SAFER CONSTRUCTION: THE DEVELOPMENT OF A VOLUNTARY CODE OF PRACTICE TO IMPROVE SAFETY PERFORMANCE IN THE AUSTRALIAN CONSTRUCTION INDUSTRY

Peter Godfrey, Director, BAS Consulting, Melbourne, Australia

Helen Lingard, RMIT University, Melbourne, Researcher, CRC – Construction Innovation, Australia

Abstract
In Australia, between 1994 and 2000, 50 construction workers were killed each year as a result of their work, the industry fatality rate, at 10.4 per 100,000 persons, is similar to the national road toll fatality rate and the rate of serious injury is 50% higher than the all industries average. This poor performance represents a significant threat to the industry's social sustainability. Despite the best efforts of regulators and policy makers at both State and Federal levels, the incidence of death, injury and illness in the Australian construction industry has remained intransigently high, prompting an industry-led initiative to improve the occupational health and safety (OHS) performance of the Australian construction industry. The 'Safer Construction' project involves the development of an evidence-based Voluntary Code of Practice for OHS in the industry.

Keywords: Occupational health and safety, social sustainability, voluntary code of practice

1.0 Introduction

The International Labour Organization estimates that there are at least 60,000 fatal accidents on construction sites around the world each year. This means one construction fatality occurs every ten minutes. Construction accounts for a staggering 17% (one in six) of all fatal workplace accidents (ILO, 2005). In Australia, between 1994 and 2000, 50 construction workers were killed each year as a result of their work. The construction industry fatality rate, at 10.4 per 100,000 persons, is similar to the national road toll fatality rate and the rate of serious injury is 50% higher than the all industries average (McWilliams et al 2001; Cole 2003). This poor performance has a major impact upon the quality of life of industry participants and their families. There is a compelling moral case for improving the industry's appalling occupational health and safety (OHS) performance. Further, with growing emphasis on corporate social responsibility, triple bottom line reporting and social sustainability, there is considerable pressure upon the larger players in the industry to actively work to eliminate deaths and reduce rates of workplace injury and illness.

Partridge (2005) defines a socially sustainable society as one that is 'just, equitable, inclusive and democratic, and provides a decent quality of life for current and future generations' (Partridge, 2005). That workplace deaths, injuries and illnesses reduce the quality of life of current and future generations is self-evident. However, the construction industry also seems to have a more harmful impact upon the quality of life of its workers than other sectors. International studies reveal that construction workers are a particularly high risk group for work-related disability. For example, Guberan and Usel (1998) followed a cohort of 5137 men in Geneva over 20 years and report that only 57% of construction workers reached 65 years of age without suffering a permanent impairment. Further, Australian research shows that many construction organizations do not provide systematic rehabilitation or return-to-work processes for injured workers (Lingard & Saunders, 2004).

The human impact of work-related deaths and injuries in the construction industry is unacceptable. However, there is also a compelling business case for the improvement of OHS. In many industrially developed nations, including Australia, the construction industry faces a severe shortage of skilled labour. As one senior manager in the construction industry has publicly stated: 'We can go and buy as much equipment as we want, we can buy construction materials from all over the world, we don't have any shortage of clients in the current market, but we haven't got enough quality people' (David Stewart, quoted in the *Herald Sun*, October 17th 2006). A recent report by the Minerals Council of Australia (2006) reveals that by 2015 the minerals sector in Australia (which competes with construction for skilled labour) will need to employ 70,000 more employees than it currently employs. The greatest absolute increase in demand is forecast for tradespersons (26,983 additional employees required) and semi-skilled employees (22,059 additional employees required). In the context of a population that is ageing, the growing shortage of skilled labour is set to become a critical issue for economic survival.

1.1 Aims

This paper reports on an industry-led initiative, titled 'Safer Construction,' which aims to improve the OHS culture and performance of the Australian construction industry. This improvement will be driven through the development (and ultimately adoption) of a Voluntary Code of Practice (VCOP) for OHS. The VCOP adopts an 'holistic' view of OHS in the construction context, articulating OHS 'best practice' for clients, designers and constructors. By engaging all of the key participant groups in the development of the VCOP, it is expected that significant improvements in the way in which construction projects are procured, designed and constructed will be achieved. These improvements will help to ensure that OHS becomes an integral part of the pre-construction activities of procurement and design, and not just an issue for those involved in the construction of a building or structure. This paper describes the rationale for the VCOP and the process by which it is being developed. The VCOP structure is outlined and some preliminary results of an analysis of OHS 'best practice' in the Australian construction industry are presented. The paper concludes with a discussion of the lessons learned from the 'Safer Construction' project.

2.0 Rationale for the project

The 'Safer Construction' project is an initiative of Engineers Australia and is championed by former Engineer of the Year, Bill Wild. When appointed as 2004 Civil Engineer of the Year, Mr Wild delivered a thought-provoking acceptance speech focused on the need to bring about genuine and sustainable improvement in the OHS performance of the Australian construction industry. On the basis of this speech, Engineers Australia's Civil College Board established a new committee, chaired by Mr Wild, to address the issue of construction OHS. Under the auspices of this committee, a task force of senior industry participants was formed and funding obtained from the Co-operative Research Centre for Construction Innovation for the ground-breaking 'Safer Construction' initiative. What makes Safer Construction unique is that the task force guiding the development of the VCOP is made up of senior representatives of major industry stakeholder groups, industry peak bodies and professional institutions. Represented are: Engineers Australia; the Property Council of Australia; the Australian Procurement and Construction Council; the Association of Consulting Architects Australia; the Association of Consulting Engineers Australia; the Royal Australian Institute of Architects; the Australian Constructors Association; and the Master Builders Association. Also invited to participate in the task force is a representative of the Office of the Federal Safety Commissioner. Thus, the task force is representative of construction clients, the design professions and constructors, as well as government and policy makers. The engagement of this diverse stakeholder group ensures that the VCOP adopts an 'holistic' view of construction OHS, reflecting a realistic and reasonable allocation of responsibility for OHS among clients, designers and constructors. As depicted in Figure 1, it is recognised that each party has some unique responsibility for construction OHS while acknowledging that the interface between these three parties also has a significant impact.

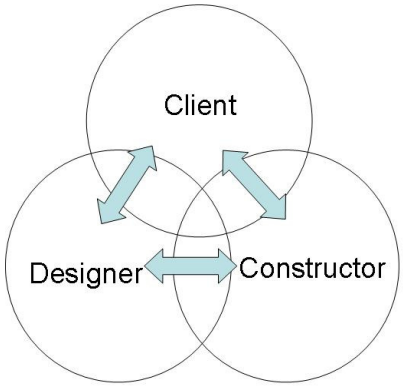

Figure 1: An 'holistic' view of construction OHS

2.1 The role of clients

Modern theories of accident causation recognise the importance of organisational issues and management actions in contributing to workplace accidents (Reason, 1990). In the construction industry, root cause analyses of accidents reveal that many on-site accidents can be attributed to professional or managerial failures arising well before work commences on site, most notably in the project planning and design stages (Bomel, 2001, Suraji et al 2001; HSE 2003). Consequently, there is a growing trend for OHS management responsibility to be driven up the supply chain, and be partially borne by construction clients, and the designers of buildings and facilities.

Research by the Health and Safety Executive (UK) identifies client requirements as being one of the most significant root causes of on-site accidents (HSE 2003). Arguably, as the initiators of projects, clients are in the best position to drive the cultural change needed to bring about further OHS improvements in the construction industry (Levitt and Samelson 1993; Liska et al 1994; Lingard & Rowlinson 2005). Bomel (2001) identified client company culture and client contracting strategies as areas presenting considerable opportunities for OHS improvement in the UK construction industry. The client's selection of project delivery strategy influences the extent to which designers are motivated to consider

issues of OHS and constructability in their design decisions (Gambatese et al 2005). Recent US-based research by Huang and Hinze (2006a; 2006b) provides the first serious attempt to empirically evaluate the impact of a range of client-led OHS initiatives on OHS performance in the construction process. The US research revealed that the involvement of the client in pre-project planning, financially supporting the constructor's safety program and participating in the day-to-day project OHS activities were important requisites for excellent project OHS performance (Huang and Hinze 2006a; 2006b). Consistent with these findings, Winkler (2006) describes how client involvement in construction contractors' OHS processes has created a set of shared values supportive of OHS in the UK construction industry. Clients make key decisions concerning the project budget, project objectives and performance criteria. Clients also determine project time-lines, which can create the type of pressures and constraints known to have a significant impact upon OHS during construction (Suraji et al 2001). The Safer Construction project recognises that there is much that construction clients can do to foster a positive OHS culture in the construction projects they procure. The VCOP identifies OHS best practices for construction clients that will enable Australian clients to push best practice into the construction projects they procure.

2.2 The role of designers

In Australia the *National OHS Strategy 2002–2012* defines the elimination of (physical) hazards at the design stage an area of national priority. The strategy aims "to build awareness and observance of this approach and to give people the practical skills to recognise design issues and to ensure safe outcomes". In his review of Victorian OHS legislation, Chris Maxwell cited statistics provided by the National Occupational Health and Safety Commission (now the Australian Safety and Compensation Council) (Maxwell, 2004). According to NOHSC:

- in a two year period ending 30 June 2002, 77 (37%) of 210 workplace fatalities recorded in the National Coroner's Information System definitely or probably had design-related issues involved and, in another 29 (14%), the circumstances were suggestive that design-related issues were involved;
- Design-related issues were definitely or probably involved in 46.5% of fatalities in the construction sector during this period; and
- Of 2,705 compensable serious and fatal injuries recorded in the National Data Set for Compensation-based Statistics, at least 30% appeared to be contributed to by design issues (NOHSC 2004).

Critics of the safe design concept as it applies to construction, argue that many of the statistics generated by bodies like NOHSC are not industry-specific and, even when the construction industry is expressly mentioned, many incidents reflect issues in the design of construction processes or plant/equipment rather than design of the finished structure (Driscoll et al 2005). Notwithstanding this problem, the case for design OHS in construction is compelling. Recent analysis identifies design as a causal factor in fatalities and serious injuries in the construction industries of other developed economies (Suraji et al. 2001; Behm 2005). Gibb et al. (2004) conducted a detailed review of 100 construction accidents that occurred in the UK and report that, in 47% of cases, a change in the design of the permanent structure would have reduced the risk of injury. This is not to say that design was the only contributing factor but that the design of the permanent structure *contributed to* the injury. Designing for OHS is also consistent with the 'hierarchy of controls' adopted in OHS risk management. This hierarchy is based on the principle that control measures that target hazards at source and act on the work environment are more effective than controls that aim to change the behaviour of exposed workers (Martens 1998). In many instances, design decisions can be regarded as the 'source' of OHS risks in the construction industry. This is illustrated by well-publicised case studies of hazard elimination or risk reduction achieved through careful consideration and selection of design options. See, for example, the documented case studies or the safe design guides published by the not-for-profit UK organizations Design Best Practice (http://www.dbp.org.uk/pages/welcome.htm) and Safety in Design (http://www.safetyindesign.org/).

2.3 The role of constructors

Constructors have traditionally borne the largest portion of responsibility for construction OHS. Constructors factor the cost of OHS into tenders for construction work, plan the construction work to be performed, source and procure materials and plant/equipment necessary to build a structure, engage and manage sub-contractors, design construction processes to be implemented and co-ordinate the resources required to deliver a building or structure. The role played by constructors in the management of OHS throughout the construction stage of a project is therefore critical. Most large construction organizations have established corporate OHS policies and implemented sophisticated OHS management systems and processes that are subject to independent third party audits. These systems include OHS risk assessments, the production of detailed plans and statements documenting safe working methods, training, monitoring and reporting processes. While these activities are critical, there often exists a 'disconnect' between the content of OHS policy statements and procedure manuals and 'lived' safety

practices on-site. Managers of construction projects face multiple goals. Production targets must be met, costs must be constrained within budgets and quality issues must be managed to ensure customer satisfaction and shareholder value. OHS is therefore only one – albeit a very important - facet of organizational performance to which construction managers/supervisors must pay attention. Unfortunately, production and cost pressures can sometimes compete with OHS goals and, if managers are not careful, employees' perceptions of performance pressures in other areas can lead them to believe that cutting corners with respect to OHS is an expected part of their job (Hofmann and Stetzer 1996). In the context of these pressures, intentions communicated by site managers and supervisors as to what top management 'really wants' are not always consistent with the contents of formal policy statements (Leather, 1987). Furthermore, taking "short cuts" can become a normal way of working where competing performance pressures exist when the consequences of unsafe working are perceived to be 'rewarding.' Such rewards could include receiving praise for completing a job earlier than expected or receiving a productivity bonus. Site level managers/supervisors play an important role in shaping employees' beliefs about importance of OHS relative to other organizational goals. For this reason, the Safer Construction project focuses on leadership behaviour and the demonstration of genuine and consistent management commitment to OHS within construction organizations. The VCOP identifies OHS best practices that support the development of strong on-site safety cultures and overcome the gap between what organizations 'say they do' with regard to OHS and what actually happens on-site.

The VCOP also focuses upon the entrenchment of OHS best practice throughout the industry. In particular, practices that will encourage the take-up of OHS best practice among small to medium-sized enterprises (SMEs) will be identified. SMEs make up the majority of firms in the Australian construction firm but are known to struggle to meet the requirements of Australia's performance-based OHS legislation due to a lack of formalised OHS management systems, resource constraints and lower levels of OHS knowledge (and/or access to expertise).

3.0 The VCOP framework

The VCOP framework establishes a project process, typical of the delivery of construction projects. The project process is divided into planning, design, construction and post-construction stages of a project. The VCOP identifies OHS best practices within each stage in the project process and identifies the roles and responsibilities of client, designer and constructor in relation to these practices.

3.1 Best Practice Principles

This section of the VCOP establishes general principles for the management of OHS within the project process. The general principles are considered 'best practice principles' based on identified exemplary OHS performance from national and international studies. The primary objective of the best practice principles is to establish a foundation for the development of a shared responsibility for all stakeholders that can have an impact on the OHS performance for delivery of a construction project. These principles are presented below.

The framework for the VCOP is driven by six principles for creating a strong OHS culture. These principles are intended to operate at an industry level and establish broad values by which organisations within the industry should operate. The best practice principles also establish a foundation for the development of a shared understanding of the importance of OHS and the development of a culture of OHS within project teams. The success of the practices identified in the VCOP is highly dependent upon corporate and project-level OHS cultures that are based on these principles.

Principle 1: Demonstrate Safety Leadership

In any construction project there are many competing objectives such as quality, cost, time and production. Furthermore, different stakeholders involved in these projects have their own objectives. In the context of these pressures, safety messages can become mixed and organisations do not always do what they commit to in formal policy statements and safety plans.

For this reason, it is critical that, from top management down to front-line supervisors, strong safety leadership is demonstrated. Safety leadership involves communicating the importance of safety in interactions with subordinates, subcontractors, suppliers and other project stakeholders throughout all processes within the project lifecycle. This communication may be verbal or non-verbal, formal or informal, written or spoken.

There is a strong behavioural component to safety leadership. It is important that senior managers lead by example and are consistent in the way they behave in relation to safety. Safety leadership is as much about what is not discussed as what is. When senior managers constantly talk about cost or production and say little about safety, this creates the impression that safety is less important than these other project goals. Within the construction supply chain, safety leadership should also be demonstrated.

Clients should demonstrate leadership through establishing clear safety objectives for the projects they procure and by appointing safety champions for the

project. Prime contractors should also establish safety leadership in the way that they manage subcontractors. Safety leadership also includes the recognition and reward of good safety management and performance as well as the constructive correction of sub-standard safety management or performance.

Principle 2: Promote Safety in Design

Effective safety management at the design stage can minimise risks to the health and safety of persons who subsequently construct, occupy and maintain a facility. Consequently the Client should ensure that a Designer who is competent in safety is engaged. Comprehensive and systematic design safety reviews should be conducted at appropriate intervals during the design process. These reviews should be based upon appropriate risk management methods. Design safety reviews should be collaborative in nature, enabling an assessment of safety risk from the design, construction and maintenance perspectives.
Safety risks arising as a result of the design should be eliminated wherever possible. Where elimination is not possible, efforts to reduce safety risk through design modification should be made. Residual risk, i.e. the risks remaining following the design safety risk management process, should be documented and clearly communicated to relevant stakeholders including the Client, the Constructor, the Owner/Occupier and personnel involved in the maintenance of the facility.

Principle 3: Communicate Safety Information

Communication and consultation are essential to the management of safety. Within construction projects, safety information should be communicated between the different stakeholders. Open and honest communication of safety information between the Client, the Designer and the Constructor (including subcontractors) must be maintained throughout the project lifecycle.

It is very important that safety communication and consultation commence as early as possible in the project process. Wherever possible, potential constructors should be consulted during the planning and design stages and given the opportunity to comment on project definition and design. Throughout construction, safety risk information should be communicated to relevant stakeholders, including (but not limited to) subcontractors, suppliers, workers, trade unions, regulators and members of the public. Within stakeholder organisations, safety expectations and procedures should be clearly communicated to the workforce. It is also vital that bottom-up communication of safety issues occurs. Consultative processes should be established to enable worker participation in the making of decisions that impact upon safety. A 'no-blame' culture should be fostered to ensure that consultative processes are open, honest and effective.

Principle 4: Manage Safety Risks

The elimination or reduction of safety risk is a requisite for improved safety performance within the construction industry. At all stages in the project process, decisions must be made on the basis of a careful consideration of the safety implications of available options. Decisions made about project options, design of the permanent structure, design of the construction process, choice of plant, equipment, materials and construction methods and project organisational arrangements should be made following an assessment of safety risks, using an appropriate and recognized risk assessment method.

Wherever possible, safety risks should be eliminated through the implementation of technological controls. Administrative or behavioural safety controls should be used only when technological solutions cannot be implemented, safety risks are low and/or as a supplement to technological controls already implemented. Safety risk information relating to the project should be recorded and made available to those who must manage or work with a risk. All project decision making that could have an impact upon safety risk should involve input from those parties that could be affected by that risk.

Principle 5: Continuously Improve Safety Performance

In order for the industry to maintain sustained improvement in safety, clear targets and appropriate Key Performance Indicators (KPIs) should be established for safety at an industry, organisation and project level and safety performance must be rigorously monitored and measured. This measurement should incorporate traditional 'lagging', as well as proactive 'leading' indicators of safety performance. The continuous improvement of safety also requires industry-wide collaboration in the form of benchmarking and information sharing.

Regular reviews of safety management performance should be undertaken through all stages of the project lifecycle. These should be conducted collaboratively between all project stakeholders including subcontractors.

Upon the completion of construction projects, a post-project review of safety performance and processes of clients, designers and constructors should be undertaken. This review should also evaluate the extent to which these parties have worked cooperatively to ensure safety in the project. Lessons from these post-project safety reviews should be captured and shared, within and between organisations in the industry.

Principle 6: Entrench Safety Practices

The vast majority of firms operating in the construction industry are small to medium-sized enterprises (SMEs). SMEs experience difficulty in fulfilling their statutory safety obligations and often do not have the requisite safety knowledge or resources to implement systematic safety risk management processes. It is essential that larger construction organisations work to disseminate safety knowledge and best practice among the SMEs they do business with.

This dissemination can be facilitated by the establishment of clear safety requirements in the selection of SME subcontractors/suppliers and the inclusion of safety requirements in sub-contracts. Construction organisations can also support the development of safety capability in SME firms through the development of long-term relationships with subcontractors/suppliers (perhaps through preferred provider schemes) and the implementation of safety mentoring schemes for SME subcontractors/suppliers. Construction organisations should also require SME subcontractor to participate fully in project safety management programs, including safety planning, training, monitoring and reporting processes.

3.2 Principles in Practice

This section of the VCOP identifies best practices that reflect the implementation of the principles at each of the stages in the project process cycle. This information is presented in the form of a 'Principles in Practice' diagram (See Figure 2).

3.3 Leadership Matrices

This section of the VCOP identifies the roles and responsibilities of project participants (stakeholders) in relation to best practices identified in the 'Principles in Practice' diagram. Responsibilities are indicated (against the three categories of project participant, i.e. client, designer, constructor). The responsibility matrices show the roles of the three principal stakeholders in a project – the Client, the Designer and the Constructor - for each of the project delivery models of:

(1) Traditional – where the Client undertakes the planning and engages a Designer to carry out the design and a Constructor to build the facility;

(2) Design and Construct – where the Client undertakes the planning and engages a consortium of a Designer and a Constructor to design and build the facility; and

(3) Collaborative – where the Client, the Designer and the Constructor form an alliance to plan, design and build the facility.

The objective of the responsibility matrix is to provide a clear understanding for all stakeholders that are able to impact the OHS performance at various stages of the delivery of a construction project.

3.4 Best Practices

In the final section of the VCOP, each of the best practices is documented using a standard layout that is intended to provide the user a concise tool for implementation, monitoring and review .The layout includes:

- **Best Practice** – the identifying name of the best practice;
- **Description** – a short description of the best practice;
- **Key Benefits** –the key benefits to be achieved by implementing the best practice;
- **Desirable Outcome** – the behavioural and procedural changes effected by the implementation of the best practice; and
- **Performance Measure** – any output measures that can be recorded for the best practice.

Throughout the VCOP, case examples of best practice have been inserted to illustrate implementation of OHS best practice for delivery of a particular element within a construction project. These examples will be developed from a study of Australian and international projects that is currently taking place.

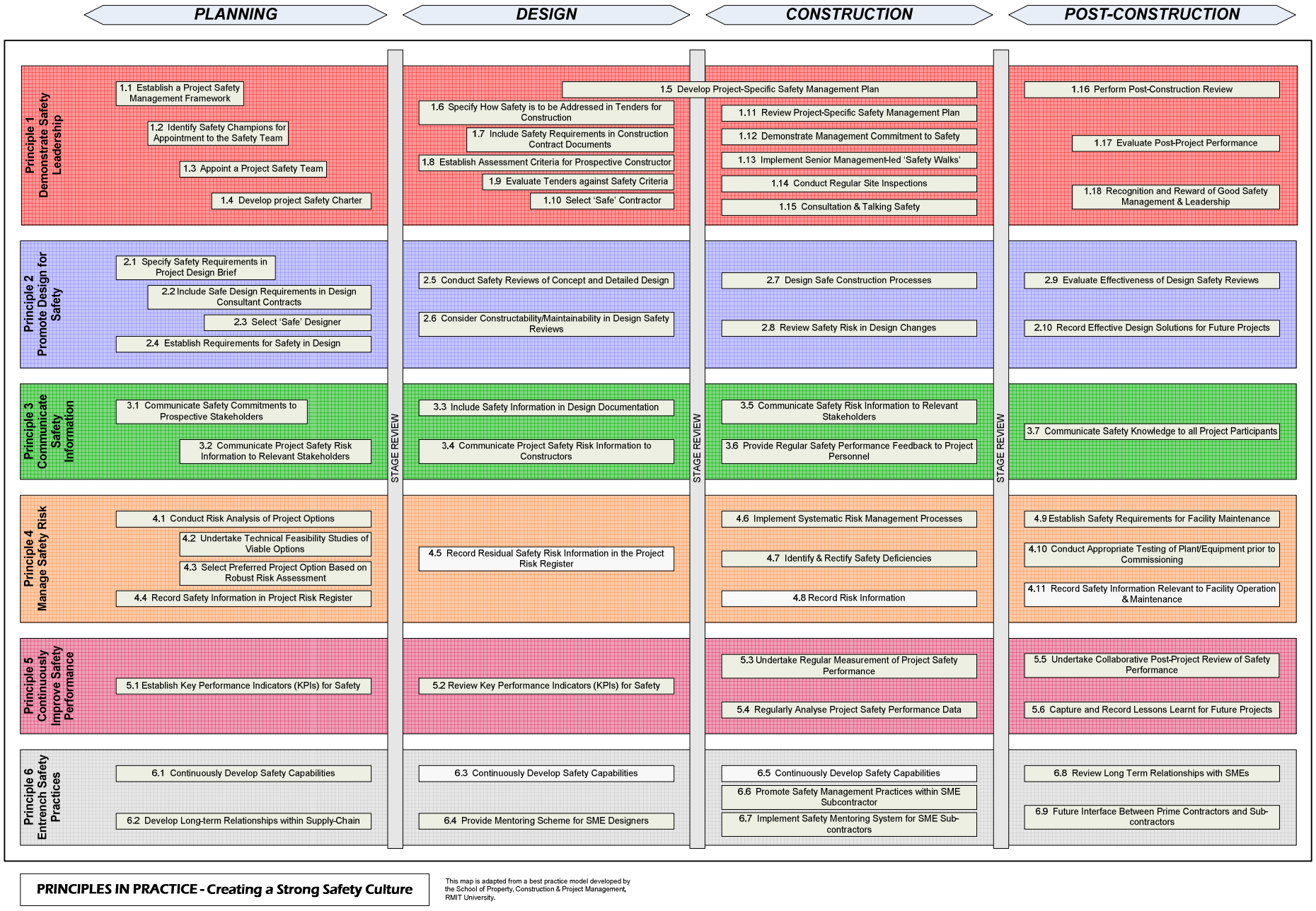

Figure 2: Principles in Practice

4.0 Discussion and conclusions

The result of the Safer Construction project will be an evidence-based VCOP which clearly establishes and explains OHS best practice for key participant groups in all construction projects throughout the construction process (from planning to commissioning). The value of this VCOP lies in the collaborative nature of its development and its voluntary nature. The impetus for the VCOP comes from industry leaders who recognise the need for the construction industry to voluntarily work towards improving its OHS standards. This is in contrast to legislative strategies adopted, for example, in the United Kingdom. In the UK, the Construction (Design and Management) Regulations were enacted in the mid-1990s and have recently been reviewed and re-written. These Regulations created statutory OHS responsibilities for construction clients and designers as well as creating a new overall OHS co-ordination role called the 'planning supervisor.' Prior to the recent review, this legislative response was widely reported to have had limited impact on the UK construction industry's OHS culture or performance. Criticisms were based on the fact that clients and designers failed to integrate OHS into their decision processes (Rigby 2003; Entec, 2000) and the creation of a new administrative role with overall coordination responsibility for project OHS, did not 'fit' comfortably with existing roles and relationships in the construction industry (Bluff, 2003). As a collaborative, industry-initiated project, it is hoped that the Safer Construction VCOP will be naturally embraced and adopted by industry stakeholders, thereby effecting genuine and sustainable cultural change with regard to OHS.

The Safer Construction process also provides some important lessons about how serious industry-wide issues, such as sustainability, can be addressed to achieve a coherent agenda for change. First, the project has demonstrated the benefit of an industry champion in the initiation and leadership of the collaborative development of an industry-wide VCOP for OHS. Through the leadership of Mr Bill Wild, a high level industry task force was engaged and committed to the dedication of resources to the Safer Construction project. The involvement of key stakeholder groups, industry peak bodies and professional institutions ensures that the VCOP is balanced and increases the likelihood that the code will be accepted and adopted throughout the Australian construction industry. Without such a champion, it is doubtful that the project would have achieved this industry-wide commitment and input into the development process, significantly reducing its likely impact. Second, the Safer Construction project highlights the importance of joint government-industry research and development efforts. Through the CRC-CI, industry, academics and government are brought together to engage in industry focused, applied research and collaboratively solve industry problems. Finally, the Safer Construction project illustrates the need for engagement of a broad range of project participants in the development and implementation of strategies to improve the long term sustainability of the construction industry. Presently, the OHS performance of construction is unsustainable. Safer Construction illustrates the need for an holistic approach in which all the key industry participant groups (i.e. clients, designers and constructors) play their part in the elimination of deaths and reduction of harm to the industry's workforce. Only when this takes place can construction claim to be a socially sustainable industry.

5.0 Acknowledgement

The authors wish to acknowledge the support of the Cooperative Research Centre – Construction Innovation in funding the VCOP development. Grateful thanks are also extended to the industry task force members for their input and comment in the development process. The work of researchers from RMIT University, Queensland University of Technology and Curtin University is also acknowledged.

6.0 References

Behm, M., (2005), Linking construction fatalities to the design for construction safety concept, *Safety Science*, 43, 589-611.

Bomel, (2001), Contract Research Report 387/2001 *Improving health and safety in construction: Phase 1: data collection, review and structuring*, Health and Safety Executive, London.

Bluff, L., (2003) *Regulating Safe Design and Planning Construction Works*, Working Paper 19, National Centre for Occupational Health and Safety Regulation, Australian National University, Canberra.

Cole, (2003), *Final Report of the Royal Commission into the Building and Construction Industry, v6 Reform – Occupational Health and Safety*, Commonwealth of Australia, Canberra

Driscoll, T. R., Harrison, J. E., Bradley, C. & Newson, R. S., (2005), Design issues in work-related serious injuries, Department of Employment and Workplace Relations, Commonwealth of Australia, Canberra.

Entec, (2000), *Construction health and safety for the new millennium*, Health and Safety Executive Contract Research Report 313/2000, HMSO, Norwich.

Gibb, A., Haslam, R., Hide, S., and Gyi, D. (2004), The role of design in accident causality, *Designing for safety and health in construction: Proc., Research and Practice*

Symp., S. Hecker, J. Gambatese, and M. Weinstein, eds., UO Press, Eugene, Ore.

Guberan, E. & Usel, M., (1998), Permanent work incapacity, mortality and survival without incapacity among occupations and social classes: a cohort study of aging men in Geneva, *International Journal of Epidemiology*, 27, 1026-1032.

Hecker, S., Gambatese, J. and Weinstein, M., (2005), designing for worker safety: moving the construction safety process upstream, *Professional Safety*, 50, 32-44.

Herald Sun, 17th October 2006, Skills, Issue May Bust the Boom, News Limited, Melbourne.

Hofmann, D. A. and Stetzer, A., (1996), A cross-level investigation of factors influencing unsafe behaviours and accidents, *Personnel Psychology*, 49, 307-339.

HSE (Health and Safety Executive), (2003), *Causal factors in construction accidents*, Research Report 156, HMSO Books, Norwich.

Huang, X. and Hinze, J., (2006a), Owner's role in construction safety, *Journal of Construction Engineering and Management*, 132, 164-173.

Huang, X. and Hinze, J., (2006b), Owner's role in construction safety, *Journal of Construction Engineering and Management*, 132, 174-181.

Gambatese, J. A., Behm, M. and Hinze, J. W., (2005), Viability of designing for construction worker safety, *Journal of Construction Engineering and Management*, 131, 1029-1036.

International Labour Organization, (2005), P*revention: a global strategy: The ILO Report for World Day for Safety and Health at Work 2005,* http://www.ilo.org/public/english/protection/safework/worldday/products05/report05_en.pdf (accessed27th November 2006).

International Labour Organization, (1992), *Safety and Health in Construction: an ILO Code of Practice*, http://www.ilo.org/public/english/protection/safework/cops/english/download/e920894.pdf (accessed 27th November 2006).

Leather, P. J., (1987), Safety and accidents in the construction industry: a work design perspective, Work & Stress, 1, 167-174.

Levitt, R. E., and Samelson, N. M., (1993), *Construction safety management*, 2nd Ed., Wiley, New York.

Lingard, H. and Rowlinson, S., (2005), *Occupational Health and Safety in Construction Project Management*, Spon Press, London.

Liska, R. W., Goodloe, D., and Sen, R. (1993), Zero accident techniques." *Construction Industry Institute, Source Document No. 86*, The Univ. of Texas at Austin.

Martens, N., (1997). The Construction (Design and Management) Regulations 1994: Considering the competence of the planning supervisor, *Journal of the Institution of Occupational Safety and Health*, 1, pp. 41-49.

Maxwell, C., (2004), *Occupational Health and Safety Act Review*, State Government of Victoria, Melbourne.

McWilliams, G., Rechnitzer, G., Deveson, N., Fox, B., Clayton, A., Larsson, T. and Cruickshank, L., (2001), *Reducing serious injury risk in the construction industry*, Policy Research Report No. 9, Monash University Accident Research Centre, Melbourne.

Minerals Council of Australia (2006), *Staffing the Supercycle: Labour Force Outlook in the Minerals Sector, 2005 to 2015,* August 2006.

National Occupational Health and Safety Commission, (2002), *National OHS Strategy 2002-2012*, Commonwealth of Australia, 2002-08-08, Canberra.]

National Occupational Health and Safety Commission, (2004), *The role of design issues in work-related injuries in Australia,* National Occupational Health and Safety Commission, Commonwealth of Australia, Canberra.

Partridge, E., (2005), Social Sustainability: challenges for the development industry, Institute for Sustainable Futures, University of Technology Sydney, http://www.isf.uts.edu.au/whatsnew/Emma%20Partridge_ISF.pdf, (accessed 27th November 2006)

Rigby, N., (2003), *Designer Initiative 17th March 2003: Final Report*, Scotland and Northern England Unit, Construction Division, Health and Safety Executive.

Suraji, A., Duff, A. R., and Peckitt, S. J., (2001), Development of a causal model of construction accident causation, *Journal of Construction Engineering and Management* , 127, 337-345.

Weinstein, M, Gambatese, J. and Hecker, S., (2005), Can design improve construction safety?: Assessing the impact of a collaborative Safety-in Design process, *Journal of Construction Engineering and Management*, 131, 1125-1134.

Winkler, C., (2006), *Client/contractor relationships in managing health and safety on projects*, Research Report 462, Health and Safety Executive, HSE Books, Sudbury.