



 **THE GUINEA GROUP**

Fostering a Strong Construction Safety Culture

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ABSTRACT: The construction industry has a reputation of being one of the most unsafe industries because of its high rates of injuries and fatalities. To improve safety performance, some construction companies have implemented innovative safety management programs. This paper reviews programs implemented by five construction companies in the United States, Australia, and Hong Kong and reviews the objectives, implementation strategies, and lessons learned from each. Seven program elements emerged in all cases: (1) The programs were focused on shaping employees' beliefs, attitudes, and commitment to achieve safe behavior on construction sites; (2) programs were based on the belief that all incidents and injuries are preventable and unacceptable; (3) there was a strong commitment to safety among top management; (4) the programs extended safety management issues to the entire supply chain and involved all stakeholders; (5) safety risk management systems were in place to identify, assess, and respond to on-site hazards, (6) clear authority and accountability for safety were established and safe behavior rewarded; and (7) a safety knowledge database was established to capture lessons learned. The paper suggests that organizations adopt a holistic strategy that focuses not only on improving the physical working environment, safety risk assessments, and employees' safety knowledge, but also on shaping employees' beliefs and attitudes that lead to safe behavior and ultimately to a strong safety culture. In conclusion, a conceptual model for balancing the art and science of managing construction safety is proposed for use by construction enterprises.

Around the world, construction industries offer substantial employment opportunities and contribute significantly to national economic growth, but they are also plagued by unacceptably high rates of injuries and fatalities. For example, in Australia, the construction industry employed 961,300 people in 2007–08, or approximately 9% of the Australian workforce [Australia Safety and Compensation Council (ASCC) 2010]. During the same period, employees in the construction industry made 14,409 claims for compensation.

The incidence claim rate was 22 claims per 1,000 employees, more than 50% higher than the average across industries of 14 claims per 1,000 employees. Furthermore, the construction industry experienced 37 fatalities (5.6 fatalities per 100,000 employees) in 2007–08, more than twice the average for all industries (2.4 fatalities per 100,000 employees; ASCC 2010). Similar statistics exist in the United States, where the construction industry has an injury rate 50% higher than that of all industries (Huang and Hinze 2006). Figures for the United Kingdom and China are similar (Zou et al. 2008). Such statis-

tics confirm the reputation of the construction industry globally as one of the most unsafe.

Traditional approaches to safety management have focused on management tools for identification, assessment, and mitigation of on-site work hazards; development of safety management systems, safety procedures, and standards; improvement of physical working conditions through selecting reliable plant components and machinery and designing better site access; training of site workers; development of better work methods; and availability of personal protective equipment (Hinze and Harrison 1981; Holmes et al. 1998; Reese 2003; Biggs et al. 2005). A more recent study focused on identifying and mitigating safety risk at the design stage of building projects (Zou et al. 2008). These functional approaches encourage safe actions, but their effectiveness depends on the accuracy with which problem areas are identified and the extent to which the approaches are implemented (Peckitt et al. 2004).

Research has shown that the majority of workplace incidents, injuries, and fatalities are attributed to unsafe work practices of employees rather than unsafe working conditions (Garavan and O'Brien 2001; Hoyos, cited in Mullen 2004). For example, some workers believe that following safety procedures, such as wearing safety equipment, is not necessary. Sawacha et al. (1999) described unsafe behavior as the most significant factor causing site accidents. Zou and Sunindijo (2010) claimed that poor attitudes toward safety and lack of interest in safety issues are contributors to high accident rates on-site. Attitudes need to be changed before behavior is changed (Geller 1998); Poriters (2000) identified the "macho image" among workers as the cause of poor safety performance and high accident rates on construction sites.

A review of current safety management practices revealed that the major issue is the lack of a sound safety culture within most organizations and industry-wide. To improve safety performance, it is important to shape a sound organizational culture regarding construction safety (Fung et al. 2005). Lingard and Rowlinson (2005) developed a model that shows how occupational health and safety attitudes might shape related behavior in construction. Their model consists of four elements: "belief about job, job attitudes, behavioural intentions, and the actual behaviour towards safety" (Lingard and Rowlinson 2005). Fishbein and Ajzen (1975) showed that behavioral intentions can translate into actual worker behavior, such as unsafe acts and risk-taking behavior. Fishbein and Ajzen also described the theory of reasoned action as a construct for behavior modification in organizations; this theory provides insight into two determinants—attitudes and subjective norms—that shape behavioral intention, which leads to actual behavior. The theory of planned behavior, an extension of the theory of reasoned action, added perceived behavioral control as another determinant that shapes behavioral intention and actual behavior. Lingard and Rowlinson (2005) explained that past

experiences and anticipated obstacles contribute to people's perception about whether certain behavior is within their control.

CONSTRUCTION SAFETY CULTURE DEFINED

The term *safety culture* can be traced back to the Chernobyl nuclear accident in 1986. At that time, a poor safety culture was identified as a contributing factor to the disaster (International Atomic Energy Agency 1986). Since then, safety culture has increased in popularity, and its poor implementation has been highlighted as the key source of major accidents (Cox and Flin 1998; Health and Safety Executive 2005). *Safety culture* has been defined in a variety of ways. The Confederation of British Industry (1990) defined safety culture as the ideas and beliefs that all members of the organization share about risk, accidents, and ill health. The Advisory Committee on the Safety of Nuclear Installations defined safety culture as the product of individual and group values, attitudes, perceptions, competencies, and patterns of behavior that determines the commitment to, and proficiency of, an organization's health and safety management (cited in Health and Safety Commission 1993).

Fernández-Muñiz et al. (2007) defined safety culture in two ways: as a set of values, perceptions, attitudes, and patterns of behavior with regard to safety shared by members of the organization, and as a set of policies, practices, and procedures relating to the reduction of employees' exposure to occupational risks, implemented at every level of the organization, reflecting a high level of concern and commitment to the prevention of accidents and illnesses. Zou and Sunindijo (2010) found that construction safety culture has three dimensions—psychological, behavioral, and corporate—and proposed a safety culture framework that includes four parts: cause, contents, measurement, and consequences.

Construction safety culture can thus be defined as an assembly of individual and group beliefs, norms, attitudes, and technical practices that are concerned with minimizing risks and exposure of workers and the public to unsafe acts and conditions in the construction environment. A good safety culture has the following characteristics (based on Ostrom et al. 1993):

- The value of and belief in occupational safety are deeply and widely shared within the organization;
- Workers have particular patterns of attitudes and beliefs regarding safety practices;
- Workers might be alert for unexpected changes and ask for help when they encounter an unfamiliar hazard;
- Workers seek and use available information that improves safety performance;
- The organization has a safety management system in

place, and this system is applied to practice and reviewed regularly;

- The organization encourages and rewards individuals who call attention to safety problems and who are innovative in finding ways to locate and assess hazards; and
- The organization has systematic mechanisms to gather safety-related information, measure safety performance, and bring people together to learn how to work more safely.

In recent years, many construction companies have actively searched for better approaches to improving safety performance. This paper presents five cases in which a company focused on the development of a construction safety culture. The cases, drawn from Australia, Hong Kong, and the United States, include Fluor Corporation, Bechtel Group, Bovis Lend Lease, Gammon Construction, and John Holland Group. The section devoted to each case presents the background, implementation, and lessons learned from the safety program.

RESEARCH METHODOLOGY

The research methodology applied to this study consisted of critically reviewing the literature and conducting case studies. Generally, the case study approach is a method of conducting qualitative research; it is an ideal methodology when holistic and in-depth investigation is needed to understand a complex issue. With case studies, participant perspectives on real situations can be captured from inside the organization, leading to an understanding of the current approach to safety management and of the details regarding safety practices. The case studies discussed in this paper were conducted by reviewing company profiles and safety management programs, including implementation processes and lessons learned. Information and data were obtained through published literature and company websites, as well as through direct interviews and discussions with company safety executives and personnel.

CASE 1: FLUOR'S ZERO INCIDENTS SAFETY PROGRAM

Background

Fluor Corporation has a long business history and is one of the largest U.S. contractors operating worldwide in 25 countries. Fluor employed 35,000 professionals and had revenues of US\$13.2 billion in 2005. Fluor devotes considerable resources to its health, safety, and environment (HSE) programs around the globe for reasons that include ethics and compliance with regulatory standards, the value placed on employees and the corporate image, the belief that safe environments are more productive, societal demands for HSE expertise and results, the need to reduce workers' compensa-

tion costs, and the desire to promote the well-being of all stakeholders, including employees, clients, shareholders, subcontractors, and communities (Fluor Corporation 2003, 2004, 2005, 2007). The corporate value Fluor places on its HSE program is motivated by the belief that no job is worth a loss of life or injury, that HSE issues can be managed, and that "zero incidents" is an attainable objective.

At Fluor, HSE responsibilities are an essential component of the business strategy. To achieve HSE objectives, leaders identify HSE risks arising from work activities and reduce them to the lowest practical levels, hold training programs, encourage individual awareness and discipline, and ask for a personal commitment that begins with the CEO and is shared by every employee.

In Fluor's Zero Incidents program, each business group monitors and creates programs to improve HSE-related performance. The safety performance of all business groups is monitored monthly, and performance is evaluated against targets set for each business group. Further, Fluor encourages employees to enhance their own well-being through education and wellness programs.

Implementation

To achieve the zero incidents goal, the company has taken a number of actions, including specifying responsibilities for management, promoting accountability and providing rewards, providing employee orientation and training, establishing a Safety Task Assignment process, enabling performance measurement and monitoring, and managing knowledge. These topics are discussed in turn in the paragraphs that follow.

Fluor's management is responsible for the following:

- Opening each company meeting with an HSE topic for discussion;
- Managing HSE activities in the same manner as productivity, quality, and scheduling;
- Integrating HSE into the company's functions and work processes;
- Accepting accountability for HSE activities; and
- Supporting all HSE initiatives.

Fluor promotes both organizational and personal accountability for HSE performance. For site managers, Fluor was one of the first contractors to award monetary incentives for superior HSE performance. Fluor implements a variety of programs to recognize desired HSE behaviors and results for groups and individuals. Senior management celebrates significant achievements and communicates these across the company. Specific groups within the company tie HSE performance to merit increases, bonuses, and other incentive compensation. Fluor involves employees in the design of recognition and reward systems.

The Bureau of Labor Statistics has estimated that more than 40% of accidents occur during the first year of service (Root 1981). Fluor provides HSE orientation and preventive training to every new employee. In addition to orientation training, employees participate in comprehensive training programs in the areas of compliance, behavior, and culture. The safety leadership training module for managers emphasizes employee coaching, communications, behavior modification, and team building skills.

In Fluor's Safety Task Assignment process, supervisors and employees

- Define the tasks for each activity,
- Identify known and potential HSE hazards associated with each task,
- Determine work practices to complete the task safely,
- Address requirements for all personal protective equipment, and
- Establish that all crew members understand the above information.

Fluor's HSE professionals and site managers use the comprehensive incident reporting system to provide management with real-time information on problem operations, issues that affect HSE performance and compliance, program deficiencies, and program successes. Fluor's monthly HSE incident summary report from each business unit reports accidents, incidents, and unplanned events; describes activities and processes that produce desired results; and indicates level of compliance with HSE systems.

Fluor's global electronic knowledge management system enables its HSE professionals and discipline experts to share collective data from lessons learned and best practices and to collaborate on real-time issues across time zones. Fluor uses internal systems to hold regular regional forums and teleconferences to address topics in the areas of root cause analysis, implementation of new regulatory standards, and emerging trends.

Lessons Learned

The Fluor case study reveals the following lessons learned for successful HSE programs:

- Top management is committed to the objectives and goals, management and implementation processes, audit and feedback mechanisms, and regular review and improvement of the HSE program. Management takes a proactive approach to creating safe work environments and is accountable for providing safety education and training for all employees, continuously reviewing the program to identify potential areas of improvement, and ensuring a thorough evaluation of all incidents.
- The organization works closely with customers, suppliers,

and contractors to ensure that the HSE program is comprehensive.

- The corporate culture includes a deep belief that all incidents and injuries are preventable and that the objective of "zero incidents" is achievable through education and training, monitoring, audit and feedback mechanisms, and continuous improvement.
- The organization has procedures for reporting HSE performance, for investigating and recording all incidents and complaints, and for taking appropriate corrective action to avoid recurrence.
- Records are maintained and information and statistics are reported to corporate and regional HSE management. Formal auditing procedures are defined and implemented. Deficiencies identified during audits are recorded formally, their implications are assessed, and corrective actions are prioritized.
- Excellent safety performance is rewarded not only verbally but also in monetary terms.
- Knowledge gained through safety task assessment and implementation is recorded and applied to future projects to increase the organization's safety management capability and maturity.

CASE 2: BECHTEL'S ZERO ACCIDENT PROGRAM

Background

Bechtel Group, founded in the United States in 1898, has more than 50,000 employees in more than 50 countries and concentrates in engineering, procurement, and construction. Currently, the company has more than 1,000 environment, health, and safety (EH&S) personnel worldwide. Bechtel's safety and health approach includes state-of-the-art safety data systems, computer-based training, and a behavior-based safety program. Its strong commitment to safety extends from the boardroom to the field, and every employee has stop-work authority: "If it's not safe, don't do it." The organization believes its dedication to safety helps keep workers safe, pays off for customers, brings down operating costs (including insurance), and raises productivity because less time is lost to accidents. Bechtel has achieved zero lost-time incidents on 90% of its projects worldwide, representing more than 100 million work hours per year (Bechtel Corporation n.d.).

Bechtel Group adopted "zero accidents" as its goal in safety practices, rather than "lowest average" in the industry. Like Fluor, Bechtel believes that every accident and injury is preventable, and this philosophy is embedded into every project through a combination of technical field procedures and ongoing training programs. Any unsafe behavior must be managed, all unsafe conditions must be corrected, all ac-

cidents must be reported and investigated, and projects in all locations throughout the world need to comply with this philosophical concept (Bechtel n.d.; Berg 2006).

The Zero Accident Safety Management System was developed with four objectives (Berg 2006):

1. Identify areas of strength within EH&S systems and processes,
2. Identify areas where improvements are necessary for continued growth of EH&S initiatives,
3. Foster ownership of EH&S processes from all levels of workers, and
4. Ensure success in EH&S program implementation.

Bechtel's EH&S management system consists of ten elements (Berg 2006): (1) commitment and leadership, (2) objectives and strategies, (3) organization and resources, (4) EH&S risk management, (5) planning, (6) competency and behavior management, (7) work with customers, (8) work with contractors and others, (9) implementation and monitoring, and (10) auditing and review.

Implementation

Bechtel's commitment to zero accidents extends to every aspect of a project, including subcontractors and partners. The implementation of Bechtel's safety management system included ensuring management commitment and support, standardizing ES&H procedures, promoting competency and behavior management, establishing employee-owned ES&H processes, and monitoring, auditing, and reviewing performance. These topics are discussed in turn in the paragraphs that follow.

Visible, sincere, consistent, believable, genuine, and constant management leadership and commitment are provided to improve safety performance. Safety is not placed behind cost, schedule, or quality. The following statement is a good example of top management's commitment in supporting safety improvement: Riley Bechtel, CEO of Bechtel Group, said,

"I sincerely believe all accidents and all injuries are preventable. Accidents don't just happen. They occur primarily because of someone's unsafe behaviour. Correcting that behaviour is the only way we'll get to Zero Accidents. Zero Accidents means exactly that—zero. When it comes to preventing accidents, nothing less than perfection will do" (Berg 2006).

The company has developed standardized ES&H procedures that are required on all projects in all countries. Minimum acceptable ES&H requirements are based on global best practices. The procedures are reviewed annually and updated as required. Performance is formally assessed to ensure

compliance at all times. The procedures allow for consideration of other specific requirements, such as country-specific regulations and standards. Since the company operates in many countries, to overcome language barriers multinational workers are provided with language training and translated work safety documents and procedures before they arrive on-site, and multilanguage safety signs with pictograms are displayed on-site (Berg 2006).

To maintain worker competency and manage behavior, Bechtel developed an ES&H competency program and procedures that include job-specific training and people-based safety processes. Employees are recognized as important entities in the company; safety improvements can be made only if all strategies receive the full support of all employees, from field workers to top management. Employees conduct regular ES&H inspections in all work areas to evaluate tools, equipment, and work conditions and follow prework and postwork requirements on housekeeping. EH&S risk management and job hazards analysis and pretask safety talks are conducted to identify and eliminate or control job site hazards. In addition, employees observe their fellow workers at work with an aim to identify and eliminate risk behaviors.

Construction safety focuses on process rather than results in the belief that when the process is successfully implemented and managed, the desired results are more probable (Berg 2006). The ES&H process includes the following three steps (Berg 2006):

1. *ES&H risk management*—ES&H hazards are identified, and all risks associated with the hazards are managed properly. The risk matrix approach is used to assess project risks, and hazards and their mitigation methods are communicated to employees. Risk assessments are updated frequently.
2. *ES&H planning*—Bechtel's plans to achieve ES&H excellence were developed taking into consideration the necessary external and internal ES&H requirements.
3. *Documentation of lessons learned*—Lessons learned from previous projects are documented and reviewed for future projects. Reviewing past mistakes gives workers the opportunity to discuss possible problems, suggest solutions, and prepare for the worst. Analyzing previous mistakes helps the organization set new strategies for future projects and influences future policy changes in the company.

ES&H performance is monitored and documented to ensure compliance with company standards. An auditing process is also conducted to ensure that safety requirements are current and identify improvements. All auditing results are reported to the management team and carefully documented.

Lessons Learned

The following elements of the Bechtel case study provide lessons learned for successful HSE programs:

- Safety is regarded as a core value in any process and workplace. Projects in all locations must adopt safety as a core requirement before planning and performing tasks. Bechtel differentiates between “priorities” and “values”; priorities can change from hour to hour and day to day, depending on aspects such as cost, quality, or schedule, but values do not change.
- Performance-based leadership can be used to change at-risk behaviors by first understanding and analyzing the reasons people behave in certain ways and then using behavioral modification techniques to improve human performance. Leadership at every level involves guiding and motivating others to want to do the right things and then to do those things in the right way (Berg 2006).
- Computer-aided, behavior-based safety trainings are provided to all employees and supply chain members. The success of safety programs depends not only on top management and supervisors, but also on general workers, clients, contractors, and others in the supply chain. Without strong support from all parties involved in the project and effective leadership from the management team, the aim of zero accidents cannot be achieved.
- The organization addresses cultural differences in language, behavioral norms, social standing, economics, religion, politics, and education. Standards and safety manuals are translated into different languages.
- The organization implements project life cycle safety management beginning with project planning through to project completion.
- A standardized job hazard analysis and database system are in place worldwide for management and employees to use when conducting safety risk identification, assessment, and responses. Lessons learned from the process are captured in the database system for future reference.

CASE 3: BOVIS LEND LEASE’S INCIDENT AND INJURY FREE PROGRAM

Background

Bovis Lend Lease (BLL) has about 7,500 employees in 93 offices around the world. The company is committed to fostering a culture in which individual employees seek to achieve a workplace free of incidents and injury (Lend Lease 2006). Its Incident and Injury Free (IIF) program focuses on improving performance and safety-related beliefs, attitudes, and organizational culture. To do so, BLL employed a consultant to provide independent advice on how to develop a safety culture, enhance environmental resources management, and audit safety performance. The IIF safety initiative was launched in November 2002.

The Incident and Injury Free program encourages employees to be intolerant of any injury or incident, regardless of frequency or severity. The main focus is on the human side of safety, on shaping workers’ beliefs about and perceptions of sound safety. For example, the IIF program provides a platform for workers to approach management if something is wrong without fear of blame. The IIF program has resulted in increased safety awareness among construction workers and provides opportunities for continuous improvement. The program has been implemented at two levels—strategic and operational.

Strategic Implementation

The strategic level of implementation involves owning, enabling, and sustaining the program. These topics are discussed in turn in the paragraphs that follow.

BLL leadership asks all parties at all levels to own—that is, to commit to and be involved in—the IIF program. Workers are encouraged to believe that all injuries are preventable; no injury is acceptable, and the organization will not rank schedule, cost, or production ahead of an injury-free workplace. All stakeholders, including clients, designers, subcontractors, and suppliers, are educated in the importance of this vision in improving safety performance. The IIF program also works as a driver of BLL’s business and industry strategy and has become a core value of the company.

To enable the organization’s alignment with IIF, all policies and management structures and roles were restructured, redesigned, and clarified to match the IIF vision. Furthermore, the IIF vision was incorporated into the communication plan to influence the culture and behaviors of the organization and employees consistent with the vision. All key business systems and processes were also aligned with the IIF vision. Training sessions were held to provide workers with vision-related skills and knowledge.

To sustain the IIF initiatives, BLL shares the benefits of its transformation with its external stakeholders. The company invests in research, innovation, and benchmarking to redefine the vision. The organization also sustains leadership commitment by reviewing, recognizing, and rewarding leader behaviors that contribute to the achievement of the IIF vision. The organization’s living communication plan uses feedback from all stakeholders to update the message and align the plan with the vision.

Operational Implementation

The operation-level implementation includes orientation, accountability and authority, reporting and management, communications, and updating. These topics are discussed in turn in the paragraphs that follow.

As part of their training, employees, owners, and supply chain members are all oriented to the IIF concept and the

ways it improves safety performance through either a 2-day IIF leadership commitment workshop or a 4 h IIF orientation training session. This orientation allows each individual to explore the daily and long-term issues addressed by the program on a personal level.

Ultimate accountability for the success of the IIF program lies with the executive committee, but operations takes the lead at all levels of the business. The health and safety director or executive committee leads the implementation of the business plan and corresponding transformation at the business unit level. Each business unit establishes a safety leadership team responsible for planning for the necessary resources (both internal and external) and ongoing facilitation and coaching all the way to the project level. Required resources include a communication platform, human resources management, information technology for information dissemination and storage, and local health and safety officers.

The communication plan for the IIF concentrates on two key areas: winning workers' hearts and minds and spreading the news about safety issues. Traditional methods of communication, such as Internet, intranet, and newsletters, are used (Lend Lease 2002). IIF communications seek to create a significant shift in mindset and attitude toward health and safety issues; to ensure that every communication opportunity is maximized, consistent with the health and safety strategy and the needs of the audience; to support, guide, and illuminate the debate, providing data on progress and constantly enlivening the effort; and to maintain the topic as a "conscious consideration" through profiling people, progress, insights, and innovations. The communication program is an integral part of the IIF business plan and is consistent worldwide. Sharing information about the Incident and Injury Free program helps embed a culture of safety at all levels of the organization.

Updates on the IIF program and data on improvements in health and safety are regularly communicated throughout the BLL group.

Lessons Learned

The following elements of the Bovis Lend Lease case study provide lessons learned for safety performance and culture development:

- The organization views the human side of safety as an important aspect of safety performance and culture improvement and seeks to shape workers' beliefs and perceptions about good safety to influence their attitudes, beliefs, and values and ultimately their behavior.
- The safety leadership team leads the organization in following the program's vision and mission and disseminates information about safety within the entire organization.

- The program helps remove communication barriers between management and workers, allowing workers the opportunity to share issues, concerns, and ideas on how to promote safety effectively.
- The program engages all supply chain members by creating an environment in which all parties work together, promoting common beliefs regarding sound safety, and providing a forum for feedback on improving safety performance.
- All employees, from the top level to the lower levels, are trained to follow safety management processes. Regular safety meetings help the company maintain a safe working environment and culture.

CASE 4: GAMMON'S SAFETY FIRST, ZERO ACCIDENT PROGRAM

Background

Gammon Construction originated as a construction business in India in 1919, and subsequent branches have been established in Asia, the Middle East, and Africa. In 1958, Gammon was organized to establish a permanent presence in Hong Kong and has become a leading contractor in that country with offices in Singapore, Malaysia, and mainland China. Its business covers piling, foundations, substructures, tunneling, bridges, buildings, marine works, and water storage facilities. The company has an annual turnover of US\$1 billion with 2,000 full-time staff, including 450 professional engineers and builders and 2,000 skilled workers (Gammon Construction 2005).

To reduce construction injuries and accidents and to understand the basis for safe behavior, Gammon carried out a large-scale survey to examine the safety culture of workers, including safety-related values, attitudes, and behavior, on 50 projects. The results showed that workers' safety behaviors were dependent on various factors, such as project nature, client requirements, supervisors' attitudes, and management support and commitment. Following this study, Gammon's management initiated a program called Safety First, Zero Accident aimed at improving workplace safety by changing workers' behaviors (Gammon Construction 2004).

Gammon's approach is to go beyond compliance to achieve the goal of zero accidents (Smyth 2006). The company put safety as the highest priority for its workforce, subcontractors, customers, and the public. The Safety and Environmental Action Committee, chaired by the director of the company, provides guidance and directives on all health and safety matters. Gammon regularly audits health and safety performance to seek further improvement.

Implementation

The company implements a comprehensive range of measures, including leadership and commitment from all levels,

safety risk assessment at the design stage, deployment of registered safety personnel at all construction sites, ongoing safety training, and the application of information technology to improve safety performance. These topics are discussed in the paragraphs that follow.

Leadership and commitment to safety from all levels are ensured at the front line by training the professional workforce; identifying, extracting, and focusing on supervisory talent; engaging in frontline risk assessment; and ensuring fair accountability. At the corporate management level, leadership and commitment to safety are ensured through the risk management process, reward and discipline, feedback from the front line, identification and swift action to address “near misses,” observation of workers’ behavior for potential risk, avoidance of complacency, constant awareness of safety issues, and special attention to night work.

Safety risk assessment is conducted at the project design stage to identify possible hazards during project implementation (e.g., construction and operation) and to find possible solutions. The design process has a significant impact on project implementation, and design changes are regularly made to reduce hazards.

Deployment of registered safety personnel at all construction sites enables the organization to continuously monitor and advise workers on safety. These personnel are responsible for preventing accidents, promoting safe working practices, and providing professional advice and training (Gammon Construction 2005). They instituted the “point and call” activity, a mind-setting approach adopted from Japan in which workers and supervisors shout out their safety goals of zero accidents to imprint safety issues in the minds of workers. Further, safety personnel provide presentations to workers at daily morning assemblies demonstrating both good and bad practices that occur on the site.

To maintain consistency in health and safety standards among subcontractors and suppliers, Gammon has a full-day training course entitled “HSE Management System for Subcontractors” that provides essential safety and health training. At the end of the workshops, participants demonstrate their understanding of the importance of safety and their commitment to ensuring zero accidents by joining Gammon in signing a Safety Charter.

In applying information technology to improve safety performance, the company has used enterprise resource planning software to provide a web-based system for reporting all environmental, health, safety, and security incidents. It provides comprehensive data analysis for identifying trends or patterns, documenting accident cause investigations, and presenting health, safety, and environmental data.

Lessons Learned

The following elements of the Gammon case study provide lessons learned for successful safety programs:

- The organization concentrates its promotion of safety leadership and commitment on two different levels: workers and corporate management.
- Safety risk assessment at the design phase reduces and mitigates safety risks.
- The “point and call” reinforces in workers’ minds the importance of safety.
- On-site safety personnel help maintain compliance with safety procedures and standards, give advice on safety issues, and act as intermediaries between workers and top management.
- Subcontractors and suppliers receive training in safety-related beliefs, attitudes, and behaviors.

CASE 5: JOHN HOLLAND’S ZERO HARM PROGRAM

Background

John Holland Group was established by Sir John Holland in 1949 and is one of the largest construction companies in Australia, with more than 2,000 employees nationwide (John Holland Group 2009a). The Group’s principal businesses include civil engineering and infrastructure construction, nonresidential building and construction, and rail construction and maintenance. The company is recognized as an industry leader in health, safety, and environmental management. Central to John Holland’s business culture is a commitment to the health and safety of its employees and everyone who visits its work areas.

John Holland’s Zero Harm approach to safety in construction sites is described as “sending our people home in the same condition in which they arrived to work” (Bookogianne 2006). The Zero Harm program links clients and the management team in achieving the goals of performing work on time, within budget, with good quality, and without sacrificing the safety and health of any workers at any time or anywhere on the site. The client sets the challenge for the company to deliver best practices on the project; the management team takes up the challenge and develops the tools to maintain good safety conditions.

Implementation

John Holland’s Occupational Health and Safety and Work Cover Management System sets clear expectations and minimum standards at the group level for all operating and support processes that are able to be consistently applied across all operations (John Holland 2009a). Besides improving the safety management system, the group also identifies primary responsibilities for all “safety-critical” positions within the group and the actions each person with such a role is required to take to ensure they meet their responsibilities and

achieve safety excellence in the workplace (Cipolla 2006). The Zero Harm targets (John Holland Group 2009b) include the following:

- Complying with all applicable laws, regulations, and statutory obligations;
- Ensuring all employees, clients, and subcontractors endorse the Zero Harm vision;
- Establishing and continually developing safety education systems and training;
- Ensuring consistent safety practices across work sites;
- Eliminating or controlling hazards;
- Undertaking regular audits of safety practices and management systems;
- Taking disciplinary action when people disregard health and safety procedures and practices;
- Ensuring that all incidents and near misses are fully investigated and actions are taken to prevent recurrence;
- Taking specific action to improve safety performance;
- Providing regular and targeted safety communication to employees, subcontractors, and clients; and
- Providing an effective system of rehabilitation and return to work for injured employees.

In addition, all employees are required to

- Adhere to the company's safe work practices, objectives, and instructions;
- Immediately report any unsafe work practices, equipment, or conditions to their supervisors;
- Not misuse, damage, refuse to use, or interfere with anything provided for the purposes of occupational health and safety; and
- Perform work in a manner that promotes health and safety for everyone.

Lessons Learned

The following elements of the John Holland case study provides lessons learned for successful safety programs:

- In safety training, the company focuses on attitudes and beliefs that lead to safe behavior.
- The safety approach focuses not only on internal employees but also clients and subcontractors.
- The responsibilities of all safety-critical positions are identified to ensure these personnel meet their responsibilities to achieve safety excellence in the workplace.
- Full investigation of all incidents and near misses leads to improvements in safety.
- Disciplinary action is taken against workers who disregard health and safety procedures and practices.

DISCUSSION

The safety initiatives and programs discussed in this paper seek to improve safety performance, reduce incidents and

injuries to zero, and shape a strong and positive safety culture. Good safety performance means continuous business for the company, and these organizations have made their attempts to improve safety paramount. Seven common themes were revealed through the study of these five cases:

1. All cases emphasized the importance of human factors, including attitudes, beliefs, values, mindsets, and behavior and performance.
2. In all five cases, programs were set up to shape the belief and value that all incidents and injuries are preventable and unacceptable to management and workers.
3. All cases reflected the importance of a commitment and leadership from top management as a fundamental factor in shaping a strong construction safety culture.
4. All cases highlighted the need to engage the entire supply chain and every project stakeholder, each of whom has interests in and influence over construction safety.
5. All cases had established safety risk management systems to support ongoing monitoring through reporting, auditing, and reviewing safety performance, as well as updating communications and procedures.
6. In these five cases, clear authority and accountability for construction safety were established, and safe behavior was rewarded.
7. A safety knowledge database was established to capture lessons learned so that risk management principles and techniques could be integrated into safety management processes in all five cases.

In addition, some of the companies began addressing the safety target earlier in the project life cycle—in the planning and design stages, rather than waiting until the construction stage—and extended this consideration to the entire project lifecycle. Several companies applied knowledge management and feedback mechanisms to close the loop of the safety management process by disseminating knowledge gained from each project to improve safety knowledge and performance on future projects.

Ultimately, the success of any safety program depends as much on people's attitudes and behaviors as it does on program design. Although it is easy to bring about behavioral change, it is very difficult to maintain the changes achieved (Loosemore and Zou 2006). Developing a safety culture for a construction project or organization does not occur overnight; it is a journey rather than a destination, and it requires a commitment from top management right down to individual employees over an extended period. Construction organizations adopting a new approach to safety management must continue to champion the new philosophy and moni-

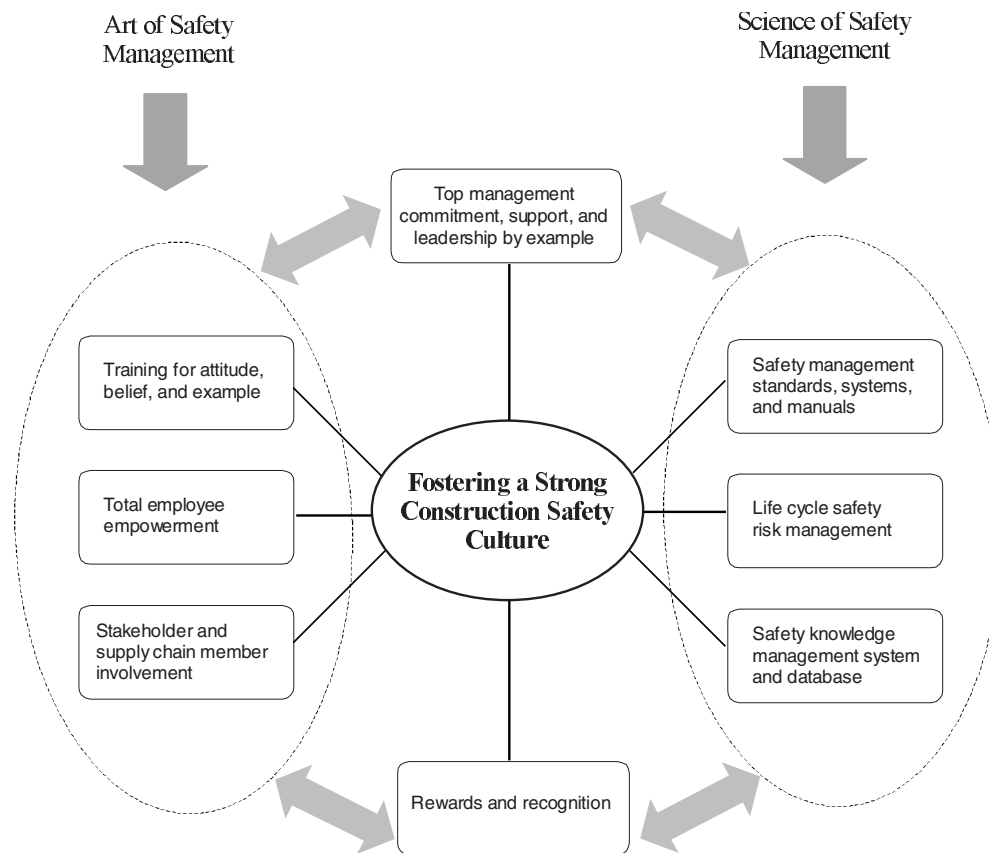


Figure 1. Conceptual model for fostering a strong construction safety culture

tor performance, learning the lessons and feeding them back into business processes and management practices. These efforts must be supported by an effective training, motivation, and performance appraisal system to reinforce appropriate behavior (Loosemore and Zou 2006).

Although fostering a strong construction safety culture is vital, developing and implementing standardized occupational health, safety, and environmental risk identification, assessment, and management systems are equally important. The vision of zero incidents can be achieved only by balancing the two sides of the coin—the science and art of construction safety management. Fig. 1 depicts a conceptual model for fostering a strong construction safety culture in which the art balances the science of construction safety management.

CONCLUSION

Safety is a fundamental physical and psychological need of human beings, and there is no exception in construction. Human resources are the main asset of any construction company. Construction is a labor-intensive industry; management needs to focus on maximizing the productivity of workers without sacrificing their health and safety, and

workers need the right mindsets, beliefs, values, and attitudes to maximize their own and others' safety. A strong construction safety culture requires both effective management systems and an appreciation of the human behavior within an organization. Shaping such a culture requires a concerted, collaborative effort between management and workers, as well as all members in the construction supply chain, throughout the entire project life cycle.

Through the literature review and study of five cases, this paper has highlighted the fundamental elements of programs that foster a strong construction safety culture in which the human side of safety is emphasized. The cases provide good examples of how construction companies can promote and develop a strong safety culture. The vision of zero incidents and injuries on construction sites is achievable when management, workers, and all other members of the construction supply chain have the right beliefs, values, and attitudes and adopt appropriate behaviors and when the organization has an integrated safety management system that encompasses not only policies, regulations, and site conditions, but also the human factors.

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