'SAFER CONSTRUCTION': THE DEVELOPMENT OF A GUIDE TO BEST PRACTICE

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ABSTRACT

In Australia, an average 49 building and construction workers have been killed at work each year since 1997-98. Building/construction workers are more than twice as likely to be killed at work, than the average worker in all Australian industries. The 'Safer Construction' project, funded by the CRC-Construction Innovation and led by a task force comprising representatives of construction clients, designers and constructors, developed a *Guide to Best Practice for Safer Construction*. The Guide, which was informed by research undertaken at RMIT University, Queensland University of Technology and Curtin University, establishes broad principles for the improvement of safety in the industry and provides a 'roadmap' for improvement based upon lifecycle stages of a building/construction project. Within each project stage, best practices for the management of safety are identified. Each best practice is defined in terms of the recommended action, its key benefits, desirable outcomes, performance measures and leadership. 'Safer Construction' practices are identified from the planning to commissioning stages of a project. The 'Safer Construction' project represents the first time that key stakeholder groups in the Australian building/construction industry have worked together to articulate best practice and establish an appropriate basis for allocating (and sharing) responsibility for project safety performance.

Keywords: Occupational health and safety, Guide to Best Practice, Client, Designer, Constructor

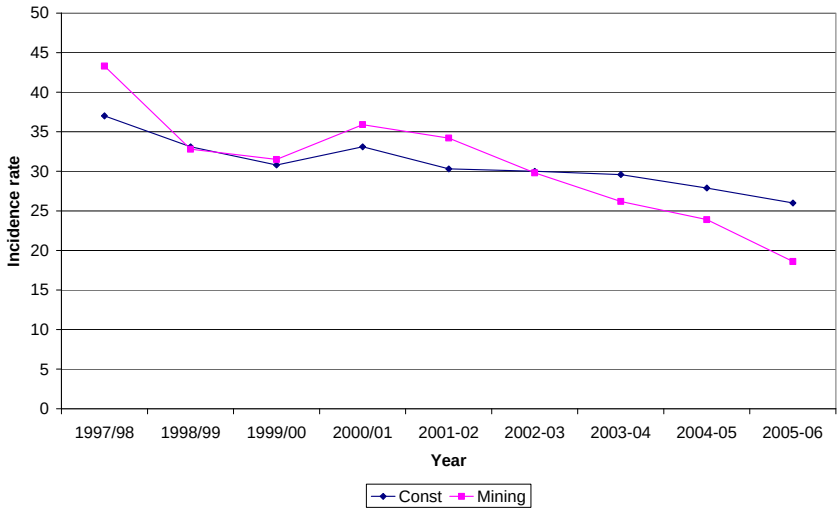
1.0 INTRODUCTION

1.1 OHS IN CONSTRUCTION

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 17% (one in six) of all fatal workplace accidents (ILO, 2005). The fatality rate in the Australian construction industry is 9.2 per 100,000 workers, compared to 3.1 for all industries and, since 1997/98 an average of 49 construction workers has been killed each year – nearly one per week (Fraser, 2007). Figure 1 shows the incidence rate of all non-fatal claims per 1,000 employees in the Australian mining and construction industries from 1997/98 to 2005-06. The incidence rate in the construction industry fell from 37.0 in 1997-98 to 26.0 in 2005-06, a decrease of 29.7%. In comparison, the mining industry incidence rate fell from 43.3 to 18.6 (57.0%) in the period. In 2002-03 the mining industry incidence rate fell below that of the construction industry and has continued to decline at a greater rate than that of the construction industry.

These compensation-based statistics are also considerably lower than those published by the Australian Bureau of Statistics (ABS). Using data collected in the Multi-Purpose Household Survey (MPHS) conducted in 2005 – 2006, the construction industry had an incidence rate of 86 per 1,000 employed people, almost twice that indicated in the ASCC compensation statistics (ABS, 2006). This difference highlights the need for a consistent approach to recording industry-level OHS performance in Australia and also suggests that compensation-based statistics do not reflect the magnitude of the construction industry's OHS problem.

Figure 1: Incidence rate of occupational injuries and diseases (per thousand employees), construction and mining, 1997/98-2005/06 (Source: ASCC, 2007)



In 2002, the *National OHS Strategy* established clear and ambitious targets for the reduction of work-related deaths, injuries and illnesses in Australia. The Strategy was agreed to by all Australian governments, the Australian Chamber of Commerce and Industry (ACCI) and the Australian Council of Trade Unions (ACTU) to sustain a significant, continual reduction in the incidence of work-related fatalities with a reduction of at least 20 per cent by 30 June 2012 (with a reduction of 10 per cent being achieved by 30 June 2007), and to reduce the incidence of workplace injury by at least 40 per cent by 30 June 2012 (with a reduction of 20 per cent being achieved by 30 June 2007). Figure 1 suggests that the response of the mining industry to the *National OHS Strategy* has been more effective than that of the construction industry. This is despite the fact that the National Strategy identified building and construction

as a priority industry due to its high incidence rate (of occupational injury and illness) and the high number of compensation claims arising in construction, compared with other industries.

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 *Guide to Best Practice for Safer Construction* ('The Guide). The Guide articulates OHS 'best practice' for key stakeholders, namely clients, designers and constructors. The Guide establishes a logical framework which can be used by construction stakeholders, as project participation evolves from one participant to another. By engaging all of the key participant groups in the development and implementation of the Guide, 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 Guide and the process by which it was developed. The structure of the Guide is briefly described and lessons learned from the development process are discussed.

1.1 BACKGROUND TO THE PROJECT

The 'Safer Construction' project was an initiative of Engineers Australia's Civil College Board which, under the leadership of Mr Bill Wild, formed a committee 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 'Safer Construction' initiative.

The task force was made up of senior representatives of major industry stakeholder groups, industry peak bodies and professional institutions. The engagement of this diverse stakeholder group ensured that the view of construction OHS reflected in the *Guide to Best Practice for Safer Construction* represents a realistic and reasonable basis for the allocation of responsibility for construction OHS.

2.0 CHANGING AN INDUSTRY CULTURE

2.2 FROM SHIFTING BLAME TO SHARING RESPONSIBILITY

The traditional approach to procuring construction work (the Design-Bid-Build model) prohibits the early involvement of constructors in the project planning and design stages. In this model, the client typically adopts an 'arms-length' approach to managing the design and construction stages, responsibility (and risk) for which is transferred to other parties via contract documents. Responsibility for the OHS of construction workers is similarly transferred in its entirety to a constructor, engaged to build a facility/structure to the specification of an independently contracted designer. In many instances this situation creates an adversarial project culture in which OHS issues, arising during the construction stage, are 'blamed' on a party upstream of the construction process. Clients, for example, have been criticised for imposing unrealistic time or cost pressures and selecting the cheapest (though not necessarily the safest) design option or supplier. Designers have also been criticised for focusing too much attention on aesthetics and failing to address OHS in 'buildability' reviews of their designs. This adversarial culture is not helpful because it fails to reflect the fact that all parties to a construction project (i.e. the client, designer and constructor) have an important role to play in promoting the OHS of people who will build the structure/facility.

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 some OHS management responsibility to be driven up the supply chain, and be partially borne by construction Clients, and the Designers of buildings and facilities.

In bringing together the perspectives of each of these parties (through their respective professional/industry associations), the Safer Construction project provides the basis for moving away from a reactive industry culture of blaming other parties for OHS problems, to a proactive culture of establishing (on a project-by-project basis) an appropriate allocation of responsibility for OHS during the planning, design, construction and commissioning stages of project delivery. The objective is not to reduce the responsibility of the constructor for the OHS of the workers and contractors they employ. Rather, the Guide aims to identify additional measures that can be taken by clients and designers prior to the commencement of construction work that will contribute to OHS during the construction stage.

2.3 THE CLIENT'S ROLE

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). At the most basic level, the client's selection of project delivery strategy determines the timing and nature of engagement of both the designer and constructor, which can have an impact upon the extent to which OHS issues are integrated into project planning and communicated within the project delivery team. 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). Clients make key decisions concerning the project budget, project objectives (including timelines) and other performance criteria, which can create the pressures and constraints known to have a significant impact upon OHS in the construction stage (Suraji et al 2001). Bomel (2001) identified client company culture and contracting strategies as areas presenting considerable opportunities for OHS improvement in the UK construction industry. In the USA, Huang and Hinze (2006a; 2006b) report that the involvement of the client in pre-project planning, financially supporting the constructor's safety programme and participating in the day-to-day project OHS activities were important requisites for excellent project OHS performance. 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. In recognition of this, the Office of Government Commerce in the UK (OGC 2004), the Scottish Executive have developed processes designed to help public sector construction clients to raise the health and safety standards of workers engaged in their construction projects. Despite these initiatives, Crosthwaite (2007) reports that public sector clients in the UK still have a relatively narrow view of their involvement in project OHS, focusing more on the selection of a competent team than on the monitoring and review of project OHS performance during the design and construction stages. The Guide recognised that there is more that Australian construction clients could do to promote OHS in the construction projects they procure.

2.4 THE DESIGNER'S ROLE

In Australia the *National OHS Strategy 2002–2012* defines the elimination of (physical) hazards at the design stage as 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". 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. In many instances, design decisions can be regarded as the 'source' of OHS risks in the construction industry. The Guide recognises that not every OHS risk can be eliminated. The aim is therefore to systematically identify OHS risks at the design stage, assess these risks and reduce them so far as is practicable, while communicating information about any project-specific residual risks associated with design to prospective constructors, enabling them to take appropriate preventive action during the construction stage.

2.5 THE CONSTRUCTOR'S ROLE

Constructors have traditionally borne the largest portion of responsibility for construction OHS. 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. Yet, there often exists a 'disconnect' between the content of OHS policy statements and procedure manuals and actual safety practices on-site. Production and cost pressures compete with OHS goals and 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; Hofmann and Stetzer 1996). The Safer Construction project placed a strong emphasis on leadership and the demonstration, by managers, of genuine and consistent commitment to OHS.

An underpinning goal of the Safer Construction project was to share knowledge and experiences about how to improve OHS throughout the construction community. To this end, the *Guide to Best Practice for Safer Construction* identified practices that could entrench OHS best practice throughout the industry. In particular, practices that would encourage the adoption of OHS best practice in small to medium-sized enterprises (SMEs) are specified. SMEs make up the majority of firms in the Australian construction industry but are known to suffer from a lack of formalised OHS management systems, resource constraints and lower levels of OHS knowledge (and/or access to expertise) than larger firms.

3.0 DATA COLLECTION

3.1 CONSTRUCTION PROJECT SURVEY

To inform the content of the Guide, interviews were conducted to identify what safety practices were currently implemented in the Australian construction industry. Data were collected for 42 construction projects. Consistent with the focus on best practice, the sample was skewed towards the better performing projects. The highest Lost Time Injury Frequency (LTIFR) rate for these projects was 25.5 and the lowest was 0. The mean LTIFR for the surveyed projects was 5.3. This compares to an industry average of 22.6 for general construction and 19.7 for construction trade services. Data were collected from a variety of different types of project. The project cost ranged from $2.7 million to $2.5 billion, with a mean value of $205 million dollars. Nineteen of the projects were procured via a Design & Build strategy, five were traditional Design-Bid-Build projects and thirteen projects were procured using an alternative strategy.

The qualitative survey data was subject to thematic analysis, undertaken independently by two occupational health and safety specialists. The researchers coded the data from each project according to whether there was evidence of specific safety management practices in the project. The data revealed well established practices for the management of safety

during the construction stage but far less activity during the planning and design stages of construction projects. For example, in only 50% of the projects was there evidence that project stakeholders other than the designer had input into design decision-making. In 64% of cases there was some attempt to eliminate safety risks during the design stage but in only 36% of the projects was this risk reduction considered to be innovative. In only 50% of the projects was project specific safety information communicated to prospective constructors and in only 40% of the projects was safety included in project specifications at the tender/award stage. Although not universal, 'best practice' in the pre-construction stages of projects was apparent, for example in some projects a detailed analysis of design safety risks was performed and innovative ways of 'designing out' OHS risks were observed. In the construction stage there was evidence of more widespread safety management activity, largely undertaken by the constructor. For example, in 90% of projects detailed work methods developed prior to commencing major construction activity, meaningful arrangements were made for worker consultation in safety risk management and training needs were carefully analysed and appropriate training was provided. However, in only 57% of projects was there evidence that on-site design changes were subject to a rigorous risk assessment to determine and manage their safety implications.

The data collected were used to identify examples of best practice, as well as areas in which substantial 'gaps' existed for incorporation into the Guide. In particular, client-led safety management in the planning and procurement of construction work was not well established and the degree to which design safety processes were implemented depended largely upon the design and construction organizations involved in the project. These data were used to distil practical examples of safety best practice which are used throughout the Guide. Gaps were then filled by a comprehensive review of Australian and international literature addressing the issue of construction safety management.

4.0 THE SAFER CONSTRUCTION FRAMEWORK

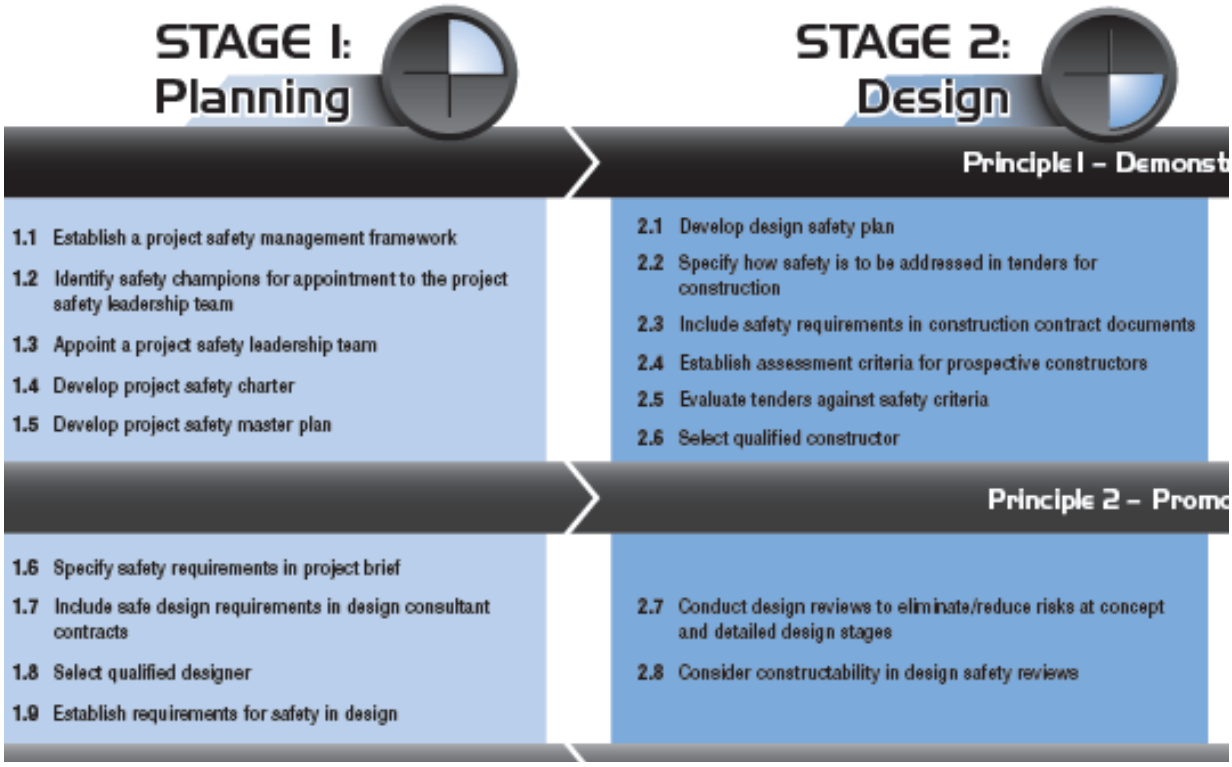
4.1 SAFER CONSTRUCTION PRINCIPLES

The *Guide to Best Practice for Safer Construction* comprises two booklets and a number of supporting documents, including a comprehensive literature review and best practice case study report. The first booklet establishes Best Practice Principles for creating a strong safety culture. These principles are intended to operate at an industry level and establish broad values by which organisations within the industry should operate. The success of the best practice tasks (detailed in the second booklet) is highly dependent upon the adoption of the Best Practice Principles at both corporate and project-level. The Safer Construction Principles are:

- Principle 1: Demonstrate Safety Leadership;
- Principle 2: Promote Safety in Design;
- Principle 3: Communicate Safety Information;
- Principle 4: Manage Safety Risks;
- Principle 5: Continuously Improve Safety Performance; and
- Principle 6: Entrench Safety Practices.

At the heart of the guide is an 'Implementation Table', specifying safety practices to be undertaken at four life cycle stages of a construction project, i.e. Planning, Design, Construction and Commissioning. The practices are numbered and organised under the principles that they represent. Figure 2 shows a small section of this Table, indicating the layout of project stages, principles and practices.

Figure 2: Layout of the Safer Construction Implementation Table.



4.2 SAFER CONSTRUCTION TASKS

The second booklet in the Safer Construction Guide identifies how the six best practice principles are applied *in practice* through the four stages of a project's lifecycle - planning, design, construction and post-construction. Each Best Practice Task is documented using a standard layout that is intended to provide a concise tool for implementation, monitoring and review .The layout includes:

- **Action** –the task to be carried out,
- **Description** –a short description of the safety best practice, an explanation of the importance of the action, and some suggested strategies for consideration,
- **Key Benefits** –the benefits to be achieved by implementing the safety best practice,
- **Desirable Outcome** –the behavioural and procedural changes effected by the implementation of the safety best practice,
- **Performance Measure** –the outputs that can be measured and recorded as evidence that the safety best practice has been carried out, and
- **Leadership** –the stakeholder with prime responsibility for implementing the action.

4.3 EXAMPLE LEADERSHIP MATRIX

Supporting documentation to the Guide also includes an example 'Leadership Matrix.' This matrix identifies the roles and responsibilities of project participants (stakeholders) in relation to the Safer Construction Tasks. Suggested roles and responsibilities are indicated (against the three categories of project participant, i.e. client, designer, constructor) for each of three 'ideal type' 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.

As it is recognised that project procurement is complex, with many hybrid forms, and that the roles and responsibilities of the stakeholders will vary from project to project, the *Guide to Best Practice for Safer Construction* also includes a series of Implementation Checklists. These are designed to enable project participants to identify, agree and document an allocation of roles and responsibilities for the Safer Construction Best Practice Tasks, appropriate to their project.

Figure 3: An example Safer Construction task box (Fleming et al 2007)

Task 1.9	Establish requirements for safety in design
Action	Following Task 1.6, the client should collaborate with the designer in order to establish and agree on the general design requirements to be considered during concept and final, detailed design. These requirements should be flexible to respond to any emerging safety issues that might arise as the project evolves.
Description	It is not always possible to identify safety risks at the start of a construction project, especially for fast-track projects where design may not be complete when construction starts. Nevertheless, early identification and safety risk assessment is important to start safety strategies and to entrench safety in project decision-making. There are many potential design issues that affect safety. Without being exhaustive, issues may include: • proximity to adjacent property or nearby roads • surrounding land use • clearances required for construction equipment and techniques • demolition of existing assets • proximity to underground or overhead services — especially electrified lines • rapid construction techniques, i.e. prefabrication versus in situ construction • staging and coordination with other works • exposure (and length of exposure) of field staff to adjacent traffic or other hazards • provision of safe working platforms • materials to be used in construction • site conditions — including foundations, and construction over other assets or over water • safety of the public • use of adjacent streets • safe operation and maintenance of the facility/structure after commissioning.
Key benefits	• Safety is built into the design both for construction and in-service conditions. • Designer is accountable for considering safety in the design. • Where possible, safety risks are eliminated or reduced through judicious design decisions.
Desirable outcomes	• A thorough understanding by the designer of the need for safe design and the safety issues that should be considered in the design of the project.
Performance measures	• A set of agreed principles for providing for safety in the design of the project.
Leadership	• Client

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5.0 CONCLUSIONS

5.1 THE POTENTIAL IMPACT OF THE GUIDE

The Guide is intended to reflect 'best practice' in the management of safety on construction sites. It is a voluntary document and it was not intended that it replace or supersede any State/Territory or Commonwealth law relating to construction OHS. In particular, legislative requirements for constructors (as employers) establish minimum requirements for on-site OHS during the construction stage. However, the Guide recommends an increased role for construction clients (in the planning stage) and designers (in the design stage) in achieving OHS best practice during the construction stage. The Guide recognises that clients, in particular, can do a great deal to drive OHS best practice in construction projects. Clients (and/or their professional advisors) make decisions about what is to be constructed, the terms and conditions upon which each of the parties is to be engaged and budget and schedule requirements for a project. The client's selection of project procurement method is particularly important because this dictates when and how other key project stakeholders will be engaged to advise on OHS in the project. For example, a designer could be expected to consider OHS during the design stage but would not reasonably be expected to advise upon the OHS risk implications of design issues during the construction stage, unless explicitly instructed to do so by the client. Defining, up-front, the roles and OHS responsibilities of key stakeholders in a project is recommended. In articulating best practice, the Guide provides an opportunity for property, design and construction professionals to enhance the professional services that they provide and improve OHS performance within the construction industry.

The *Guide to Best Practice for Safer Construction* was launched in September 2007 and it is therefore too early to ascertain it's impact. However, the extent of the Guide's adoption will be evaluated in future research.

The voluntary nature of the Guide 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 were reviewed and re-written in 2007. 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' (now replaced with an OHS Coordinator). Prior to the recent review, this legislative response was reported to have had limited impact on the UK construction industry's OHS culture and 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). It is hoped that, as a collaborative industry-initiated and endorsed document, the Safer Construction Guide will be widely adopted by industry stakeholders, thereby effecting cultural change in the Australian construction industry with regard to OHS.

5.2 THE IMPORTANCE OF COLLABORATIVE FUNDING

The involvement of key stakeholder groups, industry peak bodies and professional institutions ensures that the Guide represents a reasonable allocation of responsibility for OHS and increases the likelihood that it will be adopted throughout the Australian

construction industry. Through the CRC-CI, industry, academics and government are brought together to engage in applied research to collaboratively solve industry problems. The Safer Construction project also illustrates the need for engagement of a broad range of project participants in the development of strategies to improve the OHS performance of the construction industry. Safer Construction illustrates the need for an integrated approach in which all the key industry participant groups (i.e. clients, designers and constructors) share responsibility for OHS in construction projects.

5.3 FUTURE DIRECTIONS

The *Guide for Best Practice for Safer Construction* provides an opportunity to extend the CRC-CI's safety competency framework, which currently only addresses competencies of persons engaged in the construction stage of a project, to client and designer organizations. Thus a similar research methodology as was utilised in the development of the Safety Competency Framework could be applied to identify OHS competencies for persons engaged in construction planning, procurement and design. An extended industry-wide competency framework would identify the knowledge, skills and behaviours required to undertake the safety best practices. This information could then be integrated into human resource management, project management and OHS management processes, for example in the selection of design consultants and contractors, identification of training needs and management of project and/or employee performance.

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