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CHAIR

SAFETY IN DESIGN TOOL

TOOL 2001

WORKCOVER NSW SAFETY IN DESIGN TOOL

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preamble

CHAIR (Construction Hazard Assessment Implication Review) is a tool to assist designers, constructors, clients and other key stakeholders to come together to reduce construction, maintenance, repair and demolition safety risks associated with design.

CHAIR was developed in support of the Construction Memorandum of Understanding (MOU). The MOU was signed in 1998 between the NSW Government and the Chief Executive Officers of the principal contractors and major industry associations in the NSW construction industry.

The signatories to the MOU have worked in partnership to implement measures to improve the construction industry's OHS and injury management performance.

CHAIR was developed in close consultation with contractors and design professionals. It was prepared by Mr David Franklin and was sponsored by BHP Engineering, Bovis Lend Lease and Transfield Pty Ltd. The assistance of Mr Franklin and these organisations is gratefully acknowledged.

The Australian Council of Building Design Professions (BDP) and the Royal Australian Institute of Architects (RAIA) support the use of CHAIR. The BDP believes that along with the quality and amenity of the built environment, its safety is also determined at the design stage. "CHAIR is a tool that will enable better safety awareness and solutions for improving safety and construction through identifying potential hazards by a coordinated approach by all stakeholders.

The RAIA also believes the value of CHAIR arises from its common sense approach and practicality in drawing key stakeholders together to co-operatively plan for safety.

Other products developed under the auspices of the Construction MOU include:

Subby Pack: OHS Contractor Management Tool
Hazard Profile: Identification Tool for Metal Roofing
Identification Tool for Electrical Hazards on-site
Identification Tool for Bricklaying
Identification Tool for Formwork
Identification Tool for Aluminium Mobile Scaffolds
Identification Tool for Steel Reinforcement Fixing
Identification Tool for Concrete Placement
Identification Tool for Demolition
Supervisor Manual: OHS Training Tool
Safety Meter: Positive Performance Measurement Tool

Another valuable tool to assist small and medium-sized businesses to systematically manage safety is WorkCover's Workplace Safety Kit.

More information about each of these products can be obtained by contacting WorkCover NSW on 131050 or at www.workcover.nsw.gov.au.

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1. introduction

Consideration of occupational health and safety (OHS) issues in the design stage of a construction project has been identified as essential for improved OHS outcomes. A United Kingdom study found that nearly two thirds of the injuries and fatalities on construction sites could be traced to design decisions and lack of planning in this key element of a project (Churcher & Alwani Starr, 1996).

CHAIR, an acronym for Construction Hazard Assessment and Implication Review, is a tool that has been developed to bring together all the key stakeholders involved in design to help identify and eliminate (or minimise) inherent risks in a structured and systematic way. The name CHAIR was also selected because a function of both a chair and a design review is to provide an opportunity to sit down, pause and reflect on possible problems.

CHAIR provides a rigorous framework for a facilitated discussion that is stimulated by guidewords or prompts. These prompts assist the key stakeholders to collectively identify and reduce construction, maintenance repair and demolition safety risks associated with a design. Those risks are then formally listed for action by the appropriate stakeholders.

CHAIR recognises that a design involves key considerations such as operability, aesthetics and economics with the elements of safety. It also acknowledges that a design process may be determined by many different stakeholders and/or influences. The CHAIR methodology aims to involve these elements and influences.

It is intended to be applied to projects where the design or construction is unique, unusual, or of sufficient inherent hazard that a formal detailed assessment is warranted.

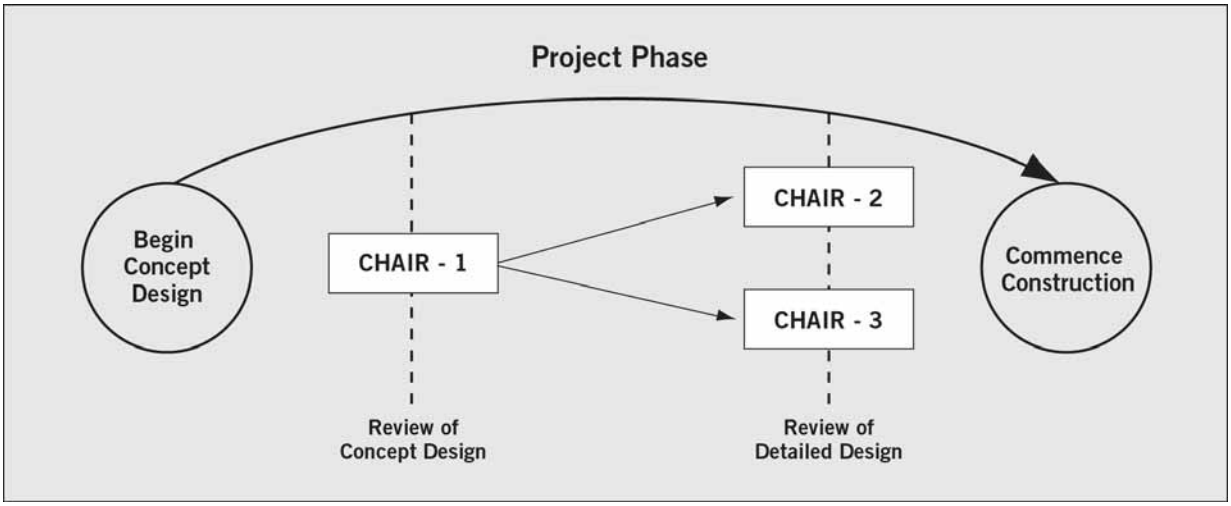
The primary aim of a CHAIR is to identify and eliminate or minimise risks in a design as soon as possible in the life of a project. There are three phases of CHAIR:

CHAIR ONE is performed at the conceptual stage of a design, which is the best opportunity to make fundamental change, even though much of the design is still to be determined.

CHAIR TWO focuses on construction and demolition issues and is performed just prior to construction, when the full detailed design is known.

CHAIR THREE focuses on maintenance and repair issues and is performed at the same time as the CHAIR 2 study.

This is illustrated in the following diagram :



For example, a CHAIR study could be used during the design stage to improve safety during the construction process by:

- designing multistorey buildings so the exterior wall covering (precast panels etc.) can be installed as soon as the framework is in place and most trades begin work on floor;
- eliminating the need for installing temporary barriers by designing higher parapet walls or an integrated guardrail system along all roof edges;
- minimising the use of temporary scaffolding by designing permanent stairways and walkways to be constructed first (Hinze 1996).

By proactively considering construction, maintenance, repair and demolition issues, the CHAIR framework should not only help reduce the number of construction industry incidents, but also assist in improving constructability and reducing the life cycle costs associated with building and civil design projects.

2. the importance of safe design

The design process involves a range of participants and stakeholders. It includes designers, specialist consultants, clients, users, approval authorities and (at times) project managers and constructors. The art of design involves consideration of a range of issues such as aesthetics, function, safety and environment. Such considerations can arise due to experience, legislation, codes and standards, expertise, logic, checklists and any other means.

Previous experience greatly assists with identification of safety risks associated with a design. However, to learn from previous experience requires an incident to have occurred, be adequately documented and the information made available to the relevant parties involved in the design process.

Codes and standards tend to address the obvious risks and are less effective in identifying previously unforeseen hazards. When a design is no longer simple or straightforward, or involves unique, unusual or potentially hazardous design, there may not exist sufficient experience or codes of practice to adequately consider all safety issues (Kletz, 1990).

There is a balance of responsibilities between a designer, a constructor and other relevant stakeholders, such as clients or specialist consultants. It is important that all participants [WC1] highlight unusual safety risks associated with a design and required construction. As outlined by Churcher & Alwani-Starr (1996), those involved in the design process should:

- **identify** the hazards presented by potential design solutions and consider the risks these hazards will generate for construction workers and others who may be affected by the construction work (e.g. members of the public);
- **include** health and safety considerations amongst the design options so that they can avoid the hazards, reduce their impact or introduce control measures to protect those at risk where it is reasonably practicable;
- **forewarn** the contractor of the residual hazards that have been identified within the design and will need to be managed during the construction work.

Eliminating the hazard is the first risk control that should obviously be considered. If the hazard cannot be eliminated (for example eliminating risks associated with maintenance by using aluminium/stainless steel, which requires no regular painting), risk can be minimised by using a series of steps known as the hierarchy of risk control. Including:

- **substituting** the system of work or plant with something safer (e.g. pre-assembled equipment at ground level rather than height);
- **modifying** the system of work or plant to make it safer (e.g. ensure attachment points for lifting, window cleaning, safety lines, etc.);
- **isolating** the hazard (e.g. introduce restricted areas);

- **introducing** engineering controls (e.g. prevent falls from buildings during construction/maintenance by increasing wall/edge height).

Only when the above risk control options have been exhausted should consideration (and more importantly reliance) be given to personal protective equipment (e.g. safety harnesses) or adopting administrative controls such as hazard warning signs.

Design is the process of considering options. In developing and understanding these options, there is also the ability to improve safety and reduce costs. For example, the costs associated with assembling large scale scaffolding may far exceed the costs associated with alternate design and/or construction materials. Similarly, an emphasis placed on achieving a design that would be safe and efficient to erect, rather than the traditional approach of minimising steel tonnage, did result in lower project costs (Holland & WorkCover, 1997).

Essentially, given the opportunity to consider the design in a formal and systematic way, a smarter design results - and a smarter design invariably leads to a safer design.

3. the CHAIR process

A CHAIR study is intended to help identify that a design needs to consider operability, aesthetics, economics, with the elements of safety in constructability and maintainability that together form the final design. A CHAIR provides a structured forum to ensure there is opportunity to forsee construction, maintenance, repair and demolition safety issues, so they can be eliminated or modified as part of the design process.

The process for CHAIR is as follows:

1. Assemble a CHAIR study team (include all stakeholders).

2. Define the objectives and the scope of the study.

3. Agree on a set of guidewords / prompts to assist brainstorming process.

4. Partition the design (CHAIR-1, CHAIR-3) or construction process (CHAIR-2) into logical blocks of appropriate size.

5. For each logical block, use various guidewords to assist with the identification of safety aspects/issues.

6. Discuss associated risks and determine if the safety risk can be eliminated.

7. If the safety risk cannot be eliminated, determine how it might be reduced.

8. Assess whether the proposed risk controls (i.e. expected safeguards, etc.) are appropriate (is the risk as low as reasonably practicable).

9. Document comments, actions and recommendations - determine appropriate method for design issues still to be resolved.

(Based on Wells 1996)

The Facilitator

The success of a CHAIR study is dependent on the ability of a facilitator to select and use the experience and expertise of the study team to critically evaluate the design. Therefore, the selection of a facilitator is critical.

The facilitator should be sufficiently removed from the design process that he or she does not take the questions or suggestions coming from workshop participants as personal criticism, nor feel the need to defend the design concept. As the whole purpose of a workshop is to test the design concept from a safety-in-construction standpoint, the role of the facilitator is to encourage workshop participants to constructively challenge the design and explore whether issues have been overlooked or sufficiently thought through.

It is recommended that the facilitator should have the following attributes:

- an understanding of the principles of safety in construction;
- the respect, or potential to quickly gain the respect, of workshop participants;
- as a minimum, a broad understanding of the project;
- the ability to bring out the views of a diverse range of people participating in the workshop to constructively challenge the design concept;
- the ability to put forward their own views and thus provoke thought, but without dominating the workshop;
- the ability to keep the workshop on track and moving along (issues that can't be resolved relatively quickly should be listed for action outside the workshop).

3.1 CHAIR-1 study: conceptual design review

Introduction

The purpose of the CHAIR-1 study is to review the conceptual design and identify the significant construction, maintenance, repair and demolition safety risks associated with a project. By identifying and understanding these risks very early in the project phase, risk controls can be established to ensure that, if these risks cannot be eliminated, they are at least managed so they are as low as is reasonably practicable.

Organisations typically perform feasibility or conceptual operational design assessments which cover the various function and elements of a design, including safety. The focus of these assessments is at a fundamental level, where it is still possible to radically change the design concept and significantly improve safety and operability. The effectiveness of such studies is diminished when time is spent on less significant issues, which are more appropriately addressed as part of detailed design.

Those involved in the design process should have an informed view of the overall "constructability" and "maintainability" of the design, as not only do they influence safety, they also influence project and operability costs. Such influences may not necessarily be mutually exclusive.

Only what is reasonable to foresee at the time a concept design is reviewed can be expected from any design review. It may be possible for risks which cannot be foreseen or addressed at the CHAIR-1 stage to be considered at the CHAIR-2 and CHAIR-3 stages.

CHAIR-1 Study Team

A designer should be well informed but is not expected to know everything, especially with regard to detailed construction techniques. Therefore, the designer, or a single third party, in isolation should not perform a CHAIR-1 study. What is required is essentially a systematic and formalised "brainstorming" workshop, which involves the appropriate stakeholders (designers, construction, maintenance, safety representatives, etc.), and is led by a facilitator who is a "third party" to the design (but could belong to one of the stakeholder organisations).

As the CHAIR-1 study is undertaken at the conceptual stage of the design process, it is difficult to indicate who should attend a CHAIR-1 meeting. The appropriate participants will depend on the type of project being considered. Participants may include: architect, design manager, construction manager, safety specialist, client, construction foreperson, project managers, engineers and service consultants. A CHAIR-1 study provides an opportunity for people to contribute to improving safety using their specialised knowledge. By using a diverse group of people and a systematic methodology, the chance of overlooking a major problem is significantly reduced.

CHAIR-1 Guidewords

A CHAIR-1 study is a form of safety analysis similar to a technique used in the petrochemical industry called Hazard and Operability (HAZOP) study.

HAZOP has been detailed extensively in literature, as well as in NSW government

publications (DUAP (1996) and MRD (1997)). One of the main elements of a HAZOP is the use of guidewords, applied to various sections of the design, to stimulate discussion and risk identification. Similarly, the methodology of a CHAIR-1 study is to divide the proposed design into logic blocks and consider the implications of the guidewords for that element.

It is critical that the guidewords provided be used as a prompt to promote discussion of issues and not as a checklist of issues to be considered.

A full list of CHAIR-1 keywords is provided at the beginning of the Chair 1 section. The development of the CHAIR-1 guidewords was based on the assumption that the CHAIR-1 study would be structured on the design (and not a proposed construction method) being divided into logical blocks.

As occurs in all such methods, there is a tendency for the number of guidewords to be increased, until eventually the method begins to lose its value (Wells, 1996). Therefore, non-specific guidewords have been selected to provide prompts to the discussions.

The guidewords have been organised into two types: "generic" (applicable in most cases regardless of the type of design to each element) and "overview" (used at the end of a CHAIR-1 study to review issues that relate to the whole design concept).

A CHAIR-1 facilitator should review the applicability of guidewords (including additional words that may be required) as part of the preparation for the CHAIR-1 workshop. If additional guidewords are suggested during a CHAIR-1 meeting, then they should be used (and recorded).

CHAIR-1 Procedure

There is a tendency with any design to keep along the same process path as first envisaged by the designer. The other difficulty is that there remains a tendency to use "add-on" safety measures as the first solution. The object of a CHAIR-1 study is to promote a full exchange of ideas in an enthusiastic environment.

A CHAIR-1 methodology follows that of most safety analysis (Harms-Ringdahl, 1993) in that:

- the design is divided into logical components for analysis;
- for each component of the design, sources of risks or other factors related to the risks of accidents are identified;
- an assessment is carried out as to the appropriateness of the risk and its controls.

As outlined by Wells (1996), the critical examination of a system requires careful chairing to stop the meeting getting bogged down or rambling too widely. Given good guidance and common sense, it is possible to obtain sensible and useful results.

CHAIR-1 Documentation

It is obviously important to document the findings, attendees, methodology, guidewords and findings of a CHAIR-1 study. A layout for recording the minutes of a CHAIR-1 meeting is provided in the Chair 1 section, "Sample - Chair 1- Minute Recording Sheet". A major component of an effective CHAIR-1 study is the recording of the meeting minutes. These are best recorded by someone who has a good understanding of the project, to ensure records are taken accurately and efficiently.

The minutes typically only recorded those identified risks that require action or follow up, or to justify where, after a detailed decision is made by the CHAIR-1 team, the existing design element is retained.

3.2 CHAIR-2 study: detailed design construction or demolition review

Introduction

A CHAIR-2 study is performed as the detailed design is approaching completion, but well before commencement of construction. In many cases, it may be possible to identify the constructor who would actually be performing the work to assist in performing the study.

CHAIR-2 is a specific type of study, in that it is focused on ways in which a design can be modified to eliminate or reduce construction and/or demolition hazards. It does not replace Job Safety Analysis or Safework Method Statements which are performed by the construction organisation and outline all the safety controls to be employed to control the risk. The primary focus of a CHAIR-2 study is to ensure that, from a design perspective, as much as can reasonably be considered practical has been contemplated and incorporated into the design to minimise construction or demolition hazards.

CHAIR-2 Study Team

As with a CHAIR-1 study, a CHAIR-2 study is performed by a group of people who are involved in the design and construction of the project, the composition of the team being dependent on the scope and nature of the design under examination. The critical elements being an appropriate CHAIR-2 facilitator, appropriate selection of CHAIR-2 workshop attendees, application of specific CHAIR-2 guidewords, and clear recording and follow-up of the minutes from the CHAIR-2 meeting.

CHAIR-2 Guidewords

A critical difference between CHAIR-1 and CHAIR-2 studies is that analysis for a CHAIR-2 study is structured towards the proposed construction (or demolition) sequence, rather than using a logical breakdown of the specific design. The reason for this is that at the detailed design stage, there is less opportunity to fundamentally change the design. However, there would exist the possibility to modify the design with regard to the intended construction or demolition method, the details of which would not have been available at a CHAIR-1 study stage. It also provides a different assessment perspective from a CHAIR-1 study for identifying safety risks.

Therefore, the guidewords to be used for a CHAIR-2 study are different to reflect the task oriented approach of the construction sequence. The aim of a CHAIR-2 methodology is to acknowledge that the basic design will be built, but also to identify design modifications that would result in safer construction or demolition techniques.

As the number of construction sequences may be large, the number of guidewords available is limited to ensure that a CHAIR-2 study does not become laborious. A list of the CHAIR 2 guidewords is provided the Chair 2 section -"SUMMARY-CHAIR 2-GUIDEWORDS".

The guidewords have been based on the approach of Critical Examination of System Safety (Wells, 1996) and are applied in the

sequence presented. Thus the first aim is to eliminate or substitute a dangerous construction or demolition step or the main causes of accidents (Davies & Tomasin, 1990). In some cases, it might be best to combine certain construction processes to make them safer. To avoid is a less stringent action and means that it may be possible to evade certain conditions or actions deemed to be undesirable. The final guideword contains some basic suggestions that might prompt other construction or demolition safety issues.

CHAIR-2 Procedure

The purpose of the CHAIR-2 study is not to identify every single construction or demolition step or risk, for a large proportion of them should be well known to competent constructors. However, it is likely that there will exist some risks which would not normally be expected in the context of the normal construction, and these are intended to be identified and assessed.

It should be noted that as part of the input prior to a CHAIR-2 meeting, it is expected that the design team would provide documentation, in broad terms, as to how it is expected the particular design would be constructed.

A CHAIR-2 methodology involves:

- the construction sequence divided into defined logical steps for analysis;
- each construction step, sources of risks or other factors related to the risks of accidents being identified;
- an assessment carried out as to the appropriateness of the risk and its controls to improve the design and clarify a preferred construction method and sequence.

CHAIR-2 Documentation

As with a CHAIR-1 study, it is important to adequately document the findings, attendees, methodology, guidewords and findings of a CHAIR-2 Study. A layout for recording the minutes of a CHAIR-2 meeting is provided in the CHAIR-2 section "Sample - Chair 2 - Minute Recording Sheet".

3.3 CHAIR-3 study: detailed design maintenance & repair review

A CHAIR-3 study is performed as the detailed design is approaching completion, but well before construction commences. It is essentially performed at the same time as a CHAIR-2. In some cases, it may be possible to identify the owner's maintenance and repair personnel who could contribute information to the study.

Depending on the size and complexity of a design, a CHAIR-3 could be performed by a single person or a small team, provided they have:

- a knowledge of hazard identification techniques and an understanding of how to rate the importance (risk or level of danger) of the problems identified;
- a thorough knowledge of the current design to the extent of understanding the function of every plant and equipment item and knowledge of the way/s each item can fail (the failure modes);
- extensive practical experience.

A CHAIR-3 study is more a document that demonstrates the appropriateness of maintenance and repair of items and plant and equipment. It would be expected that the format of the study could be flexible, with an example format provided in CHAIR-3 section, "Chair-3 Worksheet".

4. CHAIR-1 EXAMPLE ONLY

Project: Overtaking Lane for Forest Ridge Road **Element: Complete system** **Date: 29 / 02 / 00**

Drawing(s): Schematic FR-111 **Revision: A**

No.	Guideword	Risk Issue	Causes	Consequences	Safeguards	Action	Person Resp.
			GENERIC				
1.	Size	No significant risk identified					
2.1	Heights / Depths	Construction of drains	Construction / access to drain is possible confined space	Confined space injury	Designated confined space procedure	Drain design should avoid where possible the need to be classed as a confined space	D.F.
2.2	Heights / Depths	Interference with power lines	Plant equipment in contact with power lines	Injury/fatality	Safe management procedures	Designer to indicate position and height of all power lines to assist with site safety procedure	C.F.
3.	Position / Location	Poor visibility from heavy foliage	Tree type grows and needs to be maintained	Injury/fatality to road maintenance worker	Standard PPE, barriers, etc.	Flora species should be specified that will be low in height growth to avoid sight obstructions and low maintenance	B.R.
4.	Poor Ergonomics	Tripping hazard with cut trees	Trees cut but not removed	Trips, falls during construction	None	Trees to be removed should be dug out completely to avoid leaving trip hazards in road reserve	J.R
5.	Movement / Direction	No significant risk identified					
6.	Load / Force	No significant risk identified					
7.	Energy	No significant risk identified					

No.	Guideword	Risk Issue	Causes	Consequences	Safeguards	Action	Person Resp.
8.	Timing	Holiday Long weekend period greatly impact construction	Confusion, heavy traffic flow restricts construction possibilities	Injury to construction worker / member of the public	None	Commence construction phase day after holiday (recommendation to constructor from design team)	D.F.
9.	Egress/Access	Insufficient turning space for construction equipment	Insufficient area set aside by design for laydown and equipment operations	Traffic accident resulting in worker/public injury	Traffic marshals	Ensure design has sufficient turning space for construction equipment	L.D.
OVERVIEW							
10.	Environmental Conditions	Strong UV radiation	Unprotected outdoor environment	Impact to workers	PPE, hats, etc	Temporary office site location should be planned so that some suitable shade trees are retained to provide UV protection during breaks	
11.	External Safety Interfaces	No significant risk identified					
12.	Toxicity	No significant risk identified					
13.	Fire/Explosion identified	No significant risk					
14.	Environmental Impact	Need to maintain flora along roadside	Wattle and other species likely to create a need for on-going maintenance	Restricted vision results	None	Ensure flora species low in height growth and low in maintenance	A.P.
15.	Utilities and Services	No significant risk identified					
...	...	...					
19.	Inspection and Testing	No significant risk identified					

No.	Guideword	Risk Issue	Causes	Consequences	Safeguards	Action	Person Resp.
20.	Maintenance	Minimising maintenance requirements generally means minimising OHS risks	Need to regularly maintain equipment	Injury - Maintenance worker hit by vehicle	PPE	Guideposts, signs and markings are to be selected with consideration of future OHS risks in carrying out repairs and replacement	
21.	Documentation	Final documentation to contain audit of completed actions in all design safety risk reports	Design safety action not acted upon	Design does not achieve safety risks levels which are as low as reasonably practicable	N/A	Produce completed audit report one month prior to agreed construction date	R.T.
22.	Quality Control	No significant risk identified					

5. CHAIR-3 EXAMPLE ONLY

DETAILED MAINTENANCE / REPAIR SAFETY IN DETAILED DESIGN (CHAIR-3) STUDY				Reference:
System: ROADWAY	**Sub-System:**		**Item/Component:**	**DRAIN**

Maintainability Aspect	Assessment	(Good, Fair, Poor, N/A) and WHY	Recommendation/Comment	Who/Date
POSTURE / MANUAL HANDLING	GOOD	Drain cover will have handles and should be lightweight	Satisfactory	—
SIZE / WIDTH	POOR	Construction vehicle may have limited shoulder space to stop on road	Widen shoulder width to allow for safe stopping during maintenance work	D.F.
ACCESS / EGRESS	POOR	Current drain design is that it is a confined space, and that confined space procedures need to be prepared	Drain design should avoid where possible the need to be classed as a confined space	D.F.
HEIGHTS / DROPPED OBJECTS	N/A	—	—	—
WEIGHT	FAIR	Drain cover could be too heavy	Ensure drain cover design such that it can be easily lifted	P.B.
DISCOMFORT / STRESS	FAIR	Do not expect long term drain maintenance	Satisfactory	—
PERSONNEL PROT. EQUIPMENT	N/A	—	—	—
VISIBILITY	N/A	—	—	—
SLIPS, TRIPS, FALLS	N/A	—	—	—
ROTATING / MOVING EQUIPMENT	N/A	—	—	—
IS REPAIR DIFFERENT?	NO	—	—	—
OTHERS THAT MAY APPLY (list below)				
None identified				

6. case study 1 kilpatrick green

Kilpatrick Green Pty Ltd agreed to pilot the resource CHAIR - the Construction Hazard Assessment Implication Review when they renovated seven of Sydney's churches. Their expectations were far exceeded when they undertook the process which brought together the key design stakeholders to systematically address the OHS issues and workshopped safety solutions for the contractors carrying out the renovations works, for the end user and in relation to ongoing maintenance.

Kilpatrick Green is a leading multi-discipline company offering a significant range of services within the construction and engineering industry. The organisation is committed to providing a high standard of service delivery in all projects with which it is associated.

Safety is one of the company's top priority areas incorporating consistent safety promotion, safety induction and training, hazard and risk management, good communication of issues, workplace inspections, auditing of the safety system and support for safety initiatives.

In 1999, Kilpatrick Green was commissioned by the Commonwealth to insulate seven churches against aircraft noise, some of these churches were heritage listed buildings. A new safety initiative being piloted at the time was "CHAIR - the Construction Hazard Assessment Implication Review", a methodology developed to eliminate or minimise potential occupational health and safety hazards and risks at the conceptual design phase.

"We volunteered to pilot CHAIR, but with stringent safety management policy and practices already in place, expectations of the ability of the CHAIR process to raise OHS standards further weren't really all that high", said Charles Diamond, Director of Public Buildings, who was responsible for implementing the CHAIR process.

Charles was assisted by the author of CHAIR, Mr David F. Franklin, originally a senior project manager with BHP, now CH2MHILL.

The Preparation

Prior to the workshop, Charles familiarised himself with the church plans and CHAIR Guidewords, worked out the most effective way to implement the process, a method to record and delegate outcomes was prepared and compiled folders with background information for each of the participants. Both he and David agreed that the Chair-1 Study and Chair-2 Study Guidewords were relevant to this project and a method to record and delegate outcomes was prepared.

To ensure that OHS was addressed for all aspects of the renovations, each of the plans were divided into seven areas: church operations, roof, general building works, windows/doors, mechanical services, electrical services and the site.

The Chair Workshop - Keeping Up the Momentum

The key design stakeholders attending the workshops included the concept designers, architects, mechanical engineer, electrical

engineer, structural engineer and project manager. Each of the churches also appointed its own representative (in some cases this was a consultant) to participate in the process. Charles was appointed as the facilitator.

David attended the first workshop, the CHAIR-1 study, and gave his input into how the workshops should proceed, particularly in relation to keeping up the momentum.

The Chair Workshops

The first hour was spent on introductions and giving an overview of the CHAIR process and document. The group then generally visited the church sites before commencing the CHAIR workshop. One workshop was actually held in the relevant church.

After workshopping OHS issues on three churches and going through the guidewords seven times for each, it became evident that this would be "too laborious and drawn out" and the process was simplified into three areas: above the roof, below the roof and underground. A common set of OHS risks had emerged by about the fourth church.

Solutions

OHS risks and hazards for contractors carrying out the renovations, end user and maintenance of the facility were addressed, prompted by the Guidewords. Some of the solutions determined in the workshops included:

- Construction on renovations to be carried out around church operating times when services were held on Sundays and Wednesdays.
- Two churches had to address public access and safety as the church was situated in the grounds of primary schools.
- Safety harnesses were to be worn by builders on roofs until insulation mesh was put in place - to prevent any falls through the ceiling.
- Overhead wiring was to be assessed to ensure the safe use of the cherry picker at all sites.
- Negotiations with owners were made for the placement of the main switchboards to the safest location to optimise a safe maintenance environment.
- Suitable checks were arranged for any toxicity problems under floors and dust arising from works.

Approximately thirty similar issues were identified.

The process took up to approximately three and a half hours for each church.

CHAIR-2 study workshops were also conducted and OHS issues were addressed by the CHAIR-2 study Guidewords. The minutes recorded in the CHAIR-1 workshop were also reviewed to ensure that no issues had been overlooked. Due to the intensive work undertaken in the first workshop, this process took only an hour.

Closure

"By eighty percent of the completion of Documentation process, all issues in either CHAIR 1 or CHAIR 2 were formally closed off. That is, they were either confirmed as included in the documents or reasons given as to why not included", Charles said.

The CHAIR Conclusion

"It was a real benefit having all the key players come together for this process. CHAIR made you think outside your own square and

everyone could contribute to the outcomes and recommendations. This Process certainly far exceeded our expectations. The owners were enthusiastic about the process as it increased their awareness of the issues and gave them confidence that the work on their churches were being properly planned and managed".

6. case study 2 john holland

When John Holland Construction and Engineering Pty Ltd were recently awarded a contract to construct a multimillion dollar construction project, they chose to apply the CHAIR principle to identify, eliminate and minimise OH&S hazards in the concept design stage of the project. By undertaking this systematic process involving all the key stakeholders, they were able to eliminate or minimise potential hazards through improved design before construction. The result was an overall "better" design for contractors building the project, the end user and maintenance of the facility.

Introduction

John Holland is one of Australia's leading construction and engineering organisations. Their field of specialisation ranges from marine and harbour works, Mining infrastructure, petrochemical, treatment plants to sports stadiums, highways, bridges, laboratories, railways and more.

Establishing and maintaining a high standard of occupational health and safety has always been a top priority for the company and accordingly, risk assessments and safety management practices are initiated for all John Holland projects.

In one of their more recent projects, the company chose to use the "Construction Hazard Assessment Implication Review (CHAIR)" tool, developed for the Construction MOU, to bring together key design stakeholders. The tool was used to facilitate a brainstorming workshop to review the project conceptual design and identify potential OHS hazards for the construction process, end users and ongoing maintenance and repairs.

The facilitator - the key

The company's Occupational Health, Safety and Rehabilitation Manager, Sean Welsh was appointed to co-ordinate the CHAIR principle workshop. Sean said, "The key to a successful CHAIR workshop was in the selection of the facilitator. It is essential that the facilitator has a background of building and construction and a very thorough knowledge of OH&S, maintenance and repair issues so that potential problems can be immediately identified and altered to result in an improved design".

Ross Trethewy, an expert in OHS for Building and Construction from the University of New South Wales School of Safety Science, was selected as the facilitator.

Preparing for the Workshop

Sean and Ross undertook a half day preparation for the workshop which included key design aspects of the project. During this time they familiarised themselves with the plans, drawings and specifications, selected the CHAIR techniques (i.e. a CHAIR 1, 2 or 3) that were relevant to the requirements and compiled a method of recording and reporting the workshop outcomes and issues to be resolved.

Both agreed that the most effective way for them was to address potential OH&S hazards was to assess one element at a time continually posing the question - why?

For example, if a door was designed in the plan, the group workshop participants had to decide why it was there, if it was the right size/position/height/width, if it opened the right way, in if it was in the right place for it's intended purpose and so on. If a risk was identified, the group then brainstormed solutions using the theory of the hierarchy of risk control, but at the same time keeping as close as possible to the original design as possible where practicable.

The workshop process analysed elements, i.e. major and minor, using this criteria, one floor level at a time.

They devised a minute recording as follows:

No.	Hazard Issue/s	Causes / Identified Hazards (position / location / size / weight etc.)	Why ? (the reason for it being this way)	Alternatives / Suggestions / Issues	By Who Comments	Implications	+/- ($)	Benefits Who O/M/C
1.0	Element being Assessed: Production Hall - Artificial and Natural Light							
1.1	Maintaining service at or above truss level; Changing and servicing light fittings; Inspection/Test of fire detectors (monthly	Access required at > 10m falls, falling objects Access required over process plant/people Interface, disruption, damage to process equipment Truss arrangement Restricted access due to truss depth of approx. 2.5m	Lights have to above Gantry Crane Gantry required at height to gain appropriate clearances for materials handling in production hall Fire detector required at highest point of roof structure Truss design light weight, architectural	Provide independent access gantry for maintaining lights and ceiling mounted services. (winch / platform); or Side mount lights and reflect with mirrors; or Drop down lights Scissor / work-platform mounted on gantry to gain access Set position of lights and detectors Use scaffold Use Elevated Work Platform	Design Engineer	Gantry Mounted Scissor must provide access to all areas of the ceiling that require servicing - relocating services to achieve this maybe required. Scissor and Crane must comply with AS2550 and AS1481	-/+	Operators Maintenance
1.2	Cleaning Sky Lights Glass Insects Dust	Access at > 12.5m Falls / falling objects Trusses restrict access Crushing Access required over process plant/people Interface, disruption, damage to process equipment	Skylights are fixed; Artificial light is needed	Do not clean windows, insects, dust; Reversible windows and clean from external roof from fixed static line; Use scissor mounted on Gantry as above	Design Engineer Architect	Obtain appropriate level of weather seal; Maintain seal for HVAC system	-/+	Operators Maintainers

The Key Stakeholders

The group attending the workshop comprised of fourteen people. This included the client, the project manager, the people operating the plant, their safety people, the designers, architects and engineers- structural, mechanical and electrical, the company's builder's OH&S and Rehabilitation manager and the facilitator.

To prepare, each participant was requested to read through and familiarise themselves with their relevant design contributions and the CHAIR Guidewords. These guidewords list potential hazard risks and hazards at the construction phase and for ongoing maintenance and repairs - a CHAIR 1 & 3.

The Chair Study Workshop

Sean had also identified that there was a need to break down the conception that the CHAIR process was not going to change the design but rather to improve the design.

At the start of the workshop, he used the example "if the architect has designed a rounded roof, then we need to look at all the options so we can keep that design but at the same time ensure that it is workable from an occupational health and safety point of view. This may mean altering the design of the gutters, or designing out the gutters, so OH&S risks are eliminated/minimised when it comes to future maintenance and repairs".

The actual workshop was conducted at the conceptual design stage and took a total of ten "intensive" hours.

To be effective, it "was important to maintain the group's interest and momentum by moving through the relevant issues and not becoming enveloped in single side issues. This was why the choice of facilitator was so important".

By going through this process they were actually able to identify over one hundred hazards ranging from medium to high risk that could possibly have been overlooked.

Some of the results included: widening of corridors, replacement of standard single doors with an additional 1/4 door for ease of access with furniture and equipment, repositioning lights so that they could become more accessible for maintenance, some windows were redesigned so that they could flip over and be maintained and cleaned from the inside, the air conditioner was moved down a level although the duct remained in the same position, again for easier maintenance, and an elevated work platform was included for maintenance repairs.

Often the "Rolls Royce choice" of equipment was selected for lifecycle and long term safety considerations. Cost benefits were realised when these ongoing maintenance issues were addressed. All the risks and solutions that were identified in the workshop were recorded and distributed for to the relevant parties to nominated to action them further.

Other end user related issues also emerged throughout the process and included the client's realisation that there had been no consideration for rubbish storage and disposal, another, identified a significant manual handling hazard associated with the use of the structure.

The Benefits of Chair

According to Sean "significant benefits emerged from the process. In particular participants were forced to think outside their own sphere of expertise and how their design decisions impacted on other stakeholders. Participants were unanimous in their praise of the benefits of the process as the day evolved.

It is reassuring that the culture of organisations is changing. Ten years ago a builder would erect and then remove a scaffold. Now where appropriate planning has occurred in the design stage they are most likely to build in permanent access structures to not only utilize in the construction process but to provide for safety in maintenance and repairs. Systematic processes, such as CHAIR, assist in integrating OHS in the planning and design stages of a project. The CHAIR study highlighted that benefits can be cost effective and may even provide substantial savings over the life of a project whilst at the same time provide for better safety for contractors, end users and maintenance workers through creating a "safe place of work" rather than being reliant on the "safe person at work".

It certainly is a value added process for the client and the builder."

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8. the guidewords

CHAIR introduction

CHAIR

PHASES 1, 2 & 3

"CONSTRUCTION HAZARD ASSESSMENT AND IMPLICATION REVIEW"

MOU 2000: SAFETY IN DESIGN FRAMEWORK FOR MAJOR BUILDING & CIVIL PROJECTS

Construction, Maintenance, Repair and Demolition

What is a CHAIR?

- A Construction Hazard Assessment and Implication Review is a detailed and systematic examination of the construction, maintenance, repair and demolition safety issues associated with a design.
- It considers how design features have been incorporated to eliminate or mitigate potential construction hazards.
- the assessment assumes a certain level of safety management to exist at the construction site - it is a supplement to, and not a replacement of, site specific construction safety reviews.

CHAIR-1 STUDY

CHAIR-1 is a conceptual design review that examines the various elements of a design using two types of guidewords:

- Generic (applicable to each element in most cases regardless of the type of design) and
- Overview (used when considering issues that relate to the whole process)

CHAIR-2 STUDY

CHAIR-2 is a construction or demolition review performed when the detailed design is essentially complete but before the commencement of construction.

A set of guidewords (with sub-prompts) are used to assess the proposed main construction steps (rather than the design elements).

CHAIR-3 STUDY

CHAIR-3 is a maintenance and repair review performed when the detailed design is essentially complete.

A set of guidewords are applied to each element of the proposed design to ensure that maintenance and repair issues have been thoroughly considered.

Why do a CHAIR?

- A SMARTER DESIGN IS ALSO A SAFER DESIGN
- improved "constructability"
- less re-work during construction
- improved "maintainability"
- better understanding of the design by client, designer and constructor and owner

How are CHAIR's performed?

- By systematically considering in turn each element of design (CHAIR-1, CHAIR-3) or each step of the proposed construction task (CHAIR-2)
- By using a series of different CHAIR-1, CHAIR-2 and CHAIR-3 guidewords to prompt discussions by the CHAIR study team

Use of Guidewords

For each element of the design, each guideword is systematically considered and the following questions should be asked:

- (How) can it happen?
- If so, how ?
- So what?
- What do we need to do?

CHAIR Study Rules

- allow each person to be heard (respect the individual)
- focus only on the design component at hand
- no "witch hunts" or "barrow pushing"
- if issue cannot be resolved in 5 minutes, document and assign to someone for follow-up after the meeting

CHAIR 1

Summary of CHAIR-1 Study Guidewords - Generic

Summary of CHAIR-1 Study Guidewords - Overview

Sample CHAIR-1 Minute Recording Sheet

CHAIR-1 Study Guidewords - Generic

CHAIR-1 Study Guidewords - Overview

SUMMARY - CHAIR 1 - STUDY GUIDEWORDS - GENERIC

CARD NUMBER	GUIDEWORD	SUB-PROMPTS	CARD NUMBER	GUIDEWORD	SUB-PROMPTS
Chair 1. Generic 2	SIZE	Too large Too small Too long Too short Too wide Too narrow	Chair 1. Generic 7	LOAD / FORCE	High / Excess Low insufficient Additional loads (construction) Dynamics Temporary Weakness
Chair 1. Generic 3	HEIGHTS / DEPTHS	Working at heights Falls / struck by falling objects Scaffolding (shape, space to fit) Confined space Access / egress	Chair 1. Generic 8	ENERGY	Low / high energy Tension / compression Potential / kinetic Inertia / moment
Chair 1. Generic 4	POSITION / LOCATION	Too high Too low Too far Misaligned Wrong position	Chair 1. Generic 9	TIMING	Too late, too early Too short, too long Incorrect sequence Extended delays
Chair 1. Generic 5	POOR ERGONOMICS	Posture / manual handling RSI / discomfort / fatigue / stress Effect on PPE Visibility (lighting slightlines) Slips, trips, falls	Chair 1. Generic 10	EGRESS / ACCESS	No. of exit points Emergency egress, size Obstructions, lighting Entry / exit points External Impacts Maintenance People and Equipment Movements
Chair 1. Generic 6	MOVEMENT / DIRECTION	Stability Compression Physical damage Vibration Friction / slip Rotation Upwards / Downwards Reverse Expansion / Tension Rollover	Chair 1. Generic 11	MAINTENANCE / REPAIR	Posture / Manual Handling Size / Width Access / Egress Heights / Dropped Objects Weight Discomfort / Stress / PPE Visibility / Slips / Trips Rotating Equipment Other

SUMMARY - CHAIR 1 - STUDY GUIDEWORDS - OVERVIEW

CARD NUMBER	GUIDEWORD	SUB-PROMPTS	CARD NUMBER	GUIDEWORD	SUB-PROMPTS
Chair 1. Overview 2	ENVIRONMENTAL CONDITIONS	Extreme Weather Temperature Ground Noise Water	Chair 1. Overview 9	SAFETY EQUIPMENT	Personnel Protection Safety Showers Barriers / Guards
Chair 1. Overview 3	EXTERNAL SAFETY INTERFACES	Members of the public Traffic Adjacent Property Power / services External fire / plans Day / night / weekend	Chair 1. Overview 10	NATURAL HAZARDS	Earthquake Flooding Thunderstorm (lightning protection) High Winds
Chair 1. Overview 4	TOXICITY	Lead / Asbestos Handling Precautions Ventilation	Chair 1. Overview 11	INSPECTION / TESTING	Eliminating Isolation Access
Chair 1. Overview 5	FIRE / EXPLOSION	Prevention / detection Fire protection Emergency procedures	Chair 1. Overview 12	DEMOLITION	Ease Issues Documentation
Chair 1. Overview 6	ENVIRONMENTAL IMPACT	Vapour / dust Effluent / Noise Seepage / Waste	Chair 1. Overview 13	DOCUMENTATION	Operations Maintenance Inspection /Testing Sequence Emergency Records / Reports
Chair 1. Overview 7	UTILITIES & SERVICES	Lighting Air / Water Fuel / Electricity Oxygen / Water	Chair 1. Overview 14	QUALITY CONTROL	Inspection / Testing Quality Assurance
Chair 1. Overview 8	COMMISSION / STARTUP / SHUTDOWN	Requirements Sequence	Chair 1. Overview 15	CONSTRUCTION EQUIPMENT	Sequence Timing, Access

SAMPLE - CHAIR-1 - MINUTE RECORDING SHEET

Project: **Design Element:** **Date:**

Drawing(s)/Reference(s): **Revision:**

No.	Guideword	Risk Issue(s)	Causes	Consequences	Safeguards	Action(s)	Res. Person & Date Due

CHAIR-1 STUDY GUIDEWORDS

Generic

"Generic" guidewords should apply to most designs being considered – they represent the core guidewords for the CHAIR-1 study framework.

The guidewords are applied to the individual elements of the design, the focus being on how the guideword may apply to the element during the construction process.

SIZE

- TOO LARGE
- TOO SMALL
- TOO LONG
- TOO WIDE
- TOO SHORT
- TOO NARROW

HEIGHTS / DEPTHS

- WORKING AT HEIGHTS
- FALLS / STRUCK BY FALLING OBJECTS
- SCAFFOLDING (SHAPE, SPACE TO FIT, etc.)
- CONFINED SPACE
- ACCESS/EGRESS

POSITION / LOCATION

- TOO HIGH
- TOO LOW
- TOO FAR
- MISALIGNED
- WRONG POSITION

POOR ERGONOMICS

- Posture / manual handling injuries
- Repetitive Strain Injury / discomfort / fatigue / stress
- Effect of Personal Protective Equipment
- Visibility (lighting, sightlines, blind spots)
- Slips, trips, falls

MOVEMENT / DIRECTION

- STABILITY COMPRESSION
- PHYSICAL DAMAGE
- VIBRATION
- FRICTION / SLIP
- ROTATION
- UPWARDS
- DOWNWARDS
- REVERSE
- EXPANSION / TENSION
- ROLL OVER

LOAD / FORCE

- HIGH / EXCESS
- LOW / INSUFFICIENT
- ADDITIONAL LOADS DURING CONSTRUCTION, COMMISSIONING, DEMOLITION
- DYNAMICS
- TEMPORARY WEAKNESS (insufficient propping)

ENERGY

- LOW / HIGH ENERGY
- TENSION / COMPRESSION
- POTENTIAL / KINETIC
- INERTIA / MOMENT

TIMING

- TOO LATE, TOO EARLY
- TOO SHORT, TOO LONG
- INCORRECT SEQUENCE
- EXTENDED DELAYS
  (e.g. capping partial designs)

EGRESS / ACCESS

- NO. OF EXIT POINTS
- EMERGENCY EGRESS
- SIZE - WIDTH, HEIGHT, LENGTH
- OBSTRUCTIONS
- LIGHTING
- PEOPLE AND EQUIPMENT MOVEMENTS
- ENTRY/EXIT POINTS
  - LOCATION
  - ARRANGEMENT
- EXTERNAL IMPACTS
- MAINTENANCE

MAINTENANCE / REPAIR

- POSTURE / MANUAL HANDLING
- SIZE / WIDTH
- ACCESS / EGRESS HEIGHTS /
- DROPPED OBJECTS
- WEIGHT
- DISCOMFORT / STRESS / PPE (Protective Equipment)
- VISIBILITY / SLIPS / TRIPS
- ROTATING EQUIPMENT
- OTHER?

CHAIR-1 STUDY GUIDEWORDS

Overview

The purpose of the "Overview" guidewords is to consider the proposed design as a whole and determine whether there are any particular issues that need to be addressed.

ENVIRONMENTAL CONDITIONS

- EXTREME WEATHER (Wind, Rain, Hail, Light)
- TEMPERATURE (Hot, Cold, Heat, Fire)
- GROUND (GEOTECH properties, contamination, etc.)
- NOISE
- WATER
- ???

EXTERNAL SAFETY INTERFACES

- MEMBERS OF THE PUBLIC
- TRAFFIC
- ADJACENT PROPERTY / BUILDINGS
- POWER / SERVICES LOCATIONS
- EXTERNAL FIRE / EMERGENCY PLANS
- DAY / NIGHT, WEEKDAY / WEEKEND

TOXICITY

- LEAD / ASBESTOS
- HANDLING PROCEDURES
- PRECAUTIONS
- VENTILATION

FIRE / EXPLOSION

- PREVENTION SYSTEMS
- DETECTION SYSTEMS
- FIRE PROTECTION
- EMERGENCY ISOLATION SYSTEMS
- INERT ATMOSPHERE
- EMERGENCY PROCEDURES

ENVIRONMENTAL IMPACT

- VAPOUR EMISSIONS
- DUST EMISSIONS
- EFFLUENT
- NOISE
- GROUND SEEPAGE
- WASTE MINIMISATION

UTILITIES AND SERVICES

- LIGHTING
- AIR / WATER
- OXYGEN
- WATER

COMMISSIONING / STARTUP / SHUTDOWN

- REQUIREMENTS
- SEQUENCE

SAFETY EQUIPMENT

- PERSONNEL PROTECTION
- SAFETY SHOWERS
- BARRIERS/GUARDS

NATURAL HAZARDS

- EARTHQUAKE
- FLOODING
- THUNDERSTORM (LIGHTNING PROTECTION)
- HIGH WINDS

INSPECTION AND TESTING

- ELIMINATING
- ISOLATION
- ACCESS
- INSPECTION AND TESTING

DEMOLITION

- EASE
- ISSUES
- DOCUMENTATION

DOCUMENTATION

- OPERATIONS
- MAINTENANCE
- INSPECTION AND TESTING
- SEQUENCE
- EMERGENCY
- SAFETY RISK RECORDS / REPORTS

QUALITY CONTROL

- INSPECTION AND TESTING
- QUALITY ASSURANCE

CONSTRUCTION EQUIPMENT

- SEQUENCE
- TIMING, ACCESS

CHAIR 2

Summary of CHAIR-2 Study Guidewords

Sample CHAIR-2 Minute Recording Sheet

CHAIR-2 Study Guidewords

SAMPLE - CHAIR-2 - STUDY GUIDEWORDS

Construction Based Guidewords

Card Number	Guidword	Sub-Prompts	Card Number	Guidword	Sub-Prompts
CHAIR 2.2	ELIMINATE	Falls (of people) Falling material / objects Stepping on or striking against objects Caught or trapped Lifting and carrying - over exertion Asphyxiation / drowning Machinery Electricity Transport / mobile plant Toxicity, Fires and Explosions	CHAIR 2.5	AVOID	Construction/Lifting Sequence Timing / Locations Temporary Instability Access / Egress Delays / Confined Space Erection / Dismantling Heat / Cold / Noise
CHAIR 2.3	SUBSTITUTE	Falls (of people) Falling material / objects Stepping on or striking against objects Caught or trapped Lifting and carrying - over exertion Asphyxiation / drowning Machinery Electricity Transport / mobile plant Toxicity, Fires and Explosions	CHAIR 2.6	OTHER ISSUES?	Modification Isolation / engineering controls Personnel Protective Equipment Alter / rearrange Increase / reduce Simplify /Improve
CHAIR 2.4	COMBINE	Construction / Lifting Sequence Timing Locations			

SAMPLE - CHAIR-2 - MINUTE RECORDING SHEET

Project: **Construction Step:** **Date:**

Drawing(s)/Reference(s): **Revision:**

No.	Guideword	Risk Issue(s)	Causes	Consequences	Safeguards	Action(s)	Res. Person & Date Due

CHAIR-2 STUDY GUIDEWORDS

The purpose of the CHAIR-2 guidewords is to stimulate discussion on improving the proposed construction method by making modifications to the design.

ELIMINATE

- Falls (of people)
- Falling material / objects
- Stepping on or striking against objects
- Caught or trapped
- Lifting and carrying - over exertion
- Asphyxiation / drowning
- Machinery
- Electricity
- Transport / mobile equipment
- Toxicity, Fires and Explosions

SUBSTITUTE

- Falls (of people)
- Falling material / objects
- Stepping on or striking against objects
- Caught or trapped
- Lifting and carrying - over exertion
- Asphyxiation / drowning
- Machinery
- Electricity
- Transport / mobile equipment
- Toxicity, Fires and Explosions

COMBINE

- Construction / Lifting Sequence
- Timing
- Locations

AVOID

- Construction / Lifting Sequence
- Timing / Locations
- Temporary Instability
- Access / Egress
- Delays / Confined Space
- Erection / Dismantling
- Heat / Cold / Noise

OTHER ISSUES?

- Modification
- Isolation
- Engineering Controls
- Personnel Protective Equipment
- Alter / rearrange
- Increase / reduce
- Simplify
- Improve

CHAIR 3

Summary of CHAIR-3 Study Guidewords

CHAIR-3 Worksheet

CHAIR-3 Study Guidewords

CHAIR-3 WORKSHEET

DETAILED MAINTENANCE / REPAIR SAFETY IN DETAILED DESIGN (CHAIR-3) STUDY					Reference:	
System:		**Sub-System:**		**Item/Component:**		
Maintainability Aspect	**Assessment**	**(Good, Fair, Poor, N/A) and WHY**			**Recommendation/Comment**	**Who/Date**
POSTURE / MANUAL HANDLING						
ACCESS / EGRESS						
HEIGHTS / DROPPED OBJECTS						
WEIGHT						
DISCOMFORT / STRESS						
PERSONNEL PROT. EQUIPMENT						
VISIBILITY						
SLIPS, TRIPS, FALLS						
ROTATING / MOVING EQUIPMENT						
IS REPAIR DIFFERENT?						
OTHERS THAT MAY APPLY (list below)						

CHAIR-3 STUDY GUIDEWORDS

The purpose of the CHAIR-3 guidewords is to stimulate discussion on improving the maintenance and repair of the proposed design when it is in its operating phase.

POSTURE / MANUAL HANDLING

ACCESS / EGRESS

HEIGHTS / DROPPED OBJECTS

WEIGHT

DISCOMFORT / STRESS

PERSONNEL PROTECTION EQUIPMENT

VISIBILITY

SLIPS, TRIPS, FALLS

ROTATING / MOVING EQUIPMENT

IS REPAIR DIFFERENT?

OTHER ISSUES THAT MAY APPLY?

additional CHAIR study guidewords

CHAIR STUDY GUIDEWORDS

Additional

The purpose of the "Additional" guidewords section is to emphasise that other issues may exist that need to be considered, and the CHAIR facilitator should consider if these are best covered with additional guidewords prior to the workshop.

However, too many guidewords may devolve the process into a laborious checklist exercise, which can restrict the "brainstorming process".

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- _____

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WorkCover Offices

For all occupational health and safety, workers compensation and rehabilitation information, call the WorkCover Information Line – 13 10 50 from anywhere in New South Wales.

HEAD OFFICE
Office Hours 8:30am – 5:00pm
Monday to Friday
92–100 Donnison Street
GOSFORD 2250
Phone (02) 4321 5000
Fax (02) 4325 4145
Postal Address
WorkCover NSW Locked Bag 2906
Lisarow NSW 2252

WorkCover Assistance Service
Office Hours 8:30am – 4:30pm
Monday to Friday
92–100 Donnison Street
GOSFORD 2250
Phone 13 10 50

LABORATORIES

Thornleigh
5A Pioneer Avenue
THORNLEIGH 2120
Phone (02) 9484 6655
Fax (02) 9980 6849
Email lab@workcover.nsw.gov.au

Londonderry
TestSafe Australia
Ground Floor 919 Londonderry Road
LONDONDERRY 2753
Phone (02) 4724 4900
Fax (02) 4724 4999
Email testsafe@workcover.nsw.gov.au

REGIONAL and LOCAL OFFICES
Office Hours 8:30am – 4:30pm
Monday to Friday

REGIONAL OFFICES

Newcastle
956 Hunter Street
NEWCASTLE WEST 2302
Phone (02) 4921 2900
Fax (02) 4921 2929

Wollongong
106 Market Street
WOLLONGONG 2500
Phone (02) 4222 7333
Fax (02) 4226 9087

LOCAL OFFICES

Albury
463 Kiewa Street
ALBURY 2640
Phone (02) 6021 5911
Fax (02) 6041 2580

Batemans Bay
Shop 6, Fenning Place
12 Orient Street
BATEMANS BAY 2536
Phone (02) 4472 5544
Fax (02) 4472 5060

Blacktown
125 Main Street
BLACKTOWN 2148
Phone (02) 9671 8701
Fax (02) 9831 8246

Dubbo
Suite 3, 157 Brisbane Street
DUBBO 2830
Phone (02) 6884 2799
Fax (02) 6884 2808

Goulburn
21–23 Clifford Street
GOULBURN 2580
Phone (02) 4822 1243
Fax (02) 4822 1242

Grafton
NSW Government Offices
49–51 Victoria Street
GRAFTON 2460
Phone (02) 6641 5111
Fax (02) 6641 5100

Griffith
NSW Government Offices
104–110 Banna Avenue
GRIFFITH 2680
Phone (02) 6964 2027
Fax (02) 6964 1738

Hurstville
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HURSTVILLE 2220
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Fax (02) 9585 0261

Lindfield
345 Pacific Hwy
LINDFIELD 2070
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Fax (02) 9936 3030

Lismore
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Manchester Unity Building
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LISMORE 2480
Phone (02) 6622 0088
Fax (02) 6622 0090

Liverpool
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LIVERPOOL 2170
Phone (02) 9827 8600
Fax (02) 9827 8690

Narrabri
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NARRABRI 2390
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Fax (02) 6792 3532

Newcastle
956 Hunter Street
NEWCASTLE WEST 2302
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Fax (02) 4921 2929

Orange
74 McNamara Street
ORANGE 2800
Phone (02) 6361 7070
Fax (02) 6362 8820

Parramatta
Level 4, 128 Marsden Street
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Phone (02) 9841 8550
Fax (02) 9841 8490

Port Macquarie
Shops 1 & 2,
Raine & Horne House
145 Horton Street
PORT MACQUARIE 2444
Phone (02) 6584 1188
Fax (02) 6584 1788

Shellharbour
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Shellharbour Square
BLACKBUTT 2529
Phone (02) 4297 3796
Fax (02) 4296 8914

Tamworth
Shop 20, 341 Peel Street
TAMWORTH 2340
Phone (02) 6766 2490
Fax (02) 6766 4972

Lake Macquarie
Shop 2, 33 The Boulevarde
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