SAFE DESIGN IN PRACTICE

FOR DESIGNERS OF STRUCTURES

SAFE DESIGN AUSTRALIA

Acknowledgements

Safe Design Australia would like to thank the following people who have assisted in the preparation of this guide or provided feedback including Australian safe design expert Paul Breslin (M.App.Sci (OHS), Grad Dip OHM, Dip OHS, Master of Law (LLM) and Regional OHS&E Manager at Brookfield Multiplex Melbourne), Dr Michael Behm (Associate Professor Occupational Safety, East Carolina University and author of numerous papers on safe design), Michelle Cooper (Legal Advisor and Director at People, Culture, Strategies), Ted Walsh (WorkCover NSW), Nettie Dunne (graphics and editing), Arlene Lewis, Mod Films (photography), Chintana Sananikhone and Daniel Adams (graphics and editing), and Lance Patterson (Building Industry Solutions). Thank you also to Rebekah Colman, Manager Risk Services at Safe Design Australia for her significant involvement in the development of the processes outlined in this eBook and for her review of the content.

Safe Design Australia wishes to acknowledge the first edition authorship of this ebook to Sophie Barrett.

Sophie has delivered training programs on safe design throughout Australia for architects, building designers, engineers and design managers.

Sophie experienced firsthand the effects of workplace related illness on her family, having lost her father-in-law to emphysema after his 30 year battle with the disease. His illness was a result of working in a paint store and being exposed to the volatile organic compounds (VOCs) in paints during his early working life.

Today, designers have the ability to prevent these types of work related illnesses by considering the safety of the products that they are specifying. Safe design is a powerful tool in prevention and designers have an integral role in ensuring the safety of workers in the design of structures.

This edition of the ebook was edited collaboratively by the Safe Design Australia Team – Rebekah Colman, Chintana Sananikhone, John Daly and Daniel Adams.

About this guide

The content of this eBook is applicable to all the harmonised states and territories including New South Wales (NSW), Queensland (Qld), Australian Capital Territory (ACT), Northern Territory (NT), South Australia (SA), Tasmania (Tas) and the Commonwealth. Although Victoria (Vic) has yet to enact the national legislation, the legislation in these jurisdictions is very similar and the information on safe design in practice and risk management also applies to Victoria.

This eBook refers to the model legislation by Safe Work Australia and not the legislation enacted in each state, although the duties in the model legislation are the same as those in each of the harmonised states and territories. The model Work Health and Safety Act is referred to as 'WHS Act' and the model Work Health and Safety Regulation as 'WHS Regulation'. When referring to the legislation, designers should use the name of the legislation in their state or territory e.g. NSW WHS Act 2011.

This 2nd edition guide should be cited as:
Barrett, S. (2014). Colman S, Daly J, Sananikhone C, Adams D. (Ed.) Safe design in practice: For designers of structures. Safe Design Australia.

ISBN: 978-0-646-92413-7

Foreword

Rebekah Colman
Manager Risk Services
Safe Design Australia

Rebekah Colman has worked at high level in government and private practice in the area of health, building and work health and safety.

Rebekah has been integral in the development of many of the processes shown in this eBook.

I first became involved in safe design because I saw it as a great opportunity to create a safer community right from conception. I have had experience in health and safety in a variety of industries and settings and could see how many of the issues faced could be addressed through design.

Research has shown a direct relationship between design and fatalities. The National Occupational Health and Safety Commission (NOHSC) in Australia from 2000-2002 concluded that 44 per cent of all work related fatalities in the construction industry were related to design.[1] This relationship has also been confirmed in other studies in Europe (63% fatalities)[2] and the UK (36% fatalities).[3] The figures were higher when injury and illness was also considered.

Designers are in a unique position to be able to lead the way in preventing workplace injuries and illness. By working with the other stakeholders during the design and construction process they can eliminate the need for more costly interventions further down the structure's life cycle.

Designers are also able to drive a change in the market towards safer construction materials. For example, more designers are specifying the use of safer products, such as no emissions joinery material or paints with no volatile organic compounds (VOCs), which have led to an improvement in the quality of these products as well as a more competitive price.

Finally, designers have a responsible role in creating places in which people live and work. They constantly make decisions during the design process that potentially impact on the health and safety of people working in or around these structures. Safe design is about having a systematic process to ensure identification of any potential hazards that can be eliminated or minimised through design.

As you learn more about the safe design of structures, I would urge you to start by reading the Code of Practice: Safe Design of Structures. The code of practice is a valuable resource developed by Safe Work Australia and contains some excellent information on how to fulfil your duties as a designer. This eBook provides additional advice to designers on ways in which designers can fulfil their obligations.

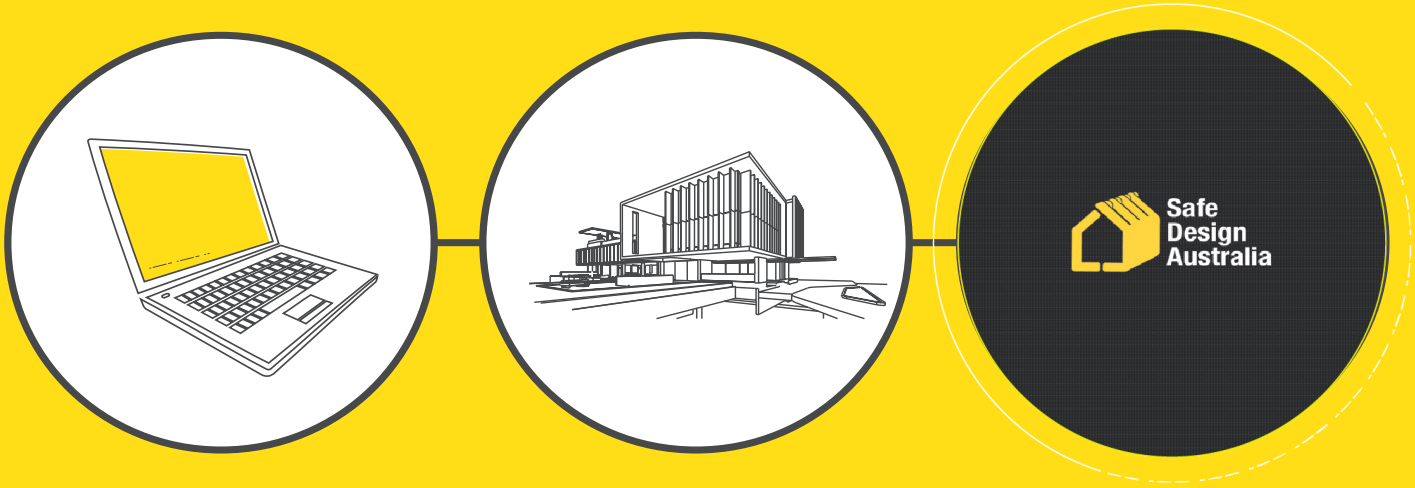
This information will assist you in understanding more about safe design, the duties of designers of structures and how you can implement safe design processes in your practice. Our team are here to support you in this journey, so please feel free to contact us should you require any further assistance.

John Daly
Director
Safe Design Australia

John Daly is the owner of Safe Design Australia, and is currently growing the business to support clients across the Asia Pacific.

John has worked for over 20 years as a safety professional. He has held HSE executive and senior consultant roles, including 5 years heading up Vodafone Group Services global Health, Safety, and Wellbeing function. John has worked as a consultant providing both consultancy and expert witness services to a range of companies across diverse industries.

John would like to acknowledge the work that has gone into developing this document along with the priveledge of working with the wide array of whs professionals his career has afforded him. This has helped Safe Design Australia develop some of the most comprehensive Safe Design training tools and content in Australia.



Who is Safe Design Australia?

Safe Design Australia (SDA) are specialist safe design consultants with a team of work health and safety consultants and risk managers operating throughout Australia. As many of our consultants have a background in architecture and design, we understand that good design is critical and believe that safe design can be achieved without compromising the design intent.

An expert team as part of your design team

The Safe Design Australia team includes experts in the areas of work health and safety, architecture, design, ergonomics, construction, public and occupational health, legislation and training. Our experience in assessing the safety of structures and workplaces extends from residential houses to high rise buildings.

Our clients include architects, building designers, developers, design and construction companies, principal contractors, engineers and local government. For more details of the services we provide please see page 65.

Safe Design Australia services

- Safe design procedures and templates
- Safe design training
- Safe design workshops
- Safe design reports and risk assessments
- Internal WHS procedures and training

Be confident that your design practice is covered.

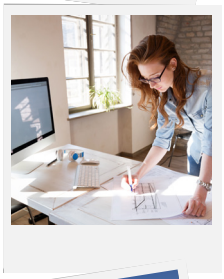
Many practices assume that they do not need to do anything in relation to their duties under the work health and safety (WHS) legislation. Designers in most states and territories now have a legal duty to design structures, so far as is reasonably practicable, that are without risk to health and safety when they are used as, or at, a workplace.

Designers need to be confident that they are protecting themselves and their practices and the people who are going to use the buildings or structures that they design.They need to understand their duties under the legislation and *how* to comply. The good news is that it is easy to comply with the legislation once you have processes in place.

Designers can meet their legislative requirements by:

1. Reading the Code of Practice: Safe Design of Structures and other WHS codes of practice.
2. Training staff in safe design and the legislative requirements.
3. Researching WHS injury statistics and specific data relating to the structure being designed.
4. Consulting with the client, workers, engineers, plant designers, specialist operators (e.g. crane operators) and the principal contractor.
5. Implementing a safe design procedure for their company and a systematic process for identifying hazards.
6. Designing structures to be without risk to health and safety.
7. Facilitating safe design workshops with key stakeholders.
8. Preparing safe design reports and other supporting documentation.
9. Engaging a safe design specialist to assist them with the above where required.
10. Having an internal WHS procedure for their staff.
11. Undertaking Safe Design Training such as Safe Design Australia's 'Not Boring Safe Design' online training course.

Contents



Introduction 7

Section 1: Safe design overview and legislation 8

Discover more about safe design including definitions, legislative requirements, consultation, designer, client and principal contractor duties, legal and insurance considerations for designers.

Section 2: Risk management in safe design 28

Learn how to follow a systematic risk management process including hazard identification, risk assessment, and implementing design controls to eliminate or minimise risks to health and safety through design.

Section 3: Safe design in practice 36

Discover practical methods for putting safe design into practice in the design practice including lifecycle considerations for safe design, a process for designers to incorporate safe design during the key stages of design, effective methods of consultation including safe design workshops, and providing safe design information including safe design reports, safe design plans and WHS files.

Section 4: Safe design case studies 50

Review our case studies to see what other designers consider during the key lifecycle phases, how they practice safe design and undertake consultation and how workshops can improve safety outcomes.

Section 5: Safe design resources 61

Connect to valuable resources for furthering knowledge in safe design including links to regulators websites and details of Safe Design Australia resources for designers. Have your safe design questions answered.

How can Safe Design Australia assist you? 65

References 66

Introduction

‘Safe design’ of structures involves designers preventing potential injuries by considering safety throughout the design process. In the early stages of a project there is greater scope to remove foreseeable hazards through design. Prevention is the most effective and affordable way to improve the safety of workers and requires the least effort compared with making changes at later stages. An analysis of fatal accidents on building sites show that about two-thirds are due to shortcomings in design and organisational problems.[4]

An analysis of fatal accidents on building sites show that about two-thirds are due to shortcomings in design and organisational problems.[4]

Designers of structures are known as ‘upstream duty holders’ and make decisions every day, as part of their expertise, which affect the safety of the people who work on, or in, these structures further ‘downstream’ in their lifecycle. These include people who construct the structure, who use the structure for the purpose for which is designed, who maintain the structure or who demolish the structure at the end of its life. It also includes the safety of people in the vicinity of the structure.

There are a number of benefits to safe design including: preventing injury and illness, improving useability of structures, improving productivity, reducing production and operational costs and encouraging innovation.[5]

Designers have the opportunity to make a difference to the health and safety of workers and end users of structures through safe design. By approaching safe design with innovation and creativity, designers can create safer workplaces without compromising the integrity of their designs.

The aim of this eBook is to assist designers in understanding the safe design legislation and how to incorporate safe design into their design process. Learning and understanding the current legislative requirements is the best way to overcome any concerns about safety in design. As you read through this document, you will discover more about safe design and the benefits it can bring to the design process. The desired outcome is for you to feel more confident in this new and exciting area.

Did you know?

Designers’ concerns about safe design legislation

Surveys[6] conducted by Safe Design Australia show that the main concerns that designers have with the safe design legislation are due to the following reasons:

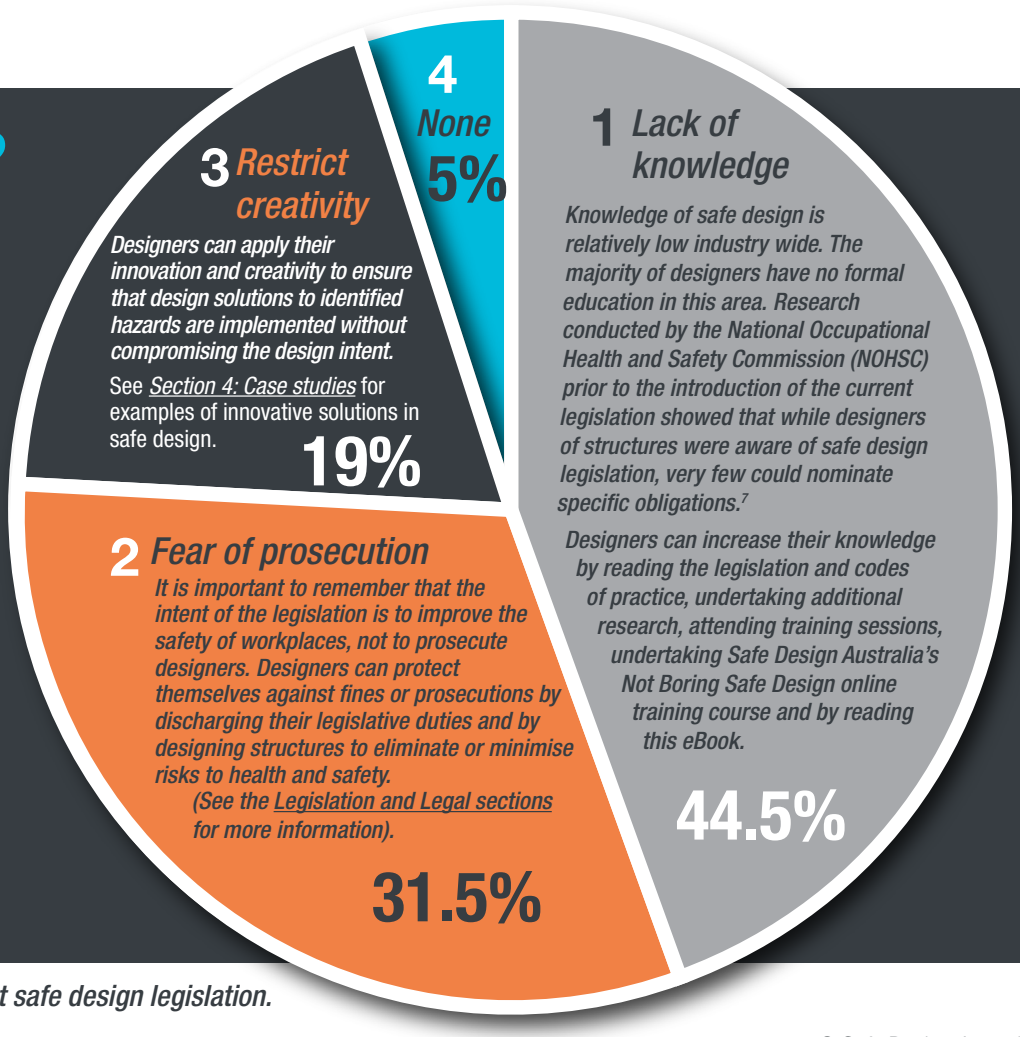


Figure 1: Designers’ concerns about safe design legislation.

SECTION 1 SAFE DESIGN OVERVIEW & LEGISLATION

- Definitions
- What is safe design?
- Legislation overview
- Consultation, cooperation and coordination
- Duties of designers
- Duties of clients
- Duties of principal contractors
- Legal overview
- Insurance considerations

Definitions

Listed below are definitions for some of the main terms referred to in the safe design legislation to assist designers in understanding their duties and the extent to which these duties apply. In this eBook, we have used the term 'designer' to cover all designers as defined below. We have used the term 'client' to cover persons commissioning a design, whether they be a person conducting a business or undertaking (PCBU) or otherwise.

Design and designer

Under the WHS Act, design in relation to plant, a substance or a structure includes:

a. design of part of the plant, substance or structure; and

b. redesign or modify a design.[8]

The Code of Practice: Safe Design of Structures defines a designer as a person conducting a business or undertaking whose profession involves them in, "preparing sketches, plans or drawings for a structure, including variations to a structure and making decisions for incorporation into a design that may affect the health or safety of persons who construct use or carry out other activities in relation to that structure." [9]

Designers can include: architects, building designers, landscape designers, interior designers, builders, town planners, engineers that design part of the structure (e.g. mechanical, structural, civil, electric, hydraulic), services and plant designers and persons specifying how alteration or demolition work is carried out. If a principal contractor or other person changes a design, they then take on the role of designer.

For more information on designers' duties refer to Duties of designers on page 17.

Person conducting a business or undertaking (PCBU)

Person conducting a business or undertaking (PCBU) is a term that is used throughout the WHS Act and Regulation in relation to the design of structures. These include PCBUs who commission construction work ('the client'), PCBUs that commission plant or structures ('the client') and PCBUs that design structures ('the designer'). The principal contractor is also a PCBU.

A PCBU is a person who conducts a business or undertaking alone or with others that can operate for profit or not-for-profit.[10] The definition of a PCBU focuses on the work arrangements and the relationships to carry out the work. In addition to employers, a PCBU can be a corporation, an association, a partnership, or sole trader. A volunteer organisation which employs any person to carry out work is considered a PCBU. Householders where there is an employment relationship between the householder and the worker are also considered a PCBU.

Did you know that Safe Design Australia can also assist you with an internal WHS policy for your workplace?

A person commissioning a design for a workplace would be a PCBU. For residential projects, a person commissioning a structure who is an owner builder, investor, developer, or is working from home or employing workers at home would all likely be considered a PCBU.

The Code of Practice: Construction Work says that a "person commissioning the design is not a PCBU if they are a home buyer, owner or occupier commissioning work on their home; or an individual undertaking maintenance, refurbishment or renovations of their own home or helping a friend".

Regardless of whether a client is considered a PCBU or otherwise, the designers' duties in relation to safe design under section 22 of the WHS Act still apply. This includes designers providing information to their clients and anyone issued with the design on any conditions necessary to ensure that the structure is designed to be without risk to health and safety when it is used as a workplace.

Designers conducting design businesses are also considered PCBUs and as such have duties in relation to the safety of their own workers when they are working for them either in or out of the office or on site. These duties are not covered in this eBook and designers should consult the regulator or other experts to ensure they are meeting their duties as a PCBU.

Principal contractor

A principal contractor is required for a construction project where the value of the construction work is $250,000 or more.

The principal contractor is a person conducting a business or undertaking that:

- commissions the construction project (the client); or
- is engaged by the client to be the principal contractor and is authorised to have management or control of the workplace.[11]

Duties of the principal contractor are discussed in more detail later in this section.

Reasonably practicable

The designer must ensure, so far as is reasonably practicable, that the structure is designed to be without risk to the health and safety of persons who manufacture or construct any component of the structure, who use the structure for the purpose for which it is designed or are involved in the maintenance or disposal of that structure. The term 'reasonably practicable' is also used in relation to consultation with other duty holders and between designers and clients on how risks to health and safety during construction can be eliminated or minimised.

'Reasonably practicable' means that which is, or was at a particular time, reasonably able to be done to ensure health and safety, taking into account and weighing up all relevant matters including:

1. The likelihood of the hazard or the risk concerned occurring;
2. The degree of harm that might result from the hazard or the risk;
3. What the person concerned knows, or ought reasonably to know, about the hazard or risk and ways of eliminating or minimising the risk (as a professional in the design field);
4. The availability and suitability of ways to eliminate or minimise the risk; and
5. After assessing the extent of the risk and the availability of ways of eliminating or minimising the risk, the cost associated, including whether the cost is grossly disproportionate to the risk.[12]

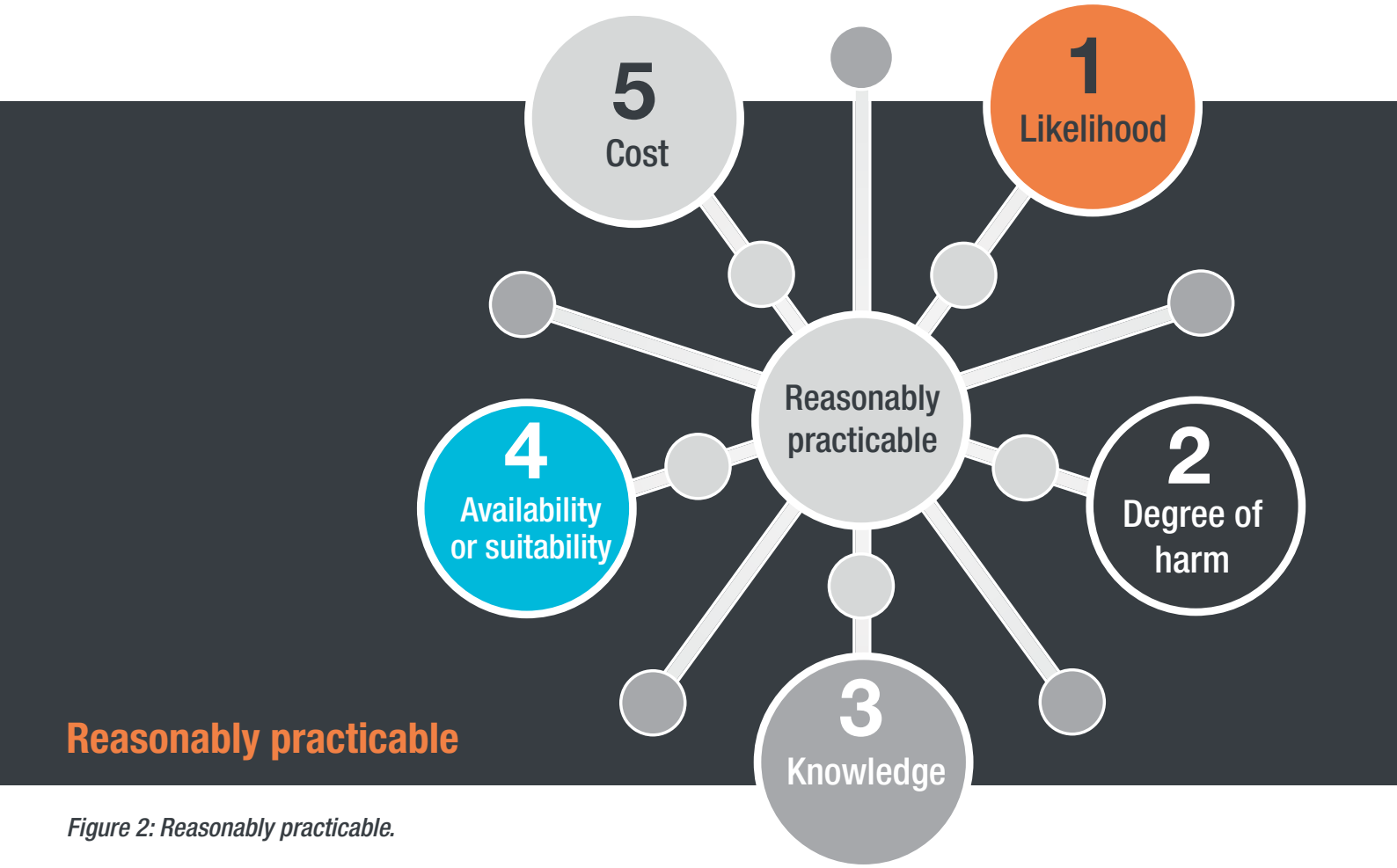


Figure 2: Reasonably practicable.

Recognised standards

'Recognised standards' include legislation, WHS codes of practice, Australian standards, building laws, the National Construction Code of Australia (NCC) and industry guidance materials.

It is important to be aware of the currency and applicability of any standards and to assess the efficacy of the standard and research current injury data to determine whether a recognised standard is adequate to address the identified hazard. In some cases, designers may need to go beyond the requirements of a standard. (For example, injury data shows that standard balustrade heights on high-rise buildings are often inadequate to address the risk of falls).

See Figure 10: Stages of a systematic approach to integrating design and risk management on page 29 for information on how recognised standards apply to safe design and risk assessment.

Structure

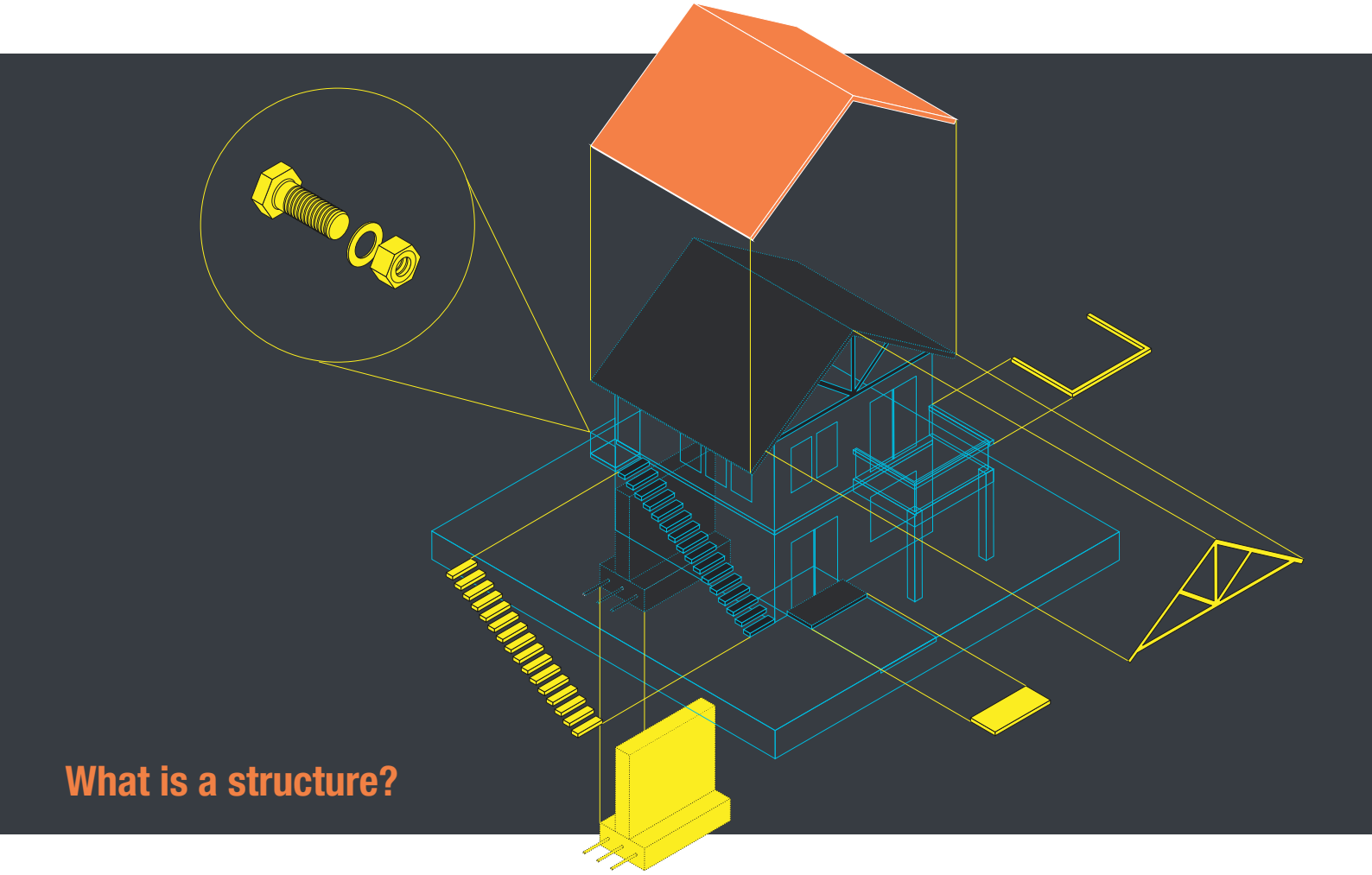
The WHS Act defines structure to mean "anything that is constructed, whether fixed or moveable, temporary or permanent, and includes:

a. buildings, masts, towers, framework, pipelines, transport infrastructure and underground works (shafts or tunnels);

b. any component of a structure; and

c. part of a structure".[13]

Examples also include all types of buildings, pipe work, tunnels, landscape elements, swimming pools, paths and roadways.



What is a structure?

What is safe design?

Safe design is the integration of hazard identification, risk assessment and control methods early in the design process to eliminate or minimise risks to health and safety throughout the construction and life of the structure being designed.[14]

"Controlling risks at the source is the most effective way to prevent work related injury, illness and death."[15]

By identifying potential work health and safety hazards early in the design process, designers can make informed design decisions to eliminate or minimise potential risks to health and safety. "Controlling risks at the source is the most effective way to prevent work related injury, illness and death."[15]

Safe design involves adopting a lifecycle approach to evaluate hazards during the stages where a structure is used as a workplace. This includes systematically identifying potential hazards during construction, maintenance, use for the purpose for which it is designed and demolition. Early consideration of potential hazards during the design process can prevent injury or illness and ensure safer workplaces for workers and users of structures.

The designer can improve the safety of their designs by understanding the proposed use of the structure and work processes, through research, testing and analysis, through selection of safer materials, through knowledge of methods of construction, maintenance and demolition, by consulting with others and by applying solutions from recognised standards. Information should be communicated to those further along in the lifecycle of the structure.

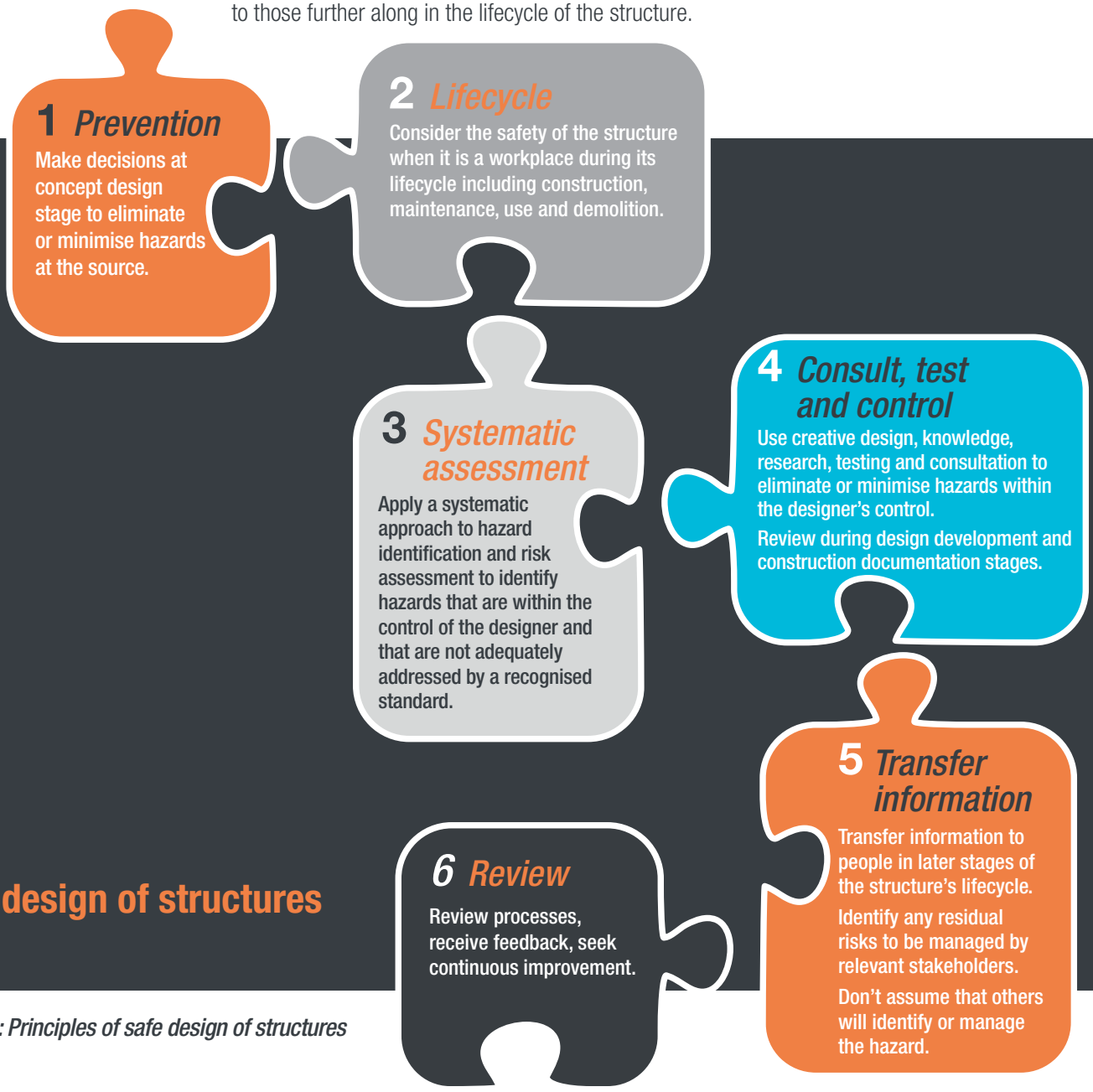


Figure 3: Principles of safe design of structures

Benefits of safe design

The benefits of safe design include the prevention of injury or illness through the early consideration of hazards. Through innovation and creativity, designers can improve the functionality and productivity of the designed workplace. Safe design can also reduce costs through improvement of work processes, reduction of accidents and potential litigation and by eliminating the potential cost of retrofitting for safety.

"For designers, safety in design provides a system to formally document a process demonstrating systematic risk management. For clients, cost savings may be found in preventing future retrofitting and downtime. Insurance premiums may be reduced as well as the risk of litigation. Occupiers may see benefits in reduced injury management interventions, increased useability, reduced maintenance costs, and improved productivity."[16]

Making changes at the design stage can be much more cost effective than making changes once the structure is in operation. For example, it can cost only $100 to change a drawing but can cost up to $10 million to clean up after an accident.[17] Additionally, there are potential financial benefits to the Australian economy with researchers claiming that annual savings of up to $1 billion are possible with a greater focus on safety and design.[18]

"For clients, cost savings may be found in preventing future retrofitting and downtime. Insurance premiums may be reduced as well as the risk of litigation.

Occupiers may see benefits in reduced injury management interventions, increased useability, reduced maintenance costs, and improved productivity."[16]

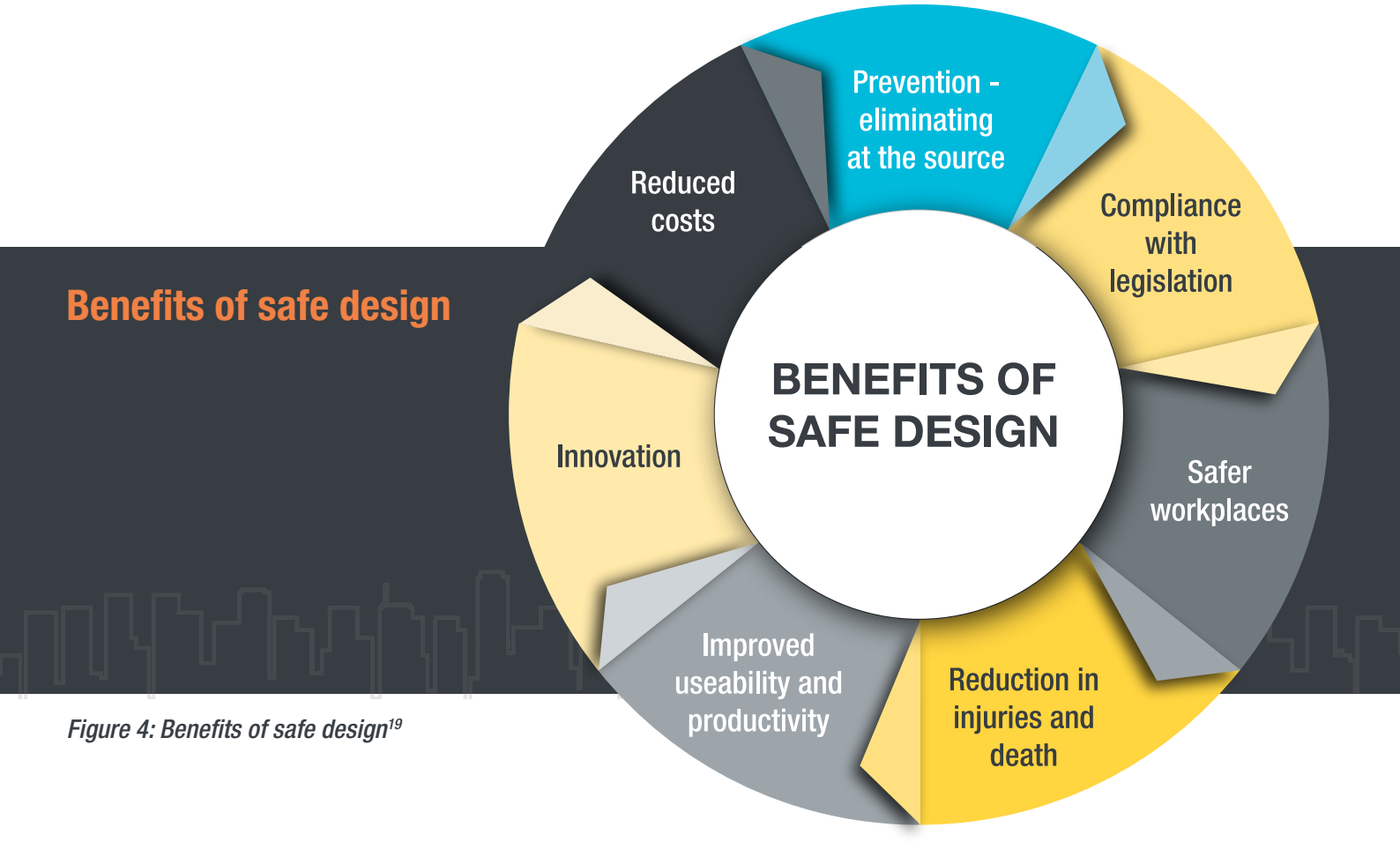


Figure 4: Benefits of safe design[19]

Legislation overview

Background

Safe Work Australia is an Australian government statutory agency that was established in 2009 with the primary responsibility of improving work health and safety and workers' compensation arrangements across Australia. After a national review into work health and safety laws across Australia and extensive public consultation, Safe Work Australia created a model work health and safety (WHS) act and WHS regulation which were endorsed by the Workplace Relations Ministers' Council (WRMC).

The harmonisation of work health and safety legislation was proposed to reduce regulatory burdens, protect the health and safety of workers and workplaces, reduce the compliance costs for business and improve efficiency of regulators.[20] All states and territories agreed to harmonise their work health and safety laws so they are similar in each jurisdiction, however, state and territory regulators are responsible for adopting and enforcing their own laws.

Legislation model

This diagram shows the elements of WHS legislation with its supporting framework and how they all fit together.

Pyramid of WHS legislation

- **Act** – outlines duties in relation to workplace health and safety including those of designers.
- **Regulations and mandatory standards** – detail mandatory requirements and provide additional information about how to fulfil duties. Other legislative provisions include the National Construction Code of Australia (NCC) including the Building Code of Australia (BCA), and building laws in each jurisdiction.
- **Codes of Practice (COP) and non-mandatory standards** - COP provide guidance on how to implement the legislation. Compliance is mandated unless the same or better is achieved.
- **Standards** - include Australian and technical standards, some referred to in legislation (law).
- **Guidance Material** - industry specific safety standards and guidance material produced by the regulators and industry.

Figure 5: Pyramid of WHS legislation[21]

Other requirements relating to safe design

While this publication refers primarily to designer's duties under the WHS act and regulation, there are other requirements that relate to safe design including the National Construction Code of Australia, the National Standard for Construction Work, Australian Standards, and other guidance material.

National Standard for Construction Work, 2005

Under the Federal Safety Commission Scheme, contractors must demonstrate integration of safe design in the construction process. The responsibilities of clients and designers, and the requirement to provide information in writing to the client under the national standard for construction work are consistent with designer and client duties under the WHS Act.[22]

Harmonisation update and state and territory legislation

Safe Design Australia can assist you with your safe design reports Australia-wide.

WHS legislation has been enacted in seven jurisdictions including the Commonwealth, New South Wales, Queensland, Northern Territory, Australian Capital Territory, South Australia Tasmania and Western Australia. At the date of this publication, Victoria has yet to enact the legislation.

Under the Victorian legislation, section 28 of the OHS Act 2004, the designer must consider the safe use and maintenance of the structure. Designers' duties do not extend to the construction and demolition phases of the lifecycle of the structure. Duties exclude residential dwellings unless they are also designed to be a workplace (e.g. aged care).[25]

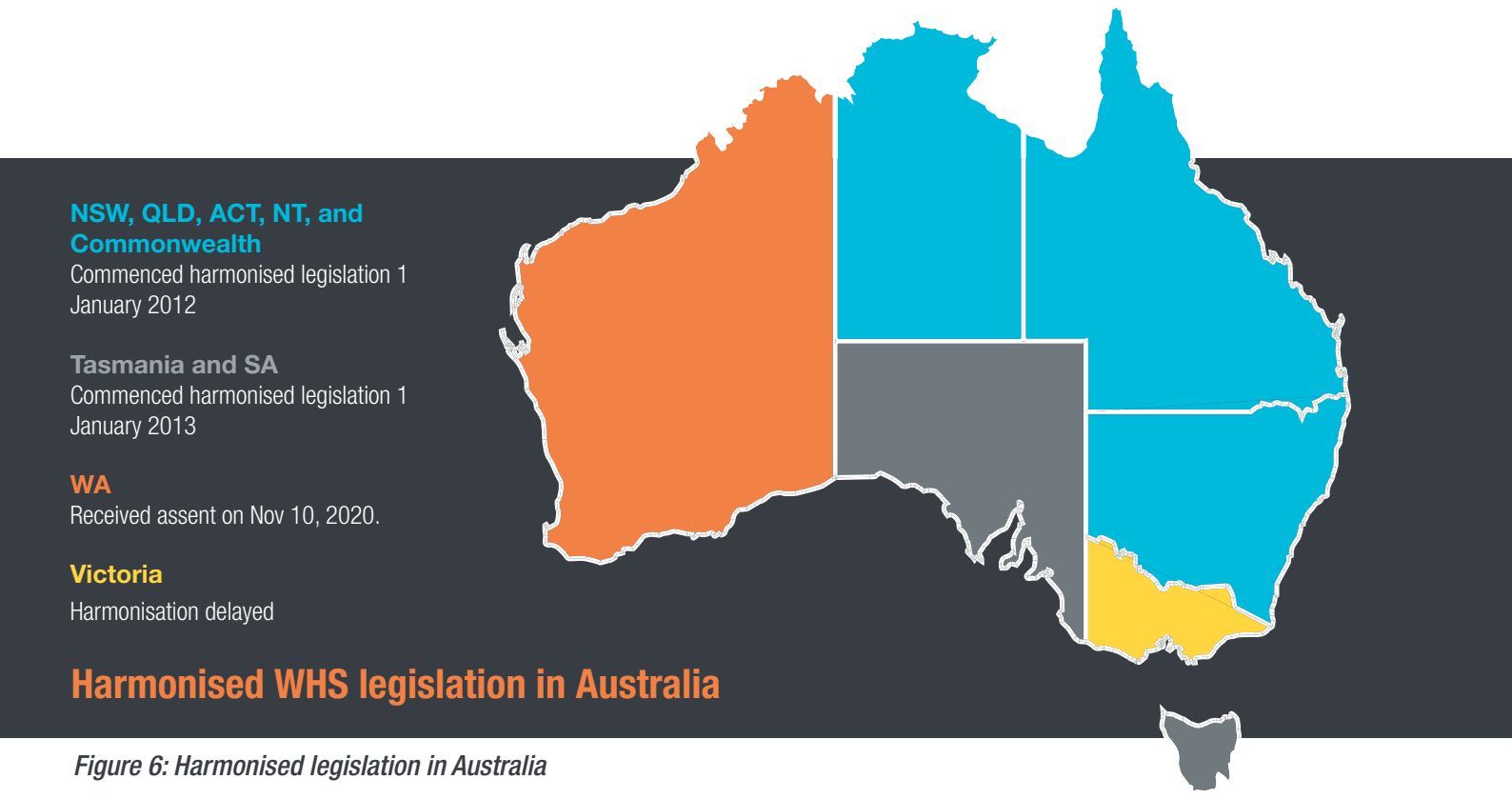


Figure 6: Harmonised legislation in Australia

There are a number of duty holders who have roles in the safe design process. These include architectural designers, other designers (including engineers), plant designers and manufacturers, the client, workers, and the principal contractor. The following section outlines the duties of each of these people under the WHS Act and WHS Regulation including the duty holders' specific duty to consult with each other on health and safety matters.

This list of requirements is not exhaustive and the designer should be familiar with the WHS Act, WHS Regulation and codes of practice to fully understand their duties and seek legal advice or advice from their state or territory regulator for clarification where required.

Consultation, cooperation and coordination

Consultation is an important process in which people with knowledge and expertise work together to share information, identify hazards and assess risks and make decisions about ways to eliminate or minimise those risks. Consultation can assist in identifying design solutions to issues that may affect the safety of workers.

It is a legal requirement for people with duties under the WHS Act to consult with each other and also to consult with workers or their WHS representative.

Section 46 WHS Act

If more than one person has a duty in relation to the same matter under the Act, each person with the duty, must, so far as reasonably practicable, consult, cooperate and coordinate activities with all other persons who have a duty in relation to the same matter.

Section 47 WHS Act

The person conducting a business or undertaking (PCBU) must consult, so far as is reasonably practicable, with workers who carry out work for the business or who are likely to be affected by a matter relating to work health or safety.

Consultation can involve meetings, discussions, workshops, and sharing of knowledge or information.

For more information on consulting with other duty holders see Section 3: Safe design in practice.

For further information consult Code of Practice: Work Health and Safety Consultation, Cooperation and Coordination.

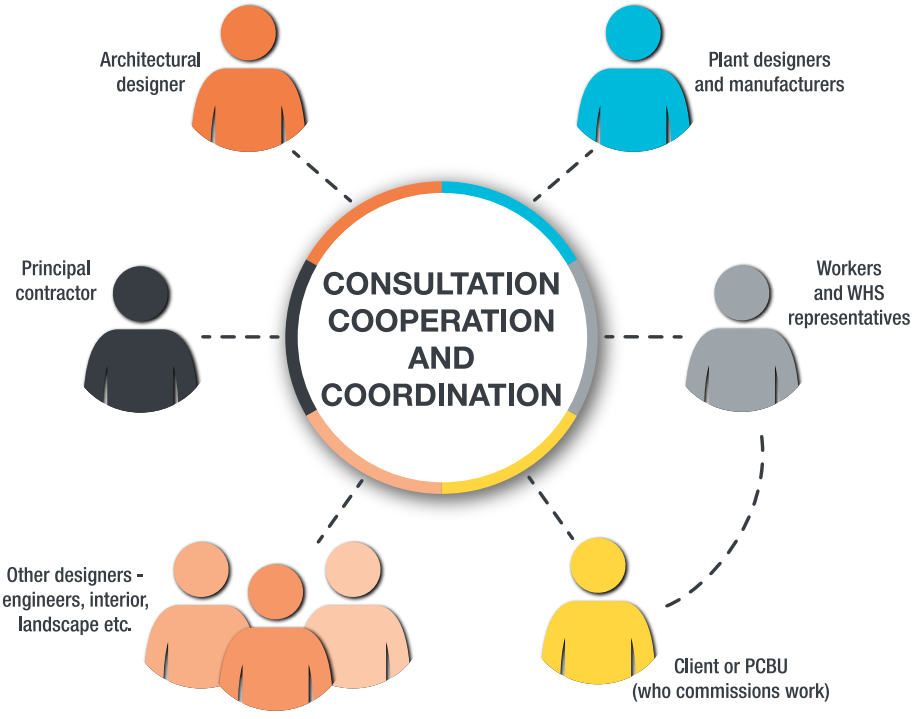


Figure 7: Consultation between duty holders in relation to safe design

Duties of designers

Duties of designers under the WHS Act

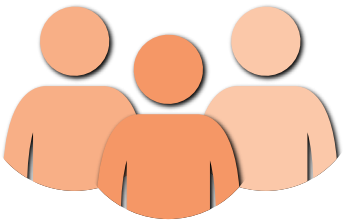
Designers are known as 'upstream' duty holders, meaning that they have influence over the safety of the structures that they design before those structures are used as a workplace and can have an effect on the safety of those who use them 'downstream' in their lifecycle.

Designers are required by legislation to design structures to be safe throughout their lifecycle as a workplace. This includes during the construction of the structure, the use for purpose for which the structure is designed, the maintenance, cleaning or repair of the structure and the eventual demolition at end of life. Designers must also consider the safety of people in the vicinity of the workplace.

Section 22(2) WHS Act

The designer must ensure, so far as reasonably practicable, that the structure is designed to be without risk to the health and safety of persons who:

- at a workplace, use the structure for the purpose for which it is designed;
- construct the structure at a workplace;
- carry out any reasonably foreseeable activity at a workplace in relation to the manufacture, assembly, use, proper demolition or disposal of the structure; and
- are at, or in the vicinity of a workplace and are exposed to the structure or whose health and safety may be affected by an activity related to the structure.



Designers also include other people who design structures or components of a structure including builders, engineers, landscape designers and interior designers. These designers also have to meet the requirements of the legislation in relation to safe design. They must also provide information on how they have designed their component of the structure to be without risk to health and safety during the lifecycle of that structure as a workplace. Designers must consult with each other to ensure that the structure is safely designed.

A PCBU (whether another designer, the client or principal contractor) who alters or modifies a design without consulting the original or subsequent designer will assume the duties of a designer.[26]

For a list of people who may be considered designers refer to the Definitions section.

Research, testing and analysis

Designers must undertake any research, testing or analysis necessary to fulfil their safe design duties. This could include researching building laws and regulations, reviewing injury data, researching materials or trialling design or engineering solutions. For more information on research, testing and analysis refer to Section 3: Safe design in practice.

Section 22(2) WHS Act

The designer must carry out, or arrange the carrying out, of any calculations, analysis, testing or examination that may be necessary to fulfill their duties.

Duties of designers under the WHS Regulation

The WHS Regulation details a three step process in relation to safe design duties:

1 **Regulation 294**

The PCBU client must consult with the designer (see Duties of clients on page 21).

2 **Regulation 295**

The designer must provide the PCBU client with a written report outlining potential hazards unique to that design that may pose a hazard to people carrying out construction work (see Information requirement on page 19).

3 **Regulation 296**

The PCBU client must provide the principal contractor with any information that they have in relation to hazards and risks at, or in the vicinity of the workplace where the construction work is being carried out (see Duties of clients on page 21).

Designers also have additional duties under the WHS Regulation. Two examples of these duties include; eliminating or minimising the need for hazardous manual tasks and the need to enter confined spaces.

Hazardous manual tasks

For further information consult Code of Practice: Hazardous Manual Tasks.

Under the WHS Regulation the designer must design the structure to eliminate the need to carry out hazardous manual tasks and where this is not reasonably practicable, the risks of musculoskeletal disorders arising from hazardous manual tasks must be minimised (WHS Regulation, reg 61).

Examples could include specification of prefabricated components that can mechanically be erected, designing the workplace to ensure adequate vehicle access or a perimeter path around buildings for maintenance access or ensuring the correct storage height of regularly accessed items.

Confined spaces

For further information consult Code of Practice: Confined Spaces.

The designer must also ensure the need to enter confined spaces is eliminated or minimised and that confined spaces have a safe means of entry and exit (WHS Regulation, reg 64).

Examples could include specifying rainwater tanks that do not have to be entered for maintenance, placing critical equipment or valves outside the confined space to eliminate the need for entry or specifying anchor points above entry points into pits to be accessed.

Information requirement

There are two specific requirements for designers to provide information, one under the WHS Act and the other under the WHS Regulation.

Under the WHS Act the designer must provide information to anyone who is issued with the design, indicating the purpose for which it is designed, the results of any testing and analysis undertaken and any conditions necessary to ensure that the designer has designed the structure to be without risk to health and safety when it is used as a workplace during its lifecycle. Current relevant information must also be provided to people who use, construct, maintain or demolish the structure on request.

Section 22(4) WHS Act

The designer must give adequate information to each person who is provided with the design in order to give effect to it concerning:

- the purpose for which it was designed;
- the results of any testing or analysis; and
- any conditions necessary to ensure that the structure is without risks when used for the purpose for which it is designed or when carrying out any activity in relation to the structure such as construction, maintenance and demolition.

Section 22(5) WHS Act

The designer must provide current relevant information on the above on request.

To meet the requirements of the WHS Regulation, the designer must provide the PCBU client with a safety report outlining potential hazards unique to that design that may pose a hazard to people carrying out construction work.

Regulation 295

The designer of a structure or any part of a structure must give the PCBU who commissions the design a written report that specifies the hazards relating to the design that, so far as the designer is reasonably aware:

- create a risk to health and safety of persons who are to carry out construction work on the structure; and
- are associated only with the particular design and not with other designs of the same type of structure.

For further information consult
Code of Practice: Safe Design of Structures.

For more information on how to provide this information and on what to include in the safety report please refer to Section 3: Safe design in practice - Providing safe design information.

Designer: Chris Vandyke Design
Photo: Sean Reason

Application of designers' duties for residential projects

Designers need to consider the safety of residential structures when they are used as a workplace. This includes during construction (including associated demolition if within the designer's scope), maintenance, cleaning and repair and demolition at end of life.

Most residential projects (e.g. residential homes, private units within a complex) are not a workplace during their use for purpose, so the designer is not required to assess safe design for use under this legislation. However there are situations where designers will need to consider the safe use for purpose for residential projects including if staff or workers will be employed or if there is an office, workshop or other type of workplace at the residence. The designer will also need to consider safe use for purpose for structures that have areas that are to be maintained or that workers will access. Examples of residential uses as a workplace may include plant rooms, foyers and lifts in high rise apartment blocks, aged care facilities, managed apartments, home offices or households that employ permanent staff such as butlers or nannies.

For those areas that are not workplaces during their use and not covered by this legislation, it is advisable that designers also consider the safe design of these spaces to ensure the safety of the occupants. The National Construction Code of Australia and AS 4226: Guidelines for Safe Design of Housing are useful references.

Designers' duties in summary

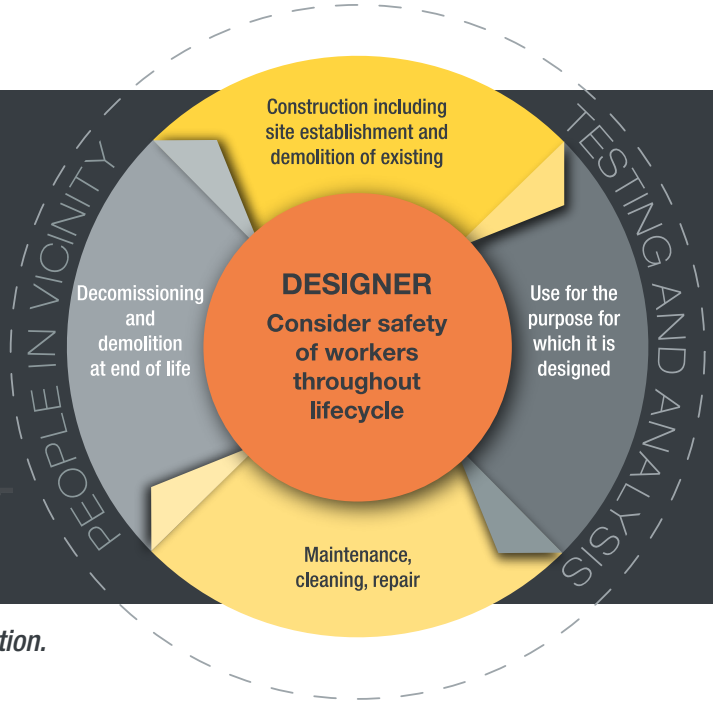


Figure 8: Designers' duties under work health and safety legislation.

Duties of clients

The Code of Practice: Safe Design of Structures refers to a person conducting a business or undertaking (PCBU) who commissions a design, construction work or a construction project as 'the client'. The client has specific duties in relation to the safe design of structures.

Duties of clients under the WHS Act

The client has duties under the WHS Act to ensure that they commission structures that are without risk to health and safety for workers throughout their lifecycle as a workplace. They must also consider those in the vicinity of the workplace.

Section 26 WHS Act

A PCBU that installs, constructs or commissions a structure that is to be used as a workplace must ensure, so far as is reasonably practicable, that the way in which the structure is installed, constructed or commissioned is without risks to the health and safety of persons who:

- install or construct the structure; or
- who use it for the purpose for which it was commissioned; or
- who carry out any foreseeable activity in relation to the proper use or demolition of the structure; or
- who are in the vicinity of the workplace.

Duties of clients under the WHS Regulation

The regulation places further obligations on the client to consult with the designer on how risks to health and safety can be eliminated or minimised. The client must also provide the principal contractor with any information that they have in relation to the hazards or risks at, or in the vicinity of the workplace where the construction work is being carried out. This would include providing the principal contractor with the designer's safety report.

Regulation 294

The PCBU client must consult with the designer, so far as is reasonably practicable, about how to ensure that health and safety risks from the design during construction are eliminated or minimised and provide the designer with any information they have in relation to the hazards and risks at the workplace where the construction work is to be carried out.

Regulation 296

The PCBU client must provide the principal contractor with any information that they have in relation to hazards and risks at, or in the vicinity of the workplace where the construction work is being carried out.

For further information consult Code of Practice: Safe Design of Structures.

Client's duties in summary

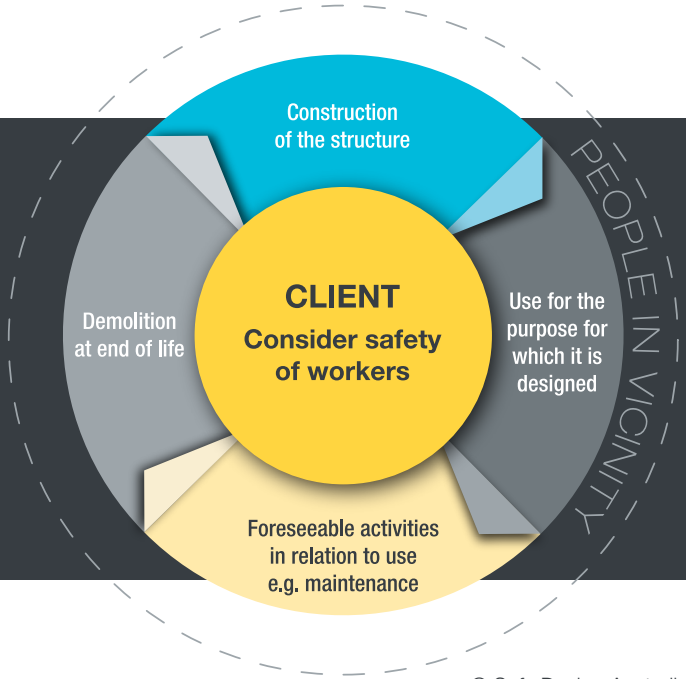


Figure 9: Client's duties under work health and safety legislation

Duties of principal contractors

A principal contractor is required for a construction project where the value of the construction work is $250,000* or more. “The principal contractor has duties to ensure that the construction work is planned and managed in a way that eliminates or minimises health and safety risks so far as is reasonably practicable.”[27] The client can be the principal contractor or the client can engage a principal contractor (builder) to discharge their duties as a principal contractor. The principal contractor must prepare a WHS management plan where the value of the construction work is $250,000 or more.

A principal contractor must:

- “manage risks associated with the construction work
- secure the workplace so unauthorised persons cannot enter
- comply with all safe work method statement (SWMS) requirements for high risk construction work.”[28]

Other health and safety duties that apply to principal contractors are:

- “general workplace management
- falls
- managing risk associated with the disposal of construction materials and waste
- the storage of plant on site when not in use
- traffic and essential services that may be affected by the construction work.”[29]

For further information consult Code of Practice: Construction Work.

In relation to safe design the client must provide the principal contractor with any information they have in relation to the hazards or risks at, or in the vicinity of the workplace including the designer’s safety report. The principal contractor must also consult with the designer. Principal contractors can also provide feedback to designers about the ‘buildability’ of their designs.[30] Where the principal contractor is also a designer or a client, the duties discussed above apply.

It is important to note that if the principal contractor alters or modifies a design without consulting the original designer then they assume the duties of a designer. Principal contractors must ensure that any changes they make do not create additional risks to health and safety.[31]

For more information on the duties of principal contractors refer to the Code of Practice: Construction Work.

*Refer to relevant State legislation to confirm requirements for the appointment of a principal contractor.

Summary of duties

Designer

- Consider safety throughout lifecycle as workplace.
- Consult with client, workers, principal contractor and other duty holders.
- Consider people in vicinity.
- Undertake research, testing and analysis.
- Provide safe design report on construction hazards to client.
- Provide safe design information on lifecycle to anyone issued with the design and on request.

Client

- Consider safety throughout lifecycle as workplace.
- Consult with designer, workers, principal contractor and other duty holders.
- Consider people in vicinity.
- Provide information to designer.
- Provide information to principal contractor on safety including designer's safe design report.

Principal contractor

Required for a construction project (refer to specific state legislation).

- Ensure construction work is managed in a way that eliminates or minimises risk to health and safety.
- Consult with other duty holders.
- Manage risks associated with the construction work.
- Secure the workplace.
- Comply with all SWMS for high risk work.

Further information on the relationship between clients, designers and principal contractors can be found in Appendix A of the Code of Practice: Safe Design of Structures.

Legal overview

It is important to remember that the purpose of the Work Health and Safety Act (WHS Act) is about encouraging a collaborative approach to risk management and involvement of all stakeholders to promote a safer outcome for workers during the lifecycle of the structure as a workplace. More than one person or entity can have a duty in relation to the same matter. Prevention of incidents is the preferred outcome.

Health and safety duties under the WHS Act

Under the WHS Act, the 'health and safety duties' (which are found in sections 19 to 29) that would most likely apply to designers are contained in:

- section 19 – the primary duty of care – imposed on all persons conducting a business or undertaking;
- section 22 – duties of designers

A related duty to that imposed on designers is contained in section 26 - duties of persons who commission structures (the client).

There are also further health and safety duties that may be relevant to designers and clients in relation to structures including duties of PCBUs who manufacture (s23), import (s24) or supply (s25) structures or those who install or commission structures (s26).

Additionally, there are health and safety duties on individuals connected with a designer, including officers (s27), workers (s28) and other persons at a workplace (s29).

Other duties and provisions of the WHS Act

There are various other provisions of the WHS Act, including duties that are relevant to PCBUs, including designers.
For example:

- sections 35 to 38 state when a duty holder must notify the relevant regulatory body in their state of a work health and safety incident.
- sections 40 to 45 relate to authorisations for particular workplaces, plant or substances and prescribed qualifications or experience.
- sections 46 to 49 provide for consultation by a duty holder with others, including workers and other duty holders.

WHS Regulation

The WHS Regulation is made under the WHS Act. The Regulation relates to a range of matters and generally provides more specific guidance and/or obligations than contained in the WHS Act. However, it is important to note that an obligation imposed by the WHS Regulation in relation to health and safety does not limit or affect any duty the person has under the WHS Act, or unless expressly stated, any other provision of the WHS Regulation (reg 11). In most instances, the failure to comply with a WHS Regulation results in a significantly lesser penalty than a failure to comply with a provision of the WHS Act.

Potential legal consequences of breach of the WHS Act for designers

In summary, the potential legal consequences for a breach of the WHS legislation are varied, but the main options available consist of:

- a monetary penalty;
- imprisonment (individuals only);
- an improvement notice;
- a prohibition notice;
- a non-disturbance notice;
- enforceable undertakings;
- adverse publicity orders;
- orders for restoration;
- work health and safety project orders;
- training orders;
- injunctions; and/or
- a civil penalty.

Prosecutions for contraventions of the WHS legislation

A contravention of the WHS legislation may result in a prosecution. Prosecutions can only be brought by the regulator, an inspector or the Department of Public Prosecutions. They are not brought by individuals who may be affected by a breach of duty. Such individuals may commence their own legal proceedings which are discussed below under 'other legal exposures'. If the defendant either enters a plea of guilty and is convicted or is found by a court to be guilty of an offence against the WHS Act, there are a number of sentencing options available to a court, including imposing a penalty.

A breach of the WHS Act generally creates greater potential legal exposure than a breach of the WHS Regulation. The potential maximum penalty for a breach of the WHS Act depends on which provision is breached and the category of the offence.

Enforceable undertakings

If a person has contravened the WHS Act, that person may propose an undertaking as an alternative to the matter being dealt with through legal proceedings. This has the benefit of improving safety in the industry.

Designers should also be aware of their obligations as a PCBU in relation to running their own design practice.

An enforceable undertaking is a legal agreement which obliges an organisation to carry out specific activities to improve not only worker health and safety, but also deliver benefits to industry and the broader community.[32] It is not an admission of guilt.

An example would be if a person is injured as a result of a design, such as because of an incorrectly designed plant door exploding outward. The designer may be required as part of an enforceable undertaking to deliver a series of presentations educating other designers on how to correctly design plant room doors.

While an offender may desire to enter an enforceable undertaking rather than be prosecuted, there is no obligation on the regulator to enter into one. The regulator is required to give the offender seeking an enforceable undertaking written notice of the decision to either accept or reject the enforceable undertaking and the reason for the decision. If a category 1 offence (i.e. reckless conduct exposing a person to death or serious injury) has been committed, it is not possible for an enforceable undertaking to be entered.

It is common for an enforceable undertaking to require a substantial commitment from the person(s) providing it and may be significantly more than the value of a monetary penalty imposed by a court.

Other legal exposures

There are a number of potential legal exposures for designers connected with health and safety, in addition to a breach of WHS legislation (which is prosecuted by a regulator). These other exposures generally involve a claim by the individual affected against the designer for a sum of money. The key exposures are summarised below in very general terms.

Civil law

Generally, a person can commence civil (or common law), as opposed to criminal, proceedings to redress a health and safety related wrong through tort law. The basis of the claim could be a claim in negligence. To establish negligence, the following key elements need to be proven:

- a duty of care was owed to the person;
- that duty was breached; and
- the breach caused injury or damage.

Alternatively, there may be a breach of contract claim. For example, if a designer who designed an unsafe structure breached the terms of the contract with the client, it is possible that a person could make a breach of contract claim.

Except in limited circumstances, the WHS Act does not give a right of action in civil proceedings in relation to a contravention of the WHS Act nor does it confer a defence to an action in civil proceedings or otherwise affect a right of action in civil proceedings (s267).

Other legal claims

Other legal claims that could be made as a result of a health and safety incident include:

- a workers compensation claim;
- a claim under anti-discrimination legislation; or
- a claim under industrial law (e.g. unfair dismissal, unlawful termination, general protections).

These types of claims are more likely to be made by an employee or contractor against an employer or principal (including by an employee or contractor of a designer) rather than a third party against a designer.

More than one consequence

It is possible that if an incident occurs, a designer may face more than one legal consequence.

For example, there may be one 'incident' for which a designer is responsible. Arising from that, there could be several legal proceedings:

- Criminal prosecution for breach of WHS Act by a regulator.
- Civil law claim (e.g. negligence, breach of contract) by an individual (e.g. client, worker, bystander) which is concerned with the rights of individuals against each other.

Insurance considerations

Professional indemnity insurance

Safe Design Australia have consulted with insurance providers and they advise that it is important that designers are aware of what is covered by their insurance policies in relation to safe design and WHS legislation. Professional indemnity insurance will cover the designer for civil or common law claims, but most do not cover criminal prosecutions or fines and penalties which may arise from breach of WHS legislation. A few insurers are now including some cover for damages and fines in their professional indemnity insurance packages. It is advisable to ask your insurer about the extent of your cover.

It is also important, when changing insurers, that designers request that the retroactive date be set to unlimited to ensure that they are covered for work prior to changing to the new insurer. If a designer retires or ceases to operate, it would be prudent to obtain run off cover as the safe design legislation applies for the life of the structure.

To make sure that they are adequately protected, designers should ensure that they fulfil their duties under the WHS Act and WHS Regulation.

SAFE DESIGN RISK MANAGEMENT

SECTION 2

- Systematic risk management process
- Risk management
- Hazard identification
- Risk assessment
- Design controls
- Review

Systematic risk management process

The Code of Practice: Safe Design of Structures recommends that designers follow a systematic risk management process including hazard identification, risk management, design controls and review. The following flow chart has been adapted from the code of practice and illustrates the systematic approach that designers can use to evaluate their designs to ensure that they are without risk to health and safety so far as is reasonably practicable.

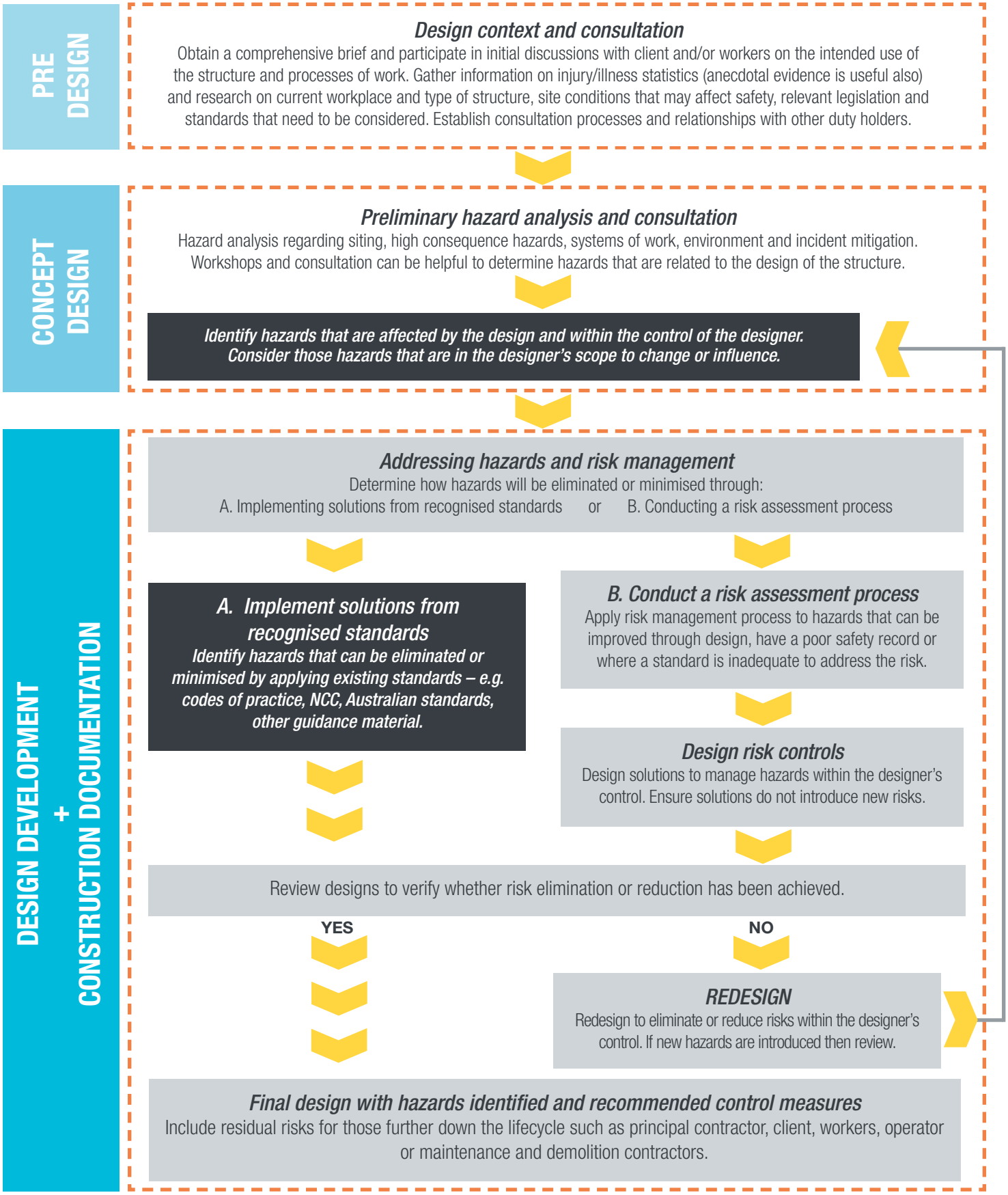


Figure 10: Stages of a systematic approach to integrating design and risk management.[33]

Risk management process

The risk management process is detailed in the Code of Practice: Safe Design of Structures and is a four step process as shown in Figure 11. This includes identifying hazards, assessing risks, determining design controls and reviewing these control measures. For safe design, this process should also include testing and analysis and consulting with other duty holders or people with specialised knowledge. Designers can refer to Australian Standard AS/NZS ISO 31000:2009 Risk Management and the Code of Practice: How to Manage Work Health and Safety Risks for additional information on assessing and managing risk.

Figure 11: The risk management process for safe design[34]

1 Hazard identification

The first step in the risk management process is identifying hazards. A hazard is a "situation or thing that has the potential to harm a person."[35] Potential hazards should be identified during the lifecycle of the proposed structure including site considerations, demolition of any existing buildings or part thereof, construction, use for purpose, maintenance and repair, and demolition at end of life. When assessing hazards it is helpful to consider the systems of work or likely workflows for workers constructing, maintaining, using or demolishing the structure. The initial project brief is a good place to start in identifying any potential issues for the workplace being designed.

A risk assessment is required where an identified hazard is within the control of the designer and is not adequately addressed by a recognised standard (e.g. code of practice, Australian standard, other guideline).

When identifying potential hazards it is recommended that designers follow a systematic process to ensure that all potential hazard areas are considered. A list of hazard categories that may be considered has been provided at the end of this section. The designer can evaluate each of these hazard categories at each lifecycle stage to identify potential issues. The designer should also consult with others and undertake any testing or analysis to assist in the hazard identification process.

The benefits of brainstorming

Brainstorming is a creative process and is something designers do well. Designers can brainstorm with their project team, the client, consultants, the principal contractor or with other designers in their practice to assess the structure they are designing and identify any potential hazards.

There is potentially a greater opportunity for innovation with brainstorming and out of the box thinking compared to checklists that may constrain ideas.[36]

2 Risk assessment

The second step is assessing the risk of injury or harm arising from the hazards identified for the particular building or structure. A risk is the possibility that harm (injury, illness or death) might occur when exposed to a hazard.[37]

For further information on risk management consult Code of Practice: How to Manage Work Health and Safety Risks.

Risk assessment for safe design requires a knowledge of construction techniques, the work environment and work processes in the workplace being designed and the types of tasks that may be undertaken during construction, maintenance, use, and demolition. It may also include testing of structures or components specified, consulting with those with specialised knowledge to identify or assess risks, consulting with other stakeholders including the client or workers, or reviewing existing documentation.[38]

When assessing risks the designer must consider the likelihood of a hazard occurring and, if it did occur, the potential extent of any harm or injury (i.e. consequences). Risk assessment is a way of deciding which hazards need to be addressed first based on the highest potential risk of injury or harm. Risk assessment involves evaluating information and requires knowledge and experience of the work environment and the processes of work to take place in the workplace being designed.

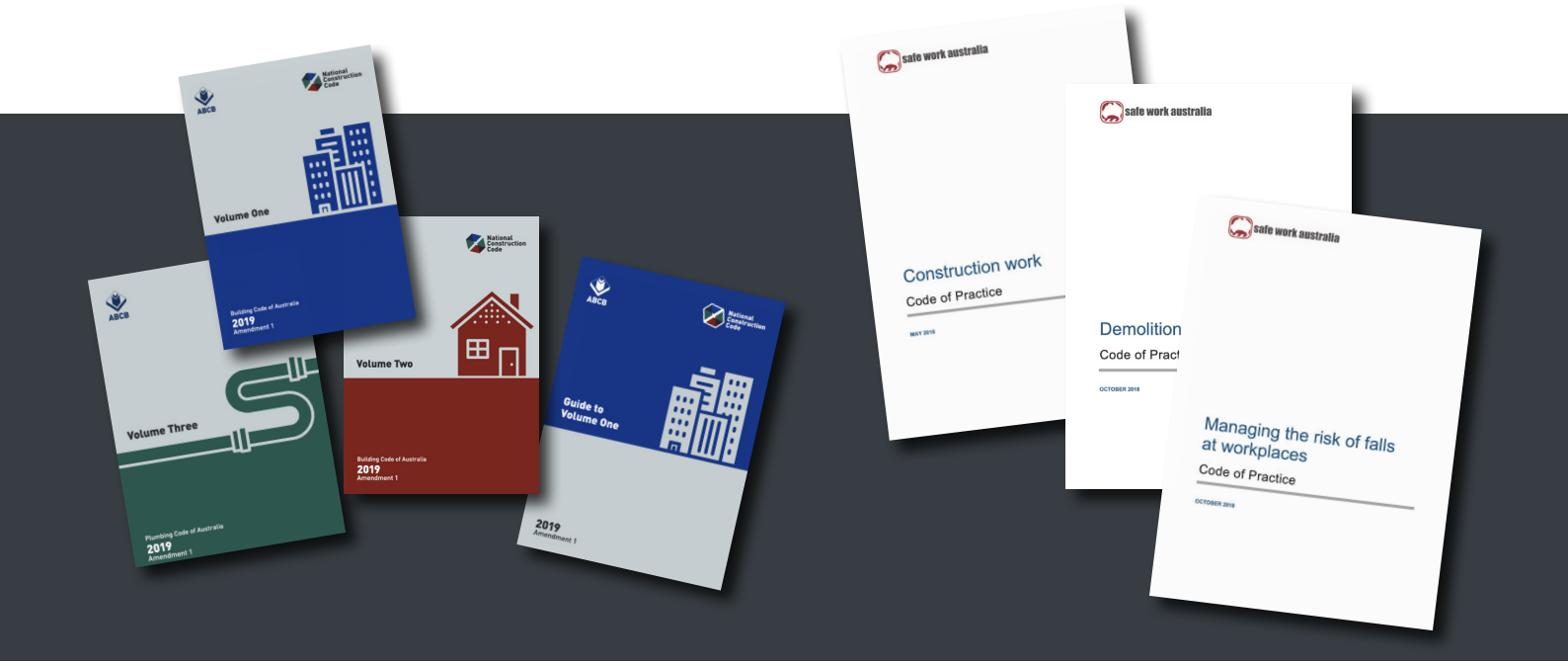


Figure 12: Recognised standards can include codes of practice, building codes and Australian standards.

Risk matrices

A risk matrix is one of the many risk management tools that can be used to determine the risk levels of any identified hazard. The matrix below has been adapted from the Australian Standard for Risk Management (AS/NZS ISO 31000).

Firstly, the designer should determine the risk level with no design controls (raw risk level). Once this has been determined, the designer should identify an adequate control (whether from a recognised standard, design control or combination of both) and revise the risk level to provide evidence of how they have designed to eliminate or minimise the hazard, so far as is reasonably practicable.

LIKELIHOOD How likely it is to happen?	**CONSEQUENCES** How severely it hurts someone (if it happens)				
	Insignificant no treatment required	**Minor** first aid treatment only; contained at site	**Moderate** medical treatment; contained but with outside help	**Major** extensive injuries, loss of production	**Catastrophic** death, irreversible damage
Almost certain expected in most circumstances	2 M	3 H	4 A	4 A	4 A
Likely will will occur in most circumstances	2 M	3 H	3 H	4 A	4 A
Possible might occur at some time	1 L	2 M	3 H	4 A	4 A
Unlikely could occur at some time	1 L	1 L	2 M	3 H	4 A
Rare may occur only in exceptional circumstances	1 L	1 L	2 M	3 H	3 H

SCORE AND STATEMENT		**ACTION**
4 A	**Acute**	ACT NOW – do something about the risks immediately. Requires immediate attention. Redesign to eliminate or reduce risk.
3 H	**High**	Highest management attention is required, action plans and management responsibility specified. Redesign as far as is reasonably practicable and alert others of any residual risk.
2 M	**Moderate**	Manage by specific monitoring or response procedures, with management responsibility specified. Redesign if reasonably practicable.
1 L	**Low**	Manage by routine procedures, unlikely to need specific application of resources.

Figure 13: Risk assessment matrix [39]

Using the risk matrix – example

1. Determine the hazard → Work at height - maintaining air conditioning plant located on the roof. There is a potential fall risk.
2. Evaluate the raw risk level (with no controls) → **4A** (consequence: catastrophic, likelihood: possible)
3. Implement design control → Relocate air conditioning plant to the ground level.
4. Revise risk level → **1L** (consequence: insignificant, likelihood: rare) The risk of falling has been eliminated.

3 Design controls

The designer should implement the most effective design controls that are reasonably practicable to eliminate or minimise identified risks to health and safety. The hierarchy of risk control will assist the designer in identifying the most effective way to control the hazard.

The hierarchy of risk control

When deciding how to implement design controls to eliminate or minimise the risk, the designer should choose the option that most effectively controls the hazard. The WHS Act and Regulation require duty holders to eliminate risks to health and safety so far as is reasonably practicable, and if it is not reasonably practicable, to minimise them.[40] Designers should work through the hierarchy of risk control when managing risks to determine the control (or combination of controls) that most effectively eliminates or minimises the risk in the circumstances.

It is important to note that elimination is always the preferred option. Personal protective equipment is the least effective method of controlling a risk and should not be relied on as the main control.

Start here

Control	Effectiveness		Description
Elimination	100%	Hazard removed	Design the hazard out e.g. relocating plant from roof level to ground level to eliminate hazard of working at heights for maintenance.
Substitution	75%	Reducing the hazard	Hazard substituted with something of lesser risk e.g. specifying low emissions paints, finishes or cabinetry. Replacing a manual process with an automatic process.
Isolation	50%	You are reducing and controlling the hazard	Hazard controlled through isolation e.g. isolating hazardous plant or chemicals.
Engineering	50%	You are reducing and controlling the hazard	Hazard controlled through engineering e.g. Safety switches, mechanical ventilators, guards around machinery.
Administration/Training	25%	These are soft controls which rely on people	Use administrative controls to influence people e.g. traffic management plan, procedures, safe work methods, signage.
Personal Protective Equipment (PPE)	5%	You are now limiting the damage	Use personal protective equipment e.g. hearing protection or hard hat.

Hierarchy of risk control

Figure 14: The hierarchy of risk control.[41]

For more information on documenting the risk management process, refer to Section 3: Safe design in practice.

Documenting the risk management process

Information on identified hazards, the risk assessment and design controls should be documented in the risk register or safe design report.

The risk management process allows the designer to follow a systematic approach to ensure that they have considered all the potential hazards relating to that design throughout the entire lifecycle when it is used as a workplace. It also provides an opportunity for the designer to identify the design controls that they have already implemented. Risk levels should be reviewed after design controls have been applied to show how risk elimination or reduction has been achieved.

4 Review

Reviewing is the final step in the risk management process. Designers should have a process in place to review the effectiveness of their design controls. This could include obtaining feedback from the client, principal contractor or maintenance personnel.

Regularly discussing safe design at staff and project meetings can be a great way to share knowledge on the types and efficacy of design controls. Lessons learned in one project can be shared with designers of future projects to ensure a process of continuous improvement.

Consultation and testing and analysis

The designer should consult with other duty holders at each stage of the risk management process. They should also undertake any testing or analysis necessary to fulfil their duties.

For more information refer to Section 3: Safe design in practice.

Hazard categories

Below are some hazard areas that can be evaluated by designers as part of a systematic approach to hazard identification. This list can also be a useful guideline when facilitating safe design workshops.

1. Access and egress
2. Adjoining areas
3. Amenities and facilities
4. Biological
5. Climatic conditions
6. Confined spaces
7. Crane operation
8. Earthworks
9. Electrical
10. Entrapment
11. Ergonomics and space
12. Falling objects
13. Falls from heights
14. Fire and emergency
15. Hazardous substances (including asbestos)
16. Heat sources
17. Lighting and ventilation
18. Manual tasks
19. Mobile plant and equipment
20. Noise
21. Precast construction
22. Psychological
23. Radiation
24. Security
25. Slips, trips and falls
26. Steel construction
27. Specialised plant and equipment
28. Stepping on or striking objects
29. Structural stability
30. Temporary Structures
31. Traffic and pedestrian management and loading
32. Underground services
33. Work at height
34. Work on or near water
35. Other workplace issues

Habitat 67, Montreal
Photo: Jeffrey M. Frank

SAFE DESIGN IN PRACTICE

- Lifecycle considerations
- Process for designers
- Consultation
- Safe design workshops
- Providing safe design information

SECTION 3

Safe design in practice

"Safe design... is part of a wider set of design objectives, which include practicability, aesthetics, cost and functionality.

These occasionally competing objectives need to be balanced in a manner that does not compromise the safety and health of those who construct, maintain or use a building or structure as a workplace."[42]

Safe Design Australia has provided designers with an overview that can assist designers in implementing safe design in the workplace. This includes considerations of potential hazards over the lifecycle of the structure during construction, maintenance, use and demolition.

To assist designers in meeting their safe design obligations at each stage of the design process from pre design to design completion, key actions have been identified in the process for designers section. Further information is provided on ways in which designers can demonstrate that they meet their safe design duties. This includes methods of consultation, safe design workshops and provision of information including safe design reports.

This section provides a basic overview only. Safe Design Australia can provide you with more detailed information and training on how to practise safe design in your workplace as part of our safe design procedure and templates package.

Innovation in design reduces time working at height and increases productivity

In a presentation paper on Safe Design Innovation by Behm, Culvenor and Genn, an innovative case study on petrol station canopy design by designers SKM for Shell was discussed. This case involved the designer making changes during the design stage to consider the safety of construction workers by minimising time working at height. The solution was for the canopy to be 'built at ground level and then jacked up' on a telescopic column by a 'hydraulic lifting process'.[43] This change resulted in a reduction in exposure of working at height by 95% as well as the added benefit of improving productivity by reducing the construction time from 25 to 30 days to only 6 to 8 days.[44]

This is a great example of how changing the current way of designing and documenting a project can lead to innovation.

Photo: Schreibschaf [45]

Lifecycle considerations

Designers need to consider safety of people during the lifecycle of the structure when it will be used as a workplace. The main phases are during construction of the structure (including civil works stage and demolition of any existing structures), use for the purpose for which the structure is designed, maintenance, cleaning or repair of the structure and demolition of the structure at end of life. Details of a few general hazards in each lifecycle stage that designers can consider have been provided below. This is not a complete list. Designers should follow a systematic approach to identifying hazards as outlined in Section 2: Risk management.

Construction

While designers may not have management and control over the actual construction work, they can discharge their duties by consulting, cooperating and co-ordinating activities, where reasonably practicable, with those who have control of construction work.[46] They must also alert the principal contractor of any potential hazards that have not been eliminated through the design of the structure.

Designers can ensure that the structures that they design can be safely constructed by considering factors such as[47]:

- identifying site hazards;
- identifying any services including potential electrical hazards;
- identifying hazardous substances in existing buildings when designing renovations;
- considering accessibility and loads of plant required for construction;
- designing to minimise manual handling by selecting building materials that are robust yet lightweight;
- eliminating or minimising large or awkward components;
- designing pre-fabricated components to reduce work at height;
- designing to ensure that confined spaces are eliminated or the need to enter these is reduced;
- considering the specification of safer materials and finishes, e.g. low VOC paints, polyester insulation;
- designing roof parapets to guardrail requirements so that they can be used as edge protection;
- reducing the spacing of roof trusses and battens or specifying safety mesh to reduce the risk of falls;
- considering reducing the risk of falls through openings;
- recommending that permanent stairs be installed early in the construction process to prevent falls and manual task hazards;

The Code of Practice: Preventing Falls in Housing Construction recommend spacing residential roof trusses at 600mm and/or battens at 450mm centres.

Prefabricating roof at ground level to eliminate work at height, Remote Building Solutions.

For further information consult Code of Practice: Construction Work.

- designing out the need for high risk construction work or communicating information that faciliates safe construction of high risk work (refer to the Code of Practice: Construction Work for further details); and
- consulting with the principal contractor and experts in relation to construction safety.

Maintenance

Designers need to consider how their structures will be safely maintained, cleaned and repaired. This can involve[48]:

- considering accessibility and loads of plant required for maintenance, e.g. perimeter paths;
- specification of durable materials;
- avoiding features that require increased maintenance at heights;
- considering general maintenance including cleaning windows, walls and roofs, changing light globes, painting;
- ensure items that require regular maintenance are located at ground level or in an easily accessible location;
- eliminating entry into confined spaces or ensuring they have a safe means of entry and exit;
- ensuring any hazardous substances required for maintenance are securely stored e.g. lockable chemical store;

Perimeter path allows access for plant for safe maintenance. Photo: Education and Training Directorate.

Specification of durable corrosion resistant materials.
Designer: Max Pritchard Architect
Photo: Sam Noonan

Designing plant at ground level for easy access.
Photo: Ildar Sagdeje, Wikimedia Commons.

- eliminating or reducing the need for hazardous manual tasks during maintenance; and
- consulting with people who have knowledge about the maintenance of the structure including engineers, property managers, maintenance workers or suppliers of equipment to determine any design controls to reduce the need for maintenance or improve safety during maintenance.

Green wall maintenance and safe design

In a paper, Safe Design of Skyrise Greenery in Singapore 2012, Behm and Poh looked at 41 rooftop and vertical greenery systems in relation to potential hazards for installation, access for maintenance and falls from heights.

By considering safe design for maintenance early in the process, designers of this vertical green wall system (shown adjacent and below) included access for maintenance with a hinged module system while eliminating the need to work at height.

Other innovative design systems observed in Singapore included movable or rotating greenery (e.g. rotating green columns), hinged systems or those with rear access. Providing safe access, choosing resilient and low maintenance planting, providing adequate setbacks and specifying irrigation and fertilising systems were actions that could be taken at the design stage to reduce maintenance complexity.[49]

For roof top greenery, 'passive systems such as nets, guardrails or parapets'[50] with internal stair access were recommended over active systems requiring the worker to have training or equipment such as harnesses.

Consideration of construction, maintenance and use loads during the design stage was raised to ensure that structures are designed to take the loads of vegetation, workers and other equipment. These loads could be verified in consultation with a structural engineer.

Photos: Michael Behm

Use for purpose

Designing workplaces to be safe for the purpose for which they are designed is an important part of the design process and is something designers generally do well.

Obtaining a thorough brief is important to identify the purpose of the workplace and systems of work. This will assist the designer in identifying any issues that may potentially affect the safety of workers.

It is also important to consult with the workers or their WHS representative on safety including finding out whether there have been past incidents at that workplace that may be prevented through design or to determine ways in which the new design can assist in improving the safety of work processes. The designer can also research any injury statistics relating to the type of use or industry for which the structure is designed.

Some considerations for designers for the safe use of structures include:

Consider systems of work

- Where does work flow?
- How do workers and the public enter or exit the building?
- Will workers be required to work at height?
- Are there any processes involving manual handling of large, heavy or unwieldy items?
- Can the distances for pushing, pulling or carrying loads be minimised?
- Have ergonomic controls been considered?
- Where are deliveries made? Are loading docks located adjacent to storage areas? Can vehicles enter and exit in a forward motion?
- Have pedestrians and vehicles been separated?
- Has the structure been designed for persons with disabilities?
- Is any special access required for plant or any equipment required to reduce manual tasks?
- Have emergency situations been considered? e.g. fire safety, stretcher access.

Identify physical components that affect worker's safety

- What tools and equipment will be required in the workplace and are there any special spaces needed or safety requirements for these?
- Has sufficient space been provided to install, operate and maintain plant? Have floors been designed to take loads for required equipment and plant?
- Are floors and stairs designed to eliminate or minimise slip and trip hazards?
- Has the potential for falling objects been addressed?
- Do processes or plant create noise and how will this affect workers?
- Have potential vibration, heat and cold, radiation, poor lighting, temperature, environmental, ventilation and air quality been considered? [51]
- Will physical components introduce hazardous manual tasks? e.g. lifting, pushing or pulling.
- Has sufficient space been provided for mechanical devices to reduce hazardous manual tasks?
- Does the building work well in emergency situations?

Consider potential mechanical and electrical hazards

- What mechanical and/or electrical safety issues could arise?
- Consider use of electricity, machinery, equipment, pressure vessels, dangerous goods, forklifts, cranes and hoists.

Consider the use of hazardous substances

- Are there any potential hazardous substances such as chemicals, including acids or poisons and those that could lead to fire or explosion?
- Are hazardous substances secured and located in positions where they are easily transported to where they need to go?
- Is a safety shower or eyewash necessary?
- Are any processes involved that may produce dust and fumes? e.g. welding.
- Are there any biological hazards? e.g. bacteria, viruses, mould, mildew, insects, vermin or animals.
- Will workers be exposed to radiation or other hazardous substances?

Consider psychosocial stressors

- Are there any psychosocial stressors in the proposed work environment and how can these be mitigated through design?
- Is occupational violence an issue?
- Do cash in transit workers have to access the workplace?
- Will the workers be safe and secure?
- Is work occurring after hours?
- What security features have been incorporated?

Demolition

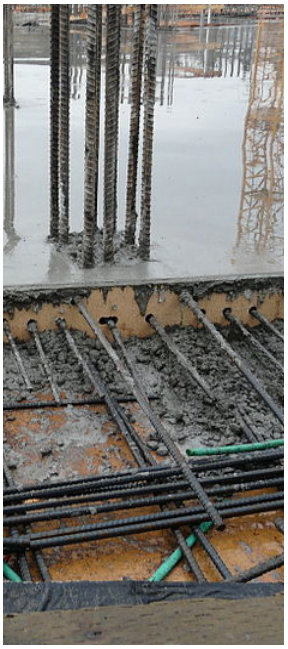
A structure should be designed to enable demolition using existing techniques. The designer should provide information so that potential demolishers can understand the structure, load paths and any features incorporated to assist future demolition, as well as any features that require unusual demolition techniques or sequencing.[52] It is important to identify the types of structures that require notification of demolition and high risk construction work. Demolition may occur during or prior to construction, during the lifecycle (renovations) or at end of life.

Designers should ensure that the structures that they design can be safely demolished by considering factors such as:

- specification of construction systems that can be safely demolished;
- access for plant and consideration of loads of plant for demolition;
- specification sequence and method of disassembling precast panels;
- special requirements for disposal of materials;
- identifying any hazardous substances or materials;
- identifying any services or electrical hazards such as overhead powerlines or underground gas;
- indicating location of any ignition sources;
- details of any hazardous demolition including precast members, tilt panels, pre-stressed or post-tensioned structures, suspended structures, stressed skin structures, slung structure (supported by a central core);
- any areas where demolition of components of the building may affect loads e.g. offset columns;
- any special demolition techniques that may be required; and
- how to best communicate information to people demolishing the structure.

For further information consult Code of Practice: Demolition.

1. Design for safe demolition.



2. Ensure post tensioned construction is clearly inidcated on the plan for safe demolition.
Image: Shakespeare, http://en.wikipedia.org/wiki/File:Post-Tensioning-Cables-5.jpg.

3. Indicate the sequence of erection of pre-cast panels to allow for safe demolition.

Process for designers

Designers should consider actions that they can take at each stage of the design process and document this information to ensure they are meeting their safe design obligations.

Pre design stage

Designers should discuss risk management strategies with the client and obtain a detailed brief so that the scope of the project is understood. For commercial projects determine systems of work and consult with workers or their WHS representative.

The designer needs to identity any issues with the site and in the vicinity and undertake research to determine any typical hazards for that type of workplace.

Concept design and design development stage

Consider safe design principles while designing the structure. Designers need to follow a systematic process to identify hazards. Brainstorming with team members and stakeholders is a good method of identifying as many potential hazards as possible. Once hazards have been identified, the designer should apply design controls using the hierarchy of risk control (see page 33). The risk assessment information should be documented in the risk register. The designer should consult with other duty holders during this stage and hold safe design workshops if required.

Safe Design Australia have developed a procedure and templates for designers to assist them in meeting their safe design obligations.

A more detailed process and checklist can be found in this documentation. Please contact us for more information.

Construction documentation and design completion stage

Consult with the design team and other duty holders (including consultants) on ways to eliminate or minimise risk, including identifying engineering solutions to any hazards identified in earlier stages that were not eliminated. For applicable projects, hold a safe design workshop with the design team, consultants, client and builder. Undertake research and testing as necessary. Include work health and safety information on the plans and update the risk register to ensure all items have been actioned. Provide the safe design report including the risk assessment to anyone who is issued with the design and highlight any residual risks from the design stage.

Construction stage and review

If the designer is involved during this stage, ensure that any changes made do not introduce any new hazards or increase risk. Document any changes on as-built plans.

Discuss potential improvements for future designs at a post construction workshop with the principal contractor, client and other stakeholders. Review processes based on feedback received.

Consultation

Consultation is a legal requirement and an important part of the safe design process. A team-oriented approach of designer, client, and principal contractor is necessary for safe design intervention to be meaningful.[53]

By working together, people involved in the design of a structure can share and communicate information on how to identify and provide solutions to health and safety risks relating to the design. Consultation should take place early in the design process to ensure that any foreseeable hazards are eliminated or minimised.

Consultation in relation to safe design can include, but is not limited to:

- consulting with the client on matters relating to health and safety and systems of work;
- consulting with contractors about safe construction or demolition methodology;
- consulting with workers or their WHS representatives on safety in the workplace being designed;
- seeking expert advice from specialists;
- consulting with other designers including engineers on their component of the structure;
- consulting with plant designers on special considerations or requirements for plant;
- consulting with others on how hazardous manual tasks, materials or hazardous systems of work can be mitigated; and
- consulting with experts about safe ways of cleaning and maintaining the structure.

Consultation can involve participating in workshops and meetings, sharing of knowledge and expertise, and sharing of safe design information including risk assessments, drawings and specifications. Designers should never assume that a hazard is someone else's responsibility. If there are multiple people working on a project, consult and clearly determine what steps will be taken and who will take them.

Safe design workshops

Our qualified risk consultants can facilitate safe design workshops or develop workshop procedures for your design projects.

The facilitation of safe design workshops for more complex projects can assist the designer in identifying hazards and consulting with other duty holders on ways to eliminate or minimise risk.

Early workshops can involve a brainstorming process where key stakeholders, led by a facilitator, consider potential hazards and evaluate the design. Subsequent workshops can encourage stakeholders to participate and consult on detailed design issues relating to the construction, maintenance, use for purpose or demolition of the structure being designed.

WorkCover NSW has developed a safety in design tool known as the Construction Hazard Assessment Implication Review Process (CHAIR Process) which uses guidewords as a prompt to promote discussion. The CHAIR process recommends the use of a facilitator to help guide the process to ensure that there are not any issues that may have been overlooked. This person should be sufficiently removed from the design process so that they do not take any suggestions as criticism or feel the need to defend the design concept. It is recommended that a diverse range of stakeholders and a systematic methodology be used to significantly reduce the chance of overlooking a major problem.[54]

The hazard categories in Section 2: Risk management or guidewords found in the CHAIR Process tool may be useful in assisting the designer or facilitator to guide discussions to identify potential hazards.

People that can participate in safe design workshops include:

- the designer
- the client
- project manager
- design manager
- engineers
- maintenance manager
- principal contractor
- workers' representative
- employer at the workplace or operator
- plant designers
- consultants that have an influence on safety decisions (e.g. childcare consultant, acoustic consultant, BCA consultant, fire services consultant)
- safe design consultant

Potential hazards should be identified and solutions proposed that improve the safety of the structure when it is used as a workplace in relation to:

- demolition of existing structures;
- civil and ground works including site layout;
- construction of structure;
- use for the purpose for which the structure is designed;
- maintenance, cleaning and repair of the structure; and
- demolition at end of life.

Information on design considerations during these lifecycle stages can be found in the previous section and these may be helpful as a basis for discussion.

The designer or facilitator should follow a systematic approach in the identification and discussion of potential hazards relating to the design. Workshop discussions and outcomes should be documented and items requiring further action noted. The workshop may be used to help populate the designer's risk register which forms part of the safety report.

For further information on safe design workshops refer to the Construction Hazard Assessment Implication Review (CHAIR) Safety in Design Tool, WorkCover NSW.

Providing safe design information

There are two specific legislative requirements for designers to provide information, one under the act and the other under the regulation.

Under the WHS Act, the designer must provide information to anyone who is issued with the design indicating the purpose for which it is designed, the results of any testing and analysis and any conditions necessary to ensure that the structure is designed to be without risk to health and safety when carrying out any activity in relation to its construction, maintenance, use and demolition. Current relevant information must also be provided, on request, to people who use, construct, maintain or demolish the structure.

To meet the requirements of the WHS Regulation, the designer must provide the PCBU client with a safety report outlining potential hazards unique to that design that may pose a hazard to persons carrying out construction work.

Other designers are also required to provide information about how they have designed their component of the structure to be without risk to health and safety throughout its lifecycle as a workplace including engineers, landscape designers, interior designers, and plant designers. You can request that they provide you with this information.

Information can be provided through making notes on the plans, providing a safety report and in a work health and safety file.

Safe design report

"The information requirements under the WHS Act may be incorporated into the safety report prepared under the WHS Regulation."

Code of Practice: Safe Design of Structures

To comply with the WHS Regulation the designer must provide a construction safety report to the PCBU to be passed on to the principal contractor. The Code of Practice: Safe Design of Structures encourages designers to provide the information required under the WHS Act in the safety report prepared under the WHS Regulation.

Safe Design Australia consider it best practice for designers to include all lifecycle stages in the safe design report to allow this information to be readily available to people further along the lifecycle of the structure. The safe design report can also assist designers to help fulfil part of their duties to consult with other duty holders and to transfer information to relevant people such as the client, other designers, the principal contractor, maintenance contractors and demolition contractors.

The safe design report under the WHS Regulation should include information on hazards unique to that design that may pose a hazard to people carrying out construction work including:

- any hazardous material or structural features or other identified construction hazards and an assessment of the risk to WHS resulting from these hazards;
- any actions you have taken to reduce the risk, e.g. design changes;
- changes to constructions methods; and
- any time construction work takes place during the life cycle of the structure.[55]

Information required under the WHS Act includes:

- the purpose for which it was designed;
- the results of any testing or analysis; and
- any conditions necessary to ensure that the structure is without risks when used for the purpose for which it is designed or when carrying out any activity in relation to the structure such as construction, maintenance and demolition.

The table below shows the lifecycle phases and information requirements under the WHS Act and Regulation.

Lifecycle stage to be considered	WHS Act section 22 Information required	WHS Regulation 295 Safety report
Construction	yes	yes
Maintenance	yes	
Use for purpose (workplaces)	yes	
Demolition	yes	

Information requirement

Figure 15: Lifecycle stages to be included in information requirements under the WHS Act and WHS Regulation

Safe Design Australia can assist designers in meeting their WHS obligations by preparing safe design reports or developing a safe design procedure, templates and training for designers to undertake their own assessments.

What should be included in the safe design report?

The safe design report can include the **information required under the act and regulation** and show how the structure has been designed, so far as is reasonably practicable to be without risk to health and safety throughout its lifecycle as a workplace. It should also provide details of any hazardous materials or structural features and the designer's assessment of the risk to construction workers arising from those hazards and any actions taken to control these risks.[56]

In the safe design report and risk assessment, designers should show evidence of a systematic risk management process when identifying hazards and provide details of any design controls using the hierarchy of risk control. For further information on risk assessment please see Section 2: Risk management.

Safe design plan

Safe Design Australia suggests adding a 'safe design plan' to your plan set to make the information in the report easily accessible to people involved during construction. This will also help to improve the communication of residual risks to people further down the lifecycle of the structure including the principal contractor, maintenance personnel and people demolishing the structure. A safe design plan could be a specific drawing in the plan set with notes relating to health and safety and residual risks highlighted. Notes and safety information should also be included throughout the drawings and specifications.

Work health and safety file

A work health and safety (WHS) file is recommended in the Code of Practice: Safe Design of Structures and can be developed by the designer to facilitate sharing of information and keeping records relating to the safe design of the structure. This could include information such as results of any testing and analysis, any design changes to eliminate or minimise identified risks, the designer's risk assessment and safety report, correspondence between stakeholders, details of any consultation or research that has been undertaken, workshop notes, safety data sheets, manuals and information on how the structure can be safely maintained or demolished.

Information storage

The designer should keep records of safe design information for the life of the structure so that this is available on request at future stages during the lifecycle. Safe Design Australia recommend that the designer have a means of storing this information as it may be requested by people working on the building in the future who make alterations or additions to the structure that may have an impact on the safety of the end users, maintenance workers or the demolition workers.

Providing results of research, testing and analysis

Under the WHS Act the designer must undertake any calculations, testing and analysis or examination necessary to fulfil their duties and to provide the results of this to anyone who is issued with the design.

Designers can research injury statistics in relation to the type of work, e.g. types of construction work, or structures used for a similar purpose. Industry and incident information is available on the regulator websites. Testing may also include examining the suitability of materials for their application. Examples could include testing of slip ratings for materials in public projects or durability of materials in extreme climate areas.

Research, testing and analysis can include, but is not limited to[57] :

- researching building and WHS laws, standards and codes of practice and guidelines;
- researching similar workplaces to the one being designed;
- obtaining data on injuries and incidents in the workplace being designed;
- researching injury and illness data relating to that industry;
- researching safer construction methods or materials, low maintenance materials and safer plant;
- researching mechanical options to reduce hazardous manual tasks;
- testing or trialling design solutions or materials; and
- obtaining hazard information from professional bodies and the regulator.

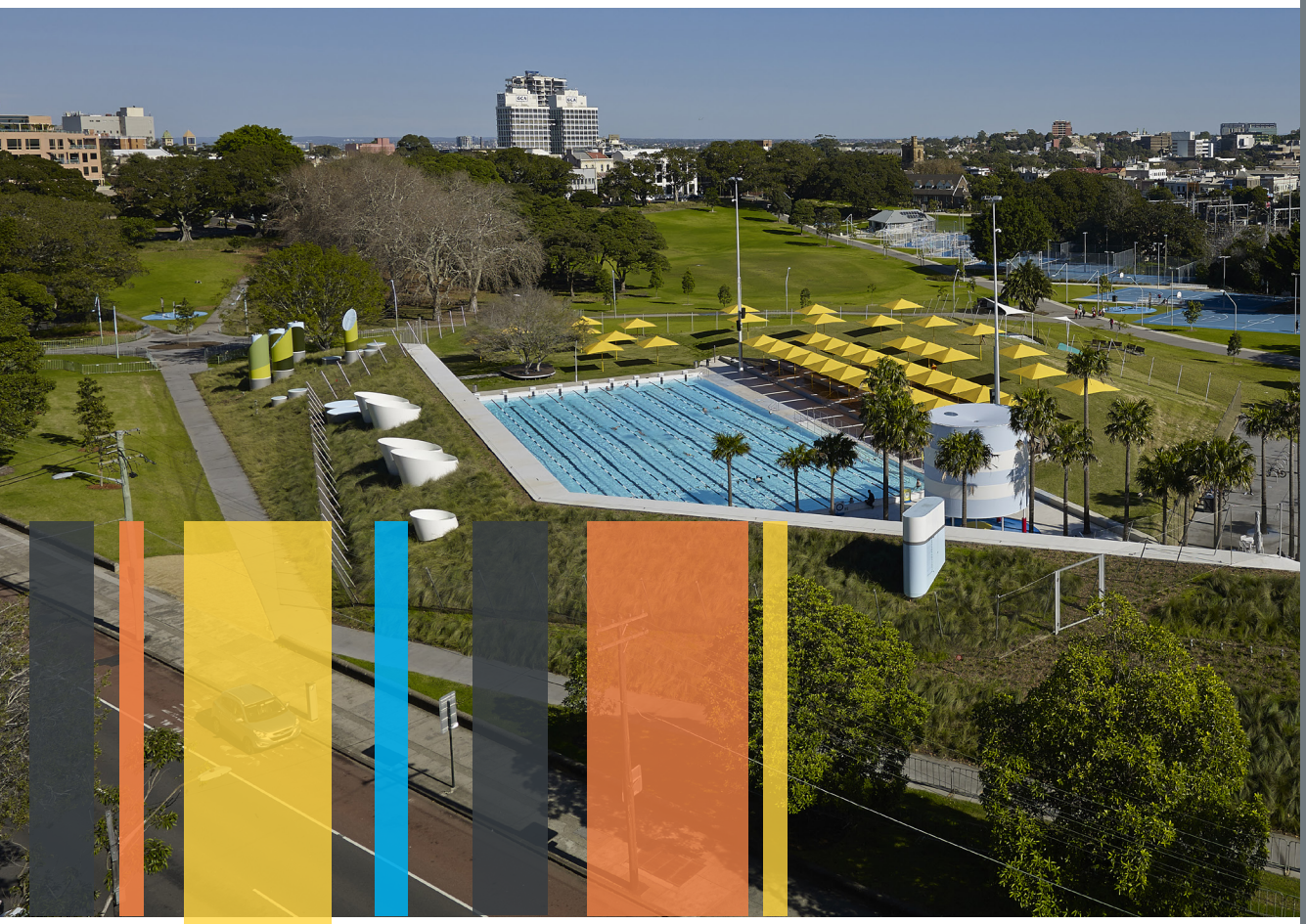
It is advisable that designers subscribe to workplace health and safety alerts from their state regulators or Safe Work Australia. These will provide the designer with updates on any injuries or incidents that may relate to industry, design or construction.

The benefits of research in safe design

A designer of a childcare centre consulted guidelines and injury statistics relating to childcare centres and discovered that a large number of deaths and injuries for this type of use occurred as a result of reversing vehicles. The carpark design was amended to include a pedestrian path in front of the vehicle parking spaces with wheel stops. This provided safe access to the centre for users.

The designer was able to identify a hazard through research and eliminate it through design.

SAFE DESIGN CASE STUDIES



- Prince Alfred Park Pool, Sydney
- AIR Apartments, Sydney
- Childcare centre
- Affinity Water, United Kingdom
- Coastal residential renovation

SECTION 4

Safe Design Australia has worked on the some of the following projects (where indicated) as a risk consultant and would like to thank the architects and designers for permission to use these projects for our case studies section. We hope that through reading these case studies, designers can see how the safe design and consultation process works in practice.

Photo: Brett Boardman

Case Study: Prince Alfred Park Pool, Sydney

Architect: Neeson Murcutt

Client: City of Sydney

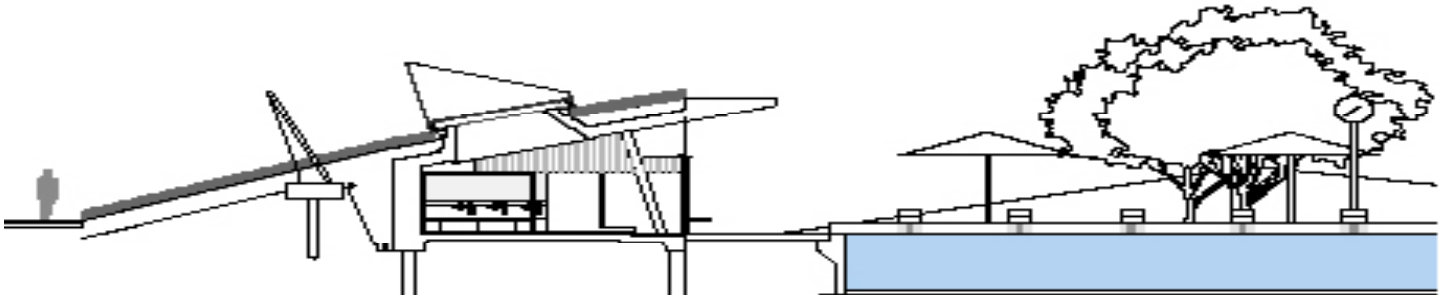
Safe Design Consultant: Safe Design Australia (construction stage)

"The overriding principle was to premiate landscape over built form, based on a conviction that in these inner urban areas, green space is sacred."[58]

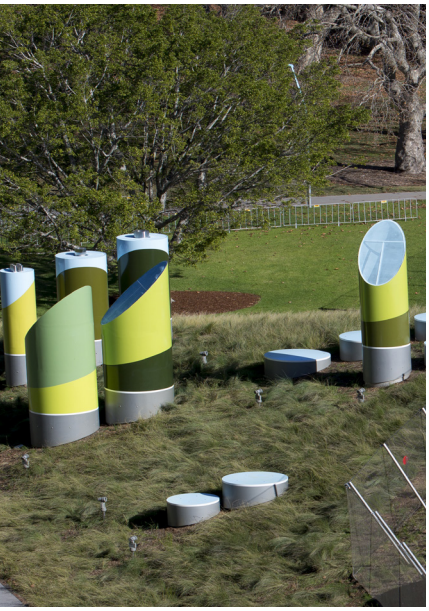
Based on this concept, a main feature of the design is the landscaped grass roof that sits over the pool building facilities. The safe design of this roof required consideration of safety in relation to potential falls as it could be accessed from street level and also consideration of how this roof would be safely maintained.

Potential unauthorised access to the roof was addressed by a 2.4 metre high fence that is setback from the edge so it does not impact on the intended visual effect. This fence is angled back and has no footholds, preventing climbing. The architect incorporated security lighting, CCTV and an alarm back to City of Sydney Security. The landscape designer reduced the need for maintenance by proposing an irrigation system and the specification of native grasses so that no mowing was required. An integrated cable access system was incorporated in the design to enable maintenance of the plants for weeding. In addition, a wide coping provides edge delineation and is illuminated by lighting from the pool deck below.

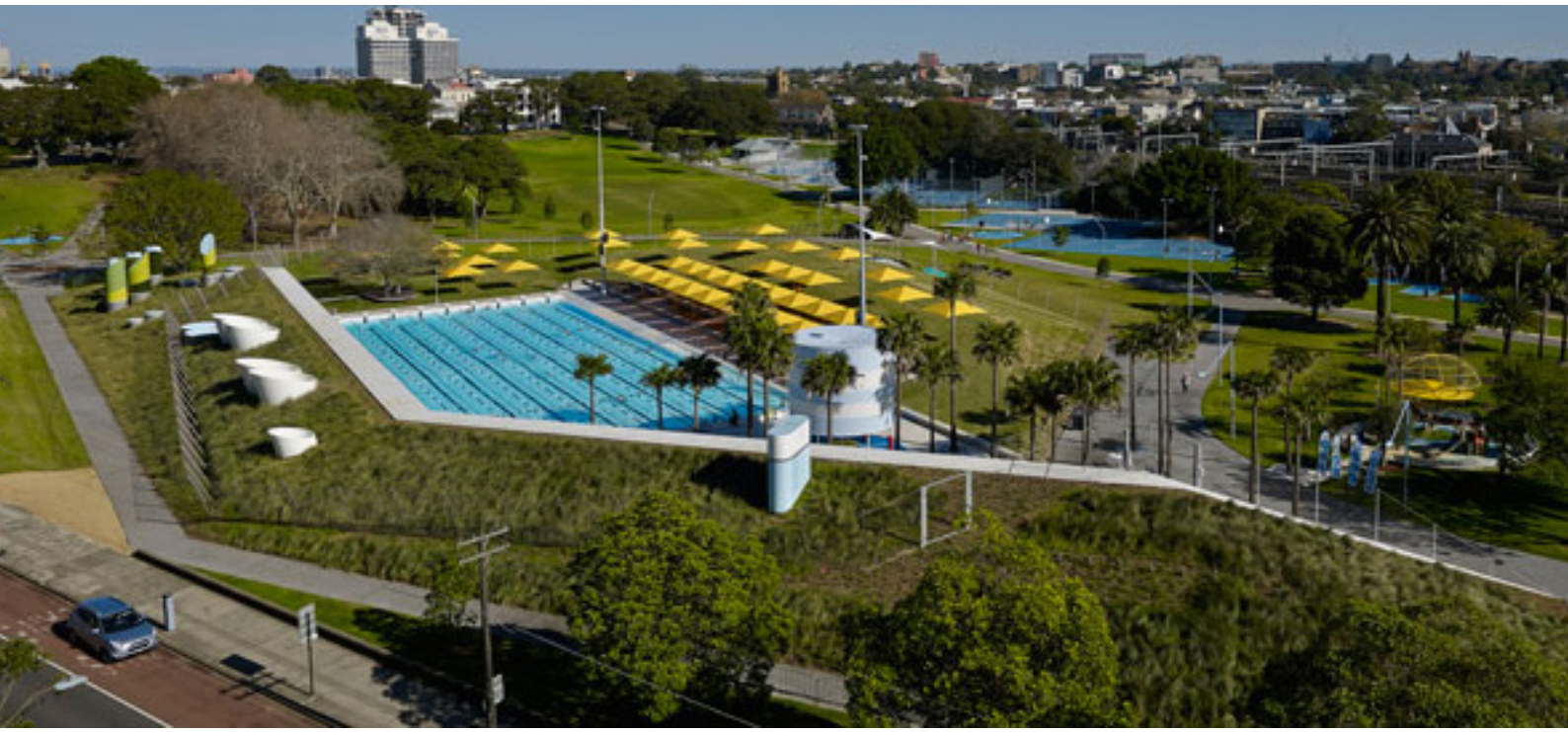
Architect successfully achieves synergy between concept and safety in public project.



Section through structure and pool, Neeson Murcutt.



To ensure safe maintenance of the structure and associated plant, the designer consulted extensively with the plant designers and design engineers. The project incorporated a concrete plant hatch above the plant rooms, fitted with lifting points, hidden in the grass mound roof should the need arise for future replacement of plant with a designated crane operation area. Large skylights and tri-generation chimneys, projecting above the grass mound, are not only safe and functional but are also sculptural as the architect originally intended.



Photos: Brett Boardman

Photo: Paul Patterson

Photos: Brett Boardman

Pivoting outdoor light poles allow maintenance access without the need to work at height.

Designated access ways for emergency access were engineered to take the loads of vehicles that may need to access the site. Research and testing was undertaken to select durable materials and surfaces and to also ensure that surfaces met slip resistance ratings for the proposed use.

Consultation involved a number of safe design workshops led by the safe design consultant with key stakeholders including the client, architect, maintenance personnel and the operator. Outcomes were documented during each stage and the risk register was updated throughout the design process and at the end of construction.

An operations and maintenance plan was created at the completion of the project incorporating residual risks and safety controls so that people further along in the lifecycle of the structure could be made aware of safety issues.

Construction:	Demolition of existing pool and structures, underground services, public domain issues.
Maintenance:	Grass mound, accessible plant, durable materials, working safely at height.
Use:	Emergency vehicle access, security, fall prevention, slip resistance.
Demolition:	Communication of information, removal of plant.

Key elements of safe design addressed

Architect considers safe design at concept design workshop.

Case Study: Air Apartments, Sydney

Architect: Robertson + Marks

Client: Holdmark

Safe Design Consultant: Safe Design Australia

The proposed structure is to be located in the St Leonard's CBD on the site of an existing building that had been demolished. A safe design workshop took place early in the design development phase of the project so that the designer could consider safe design and eliminate any potential hazards early in the project.

The proposed design of the structure incorporates a basement that is to be built to the site boundaries. Hazards associated with potential vibration and effects on the structural stability of the neighbouring structures were discussed, and the designer and structural engineer determined an appropriate system of construction to ensure that the basement works would not adversely impact the neighbouring structures. In consultation with the principal contractor, vibration monitoring was proposed to be used on adjacent structures during construction.

The facade design included the unique feature of large horizontal blades that project from the building. There was the potential for maintenance loads on these blades and an accessibility issue for facade

maintenance. Consultation with a facade consultant was recommended and the possibility of an integrated building maintenance unit was discussed. Pre-fabricated façade elements were proposed to reduce the need to work at height and minimise onsite welding during construction.

Another challenge for the project team was the requirement for separation between public and private uses to ensure the security of residents. To address this separation retail, restaurant and fitness centre areas with public access were proposed at ground level to be accessed directly from the public domain with restricted access via the lifts to the serviced apartments and private residential levels. Secure access to the car park by the public and tenants was addressed through the provision of a designated area on the first basement level for public parking with CCTV surveillance. Secure residential parking was provided on the lower levels with access via a mechanical boom gate controlled by a swipe card with a security intercom system. CCTV surveillance and security lighting was also provided.

The potential for objects to fall from balconies on to people below was considered and the team determined that this would be further considered through the design development stage with the location and screening of balcony spaces and the use of landscaping below these areas. Safe balustrade heights were also discussed.

Plant and services considerations included the provision of a plant platform on the roof with keypad entry for security, stair access to allow workers to carry small plant and equipment, and a parapet to reduce falls and protect maintenance personnel from high winds at altitude. Additional secure plant rooms were proposed in the basement area. Bollards were proposed outside lift and plant doors to prevent vehicles blocking access/egress to and from these areas. The waste management system involved the separation of commercial and residential waste. The residential garbage chute system was integrated into the building infrastructure and was designed to reduce the risk of manual handling with inlets provided at each level and with an angled chute and exclusion zones to reduce the risk of objects falling on garbage workers below.

The pool and spa deck is a unique design feature with large circular vision panels between the base of the pool and the foyer below. Further research and testing was proposed to determine safe materials and construction methods as well as safe maintenance. Discussions occurred at the safe design workshop between the designer and the engineer on the anticipated plant loads (e.g. scissor lift) required on the suspended slab for maintaining the pool windows above the foyer. A plant room and lockable store for pool chemicals was proposed below the pool deck which led to discussions at the workshop on how the location might be reviewed during the design development stage to reduce the need for manual tasks including carrying of pool chemicals up and down stairs or whether alternative mechanical methods were practicable. The pool area was designed for safe use with a proposed non-climbable 2.1 metres balustrading to prevent falls and falling objects.

Construction:	Prefabrication of façade elements to reduce working at heights, consideration of impact of construction on adjoining structures, temporary stability of basement areas during construction.
Maintenance:	Unique façade projections requiring further research or consultation including loads during maintenance or consideration of building maintenance unit, pool deck chemical storage accessibility and manual task considerations, accessibility of pool plant for maintenance, maintenance of feature circular windows from pool to foyer below including structural consideration of plant loads in foyer.
Use:	Security of car park, separation of residential from retail and public domain areas, falling objects and safe balustrade heights, waste management system.

Key elements of safe design addressed

Case Study: Childcare Centre

This case study is a compilation of issues from several different childcare projects.

Safe Design Consultant:
Safe Design Australia

The brief to the designer was to convert an existing three storey building into a large childcare centre. The existing building was built in the 1960s and the designer visually identified asbestos and lead based paints and a hazardous materials survey was organised to confirm the location of the hazardous substances. These were proposed to be removed during construction. There was a power geneartion plant across the road so the designer considered the potential health effects of electro-magnetic radiation (EMR) and researching various claddings and glazing to reduce exposure.

The client had strong beliefs and evidence in the importance of outdoor play and wanted to incorporate outdoor areas into the design. The designer achieved this by creating large balconies on each level, however, this created some potentially significant hazards including the possibility of children moving and climbing on outdoor furniture and falling.

The designer used safe design to address this hazard by increasing the balustrading above the standard height to 1.6 metres and by specifying glass balustrading with no footholds. Other safe design measures included the specification of soft fall and shading to the outdoor playground equipment and provision of windows for surveillance from internal staff areas. Garden beds were located in these outdoor areas with consideration of plant location and species to ensure that they were located out of reach and non-toxic to children if ingested. The designer undertook research in to the types of treatments for the feature timber balcony posts to eliminate the chance of splinters and so these they were non-toxic to children.

The reception area was located to have clear surveillance of people entering and access was controlled through secure glass doors to prevent unauthorised people from entering the centre. A sign-in area for parents was provided. The layout design included separation and soundproofing of the baby area from toddler area, clear sightlines from baby nappy change and food preparation areas to play areas to allow staff to supervise others while undertaking these tasks. A central staff control area was provided to allow for supervision of each group. Heat sources such as the hot water system and oven were isolated from children to avoid potential harm. A lockable cleaners store was provided to store cleaning chemicals. The designer specified no volatile organic compounds paints and low emissions joinery and carpets to prevent the potential health effects from the off gassing of these products, particularly for those children with asthma. This also had the added benefit of providing safer products for construction workers during the construction stage.

Plant was relocated from the roof to ground level to allow for easy access for maintenance. Some air conditioning units were located on the balcony area, but these were located away from the edges and in a screened area. The openings in these screens were resized during the design process to eliminate the potential hazard for hand and finger entrapment. Windows were openable from the inside to allow for easy cleaning, but were secured to prevent access by children.

The original basement car park design did not incorporate pedestrian paths and research indicated that this was a significant hazard in child care centres. The design was revised to include pathways with wheel stops in front of the car spaces and one-way traffic to allow for better traffic flow.

To facilitate the evacuation of babies during a potential fire emergency, fire safety cots were specified and a room provided for their storage in an appropriate location. The babies would be placed in these cots to be evacuated by staff. To prevent children from exiting through the fire safety door it was programmed to only unlock when the alarm was activated. The designer also consulted with the workers' WHS representative on the proposed safe lock down procedure for the centre to ensure that areas could be safely secured in the event of a lock down in an emergency situation.

Key elements of safe design addressed

Construction:	Identification and removal of asbestos and lead based paints, Specification of no VOC paints and low VOC cabinetry and carpets, location of plant at ground level.
Maintenance:	Plant located at ground level for easy access, windows openable from the inside for cleaning—but secure to prevent access by children.
Use:	Balustrading heights increased to outdoor areas to eliminate falls, consideration of reversing vehicles and traffic management, passive surveillance of areas, selection non toxic paints, no VOC paints and low VOC cabinetry and carpets, special requirements for fire evacuation for babies and children, designing for EMR, elimination of potential for hand and finger entrapment, and identification and isolation of heat sources.

Case Study: Affinity Water, United Kingdom

Architect: Scott Brownrigg

Client: Goodman

This buliding was designed for Affinity Water in Hatfield Business Park in the United Kingdom. The client wanted a statement building that would reflect their corporate ethos, promote collaborative working and energise their staff. Using a innovative combination of environmental design and safe design this building has created not only a positive environment for the office workers but also a safe environment for maintenance workers.

Innovative office design for safe maintenance.

The designer of this building has considered safe maintenance of the structure by integrating edge protection and platforms into the facade for cleaning of windows. These platforms are accessed by the external fire stairs.

A full height statement winter garden was incorporated surrounded by glass to improve the internal work environment for workers. To maintain this glass facade, a special scissor lift and system was developed to allow for regular cleaning of the large areas of glass. A perimeter path was incorporated adjacent to the building to facilitate safe maintenance using the proposed mobile plant.

To allow for safe access to the plant located on the roof of the structure, the designer incorporated an integrated parapet to provide permanent edge protection. This feature has eliminated the need for temporary edge protection and fall protection equipment during maintenance of the roof plant. The designer did not want this parapet to affect the visual or sun shading effect of the feature awning around the roof, so the parapet was concealed behind the awning.

Maintenance: Integration of cleaning platforms and edge protection in the façade design, perimeter path, parapet for roof edge protection during plant maintenance.

Key elements of safe design addressed

Case Study: Coastal residential renovation

This case study is a compilation of issues from several different residential projects.

Safe Design Consultant:
Safe Design Australia

The designer was commissioned to renovate a coastal house, including the addition of a second storey, an upper storey balcony, an entry void and stair, and some internal upgrades.

Site factors considered were the presence of overhead power lines and underground gas, the instability of the slope (geotechnical report required), and the potential for acid sulphate soils (acid sulphate soils study required).

The designer identified the potential presence of asbestos, lead based paints and polychlorinated biphenyl (PCBs) in the existing structure, and organised a competent person to confirm the location of these hazardous substances. The designer and client discussed the asbestos and decided that it should all be removed as part of the new works.

As the additions included a new upper storey on top of the existing structure, the designer consulted with a structural engineer to verify the capacity of the structure to take the load of the new level and any additional support that would be required to ensure the stability of the structure. As the site was in a coastal area, the engineer investigated the existing structure to ensure that prior damage from corrosion would not affect the integrity of the structure.

During the documentation stage, the spacing of the roof trusses for the upper level was revised to 600mm centres with battens at 450mm centres to reduce the risk of falls during construction. The roof pitch was kept below the critical angle of 26 degrees at 22 degrees (see Code of Practice: Preventing Falls in Housing Construction) to improve worker safety.

To reduce exposure of the construction workers to hazardous substances, the designer specified paints and adhesives that had no volatile organic compounds (VOCs) and no emissions materials for internal joinery.

New materials were selected for durability and to reduce the need to maintain the building at heights including the use of stainless steel roof sheeting and fixings. Air conditioning units and fans were selected that were more durable for the environment. Air conditioning units were located to the rear of the residence for protection from salt spray and at ground level for easy maintenance. To increase durability and reduce the need for ongoing maintenance, the designer selected a tiled concrete slab for the rear veranda, durable composite decking made from recycled plastic for the entry deck, and stainless steel balustrading. To eliminate confined spaces, rainwater tanks were selected that did not have to be entered to be maintained.

High level windows were originally proposed over the staircase and were considered a potential hazard for maintenance. These windows were relocated over a hallway where they could be accessed for cleaning. Louvres were specified on the upper storey to allow cleaning from the inside. Wall mounted LED lighting in the void area was proposed to reduce the risk of work at height for lighting maintenance.

The designer eliminated or minimised risks—so far as was reasonably practicable—and communicated residual risks to others further down the lifecycle including the principal contractor, maintenance contractors and demolition contractor in the safety report. The designer provided the safety report to the client, who was advised to provide this to the principal contractor. This report was also issued by the designer with tender documentation and submitted with the plans to the local council.

Construction:	Site features including slope and presence of overhead power lines, stability and load bearing capacity of existing structure, corrosion damage to existing structure, identification of hazardous substances including asbestos in existing structure, spacing of roof trusses, roof pitch, use of non- hazardous materials for new construction, selection of low VOC paints and internal joinery.
Maintenance:	Anti-corrosive and durable materials and plant to reduce maintenance, location of windows and lighting for easy maintenance, elimination of a confined space.

Key elements of safe design addressed

SAFE DESIGN RESOURCES

- Regulator websites
- Safe Design Australia resources
- Frequently asked questions
- How Safe Design Australia can assist you

SECTION 5

Resources

Visit our website for free resources to help you with practising safe design.

Regulator websites

For a list of helpful links and resources relating to safe design please visit the resources section of our website: www.safedesignaustralia.com.au

SafeWork NSW - www.safework.nsw.gov.au

Workplace Health and Safety Queensland - www.worksafe.qld.gov.au

SafeWork SA - www.safework.sa.gov.au

WorkSafe ACT - www.worksafe.act.gov.au

NT WorkSafe - www.worksafe.nt.gov.au

WorkSafe Tasmania - www.worksafe.tas.gov.au

Worksafe Victoria - www.worksafe.vic.gov.au

WorkSafe WA - www.commerce.wa.gov.au

Comcare (Australian Government) - www.comcare.gov.au

Other useful resources

Links to other great safe design resources can be found on our website including:

- Subscribe to WHS alerts at regulator sites
- Good international sites on safe design
- National, state and territory injury databases
- Codes of practice

Safe Design Australia resources for designers

To access our library of resources for designer visit our online shop here –

The shop resources include-

- Design Information Form
- WHS file
- Safe Design Report and Risk Assessment Template
- Safe Design Workshop Guide
- Safe Design Project Review Form
- Company Safe Design Procedure Template

Frequently asked questions

The following questions were asked by architects and building designers throughout Australia.

These answers are based on our opinions and discussion with the regulators and our legal advisors.

Q. Why is the legislation targeting designers?

A. National and international research indicates that design is implicated as a major causation factor in fatalities, diseases and injuries to construction workers, maintenance workers, end users and the public (Breslin, 2009). Designers are considered 'upstream duty holders' and as such their decisions can greatly affect the health and safety of people who use their designs downstream in the lifecycle of these structures. Early consideration of safety at the design stage is one of the most effective ways of eliminating or reducing hazards and risks.

Q. Does the safe design legislation apply to residential projects?

A. Yes. The WHS legislation applies to residential projects to the extent that at some stages in their lifecycle residences are workplaces such as during construction, maintenance or repair by workers, or demolition at end of life. If the residence contains a workplace such as an office or workshop, or the owner employs staff that will be working at the residence, additional considerations would apply relating to the use of that workplace for that purpose. Other examples of residential projects that are workplace during their use include aged care or managed apartments.

Q. Do I need to include all potential hazards in my safety report?

A. Only those hazards in the control of the designer and that are not adequately covered by a recognised standard (i.e. Australian standard, code of practice, NCC or other guideline) need to be included in the risk assessment process. Designers can identify the standards they apply to manage risks where possible (e.g. in reference list or list of recognised standards). Any residual risks from the design stage to be managed by those further down the lifecycle of the structure should also be detailed. See Section 2: Risk management for further information.

Q. Do I have to prepare my own safe design reports or can I engage a consultant?

A. Designers can seek the advice of experts to assist them in discharging their duties and to prepare their safe design reports and risk assessments. It is important to ensure that you are receiving good advice and that the WHS consultant that is engaged has experience in the types of structures being assessed and holds professional indemnity insurance. It is important to note that designers cannot transfer their duties to another person and will remain the duty holder and must design the structure to be without risk to health and safety as far as is reasonably practicable.

Q. If someone asks for safe design information on a structure that I have designed in the past do I have to provide this?

A. Yes. There is a specific requirement under s22(5) of the WHS Act to provide current relevant information, on request, on how the designer has designed the structure to be without risk to health and safety to persons carrying out any activity relating to the construction, use, operation, maintenance, manufacture, demolition or disposal of that structure.

Legal Q & A

For answers to further questions please visit the FAQ section of our website or email us.

We would like to thank our legal advisors People, Culture, Strategies for providing this information.

Q. How long do designers need to keep information?

A. It would be advisable for designers to keep the safe design information for the life of structure. While there is a time limit on WHS prosecutions being commenced, other legal claims are subject to a statute of limitations.

Q. Legally does there need to be a direct link to negligence on the part of the designer causing the injury in order to prosecute?

A. For a prosecution under the WHS Act, negligence is not necessary. The test is whether the designer did everything reasonably practicable to ensure that the structure is safe and without risks to health and safety. Under the WHS Act, there doesn't need to be an incident for a breach of legislation – it is enough that there is a risk to health and safety, although in practice, most prosecutions arise after an incident. The penalty isn't determined by the harm caused, but rather the risk of harm, and the penalty is based on the harm that could have occurred, e.g. a faulty design results in person breaking an arm, or if a design flaw could have caused the person's death.

Q. What happens if a designer has followed a systematic process and just misses something?

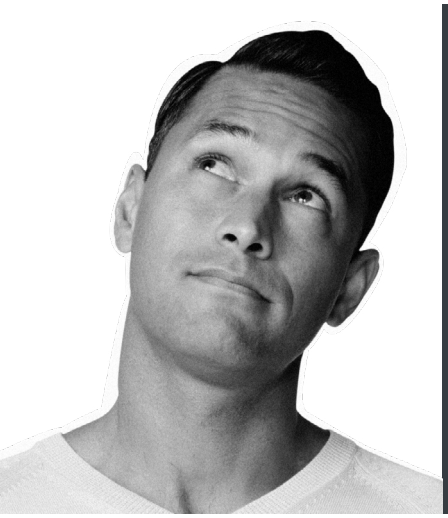
A. For the WHS Act, it depends on whether it was something the designer should have foreseen. A blanket systematic process, while a good start, will usually not be enough – the designer should always look at each design individually and try to think of all of the foreseeable risks for that design. Consultation is also essential in identifying risks.

Q. If you specify a safe material and the client overrides you (e.g. changes non-slip tile to slippery porcelain tiles) to what extent are you responsible? Have you discharged your duties by making them aware of this risk?

A. The PCBU client also has a duty in relation to ensure safety and to consult with the designer. The designer should point this out to the client and it will hopefully push the client into taking the safe option. Presumably, the designer would not recommend or allow something that is blatantly 'unsafe' and the main issue would be about the safest possible option that is reasonably practicable. If the client disregards its own obligations and wants an unsafe option, it would be advisable to include a note on the plans and in the specification that designer strongly recommends x because of y, provide details of the problems with the unsafe option and indicate that the designer does not recommend it (and that the decision was taken over by the client).

Note: Safe Design Australia is not qualified to provide legal advice and designers should contact the regulator in their jurisdiction or seek independent legal advice for their questions relating to safe design.

How can Safe Design Australia assist you?



AUSTRALIA WIDE SERVICE

- Safe design procedures and templates
- Safe design training
- Safe design workshops
- Safe design reports and risk assessments
- Internal WHS procedures and training

SAFE DESIGN AUSTRALIA

www.safedesignaustralia.com.au
info@safedesignaustralia.com.au
Call 1300 732 732

We understand that good design is important and believe that safe designs can be achieved without compromising design intent.

Safe Design Australia understands the legislation and how designers can best discharge their duties. We have developed a system that works and has been reviewed by the regulators.

Safe design reports

Our easy electronic service means that you can submit your plans and accompanying documentation for a safe design evaluation. This should ideally be at concept or design development stage. The report will include a risk register detailing any identified hazards, your existing design controls, recommended consultation and any additional recommended controls to ensure that your design has eliminated or minimised these hazards. We will also detail any residual risks to be managed by the client, maintenance personnel, the principal contractor or the demolisher at end of life.

Procedures, templates and training

Safe Design Australia have developed an effective procedure for implementing safe design in practice. With a full set of templates, tailored to your organisation, including safe design report, risk register, process for designers checklist, work health and safety file, workshop template and residential plan notes; the procedure will make the process clear and give you all the tools you need. The package is accompanied by a number of electronic training modules and CPD points are available.

Value adding

As part of our commitment to safe design, we offer designers additional support including updates on safe design and injuries relating to design through our blog, fact sheets for designers and clients (available from our website), contact and query support through our website and resources like this eBook and our online course 'The Not Boring Safe Design Course'.

NOT BORING SAFE DESIGN COURSE

Enroll in Safe Design Australias acclaimed 'Not Boring Safe Design Course' and upskill today.

Go on...you know you want to... Click HERE

References

Archer, R., Borthwick, K., Travers, M. & Ruschena, L. (2012). WHS – A Management Guide (3rd ed.), South Melbourne: Cengage Learning.

Australian Safety and Compensation Council. (2006). Guidance on the Principles of Safe Design for Work. Canberra: Australian Government. Retrieved April 31, 2014, from http://www.safeworkaustralia.gov.au/sites/swa/about/publications/Documents/154/GuidanceOnThePrinciplesOfSafeDesign_2006_PDF.pdf

Bluff, L. (2003). Regulating safe design and planning of construction works. Canberra: Australian National University. Retrieved January 31, 2014, from https://digitalcollections.anu.edu.au/bitstream/1885/41229/3/CDM.WP19.pdf

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

Breslin, P. (2009). National harmonisation: designers' duties of care in the Australian building and construction industry. Journal of Occupational Health and Safety. pp.25(6), 495-504.

Breslin, P. (2011). National Harmonisation of OHS Legislation in Australia. Australian Construction Safety Journal. 1(3), pp.10-16.

Breslin, P. (2013). Presentation: 'Focus on leading edge concepts of safer by design'. Retrieved January 31, 2014, from http://liquidlearning.com.au/documents/SIC0713/Paul%20Breslin.pdf

Cowley, S., Culvenor, J. & Knowles, J. (2000). Safe design project - Review of literature and review of initiatives of OHS authorities and other key players. Canberra: National Occupational Health & Safety Commission. Retrieved January 31, 2014, from http://www.safeworkaustralia.gov.au/sites/SWA/about/Publications/Documents/290/Review_LiteratureAndInitiatives_OHSAuthoritiesAndOtherKeyPlayers_2000_PDF.pdf

Commission for Occupational Safety and Health WA. (2008). Code of practice: Safe design of buildings and structures. Perth: Government of Western Australia.

McGregor Tan Research. (2000). NOHSC Safe Design Project, Market Research. Canberra: Commonwealth of Australia.

Safe Work Australia. (2012). Code of Practice: Safe design of structures. Canberra: Safe Work Australia.

Safe Work Australia. (2012). Code of Practice: How to manage work health and safety risks. Canberra: Safe Work Australia.

Standards Australia. (2009) AS/NZS ISO 31000 Risk management: principles and guidelines. Sydney: Standards Australia.

Standards Australia (2008) AS 4226 Guidelines for safe housing design. Sydney: Standards Australia.

WorkCover NSW. (2001). CHAIR Safety in Design Tool. Sydney: WorkCover NSW.

Worksafe Victoria. (2008). Designing safer buildings and structures. Melbourne: Victorian Government.

End notes

[1]Australian Safety and Compensation Council. (2005). Design Issues in Work Related Serious Injuries. Canberra: Commonwealth of Australia, p14. Cited in Breslin, P. (2011). National Harmonisation of OHS Legislation in Australia. Australian Construction Safety Journal. 1(3), pp.10-16.

[2]Commission of European Communities. (1993). Safety and health in the construction sector. Luxembourg: Office for Official Publications for the European Communities. Cited in Breslin, P. (2007). Improving OHS standards in the building and construction industry through safe design. Journal of Occupational Health and Safety. 23(1), pp.89-99.

[3]Churcher, D., & Alwni-Starr G. (1996). Incorporating Construction Health and Safety into the Design Process, Implementation of Safety and Health on Construction Sites. Proceedings of the First International Conference of CIB Working Commission, Lisbon, Portugal 4-4 September. Rotterdam. pp.29-39. Cited in Breslin, P. (2011). National Harmonisation of OHS Legislation in Australia. Australian Construction Safety Journal. 1(3), pp.10-16.

[4]European Foundation for the Improvement of Living and Working Conditions. (1991). From Drawing Board to Building Site. Luxembourg: Office for Official Publications of the European Communities, p.29.

[5]Safe Work Australia. (2012). Code of practice: Safe design of structures, Canberra: Safe Work Australia, p.4.

[6]Informal online polls by Safe Design Australia of over 300 architects and building designers on their concerns about the harmonised legislation during free webinar sessions from 2012-2013.

[7]McGregor Tan Research (2000) NOHSC Safe Design Project, NOHSC.

[8]Safe Work Australia. (2011). Model Work Health and Safety Bill. Canberra: Safe Work Australia, p.4.

[9]Safe Work Australia. (2012). Code of practice: Safe design of structures. Canberra: Safe Work Australia, p.5.

[10]WorkCover NSW. (2011). Fact Sheet - PCBUs, Workers and Officers. Sydney: NSW Government.

[11]Safe Work Australia. (2012). Code of practice: Safe design of structures. Canberra: Safe Work Australia, p.5.

[12]Safe Work Australia. (2011). Interpretive Guideline – model Work Health and Safety Act – the meaning of 'Reasonably Practicable'. Canberra: Safe Work Australia.

[13]Safe Work Australia. (2011). Model Work Health and Safety Bill. Canberra: Safe Work Australia, p.7.

[14]Safe Work Australia. (2012). Code of practice: Safe design of structures. Canberra: Safe Work Australia, p.4.

[15]WorkSafe Victoria. (2004). Designing safer workplaces. Melbourne: Victorian Government.

[16]Angelides, A. & Xinos, G. (2013). Safety in Design- A Process. Retrieved January 1, 2014 from http://www.functionalaccess.com.au/1/post/2013/10/safety-in-design-sid-a-process.html

[17]Breslin, P. (2007). Improving OHS standards in the building and construction industry through safe design. Journal of Occupational Health and Safety. 23(1), p.98.

[18]Trethewy, R. (2003). Enhanced safety, health and environmental outcomes through improved design. Journal of Engineering, Design and Technology, Southern African Built Environment and Research Center. 1(2), 189. Cited in Breslin, P. (2011). National Harmonisation of OHS Legislation in Australia. Australian Construction Safety Journal. 1(3), pp.10-16.

[19]Australian Safety and Compensation Council. (2006). Guidance on the Principles of Safe Design for Work. Canberra: Australian Government. p.7. Retrieved April 31, 2014, from http://www.safeworkaustralia.gov.au/sites/swa/about/publications/Documents/154/GuidanceOnThePrinciplesOfSafeDesign_2006_PDF.pdf

[20]Safe Work Australia. (2010). Explanatory Memorandum – Model Work Health and Safety Act. Canberaa: Safe Work Australia. Retrieved January 31, 2014, from http://www.safeworkaustralia.gov.au/sites/swa/about/publications/pages/explanatorymemorandum

[21]Archer, R., Borthwick, K., Travers, M. & Ruschena, L. (2012). WHS – A Management Guide (3rd ed.), South Melbourne: Cengage Learning. p.27.

[22]Breslin, P. (2013). Presentation: 'Focus on leading edge concepts of safer by design'. Retrieved January 31, 2014, from http://liquidlearning.com.au/documents/SIC0713/Paul%20Breslin.pdf

[23]Breslin, P. (2013). Presentation: 'Focus on leading edge concepts of safer by design'. Retrieved January 31, 2014, from http://liquidlearning.com.au/documents/SIC0713/Paul%20Breslin.pdf

[24]Worksafe WA. (1996). Occupational Safety and Health Regulations 1996. Perth: Government of Western Australia, p.137.

[25]Worksafe Victoria. (2008). Designing safer buildings and structures. Melbourne: Victorian Government, p.3.

[26]Safe Work Australia. (2012). Code of practice: Safe design of structures. Canberra: Safe Work Australia, p.5.

[27]Safe Work Australia. (2012). Code of practice: Safe design of structures. Canberra: Safe Work Australia, pp.5-6.

[28]WorkCover NSW. (2013). Principal contractor duties. Retrieved January 31, 2014, from http://www.workcover.nsw.gov.au/newlegislation2012/your-industry/construction/Pages/principal-contractor-duties.aspx

[29]WorkCover NSW. (2013). Principal contractor duties. Retrieved January 31, 2014, from http://www.workcover.nsw.gov.au/newlegislation2012/your-industry/construction/Pages/principal-contractor-duties.aspx

[30]Safe Work Australia. (2011). Code of Practice: Construction Work. Canberra: Safe Work Australia, p.41.

[31]Safe Work Australia. (2011). Code of Practice: Construction Work. Canberra: Safe Work Australia, p. 40.

[32]Workplace Health and Safety Queensland.(2013). Enforceable undertakings. Retrieved January 31, 2014, from http://www.deir.qld.gov.au/workplace/law/enforceable-undertakings/index.htm

[33]Safe Work Australia. (2012). Code of Practice: Safe design of structures. Canberra: Safe Work Australia, p.12.

[34]Safe Work Australia. (2012). Code of Practice: How to manage work health and safety risks. Canberra: Safe Work Australia, p.5.

[35]Safe Work Australia. (2012). Code of Practice: How to manage work health and safety risks. Canberra: Safe Work Australia, p.4.

[36]Behm, Dr M. (2012). Safe design leads to construction innovation, Safety: Adapting for change. Achieve. the Sinclair Knight Merz magazine. (2), 1-3. Retrieved from http://www.globalskm.com/site-documents/Insights/achieve/issue2_2012/achieve_2_12_eng_safe-design-leads-to-construction-innovation.pdf

[37]Safe Work Australia. (2012). Code of Practice: How to manage work health and safety risks. Canberra: Safe Work Australia, p.4.

[38]Safe Work Australia. (2012). Code of Practice: Safe design of structures. Canberra: Safe Work Australia, p.16

[39]Standards Australia. (2004). HB 436:2004 Risk Management Guidelines, companion to AS4360 Total Safety Services. Sydney: Standards Australia, p.55.

[40]Safe Work Australia. (2012). Code of Practice: How to manage work health and safety risks. Canberra: Safe Work Australia, p.3.

[41]My HSE. (2011). Effectiveness percentages for hierarchy of risk control. Retrieved January 31, 2014, from http://my-hse.blogspot.com.au/2011/04/effectiveness-percentage-for-hierarchy.html

[42]Breslin, P. (2011). National Harmonisation of OHS Legislation in Australia. Australian Construction Safety Journal. 1(3), pp.10-16.

[43]Behm, M., Culvenor, J., & Genn, K. (2011). Can Safe Design be a Source for Construction Innovation? Paper presented at CIB W099 International Conference – Prevention: Means to the End of Construction Injuries, Illnesses, and Fatalities. Washington DC.

[44]Behm, M., Culvenor, J., & Genn, K. (2011). Can Safe Design be a Source for Construction Innovation? Paper presented at CIB W099 International Conference – Prevention: Means to the End of Construction Injuries, Illnesses, and Fatalities. Washington DC.

[45]Schreibschaf,I. (2007). File: Petrol Station Shell Hennstedt.jpg. Wikimedia Commons. Retrieved from http://commons.wikimedia.org/wiki/File:Petrol_Station_Shell_Hennstedt.jpg Photo for reference only and not of telescopic canopy.

[46]WorkCover NSW. (2012). Designers duties relating to structures in NSW. Presentation to AIA December 2012.

[47]Safe Work Australia. (2012). Code of Practice: Safe design of structures. Canberra: Safe Work Australia, pp.20-21.

[48]Safe Work Australia. (2012). Code of Practice: Safe design of structures. Canberra: Safe Work Australia, pp.20-21.

[49]Behm, M., & Poh C. (2012). Safe design of skyrise greenery in Singapore. Smart and Sustainable Built Environment. 1(2), pp.186 – 205.

[50]UK Health and Safety Executive (2005). Walking on Roofs. London: Health and Safety Executive. cited in Behm & Poh (2012) Safe design of skyrise greenery in Singapore, Emerald Group Publishing, p.193.

[51]ComCare. (2004). Identifying Hazards in the Workplace. Canberra: Australian Government.

[52]Safe Work Australia. (2012). Code of Practice: Safe design of structures. Canberra: Safe Work Australia, p.22.

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

[54]WorkCover NSW. (2001). CHAIR Safety in Design Tool. Sydney: WorkCover NSW, p.10.

[55]WorkCover NSW. (2012). Designers duties relating to structures in NSW. Presentation to AIA December 2012

[56]Safe Work Australia. (2012). Code of Practice: Safe design of structures. Canberra: Safe Work Australia, pp.9-10.

[57]Safe Work Australia. (2012). Code of Practice: Safe design of structures. Canberra: Safe Work Australia, pp.11.

[58]2014 Sydney Design Awards. (2014), Prince Alfred Park + Pool. Retrieved January 31, 2014, from http://www.sydneydesignawards.com.au/sda2013/entry_details.asp?ID=11962&category_id=5299

SAFE DESIGN AUSTRALIA

www.safedesignaustralia.com.au
info@safedesignaustralia.com.au
1300 732 732

How does our report service work?

Submit your plans and accompanying documentation electronically. We will review the documentation and request any further information from you, your client, or your consultants. The report will include any identified hazards, your existing design controls, recommended consultation and any additional recommended controls to ensure that your design has eliminated or minimised these hazards. The report will also detail any residual risks to be managed by the client, maintenance personnel, the principal contractor or the demolisher at the end of life.

Safe Design Australia understands the legislation and how designers can best discharge their duties. We have developed a system that works and has been reviewed by the regulators. For a minimal outlay, our professional reports can provide long term cost savings.

AUSTRALIA WIDE SERVICE

- Safe design procedures and templates
- Safe design training
- Safe design workshops
- Safe design reports and risk assessments
- Internal WHS procedures and training

Call 1300 732 732

We understand that good design is important and believe that safe designs can be achieved without compromising design intent.

SAFE DESIGN DOCUMENTATION AND TEMPLATES

We've developed a range of Safe Design Documents and Templates specifically for building designers to use to help them meet their obligations under WHS legislation.

CLICK HERE to purchase now.