideration must be made in future research when undertaking similar research in other countries.

Thirdly, Geller's principles were discussed generally for all industries but safety professionals of construction management should seek their own insights on achieving the safety culture and may establish different set of achievable goal according to those principles.

7. CONCLUSION

Working safely leads to a "real" success. Providing a safer workplace can generate many financial benefits, including savings in direct and indirect costs, fewer penalty fines and litigation claims, lower insurance premiums, and reduced medical expenses, and subcontractor's costs, resulting from fewer accidents. This studied organization commits to striving for an accident-free working environment. All participants offer maximum effort and assistance to one another, constantly stressing the importance of safety. Its top management has put much effort into safety because they are convinced that it is the right track to success. Their employees and workers also show their focus and contribute on fully implementing, at all levels, those actions arising from the safety commitment. However, it is clear that a safe workplace cannot be created overnight; it has to undergo a process that requires the efforts and contributions of every single employee and subcontractor.

This paper studied how safety culture is fostered and drive to a success. The evidence is that G-Force accident rate per thousand workers dropped to 6.4 in 2009, a 74% reduction from the 2001 baseline of 24.5 and a 44% decrease from the rate of 11.4 in 2005. The downward trend of incident rate shows that G-Force moves towards its "Zero Harm" target by 2012, and its commitment to health and safety is paying dividends with a range of achievements and awards of which every member of the organization can be proud of.

In conclusion, collaboration is the essence to realize the safety culture within an organization. Safety management is not merely a "top down" approach, but requires the positive "bottom up" actions from the other end. The successful story of this company demonstrates the contribution of safety management in construction management. Moreover, the lesson learnt from this case

studied organization is an exemplar for other companies seeking the path of success. This may assist other construction companies to improve their overall construction management context.

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