Presentation Outline
1. Global Trend in Safe Design
2. Common Features of Principles in Safe Design Planning

Benchmarking Countries
- EU
- UK
- Australia
- USA
- Singapore

Why safe design is important?
UK study reveals that 60% of injuries and fatalities on construction sites were traceable back to design decisions and lack of planning

Source: Churcher & Ameani-Starr. 1996

Australian research reveals:
- 37% of the workplace fatalities related to design issues
- 14% of the fatalities suggestive that design issues were involved
- 30% of the serious non-fatal injuries contributed by design
- Design related issues prominent in machinery & fixed plant group, mobile plant & transport group
- 50% of the incidents in agriculture, trade and mining probably contributed by design issues
- Inferior designs contributes to work-related injuries in Australia

Source: ASCC, 2005

US research
- 22% of 226 injuries that occurred from 2000-2002 in Oregon, WA, and CA
- 42% of 224 fatalities in US between 1990-2003


US statistics
- The 2009 Workplace Safety Cost Index amounted to US$52 billion dollars (Liberty Mutual).
- The associated indirect costs equal 2-10 times.
- Construction injury equal to 6-8% of the gross construction cost (University of Tennessee study).

July 2007 Workshop Prevention Through Design (PtD)
- PtD or safety through design is defined as the integration of hazard analysis and risk assessment methods early in the design and engineering stages and taking the actions necessary so that risks of injury or damage are prevented.
- It addresses S&H needs by eliminating hazards and minimizing risks throughout the life cycle of work premises, tools, equipment, machinery, substances, and work processes including their construction, manufacture, use, maintenance, and ultimate disposal or re-use.
- The National Institute for Occupational Safety and Health (NIOSH) currently leads a nationwide initiative called Prevention through Design (PtD).
Singapore The Nicoll Highway incident
Committee of Inquiry (COI)

to address safety and health issues through the life-cycle of a building including the design stage, construction and even maintenance of the building.

Table of Summary of Safe Design in Various Developed Countries and Hong Kong

<table>
<thead>
<tr>
<th>Country/City</th>
<th>EU</th>
<th>UK (CDM)</th>
<th>Australia (Safe Design)</th>
<th>USA (Prevention through Design-Pd)</th>
<th>Singapore (Safe Design)</th>
<th>Hong Kong (CDM &amp; Safe Design)</th>
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<td>1. Prevent or reduce occupational risks at all stages of work</td>
<td>Risk management approach</td>
<td>- Risk management approach</td>
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</table>
3. Benchmarking Good Practice - Safety in Planning and Design in Developed Countries

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<th>Country/City</th>
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<th>Australia (Safe Design)</th>
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<tr>
<td>Approach adopted</td>
<td>Depends on development of member states e.g. Ireland The Safety, Health &amp; Welfare at Work (Construction) Regulations 2006 Include a general clause first, then detailed provisions on design requirements in updated regulations</td>
<td>1. promotion 2. encouragement 3. professional collaboration 4. training 5. publish CoP &amp; guidelines 6. enforcement</td>
<td>1. promotion 2. encouragement 3. professional collaboration 4. training 5. publish CoP &amp; guidelines 6. develop risk assessment tool &quot;CHAIR&quot;</td>
<td>1. promotion 2. encouragement 3. professional collaboration 4. training 5. NIOSH leads nationwide initiative on PID 6. industry developed tool for safe design reference</td>
<td>1. promotion 2. encouragement 3. professional collaboration 4. training 5. publish Guidelines 6. consultancy service for government projects offered by MOM 6. internal guidelines in HA</td>
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Benefits of getting it right the first time

![Diagram showing the benefits of getting it right the first time](image)

- **Low Cost**
  - Ease of safety implementation
  - Cost of safe design

- **Medium Cost**
  - Moving safety from an afterthought to forethought in the design

- **High Cost**
  - Starts with establishing principles and context
  - Mandate and commitment
  - Design of framework for managing risk
  - Continual improvement of the framework
  - Implementing risk management
  - Monitoring and review of the framework

3. Benchmarking Good Practice - Safety in Planning and Design in Developed Countries

Safe Design Lifecycle

Prevention Through Design
Holistic approach
• Inception
• Design
• Construction
• Operation
• Maintenance
• Demolition / Disposal

Resources and Processes

- Establish design for safety expectations
- Include construction and operation perspective
- Identify design for safety process and tools

(Source: Hecker et al., 2005)
UK CDM Regulations 2007 (1994)

The Construction (Design & Management) Regulation 2007 places legal duties virtually on everyone involved in construction work.

- Clients
- CDM coordinators
- Designers
- Principal Contractors
- Contractors
- Workers

Objectives of CDM Regulations

1. Protect OSH of people in construction, and others who may be affected by their activities;
2. Require a systematic management approach from concept to completion: hazards must be identified and eliminated where possible and the remaining risks reduced and controlled;
3. Reduce risks by “safe design” during construction and throughout the life cycle of the structure.

Design Review Process (DRP)

Design Review Process (DRP) is done through the GUIDE Process with principle:

1. review in a Group (Safety & Health Review Committee SRC)
2. Understand the full design concepts
3. Identify the risks
4. Design around the risks identified to eliminate/mitigate
5. Enter all information to Safety and Health Risk Register (RR) - vital design change affecting safety & health or residual risk to be mitigated

Design

- Reduction of OSH Risks
  - Avoid
  - Reduce
  - Control

Designer

1. Must eliminate hazards and reduce risks from the start of the design process;
2. Designs should be safe to build; safe to use; safe to clean and maintain; safe to demolish;
3. Should in form others of significant or unusual risks which remain;
4. Amount of effort put in to risk reduction should be proportionate to the risk.

Continuous Documentation

- The (health and safety) risk register
  - A ‘live’ document
  - Managed by the planning supervisor
  - Populated by all project team members
  - Regularly re-visited
  - On the agenda at “all” meetings
  - Monitored to demonstrate progress
  - Used as a reminder of outstanding actions
  - A measure of performance
Discrete Documents
• Pre-construction Health and Safety Plan (including Risk Register)
• Construction Health and Safety Plan
• Health and Safety File

Designers
• Professional qualification
• Knowledge of construction
• Awareness of relevant legislation
• Health and safety design methods
• Skills and training of employees
• The time allowed
• The technical facilities
• Method of communicating issues
• Dealing with remaining risks
• Advice of the Planning Supervisor

Safe design process effectiveness
Problems:
• Lack of experience – leader and participants
• Inappropriate team selection – mix and level
• Lack of support by senior management – attendance
• Incorrect or out of date information
• “Human error” factor

Some Observed Weakness of Designers (UK & Australia)
Australia (Victoria)
• Only half design companies do collect basis information from client or research.
• Many designers are using a first-principle approach rather than risk management eg minimising potential for fall for aged care.
• Principal designers are tending not to let other designers have a view of the operational and OHS issues of the final workplace.
• Designers may have a narrow view of OHS-often excludes people on people issues (occupational violence, manual handling)

UK (HSE)
1. Many designers were unaware of their duties under the CDM Regulations.
2. Not thinking about safety aspects when it came to maintenance, repairing and cleaning.
3. Not realizing problems they were causing for contractors, trying to manage the risks as a result.

UK Challenge
• To change attitudes
• To change behaviours
• Achieve sensible risk management
• Continued lack of awareness by dutyholders, particularly SME’s
• Confusion between civil contracts and CDM 2007
• ‘Paper chasing’ - right information to right people, right time
• Clients and Designers can do more

Barriers in US
1. Potential solutions to these barriers involve long-term education and institutional changes.
2. Designers’ fear of undeserved liability for worker safety.
3. Increase both direct and overhead costs for designers. Educate owners that total project costs and total project life cycle costs will decrease.
4. Few design professionals possess sufficient expertise in construction safety.
3. Benchmarking Good Practice - Safety in Planning and Design in Developed Countries

Anchorage (eyebolt on wall) for fall arresting system for routine maintenance

Safe access for disabled

Attached working platform for maintenance of lifting spreader and lifting block of crane operation

You have to pay for special design (such as special formwork, production method, packaging, routine maintenance and repair etc.)

You have to consider the routine maintenance and repair for special design (such as special cleaning method)

Designer: safe design for marvelous building

Appropriate adoption of competence in design, and partnership in the right approach
### Appendix A

*Reference: Guidance Notes on Construction Design and Management - the then ETWB (the present DEVB), HKHA, OSHC, 2006*

#### Construction Design and Management Process

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<td>Designer</td>
<td>Extracted information</td>
<td>Designer</td>
<td>Tenderer</td>
<td>Contractor</td>
<td>Contractor</td>
<td>Information from maintenance activities</td>
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<td>Detailed Design</td>
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<td>Construction method related input</td>
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<td>Information from maintenance activities</td>
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#### LEGEND:
- Life of documents
- Information flow
- Action Party
Appendix B

Reference: Guidance Notes on Construction Design and Management - the then ETWB (the present DEVB), HKHA, OSHC, 2006

Proforma for “Summary of Health and Safety Concerns”

A. Project Profile

B. Site Environment

C. Site Constraints

D. Record of Consultation / Brainstorming Sessions

1. Date of consultation / brainstorming session: 

<table>
<thead>
<tr>
<th>Attendance</th>
<th>Post / Department</th>
<th>Contact details</th>
<th>Special Role</th>
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<tbody>
<tr>
<td>a.</td>
<td></td>
<td></td>
<td>Chairman / Facilitator</td>
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<td>b.</td>
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<td>c.</td>
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<td>h.</td>
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<td>Note-taker</td>
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2. Record of Major Issues Raised (including written concerns) and Responses:

<table>
<thead>
<tr>
<th>Major Issues Raised by Stakeholders</th>
<th>Responses [see Note (1)]</th>
<th>Any Action Required [see Note (2)]</th>
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<tr>
<td>a.</td>
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<td>Yes / No</td>
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<td>b.</td>
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Record prepared by ____________________________ (Name of Officer)
Post ____________________________ Date ____________________________

Countersigned by ____________________________ (Name of Project Supervisor)
Post ____________________________ Date ____________________________

Notes

1. The designer’s response to any risks identified will vary according to the stage of design development. There is more flexibility to avoid or reduce risks at the start of the design process during preliminary stage, than during the detail stage when control measures may be more appropriate for dealing with any remaining risks.

2. At preliminary design stage, the designers of a project can do a great deal to avoid and reduce significant risks. One approach to achieve this is to alter the way the construction is planned including the sequence of construction that is assumed. This is a powerful tool, but it requires in-depth understanding of the construction process and the options that are feasible. For instance, designers can reduce the need to work at height by adopting modular sections, which can be pre-fabricated at ground level and sequentially lifted into place. This does not eliminate working at height entirely but should reduce it significantly.
Appendix C

Reference: Guidance Notes on Construction Design and Management - the then ETWB (the present DEVB), HKHA, OSHC, 2006

Proforma for “Hazard and Impact Summary”

A. Project Profile

B. Site Environment

C. Site Constraints

D. Hazards and Impacts

<table>
<thead>
<tr>
<th>Task</th>
<th>Hazards and Impacts</th>
<th>Risk Assessment Rating+</th>
<th>Control Measures</th>
<th>Hazards Resolved Yes / No</th>
<th>Necessity to Notify Contractor Yes / No</th>
<th>Other Relevant Parties to Be Notified</th>
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Note +: Risk Assessment Rating is given in Appendix F, item (c)

Record prepared by ____________________________________________ (Name of Officer)

Post ___________________________ Date _______________________

Countersigned by ____________________________________________ (Name of Project Supervisor)

Post ___________________________ Date _______________________

Plan together for occupational safety
A healthy workforce makes a prosperous trade
Appendix D

Reference: Guidance Notes on Construction Design and Management - the then ETWB (the present DEVB), HKHA, OSHC, 2006

Coverage of a “Pre-tender Health and Safety Plan”

The items to be covered in the Pre-tender Health and Safety Plan include:

Nature of Project
(a) Client’s name;
(b) Location;
(c) Nature / description of construction work to be carried out;
(d) Timescale / Programme for completion of the construction work;

Existing Environment
(e) Surrounding land use and related restrictions, e.g. existence of premises such as schools, court buildings, shops, etc. adjacent to the proposed construction site, planning restrictions which may affect safety and health, e.g. for noise, air quality, etc.;
(f) Existing services, e.g. underground and overhead lines;
(g) Existing traffic systems and restrictions, e.g. access for fire fighting equipment, times of delivery, ease of delivery, parking, loading and unloading operations;
(h) Existing structures, e.g. any special health and safety problems that may be caused by materials in existing structures being demolished, refurbished, altered or added to, any fragile materials which require special safety precautions, instability problems;
(i) Ground conditions, e.g. contamination, overall instability, possible subsidence, old mine workings, underground obstructions, disused tunnels, ground anchors, soil nails;
(j) Proximity to railway lines, tram lines, or live traffic with possible restrictions on the operation of cranes etc.;

Existing Drawings
(k) Available drawings on the existing environment such as structure(s) and services as mentioned for items (e) to (j) above;

The Design
(l) The risks identified by designers that have not been eliminated during the design stage. The residual risks will need to be addressed by the tenderers in their Outline Health and Safety Plan and considered further by the contractor in the Construction Health and Safety Plan after the contract award;
(m) The principles of the structure design and any precautions or sequences of assembly that need to be followed during construction, e.g. temporary support requirements during periods when the structure may be unstable;

Construction Materials (if applicable)
(n) Health hazards arising from construction materials where particular precautions are required, either because of their nature or their intended use;

Site-wide Elements
(o) Positioning of site access and egress points (e.g. for deliveries and emergencies);
(p) Location of temporary site accommodation;
(q) Location of unloading, layout and storage areas;
(r) Traffic / pedestrian routes, headroom restrictions;
(s) Existing welfare facilities if contractors are allowed use of them;

Project Concurrent with Client’s or End-user’s Undertakings
(t) Consideration on safety and health issues arising where the project is to be located in premises occupied or partly occupied by the client or end-user; provide details of operations which will continue as part of the client’s or end-user’s undertaking, e.g. office work on the floors below that which is being refurbished, factory processes, etc.;
(u) Restrictions on access, e.g. one particular site entrance may be the only access available for the contractor to use;
(v) Other restrictions e.g. on noise levels, use of percussive machines which cause excessive vibrations etc.;

Site Rules
(w) Specific site rules which the client or designers may wish to specify relating to the construction and maintenance of the project;
3. Benchmarking Good Practice - Safety in Planning and Design in Developed Countries

Continual Liaison

(x) Procedures for considering the safety and health implications of design elements during the construction stage;

(y) Procedures for dealing with unforeseen events during construction that may result in substantial design change; and

(z) A specific procedure should be established on how and when the contractor, sub-contractors or other parties should provide information relevant to the operation and maintenance of the project to the Client’s Contract Supervisor for incorporation into the health and safety file.

General Notes:

(1) Where some items are considered by the Project Supervisor as inappropriate for the project, they may be excluded from the Pre-tender Health and Safety Plan. The Project Supervisor should also determine the level of details to be provided.

(2) It is not necessary to mention every hazard or assumption in the Pre-tender Health and Safety Plan as this can obscure the significant issues, but significant hazards do need to be pointed out, particularly those that are:

- unlikely to be obvious to a competent contractor or other (competent) designers;
- unusual; or
- likely to be difficult to manage effectively.

(3) Relevant information on hazards and impacts provided for construction or future work should be clear, precise and in the form suitable for the users, for example by:

- notes on drawings (the best solution in most cases where the information is not long or complicated);
- supporting documents if necessary, referenced from the notes on the drawings;
- a register or list of significant hazards with suggested control measures; and
- suggested construction sequences showing how the design could be erected safely, where this is not obvious.
Appendix E

Reference: Guidance Notes on Construction Design and Management - the then ETWB (the present DEVB), HKHA, OSHC, 2006

Examples of Issues to be Addressed at Preliminary Design Stage

1. General Issues
   • location and orientation of building structure - whether the design can minimize the level of impact both during construction and afterwards;
   • aesthetic appearance of project structures, with due consideration given to its likely impact to safety of maintenance;
   • suitability of site ground conditions - whether there might be contaminated land, high tension cables, gas mains, tunnels, railway lines, etc. near the site which require special consideration;
   • impacts due to construction works, such as tree felling, deep excavations, dewatering, increased traffic, hazardous installations, involvement of asbestos, etc.,
   • impacts of the works on adjacent dwellings/schools/hospitals;
   • concerns over the buildability issues, e.g. availability of suitable location for positioning of mobile cranes for manoeuvring and lifting of heavy plant and equipment;
   • concerns over the maintainability, e.g. access and facilities for cleaning external facades, inspection, maintenance, and removal and replacement of plant and equipment; etc.

2. Other Issues for Specific Types of Works
   Further examples on the issues that should be addressed at preliminary design stage for particular types of works are given in the checklist in Appendix A of ETWB TCW No. 19/2003.
Appendix F

Reference: Guidance Notes on Construction Design and Management - the then ETWB (the present DEVB), HKHA, OSHC, 2006

Risk Assessment Method

The contribution of each of the elements for a risk assessment, viz. consequence and likelihood should be determined first, and then be rated according to a combination of these two elements.

(a) Consequence

Normally three ratings of severity should be adequate:

HIGH (3) fatality, major injury or illness causing long-term disability, amputations, major fractures, etc.
MEDIUM (2) injury or illness causing short-term disability, lacerations, burns, serious sprains, minor fractures, etc.
LOW (1) superficial injuries, minor cuts or bruises or minor illness, etc.

(b) Likelihood

The probability of harm to occur is often strongly associated with the method of construction and how many workers would be involved, how often would they be exposed to the hazard, and for how long. The following ratings can be adopted:

HIGH (3) Certain or nearly certain to occur
MEDIUM (2) Reasonably likely to occur
LOW (1) Very rarely or never occurs

(c) Risk Assessment Rating

<table>
<thead>
<tr>
<th>Probability that Harm will Occur (or likelihood)</th>
<th>Likely Severity of the Harm (or consequence)</th>
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</thead>
<tbody>
<tr>
<td>Low (1)</td>
<td>Low (1)</td>
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<td>Medium (2)</td>
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<td>High (3)</td>
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</tbody>
</table>

The risk rating is given by multiplying the assessed risk severity and the probability of occurrence, as can be seen in the table above. Risk ratings of 1 and 2 can be considered as tolerable. For risk ratings between 3 & 4, further consideration of ways to eliminate or reduce the risk is needed, and the resulting additional risk management measures selected just be stated. Where the risk rating is 6 or above, alternative design options or alterations to the design should be considered, otherwise detailed justification should be provided.
Appendix G

Source: OSHC

Safe Design Process and Risk & Solutions Register
Safe design process should incorporate safe design principles, risk management, consultation and reporting to suit any particular requirements and constraints of project. The process involving eight basic steps should begin as early as possible:

1. Discuss the project.
2. Identify stakeholders.
3. Determine the consultation process.
4. Prepare a risks and solutions register.
5. Provide an initial report.
6. Amend and finalise the design.
7. Provide a final report.
8. Review the design.

Risks and Solutions Register
Identify issues or risks, likelihood and possible consequences, develop solutions (where practicable) to address such risks, in consultation with stakeholders, and record in a risk and solution register. The table below can be used as a quick reference for some issues and risks to consider.

<table>
<thead>
<tr>
<th>Issue or risk</th>
<th>Points to consider</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access and egress</td>
<td>Access and egress requirements, including the number and position of exit points, emergency procedures, obstructions and lighting. Safe access for maintenance should be included.</td>
</tr>
<tr>
<td>Building material</td>
<td>Risks relating to the material the building or structure is made of, e.g. material flammability or emission of toxic fumes.</td>
</tr>
<tr>
<td>Building profile</td>
<td>Construction and maintenance risks relating to the shape and complexity of the building profile.</td>
</tr>
<tr>
<td>Confined spaces</td>
<td>Risks relating to work in enclosed spaces, including the release of fumes and lack of ventilation.</td>
</tr>
<tr>
<td>Construction method and equipment</td>
<td>How the temporary position of construction plant and materials, the use of scaffolding, the movement and operation of equipment, and the sequence and timing of works, affect the safety of construction and other workers.</td>
</tr>
<tr>
<td>Dangerous goods and hazardous substances</td>
<td>Risks relating to the storage and handling of dangerous goods and hazardous substances, during construction and end use of the building or structure.</td>
</tr>
<tr>
<td>Demolition</td>
<td>Risks relating to the eventual demolition of the structure, including premature collapse and the emission of hazardous materials during demolition.</td>
</tr>
<tr>
<td>Electrical wiring and equipment</td>
<td>Risks relating to electrical works, including overhead and underground cables.</td>
</tr>
<tr>
<td>Emergency procedures</td>
<td>Risks relating to fires and other serious incidents requiring evacuation and emergency procedures.</td>
</tr>
<tr>
<td>Environmental conditions</td>
<td>Risks created by weather, including high and low temperatures, wind and rain. Risks include the potential impact of environmental extremes, such as earthquakes, flooding, lightning and high winds.</td>
</tr>
</tbody>
</table>
Environmental impact  | The health and environmental impact of construction and the ongoing operation of the building or structure, including the escape of vapour, dust or effluent.
--- | ---
Ergonomics and manual handling  | Risks relating to posture, static loading, manual handling (lifting, pushing, carrying, throwing) and repetitive movements (packing, typing, assembling, sorting, using hand tools), e.g. installing sheets of wall board and ceiling tiles.
--- | ---
Excavation  | Risks relating to excavations near to or during construction, including the stability of structures and using plant and machinery near an excavation, and falls into the excavation.
--- | ---
Fire and explosion  | Risks relating to the storage and use of flammable materials and liquids.
--- | ---
Heights and depths  | Risks relating to working at heights, including falls and dropped objects.
--- | ---
Maintenance, inspection and testing  | Risks relating to the inspection, cleaning, maintenance and testing of plant and structures (including building maintenance units).
--- | ---
Movement of materials, plant and vehicles  | The size and movement of plant and materials, and the space required for their safe movement. Risks relating to the movement of equipment and materials during construction, as well as at the completed workplace – including ramps, slopes, floor surfaces, and distances and equipment to be moved.
--- | ---
Noise  | Risks relating to the use of noisy equipment during construction and in the completed workplace.
--- | ---
Safety equipment  | The provision of safety equipment, such as safety showers, barriers, guards and anchor points for fall-arrest systems.
--- | ---
Slips, trips and falls hazards  | Risks relating to slips, trips and falls, including steps, ramps, ladders and floor surfaces.
--- | ---
Structural strength and stability  | Structural strength and stability, including the permanent and temporary loads borne by the structure itself, as well as the integrity of temporary supports.
--- | ---
Utilities and services  | The provision of lighting, air, ventilation, water, fuel and electricity during the construction process, as well as the ongoing operation of the building or structure.
--- | ---
Violence  | Risks arising from violent customers, robberies and other illegal activities, particularly entrapment points and the potential risks for individuals working in isolation.
Appendix H

Source: OSHC

Safe Design Review from Concept Design to Pre-Construction Stages

Step 1: Concept Design Review

<table>
<thead>
<tr>
<th>Considerations</th>
<th>Details / Hazards Identified</th>
</tr>
</thead>
</table>
| 1. Solid       | • Has the soil profile of the site of the proposed project been studied by the competent person?  
• Are there buildings or structures that may have shallow foundation in the vicinity of the proposed project?  
• Will there be possible lowering of ground water table as a result of the proposed construction?  
• Will there be possible settlement due to the proposed project?  
• Are there any possible preventive measures to ensure settlement is minimised? |
| 2. Public      | • Will the commencement of the project affect the public in any way?  
• Will the commencement of the project affect the traffic in any way? |
| 3. Services    | • Are there underground services in the site that need to be removed for the project?  
• Will the removal of these services, if any, be a hazard to the workers or the public? |
| 4. Others      | • Are there any special features that require special arrangements during construction?  
• Can the method of construction/sequence be identified at present?  
• Are there any hazards associated with the method of construction/sequence that can be dealt with at present?  
• Are there any foreseeable hazards that can be identified and eliminated? |

Step 2: Detailed Design, Pre-construction, Maintenance and Repair Review

<table>
<thead>
<tr>
<th>Considerations</th>
<th>Details / Hazards Identified</th>
</tr>
</thead>
</table>
| 1. Prefabrication | • Can elements such as steel structures be prefabricated, assembled on ground and then lifted to position for installation?  
• Can the cutting of steel members be done off-site, under controlled conditions to reduce the dust created?  
• Can site welding be reduced so as to reduce fire or burn risks and prefabricated nuts and bolts used as connections? Can prefabricated elements be provided with designed lifting points, and the weight, the centre of-gravity marked on the drawings and on the items?  
• If the prefabricated structure is required to be temporarily suspended for a period of time before final installation, are there means to ensure the hazards arising are removed?  
• Can joints in vertical steel structure members be designed such that bolting can be done while on the ground?  
• Can connections be designed to minimise risk of incorrect assembly (e.g. unique bolt layout for each connection) and clear instructions provided on drawings? |
| 2. Heavy Lifting | • Consider the work process and the equipment required for heavy lifting.  
• Can the position for parking of these equipment be finalised and cordoned off?  
•Does a foundation for these lifting equipment need to be designed so as to minimise settlement and failure of support?  
• Consider the worst case scenario. Can this scenario be prevented or managed to minimise injuries? |
### 3. Falling from Height
- Can the need to work at height be removed? E.g. removing the need to work from ladders, removing the need to work where a safe means of access cannot be provided.
- Can fragile roofing materials be removed or an alternative access route (including a work platform) to the roof be designed?
- Can there be early installation of permanent access, such as stairs, to reduce the use of ladders or scaffolds?
- Can edge protection or other features that increase the safety of access and construction be designed and installed?
- Can anchor points for installation of life-line or safety harnesses be mounted where work platforms cannot be installed?
- Can floor openings, if any, be minimised?

### 4. Temporary Works and Sequencing
- Can a safer means of access or egress be used instead of the temporary means?
- Can permanent staircase and lifts be completed first and used during the construction stage?
- Will the design affect the work process and stages during construction?
- Can temporary works required during construction be planned for? E.g. specifying the type and position of the temporary works so as to ensure spatial considerations have been considered.
- Are there special construction considerations that need to be highlighted to the contractor for his construction?
- Will the sequence of construction create any temporary unstable working platform, which requires additional bracing?
- Can adequate safety factors be incorporated in the design such that overloading or collapse of the permanent or temporary structure is not possible?

### 5. Layout
- Can the layout be optimised to prevent any accidents from the flow of traffic, pedestrian, equipment, etc. within and around the site during the construction stage?
- Consider the flow of traffic, pedestrian, equipment within and around the site during the permanent stage. Can the layout be optimised to prevent any accidents?
- Is there a need to designate specific material, equipment, vehicular and human traffic flow diagram?

### 6. Confined Space
- Will the design create any confined space in the permanent or temporary stage?
- Can the confined space be removed from the design?
- Can the requirement to enter the confined space be minimised by removal of vital equipment or controls from the confined space?

### 7. Emergency Route
- Is the emergency route for both the temporary and permanent stages the shortest and most direct?
- Is lighting, directional sign, warning notice and standby electricity supply adequate along emergency route for mass evacuation?

### 8. Health Hazards
- Can less hazardous materials be specified? E.g. solvent-free or low solvent adhesives and water-based paints.
- Can processes that create hazardous fumes, vapors, dust, noise or vibration be avoided? E.g. disturbing existing asbestos, cutting chases in brickwork and concrete, breaking down cast-in-situ piles to level, scrabbling concrete, hand-digging tunnels, flame cutting or sanding areas coated with lead paint or cadmium.
- Can materials that are easier to handle be specified? E.g. lightweight building blocks, limiting the weight of formwork components to less than 25kg.

### 9. Weather
- Is there a possibility of floods in the site? If so, how can the hazard be minimised in the temporary and permanent stages?
- Is there a possibility of lightning strike in the site? If so, how can the hazard be minimised in the temporary and permanent stages? Are there any other adverse weather conditions that can affect the ability to safely construct the work?
- What are the effects of extreme temperature or humidity on instrumentation?
### Step 3: Pre-Construction Review

#### Considerations

<table>
<thead>
<tr>
<th>Details / Hazards Identified</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Temporary Works and Sequencing</strong></td>
</tr>
<tr>
<td>• Can a safer means of access or egress be used instead of the temporary means?</td>
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<td>• Will the design affect the work process and stages during construction?</td>
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<td>• Can temporary works required during construction be planned for? E.g. specifying the type, position of the temporary works so as to ensure spatial considerations have been considered.</td>
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<tr>
<td>• Are there special construction considerations that need to be highlighted to the contractor for his construction?</td>
</tr>
<tr>
<td>• Will the sequence of construction create any temporary unstable stage, which requires additional bracing?</td>
</tr>
<tr>
<td>• Can adequate safety factors be incorporated in the design such that overloading or collapse of the permanent or temporary structure is not possible?</td>
</tr>
<tr>
<td>• Will there be possible basal heave and piping during excavation?</td>
</tr>
<tr>
<td>• Will there be possible settlement due to the proposed project?</td>
</tr>
<tr>
<td>• Has a proper schedule for monitoring of instrumentation been provided?</td>
</tr>
<tr>
<td>• Will there be any adverse effects on adjacent structures during the removal of temporary works?</td>
</tr>
<tr>
<td>• Are there any alternatives or measures that could reduce or minimise such adverse effects?</td>
</tr>
<tr>
<td><strong>2. Specialist Design</strong></td>
</tr>
<tr>
<td>• Are there any safety concerns on elements of specialist design to be considered by the main contractor?</td>
</tr>
<tr>
<td>• Can alternative safe work practices be employed to mitigate such concerns?</td>
</tr>
<tr>
<td><strong>3. Others</strong></td>
</tr>
<tr>
<td>• Have the risks and hazards identified in STEP 1 and STEP 2 been addressed or mitigated?</td>
</tr>
</tbody>
</table>