Hong Kong Housing Authority

PICTORIAL GUIDE TO Planning and Design for Safety

2017 SECOND EDITION

Disclaimer

The Pictorial Guide was first published to promote good practice in planning and design for safety in project life cycle, with contents compiled on the basis of the presentations in the “From Cradle to Cradle - Workshop on Planning and Design for Safety in Project Life Cycle for Public Housing Developments” convened on 31 March 2010.

This new edition is compiled to include more examples of Housing Authority projects on planning and design of safety built up in past few years and to present the latest practice of our safety considerations for a development throughout the stages of design, construction, hand-over for intake and occupation, management and maintenance.

Under no circumstances, should Hong Kong Housing Authority, Housing Department, the presenters and the editors be held responsible for any legal or other liabilities in respect of the accuracy, reliability, completeness or any other aspects of the information provided in the Pictorial Guide.

The Pictorial Guide can be downloaded from the Hong Kong Housing Authority Site Safety Website:

www.housingauthority.gov.hk/sitesafety

First Edition October 2010
Second Edition 2017

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List of Annexes

Foreword

"We pledge our commitment to observe and drive planning and design for safety".

Construction and maintenance works involving temporary or transient working environment entail inherent hazards and they are "never safe enough". Bearing in mind that "right attitudes produce right actions", managing safety throughout the project life cycle should not merely be a notion; it should in effect underpin the everyday actions of all practitioners for all project undertakings.

As a proactive and caring public sector developer, the Housing Authority (HA) has always been striving to promote safety and health through our system drivers along the supply chain. Further to bestowal of the Safety Leadership Award (first runner-up in the Client-Developer Category) to HA in 2010 for our continuous efforts in initiating and maintaining safe leadership actions that have positively influenced the entire industry, the Lighthouse Club and Construction Industry Council have recently presented the Safety Leadership Award 2016 (Gold Award in the Client-Developer Category) to HA in recognition of our exemplary safety leadership in practice through the inception, design and construction of our projects. Our commitment to engagement with safety management system, addressing safety in the design process and implementation of safe working practices during the construction phase are commended. Indeed, "Safety First" is always an integral part of our work and this is our "Safety DNA".

It is my pleasure to witness the success of the Planning & Design for Safety Workshop held on 31 March 2010. The signing of the charter with stakeholders pledging our commitment to observe and drive planning and design for safety is really a fruitful achievement of the workshop. We emphasize "ZERO incident" as a performance goal to provoke vigilance on all fronts.

The essence of the Workshop was published in the Pictorial Guide in 2010. To sustain the momentum of good design practice, I have therefore asked my colleagues to update the Pictorial Guide. This second edition (2017) of the Pictorial Guide serves to beef up the first edition by incorporating the essence of the latest practice and experience of design for safety of Housing Authority gained from our projects throughout the stages of design, construction, management and maintenance. I hope that readers will find this revised Pictorial Guide a useful and handy reference as their "Safety Companion" in their daily work. I would like to take this opportunity to thank the co-organiser, presenters, participants in the Workshop and my colleagues to make possible such a meaningful and purposeful event and publication! I also wish to give special thanks to those who have helped review and update the content of this 2017 Edition.

Looking ahead, we will continue to propagate our "Safety DNA", engage practitioners including contractors, professional service providers, staff members and other stakeholders with a view to promoting awareness and good practice on planning and design for safety.

Ms Ada FUNG
Deputy Director (Development & Construction)
Housing Department

January 2017

Introduction

Background and purpose of the Pictorial Guide

Jointly organised by the HA and the Occupational Safety and Health Council (OSHC), a safety workshop on "From Cradle to Cradle – Workshop on Planning and Design for Safety in Project Life Cycle for Public Housing Developments" was held on 31 March 2010, with a charter signed by all signatories pledging commitment to observe and drive planning and design for safety.

Ms Ada Fung, Deputy Director of Housing (Development and Construction), and Mr Lee Kai-ming, Chairman of the Occupational Safety and Health Council, signed the Planning and Design for Safety Charter

Discussion forum with industry practitioners

Representatives from the OSHC, the Labour Department, the Hong Kong Construction Association, the Hong Kong Federation of Electrical & Mechanical Contractors, the Lifts & Escalators Contractors Association, the Hong Kong Construction Sub-contractors Association, the Hong Kong Professional Hoisting Engineering Association and the Housing Department (HD), as well as the Building Information Modelling Consultant from the Hong Kong Polytechnic University participated in the Workshop as speakers, with topics covering risk factors and considerations for planning and design of projects and construction, as well as planning and design for safety at the operation, implementation, management and maintenance stages.

The Pictorial Guide is a collection of information from the presentations in the Workshop and stakeholders with a view to reinforcing their messages in substance and in practice to all relevant parties.

This 2017 Edition updates the safety design guidelines and practices implemented in temporary works and permanent design as a handy reference by designers in construction. Major enhancements with new information added in the content include the following:

- **Chapter 2 – latest version of safety auditing system and accident statistics.**
- **Chapter 3 – Guidance Notes of Design for Safety published by Development Bureau.**
- **Chapter 8 – staircase in lieu of catladder to roof top; railing for canopy, roof of covered walkway and footbridge; window design for air conditioner; twin roof water tank; anchorage for safety harness in lift lobby before access to lift pit.**
- **Chapter 9 – BIM and 3D printing for ELS works; steel cage fixing of large diameter bored pile, pile cap and transfer structure; protection to protruded bars; overhaul of construction plant.**
- **Chapter 10 – maintenance platform for building services installations; lock-out-tag-out; hazardous trade processes in lift shaft, access to lift pit and emergency stop button; builders' lift.**
- **Chapter 11 – photos of good practice added.**
- **Chapter 12 – natural terrain hazard mitigation measures; temporary pre-stressed ground anchors for ELS; soil nailing; safety precautions in ground investigation.**

Objectives and topics of the workshop:

- Objectives: to promote awareness of the importance and good practice of planning & design for safety in project life cycle for public housing developments (from planning, design, construction, to occupation and maintenance).
- Topics relating to planning and design for safety include the following (though not exhaustive) –
  - General risk factors / considerations for project planning and design
  - Risk factors / considerations for construction planning and design
  - Planning & design for safety at operation, implementation, management & maintenance stage

Who are "designers" involved in the planning and design process?

- Designer for procurement of permanent works design & planning and execution of construction, renovation, maintenance, alteration & addition and demolition = Client (project owner / developer in charge of procurement, project manager)
- Designer for permanent works and facility management = Personnel involved in the design, details and specification of permanent works and facility management: architect, engineer, maintenance surveyor, facility / property manager
- Designer for temporary works and works execution during construction or maintenance = Expert builder or duty holders engaged to carry out the works. Also as Client or Employer.

Role of "designers"

Categorically speaking, each "designer" has a unique role to play in the context of project developments –

Designer	Role
1. Designer for procurement	• Execute procurement in accordance with corporate policy and objectives to meet client requirements • Implement check and balance measures, including performance monitoring and process reviews, to safeguard client's interest
2. Designer for permanent works and facility management	• Deliver professional service and execute project to fulfill client brief and in compliance with statute and code of practice • For contract administration (where applicable), manage project according to the terms of contract • Oversee client's interest during the delivery process
3. Designer for temporary works and works execution during construction or maintenance	• Execute Works in accordance with the Contract, in compliance with statue and code of practice • As expert builder • "Duty holder" for construction safety under the regulatory regime of industrial undertaking • Also as Client or Employer

Our visions

In essence, the process of safety and health management should be brought forth among others at the upfront and made more transparent by –

- Bringing forward project specific concerns to be addressed in advance;
- Provoking active communication amongst all parties;
- Giving more attention to aspects concerning hazards in construction, safety in use, manageability and maintainability;
- Facilitating focus review; and
- Inculcating a considerate culture in the project management process.

Our next questions would be "What is safe design?" and "How can designers practise safe design?". The various topics of planning and design for safety are multi-faceted, yet interwoven and with a common purpose, with principles of risk management essentially comprising the following –

- Assess the risks;
- Avoid the risks;
- Reduce the risks;
- Control / manage residual risks; and
- Inform relevant parties who need to attend to this control / management of residual risks.

After all, "prevention is better than cure" is the essence to planning and design for safety. We hope that through issuance of this Pictorial Guide, it would provide a practical guide to foster such practice as well as stimulate considerations to address foreseeable risks, as reasonably practicable, to occupational safety and health issues throughout project life cycle.

Acknowledgements

We are much indebted to the advice and support from the co-organizer, supporting organizations, all participants and speakers for their contribution to the Workshop on Planning and Design for Safety and the production of the Pictorial Guide in 2010–

Co-organizer

- Occupational Safety & Health Council (OSHC)

Supporting Organizations

- Labour Department (LD)
- Hong Kong Construction Association (HKCA)
- Hong Kong Federation of Electrical & Mechanical Contractors (HKFEMC)
- Lifts & Escalators Contractors Association (LECA)
- Hong Kong Construction Sub-contractors Association (HKCSA)
- Hong Kong Professional Hoisting Engineering Association (HKPHEA)

External Guests

- Mr LEE Kai-ming SBS, JP (OSHC)
- Mr Conrad WONG (HKCA)
- Mr Stephen LEE (HKCA)
- Mr Otto POON (HKFEMC)
- Mr Stephen KUOK (LECA)
- Mr Michael LEUNG (HKCA)
- Mr KK CHAN (HKCSA)
- Mr WY WONG (LD)
- Mr Jason WONG (OSHC)
- Professor Heng LI (Hong Kong Polytechnic University)
- Mr KM NG (HKPHEA)

We are indebted to the permission from Development Bureau for the use and reproduction of the information contained in DEVB's publication Guidance Notes of Design for Safety for the purpose of this revision. Finally, but not least, we take this opportunity to express our sincere gratitude to the administration, department representatives and helpers for producing this revised edition, your guidance, contribution and cooperation have been invaluable.

Safety and Health Unit
Development and Construction Division
Housing Department

January 2017

This Guide comprises the speeches and presentations at the workshop held in 2010 plus the latest safe practice by works colleagues in the past few years. While every effort has been made to ascertain the completeness of information and messages presented in this publication, should there be any omissions or feedback, please feel free to send your comments to Safety and Health Unit, Development and Construction Division, Housing Department:

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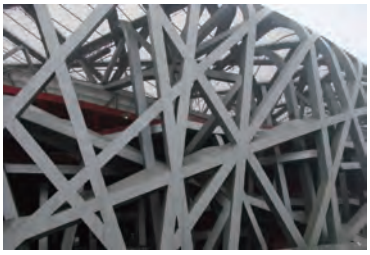
1. Opening and Overview

Presenter: Ms Ada FUNG (HD)

Objectives of Workshop

Emphasize the importance and practice of planning and design for safety

- **Planning & Design for Safety * A Shared Responsibility**
- **Safety is More Than a System....It's a Culture!**
- **12 C's for Team Building * Plan - Do - Check - Act**
- **Project Development & Delivery * Risk Management * EFQM**
- **Who * What * How**
- **Topics for Experience Sharing**
- **"4C" Approach in Promoting Site Safety of "4D" Industry**



- What has this picture inspired you?
- How can people carry out cleansing and maintenance works?
- What are the provisions to ensure the safety of end-users and maintenance / cleansing workers?
- Has this stimulated you to think about the required resources and safety aspects during operation and maintenance of the project life cycle?

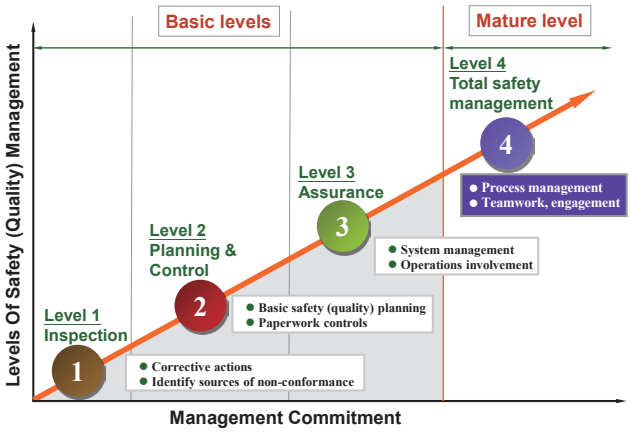
Planning & Design for Safety * A Shared Responsibility

Safety is everybody's business.
Safety & Quality goes hand in hand.
Prevention is better than cure.

- Planning and design for safety – a shared responsibility - teamwork is important!
- Consideration of safety aspects for construction, operation, maintenance and management in planning, design and implementation stages
- Both temporary and permanent designs should be well considered to minimize safety risks for workers carrying out construction, maintenance and management work, as well as end users
- Execution method for construction or maintenance works should be carefully planned by Contractors to eliminate, reduce and manage risks to workers

Safety is More Than a System....It's a Culture!

Maturity Levels of Safety Management



Escalating safety to the next level
Safety leadership ≠ safety management

Escalating safety to the next levels requires:-

- Commitment
- Leadership
- Engagement
- Expectation

- Make safety "visible"
- Safety ....more than a system .... It's a culture

Subjective	Objective
Intention	Behaviour
Values Attitudes Belief	Plans Activities
Culture	System
Ethics Morale Justice Faimess	Organisation structure Policy Work procedures
Leadership	Organisation / System

12 C's for Team Building • Plan–Do–Check–Act

12 C's for Team Building

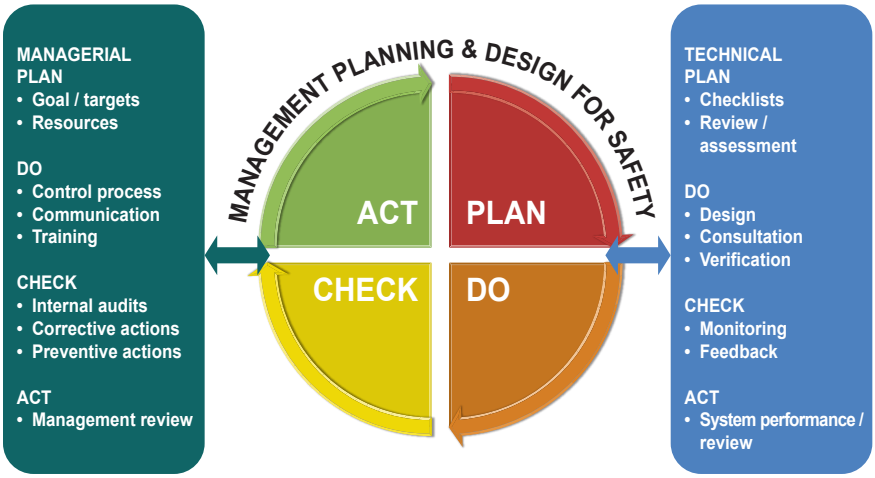
"Teamwork" is the ability to work together toward a common vision. The ability to direct individual accomplishments toward organizational objectives. It is the fuel that allows common people to attain uncommon results."

...Andrew Carnegie

- **C**lear expectation
- **C**ontext
- **C**ommitment
- **C**ompetence
- **C**harter
- **C**ontrol (freedom & empowerment)
- **C**ollaboration
- **C**ommunication
- **C**reative innovation
- **C**onsequences
- **C**oordination
- **C**ultural change

1. Opening and Overview

Plan-Do-Check-Act

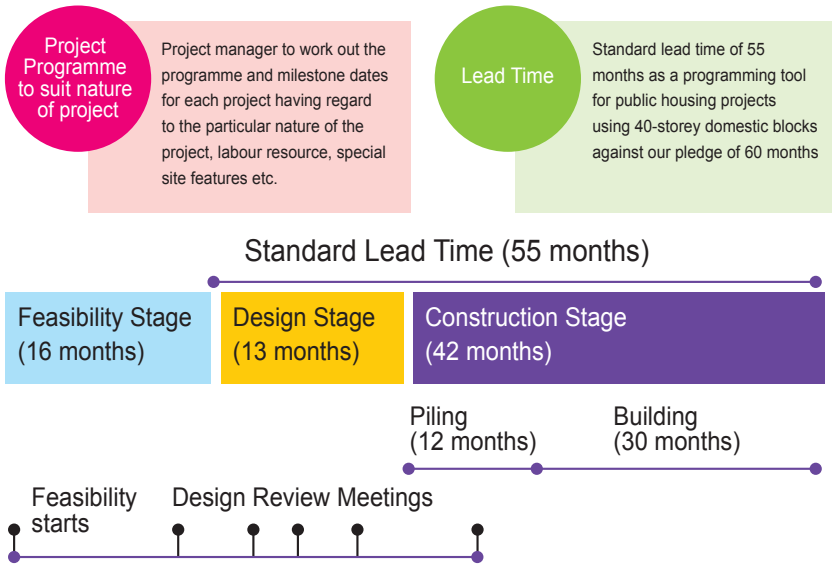


Project Development & Delivery • Risk Management • EFQM

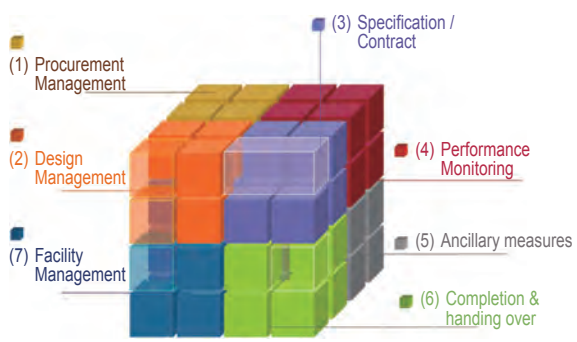
Project Development & Delivery

- Roadmap of project development & delivery process --- from planning, design, tender/contract, construction, completion, handing over to occupation, management and maintenance
- Process management & mechanisms

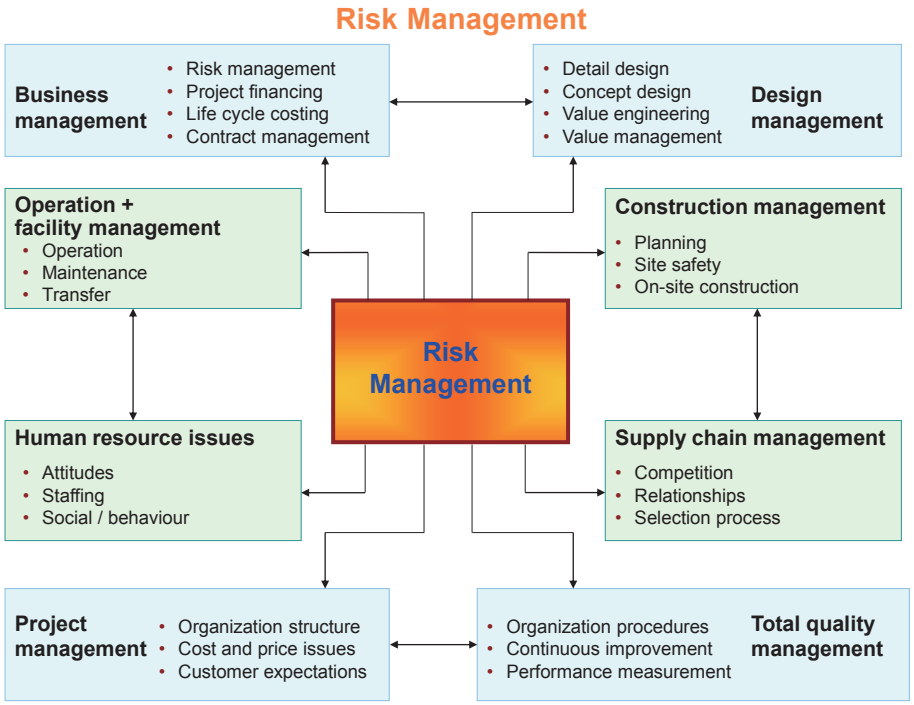
Project Programme

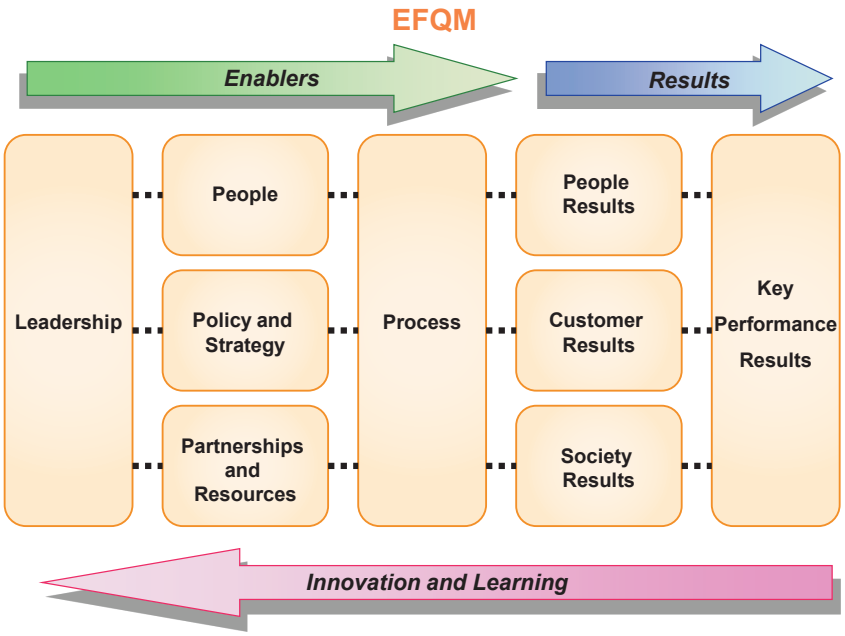


Process Management



1. Opening and Overview





Who • What • How

Who is "designer"?

- Procurement Designer
- Designer for permanent works and facility management
- Designer for temporary works and works execution during construction or maintenance

What is Safe Design?

- Safe design involves holistic considerations such as client / users' requirements, function, operation, aesthetics, environment-friendliness, durability, maintainability and life-cycle cost effectiveness etc. embracing elements of safety and in compliance with statute and contract.
- It is about making sound judgment and decisions on choices about design, materials, method of construction to enhance occupational safety in project life cycle with **sustainability in mind**.
- It improves risk management of OSH issues.

1. Opening and Overview

How can "Designer" practise safe design?

- Identify the hazards and detailing methods, sequences and materials etc. to be adopted through project, to reduce risks during construction, commissioning, maintenance and demolition.
- Collaborate with other designers to identify hazards at interfaces and overlapping areas in order to reduce risks.
- Provide safety and health information for incorporation into safety plan / maintenance / operation plan.

Topics for Experience Sharing

- **Perspective from Designers for Procurement**
  – from PSP to contractors
- **Benchmarking Safety in Project Planning & Design**
  – Modelling best practices around the globe
- **Perspective from Designers for Temporary Works and Works Execution of Construction or Maintenance Works**
  – Swiss Cheese Safety Management -- Six Point Safety Focus to achieve zero harm
- **Case Studies**
  – Learning from past incidents
- **Useful Tools Utilizing Information Technology**
  – Integration of CDM and BIM
- **Perspective from End Users**
  – Practical and vivid examples
- **Designers for Permanent Works or Facility Management**
  – Design and technical expertise, ingenuity, collaboration and common sense

Discussion Forum

– Views and opinions

"4C" Approach in Promoting Site Safety of "4D" Industry

HA's 4C Core Values	"4D" Industry
• Caring	• Dirty
• Customer - focused	• Dangerous
• Committed	• Demanding
• Creative	• Disruptive

Unique nature of construction & maintenance works

- Volatile & mobile workers
- Transient working environment
- Heavy plant & machinery
- Involve sub-contracting
- Intensive manual labour work

Vision

- To help all families in need gain access to adequate and affordable housing

Mission

- To provide affordable quality housing, management, maintenance and other housing related services in a proactive and caring manner
- Cost - effective and rational use of public resources
- competent, dedicated and performance-oriented team

The Programme begins.....

2. Perspective from Designers for Procurement

From: Development & Procurement Sub-division

Synopsis

- Who is "Designer"?
- Procurement Cycle and Procurement Management
- Learning from Incidents
- Charting Safety Forward
- Aspirations

Who is "Designer"?

Who is DESIGNER ?		
Designer for procurement	**Designer for permanent works and facility management**	**Designer for temporary works and works execution during construction or maintenance**
• Client • Project owner • Developer • Project manager	• Engineer • Architect • Maintenance surveyor • Facility manager	• Contractor • Expert builder • Duty holder for construction safety • Also as Client or Employer

Procurement Cycle and Procurement Management

- To provide information on safety and health criteria in new projects and maintenance operations for contractors, the public and other key stakeholders;
- To make safety and health performance one of the critical considerations in tender selection for all new and existing building projects;
- To build up a safety profile of contractors for continuous assessment of safety performance;
- To monitor contractor's performance by independent and in-house assessment;
- To work through partnership by incorporation of contractors' input in respect of safe construction technology and equipment; and
- To promote safety and health issues particularly related to HA projects to enhance the safety and health of all persons involved.

Listing of Contractors

All listed Contractors should be accredited to

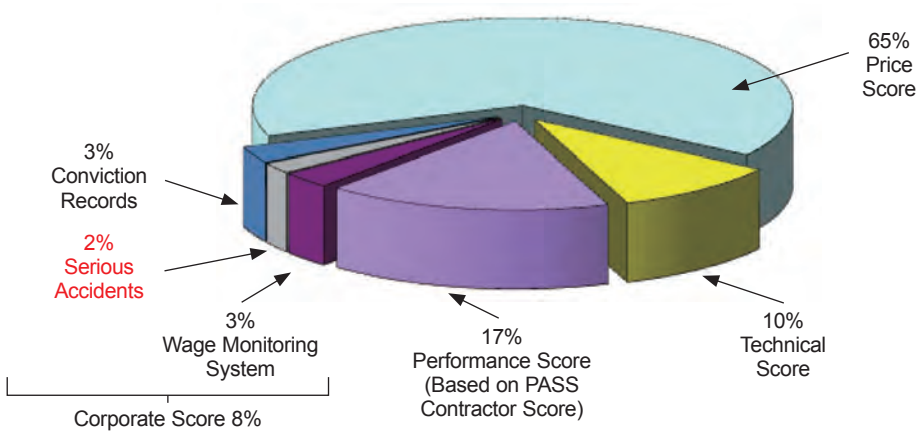
- **OHSAS 18001**
- ISO 9001
- ISO 14001
- ISO 50001

2. Perspective from Designers for Procurement

List Management Systems

- List management, contractors' performance subject to regular reviews
- Report of financial capability and updated ISO certification from Contractor
- Guide to Registration of Contractors & Service Providers
- Tendering Evaluation
- Preferential Tender Award System
- Technical submission
- Quarantine for risk management

Preferential Tender Award System (PTAS)

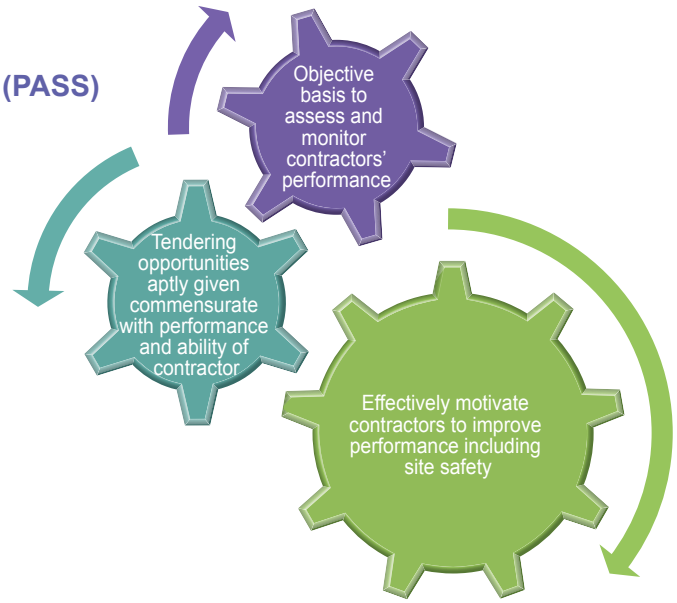


Components of Corporate Score

Component of Corporate Score	Building Contract	Nominated Sub-contract	Piling Contract
• Recent Serious Accidents (Demerit Points)	2	2	2
• Conviction Records (Demerit Points)	3	3	-
• Wages Payment Monitoring System (Bonus Points)	3	3	3
Total Scores =	8	8	5

Performance Monitoring – Performance Assessment Scoring Systems (PASS) Main functions:

- List management
- Tendering process
- Performance monitoring
- Review



2. Perspective from Designers for Procurement

Performance Monitoring – Housing Authority Safety Auditing System (HASAS)

An independent expert system to assess the effectiveness of Safety Management System

+

Align Top Management, Supervisors and Workers to the same standards

=

HA Safety Auditing System (HASAS)

- Encourage contractors to conduct safety climate index surveys and adopt work safe behaviour programme
- Enforce Safe Working Cycle
- Recognize innovative safety initiatives

System enhancements of HASAS to version 1.5.1 for implementation from April 2016 and onwards

- Record required for verification is reduced. Documents verified in previous audits are not needed unless there is a material change. Logbooks and routine inspection forms with lists of checking items is accepted as evidence to obviate the need of preparing detailed inspection checklists.
- Generic risk assessments for non-high risk activities do not need to be reviewed in each quarter. Specific risk assessments should only be reviewed according to the project progress or as arranged in the Safety Plan.
- Maintain the mandatory checking of tower crane lifting operation on working floor and ground floor by Accredited Safety Auditors in each and every audit, amongst checking of other high risk operations on site.
- Maintain the generic checklist for high risk activities for which safety control measures or step-by-step safe operation procedures have to be submitted along with site demonstrations for safety audits.
- Maintain the "Critical Pass" elements.
- Forge the implementation of Safe Working Cycle (SCI), foster Work Safe Behaviour practice and encourage safety innovation.
- Highly recommend Safety Climate Index Survey but do not make it compulsory.
- Internal safety training for Work Safe Behaviour (WSB) observers can be conducted by staff who have completed the Train-the-Trainer course for WSB and SCI.

- Scope of pre-employment health examination is confined to those required under the law.
- Maintain the link to Pay for Safety Scheme on account of performance driven criteria, based on safety audit results.
- Unsatisfactory safety performance, occurrence of serious accident or near miss incident with potentially serious consequence.
  - **Trigger CRC to interview** the contractor
  - **Additional safety audit**
  - **Close monitoring** of the contractor's safety performance

2. Perspective from Designers for Procurement

Safety Climate Index Surveys

- 794 returns from 9 new works building contracts (2008)

OBSERVATIONS

STRENGTHS

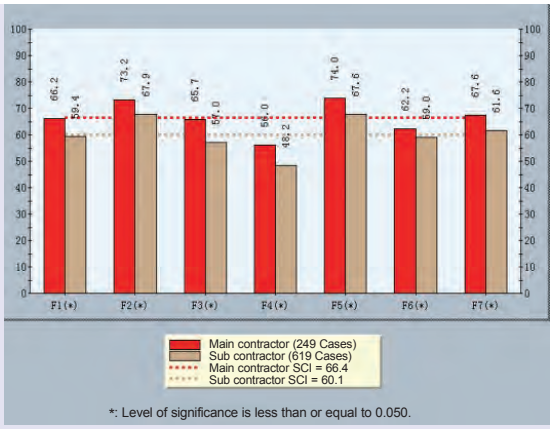
- Factor 2 - Safety Resources and Support
- Factor 5 - Personal Involvement in Safety and Health

AVERAGE

- Factor 7 - Safety Promotion and Communication
- Factor 1 - Corporate and Management Commitment

WEAKNESSES

- Factor 6 - Safe Working Attitude
- Factor 3 - Awareness of Risk-taking Behaviour and Hazards
- Factor 4 - Perception of Safety Rules and Procedures



FINDINGS

- Main contractors are more capable of carrying out safety functions than subcontractors
- "Leading from the Top" is the most effective driving force in fostering site safety
- Workers in general hold that it is not easy to comply with the safety regulations and operational guidelines
- Workers are of the view that the attitude of fellow workers can uplift influence on the work practices among them

Learning from Incidents

Case 1 - Collision of tower cranes occurred in two adjoining building sites

The tower crane of Site B entered into the overlapping working zone of the tower cranes of the two Sites A & B. The sling of tower crane in Site A was hit by the tower crane in Site B and the concrete skip being hoisted in Site A was swung to the external wall of Site A causing minor damage to the scaffolding. There was no personal injury in the incident.

Lesson learnt from the incident –

- Risk assessment
- Coordination
- Supervision
- Handling the incident
- Precautionary measures
- Safety awareness and training

Enhancement measures at site	
1	Enhanced coordination and communication for site operations
2	Anti-collision system with "permit to work" for by-pass
3	Responsible person to manage and control bypass key

Case 2 - An accident involving falling object in a construction site

A worker on the ground floor was injured by a long reinforcement bar dropped from the working floor. Instead of calling for ambulance, the contractor arranged their safety officer to accompany the injured person to hospital by taxi for medical treatment.

Lesson learnt from the incident –

- Risk assessment
- Coordination
- Supervision
- Handling the incident
- Precautionary measures
- Safety awareness and training

Enhancement measures at site	
1	Enhanced coordination and communication for site operations
2	Tightened supervision & sub-contractors management
3	Observe immediate & timely notification of incident report; handling the injured; training and communication to site team

2. Perspective from Designers for Procurement

Case 3 - An accident involving a worker being struck by a metal pile

While a protruding portion of a socket H-pile was being cut above a slope, a section of the pile suddenly fell down and struck against a worker who was assisting in aligning the gas hoses of the flame cutting equipment nearby. The worker was seriously injured. No support to the concerned portion of H-pile was provided during the cutting.

Lesson learnt from the incident –

- Risk assessment
- Coordination
- Supervision
- Handling the incident
- Precautionary measures
- Safety awareness and training

Enhancement measures at site	
1	Early planning of site works; avoid haphazard operations
2	Conduct risk assessment, implement precautionary measures
3	Train all site personnel; strengthen communication

Case 4 - An accident involving tower crane lifting of metal formwork

Metal moulds were lifted from ground floor to the working floor of a domestic block by a tower crane. A rigger was assigned to station on the ground to hook the metal moulds.

When the tower crane operator was lowering the hook of the tower crane to the ground for lifting the last piece of metal mould to the working floor, the rigger hurriedly instructed the crane operator to stop lowering the hook through the walkie-talkie. A moment later, the crane operator found the rigger lying on the ground and injured.

Lesson learnt from the incident –

- Risk assessment
- Coordination
- Supervision
- Handling the incident
- Precautionary measures
- Safety awareness and training

Enhancement measures at site	
1	Review of lifting procedures, site demonstrations with photos, briefing to site personnel
2	Slow down motion of lifting in proximity to lifting object
3	Suggest to install CCTV at lifting zone

Charting Safety Forward

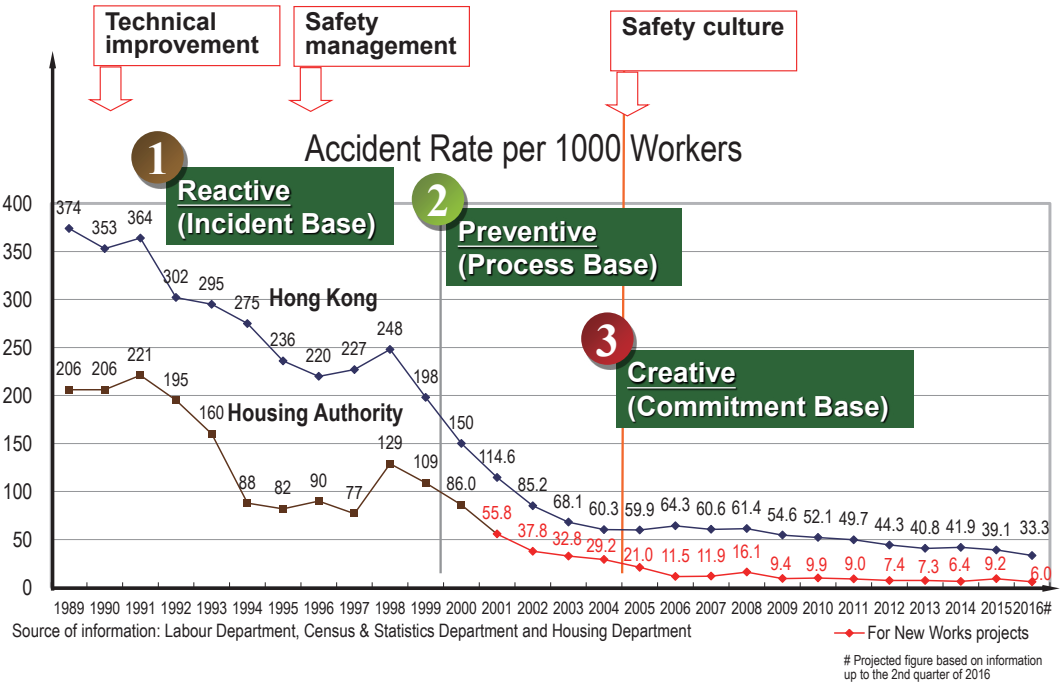
(1) Further contractual enhancement measures

- **Safety Helmet with Chin Strap**
- **Tower Crane Lifting**
  - CCTV Surveillance System in Lifting Zones
  - Log Book under Lifting Operation Plan
  - Appoint Responsible Person for Lifting Operation
  - Computerised Surveillance in Site Office
  - Permit to work

2. Perspective from Designers for Procurement

(2) Enhancing collaborative learning

- **Safety Training Programme for Resident Site Staff** (2-year full launching phase from 2010 and onwards + incubation) --- basic safety management + basic accident prevention + construction safety modules
- **Safety Training Programme for Professional Staff (& technical grade staff) encompassing "design for safety"**
- **Web-based Site Safety Training Refresher Courseware**



Ongoing targets

- No fatal accident
- Accident rate per 1000 workers not more than 9 per year (from 2016/2017 onwards)
- Zero incident

Aspirations

- **Getting together is a beginning.**
- **Working together is progress.**
- **Collaborating together is success.**

Key Success Factors

- Partnering through **teamwork**
- Building a considerate **work culture**
- Work to achieve better value **in service delivery**
- **Commitment** for continuous improvements

CARE

- **C**ommitment
- **A**ttitude
- **R**esponsibility
- **E**ffectiveness

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

Presenter: Mr Jason WONG (OSHC)

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 & Alwani-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[1]
- 42% of 224 fatalities in US between 1990-2003[1]

[1]Behm, M., "Linking Construction Fatalities to the Design for Constr. Safety Concept" (2005)

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).

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

Singapore The Nicoll Highway incident

Committee of Injury (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

Country/City	EU	UK (CDM)	Australia (Safe Design)	USA (Prevention through Design-PtD)	Singapore (Safe Design)	Hong Kong (CDM & Safe Design)
Rationale	Council Directive 92/57/EEC 24 June 1992 on the implementation of minimum safety and health requirements at temporary or mobile construction sites	Follow EU Directive	– National OHS Strategy 2002-12 – Model Work Health and Safety Bill 2010	Workshop on Prevention Through Design & Survey	OSH Review & enquiry of tragedy Nicoll Highway	Coping with global development and continuous improvement

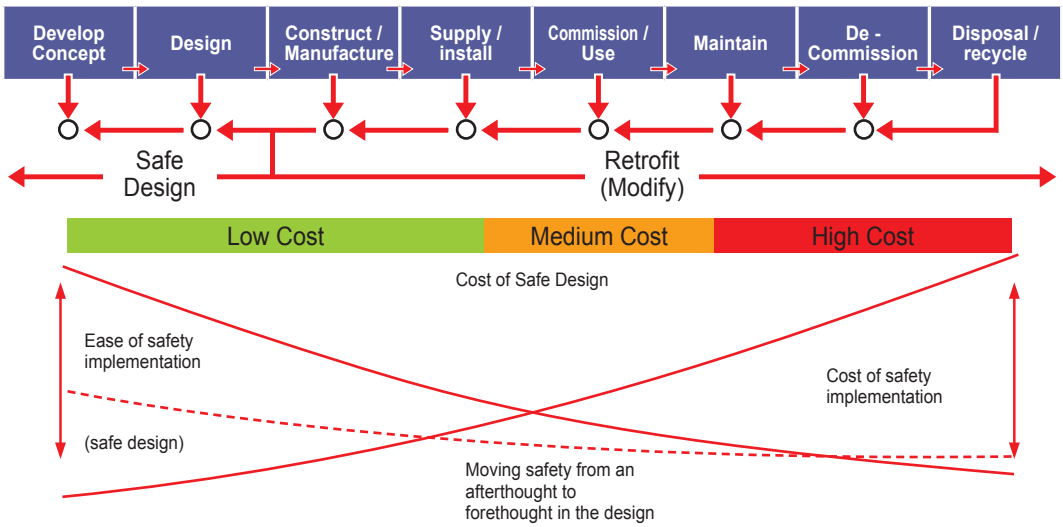
Country/City	EU	UK (CDM)	Australia (Safe Design)	USA (Prevention through Design-PtD)	Singapore (Safe Design)	Hong Kong (CDM & Safe Design)
Specific Legislation	– EC Directive 92/57/EEC – National Execution Deadline is 31/12/1993 – 27 member states have their regulations 31/12/1993-1/1/2007	CDM 1994 & 2007	All member states except New South Wales	No specific	No specific	No specific

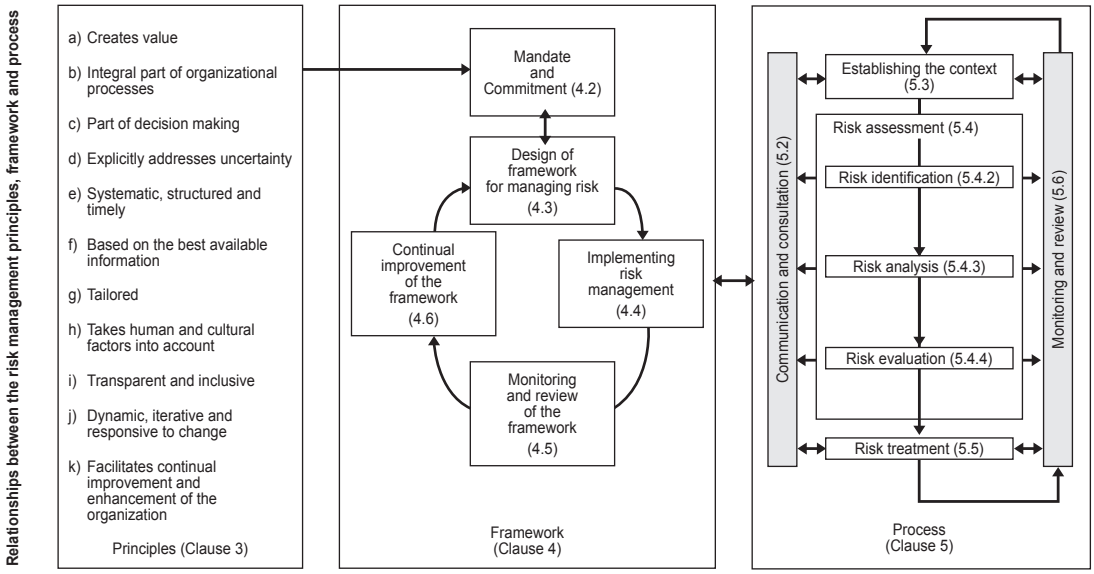
Country/City	EU	UK (CDM)	Australia (Safe Design)	USA (Prevention through Design-PtD)	Singapore (Safe Design)	Hong Kong (CDM & Safe Design)
Safe Design Principle	1. Prevent or reduce occupational risks at all stages of work 2. General principle of prevention at 89/391/EEC	Risk management approach	– Risk management approach – 5 Safe Design Principles in Australia	Risk management approach	Risk management approach – Modify UK CDM	– Risk management approach – Modify UK CDM and taking reference to overseas best practice (existing)

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

Country/City	EU	UK (CDM)	Australia (Safe Design)	USA (Prevention through Design-PtD)	Singapore (Safe Design)	Hong Kong (CDM & Safe Design)
Approach adopted	Depends on development of member states e.g. Ireland. The Safety, Health & Welfare at Work (Construction) Regulations 2006 Include a general clause first, then detailed provisions on design requirements in updated regulations	1. promotion 2. encouragement 3. professional collaboration 4. training 5. publish CoP & guidelines 6. enforcement	1. promotion 2. encouragement 3. professional collaboration 4. training 5. publish CoP & guidelines 6. develop risk assessment tool "CHAIR"	1. promotion 2. encouragement 3. professional collaboration 4. training 5. NIOSH leads a nationwide initiative on PtD 6. industry developed tool for safe design reference	1. promotion 2. encouragement 3. professional collaboration 4. training 5. publish Guidelines 6. consultancy service for government projects offered by MOM	1. promotion 2. encouragement 3. training 4. publish Guidelines & Worked Examples 5. pilot projects and contract provision in selected government projects 6. internal guidelines in HA

Benefits of getting it right the first time

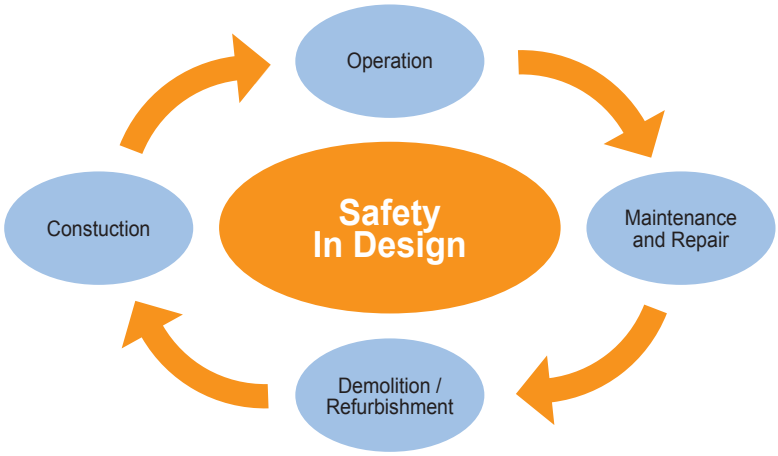




1. ISO 31000 – Risk Management – Principles and Guidelines,15-11-2009 Edition
2. IEC/FDIS 31010:2009(E) – Risk Management – Risk Assessment
3. BS18004:2008 – Guide to Achieving Effective Occupational Health and Safety Performance

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

Safe Design Life Cycle

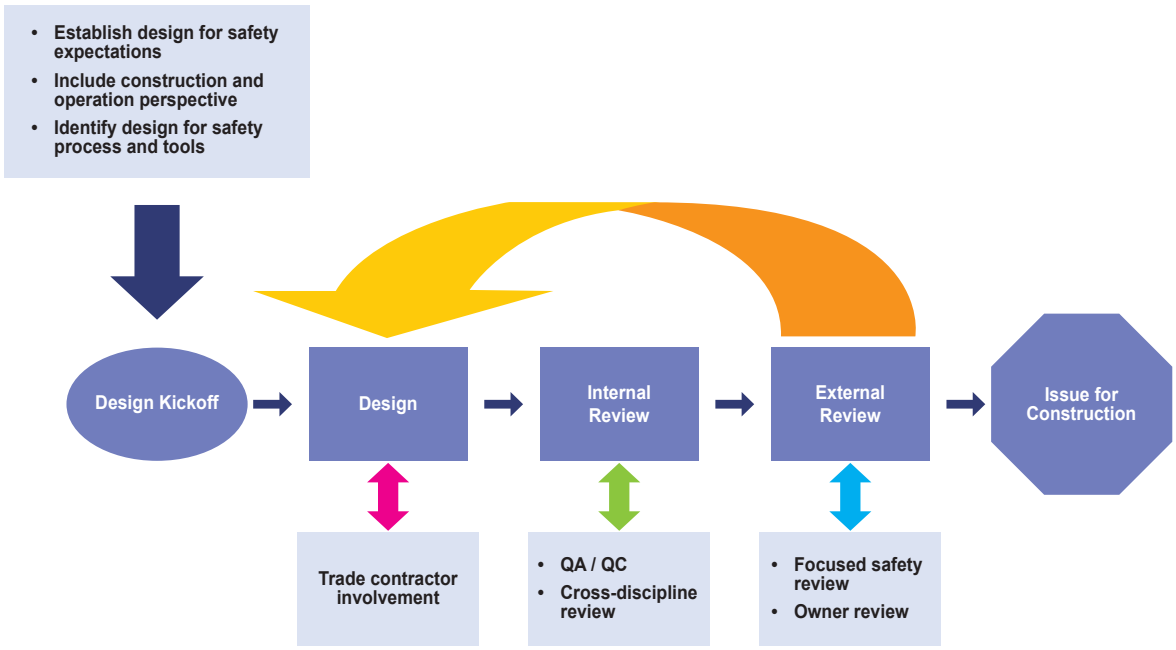


Prevention Through Design

Holistic approach

- Inception
- Design
- Construction
- Operation
- Maintenance
- Demolition / Disposal

Resources and Processes



(Source: Hecker et al., 2005)

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

UK CDM Regulations 2007

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 inform 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

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

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 basic 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

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

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.

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

Safe access for disabled

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

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, packageing, routine maintenance and repair etc.)

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

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

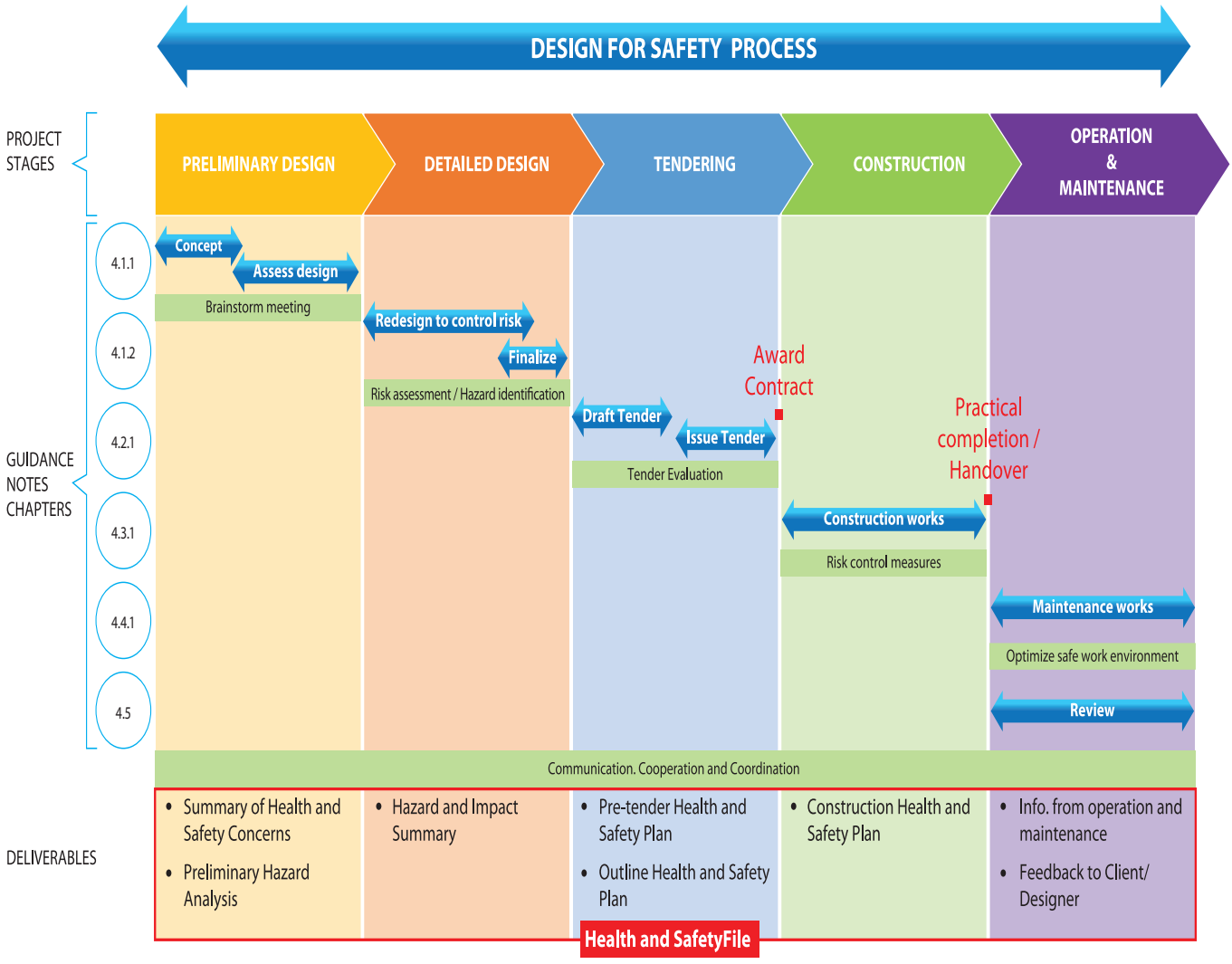
Designer: safe design for marvelous building

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

Annex A

Reference: Guidance Notes of Design for Safety — DEVB

Design for Safety Process



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

Annex B: Proforma for "Summary of Health and Safety Concerns"

Reference: Guidance Notes of Design for Safety — DEVB

A. Project Profile

_____

_____

_____

B. Site Environment

_____

_____

_____

C. Site Constraints

_____

_____

_____

D. Record of Consultation / Brainstorming Sessions

Date of consultation / brainstorming session: _____

	Attendance	Post / Department	Contact Details	Role
1				e.g. Chairman / Facilitator
2				
3				
4				
5				
6				e.g. Note-taker

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

E. Preliminary Hazard Analysis Checklist

Significant Hazards and Designers' Action ↓ / Design Areas and Construction / Maintenance Activities →	Significant Hazards Identified During Design *(Tick if applicable)*																								Designers' Actions
	Hazardous Substances	Contamination	Fall From Height	Falling Objects	Site Plant Vehicles	Collapsing Structure	Manual Handling	Lifting Operations	Buried / Overhead Services	Interface With Others	Cut / Drilling Concrete	Noise and Vibration	Deep Excavations	Asbestos	Fire Means of Escape	Highway Traffic	Restricted Access	Access for Maintenance	Component Replacement	Confined Spaces	Working Over or Near Water	Temporary Works Required	Others		Key C=Comments/Qualification; I=Information required to assist design G=Guidance, summary of Principles of Prevention that MUST be applied to a significant risk when designing A=Avoidance (Design to avoid identified hazards but beware of introducing others) CT=Control and Transfer (Design to provide acceptable safeguards or transfer the hazard with information)
Site Set Up Logistics																									
Access To Site																									
Site Offices and Compound																									
Site Surveys																									
Temp Services																									
Public / Highway Traffic Safety																									
Demolition and Dismantling																									
Design Areas and Associated Construction Activities																									
Ground Excavation Works																									
Piling																									
Concrete Substructure																									
Slabs																									
Interfaces																									
Drainage and Utility Services																									
Superstructure Frame																									
Superstructure Flooring																									

Notes: The activities and hazards are listed for reference, other related should be considered depending on actual condition.

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

Significant Hazards and Designers' Action ↓	Significant Hazards Identified During Design *(Tick if applicable)*	Designers' Actions
Design Areas and Construction / Maintenance Activities ←		
Roofing System	Hazardous Substances	Key C=Comments/Qualification; I=Information required to assist design G=Guidance, summary of Principles of Prevention that MUST be applied to a significant risk when designing A=Avoidance (Design to avoid identified hazards but beware of introducing others) CT=Control and Transfer (Design to provide acceptable safeguards or transfer the hazard with information)
Windows and Curtain Walling	Contamination	
Brick Blockwork	Fall From Height	
Cladding	Falling Objects	
Chimney / Flue	Site Plant Vehicles	
Mechanical - Lifts	Collapsing Structure	
Mechanical - AC Units	Manual Handling	
Electrical - Power	Lifting Operations	
Lighting	Buried / Overhead Services	
Internal Walls Painting	Interface With Others	
Floor Screed	Cut / Drilling Concrete	
Tiling	Noise and Vibration	
Testing & Commissioning	Deep Excavations	
Maintenance	Asbestos	
Window Cleaning	Fire Means of Escape	
Component Replacement	Highway Traffic	
	Restricted Access	
	Access for Maintenance	
	Component Replacement	
	Confined Spaces	
	Working Over or Near Water	
	Temporary Works Required	
	Others	

Notes: The activities and hazards are listed for reference, other related should be considered depending on actual condition.

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

F. Record of Major Issues Raised (including written concerns) and Responses:

	Major Issues Raised by Stakeholders	Responses [see Note (1)]	Any Action Required [see Note (2)]	
			Yes / No	Action Parties
1				
2				
3				
4				
5				
6				

Record prepared by: _____ (Name of Officer)

Post: _____ Date: _____

Countersigned by: _____ (Name of Designer)

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 the 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.

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

Annex C: Proforma for "Hazard and Impact Summary"

Reference: Guidance Notes of Design for Safety — DEVB

A. Project Profile

_____

_____

B. Site Environment

_____

_____

C. Site Constraints

_____

_____

D. Hazards and Impacts

	Task	Hazards and Impacts	Risk Assessment Rating	Control Measures	Residual Risk Yes / No	Necessity to Notify Contractor Yes / No	Other Relevant Parties to be Notified
1							
2							
3							
4							
5							

Note: Risk Assessment Method is given in Appendix H. [Annex F in the Chapter 3 of this Pictorial Guide]

Record prepared by: _____ (Name of Officer)

Post: _____ Date: _____

Countersigned by: _____ (Name of Designer)

Post: _____ Date: _____

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

Annex D: Pre-tender Health and Safety Plan

Reference: Guidance Notes of Design for Safety — DEVB

The Pre-tender Health and Safety Plan contains information based on the Hazard and Impact Summary and should be included in the tender documents for reference by the tenderers. The aim is to draw the tenderers' attention to the significant health and safety risks that are unlikely to be obvious to a competent contractor or other competent designers, or such risks are likely to be difficult to manage effectively. The information to be incorporated should be clear, precise and in a form suitable for the users. Therefore, designers do not need to mention every risk or assumption, as this can obscure the significant issues.

The Pre-tender Health and Safety Plan includes:

- Nature of Project;
- Client's name;
- Location;
- Nature / description of construction work to be carried out;
- Timescale / Programme for completion of the construction work;
- Drawings.

Existing Environment:

- 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.;
- Existing services, e.g. underground and overhead lines;
- Existing traffic systems and restrictions, e.g. access for fire fighting equipment, times of delivery, ease of delivery, parking, loading and unloading operations;
- 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;
- Ground conditions, e.g. contamination, overall instability, possible subsidence, old mine workings, underground obstructions, disused tunnels, ground anchors, soil nails;
- Proximity to railway lines, tram lines, or live traffic with possible restrictions on the operation of cranes etc.

The Design:

- The risks identified by designers that have not been eliminated during the design stage. These 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;
- The principles of the structure's 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):

- Health hazards arising from construction materials where particular precautions are required, either because of their nature or their intended use.

Site-wide Elements:

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

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

Project Concurrent with Client's or End-user's Undertakings

- Consideration of 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.;
- Restrictions on access, e.g. one particular site entrance may be the only access available for the contractor to use;
- Other restrictions e.g. on noise levels, use of percussive machines which cause excessive vibrations etc.

Site Rules

- Specific site rules which the client or designers may wish to specify relating to the construction and maintenance of the project.

Continual Liaison

- Procedures for considering the safety and health implications of design elements during the construction stage;
- Procedures for dealing with unforeseen events during construction that may result in substantial design change; and
- 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 incorporate into the 'Health and Safety File'.

General Notes:

(1) Where some items are considered by the Designers as inappropriate for the project, they may be excluded from the Pre-tender Health and Safety Plan. The Designers 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.

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

Annex E: Design for safety Red, Amber and Green lists

Reference: Guidance Notes of Design for Safety — DEVB

Red, Amber and Green lists are practical aides to designers on what should be eliminated/avoided and what to encourage to complete during design stage.

* The lists are examples and it is suggested that client and designers should prepare their own lists.

Red Lists: Hazardous procedures, products and processes that should be eliminated from the project where possible.
• Lack of adequate pre-construction information, e.g. asbestos surveys, geology, obstructions, services, ground contamination etc.
• Hand scabbling of concrete ('stop ends', etc);
• Demolition by hand-held breakers of the top sections of concrete piles (pile cropping techniques are available);
• The specification of fragile roof lights and roofing assemblies;
• Processes giving rise to large quantities of dust (dry cutting, blasting etc.);
• On-site spraying of harmful substances;
• The specification of structural steelwork which is not purposely designed to accommodate safety nets;
• Designing roof mounted services requiring access (for maintenance, etc), without provision for safe access (eg. barriers).
• Glazing that cannot be accessed safely. All glazing should be anticipated as requiring cleaning and replacement, so a safe system of access is essential.
• Entrances, floors, ramps, stairs and escalators etc not specifically designed to avoid slips and trips during use and maintenance, including effect of rain water and spillages.
• Design of environments involving adverse lighting, noise, vibration, temperature, wetness, humidity and draughts or chemical and/or biological conditions during use and maintenance operations.
• Designs of structures that do not allow for fire containment during construction
• During excavation, unable to allow sufficient space for the battering (sloping) or benching of excavations, to minimize the risk of collapse. Where possible, avoid locating excavations near static loads (such as buildings, walls and immobile plant) or dynamic loads (including traffic and excavation equipment)

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

Amber Lists: **Products, processes and procedures to be eliminated or reduced as far as possible and only specified/allowed if unavoidable. Including amber items would always lead to the provision of information to the duty holders.**
• Internal manholes / inspection chambers in circulation areas;
• External manholes in heavy used vehicle access zones;
• The specification of "lip" details (i.e. trip hazards) at the tops of pre-cast concrete staircases;
• The specification of shallow steps (i.e. risers) in external paved areas;
• The specification of heavy building blocks;
• Large and heavy glass panels;
• The chasing out of concrete / brick / blockwork walls or floors for the installation of services;
• The specification of heavy lintels (the use of slim metal or hollow concrete lintels being alternatives);
• The specification of solvent-based paints and thinners, or isocyanates, particularly for use in confined areas;
• Specification of curtain wall or panel systems without provision for the tying (or raking) of scaffolds;
• Substituting dangerous with inherently less dangerous chemicals.
• Modify the design to reduce areas where dust and dirt can collect and thus eliminate the need for cleaning at height
• Design plant to extract dust and fumes effectively rather than deposit them in areas that will need cleaning
• Simplify the process control and reduce the sensitivity to deviation, thereby improving reliability of control systems when handling the hazardous chemicals.
• Using specific building components and construction methods that can eliminate the need for falsework or formwork for temporary works.
• Anchor points should be provided at suitable spacings to limit the worker's movement to the protected area for temporary works.
• Information about restrictions, proper use and load bearing capacities of structural components, and on lateral forces to be supported by temporary works equipment should be provided for designing the temporary works.
• Site traffic routes that do not allow for 'one way' systems and/or vehicular traffic segregated from site personnel
• Site layout that does not allow for adequate room for delivery and/or storage of materials, including specific components.
• Heavy construction components which cannot be handled using mechanical lifting devices (because of access restrictions / floor loadings etc.)
• On-site welding, in particular for new structures.
• Need to use large piling rigs and cranes near overhead electric power lines or where close to obstructions which prevent the guarding of rigs

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

Green Lists: **Products, processes and procedures to be positively encouraged.**
• Adequate access for construction vehicles to minimise reversing requirements (one-way systems);
• Provision of adequate access and headroom for maintenance in plant rooms, and adequate provision for replacing heavy components;
• Thoughtful location of mechanical / electrical equipment, light fittings, security devices etc. to facilitate access and keep away from crowded areas;
• The specification of concrete products with pre-cast fixings to avoid drilling;
• Specify half board sizes for plasterboard sheets to make handling easier;
• Early installation of permanent means of access, and prefabricated staircases with hand rails;
• The provision of edge protection at permanent works where there is a foreseeable risk of falls after handover;
• Practical and safe methods of window cleaning (e.g. from the inside);
• Off site fabrication and prefabricated elements to minimize on site hazards;
• Encourage the use of engineering controls to minimize the use of personal protective equipment;
• Using high durability and low maintenance materials that do not need to be re-coated or treated;
• Designing the structure so that maintenance can be performed at ground level or safely from the structure, for example, positioning air-conditioning units and lift plant at ground level and designing inward opening windows etc.
• Using continual support beams for beam-to-column double connections, be it adding a beam seat, extra bolt hole, or other redundant connection points during the connection process. This will provide continual support for beams during erection – to eliminate falls due to unexpected vibrations, misalignment and unexpected construction loads;
• Reducing the space between roof trusses and battens to reduce the risk of internal falls during roof construction;
• Separate heavy transport access from lighter vehicle access, and separate pedestrians from vehicle access.

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

Annex F: Risk Assessment Method

Reference: Guidance Notes of Design for Safety — DEVB

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 occurring 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 occur

(c) Risk Assessment Rating

	Likely Severity of the Harm (or consequence)		
Probability that Harm will Occur (or likelihood)	**Low (1)**	**Medium (2)**	**High (3)**
Low (1)	1	2	3
Medium (2)	2	4	6
High (3)	3	6	9

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 and 4, further consideration of ways to eliminate or reduce the risk is needed, and the resulting additional risk management measures selected must 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.

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

Annex G: Good design practices

Reference: Guidance Notes of Design for Safety — DEVB

Design for Safe Maintenance

Risks relating to cleaning, servicing and maintaining a structure can be controlled by:

- Designing the structure so that maintenance can be performed at ground level or safely from the structure, for example, positioning air-conditioning units and lift plant at ground level, designing inward opening windows, integrating window cleaning bays or gangways into the structural frame.
- Designing features to avoid dirt traps.
- Designing and positioning permanent anchorage and hoisting points into structures where maintenance needs to be undertaken at height.
- Designing safe access, such as staircases, and sufficient space to undertake structure maintenance activities.
- Avoid locating high maintenance items above stairways and other recesses.
- Eliminating or minimising the need for entry into confined spaces.
- Using high durability and low maintenance materials that do not need to be re-coated or treated.
- Locating maintenance items of roof near the centre of the roof, away from hazards such as skylights and roof edges, and providing dedicated access walkways, including handrails and non-slip surface. Marking hazards and on-walk areas.

Design for Safe Construction

Control measures for risks relating to the construction of a structure include:

- Providing adequate clearance between the structure and overhead electric lines by burying, disconnecting or re-routing cables before construction begins, to avoid 'contact' when operating cranes and other tall equipment.
- Designing components that can be pre-fabricated off-site or on the ground to avoid assembling or erecting at heights and to reduce worker exposure to falls from heights or being struck by falling objects, for example fixing windows in place at ground level prior to erection of panels.
- Designing parapets to a height that complies with guardrail requirements, eliminating the need to construct guardrails during construction and future roof maintenance.
- Using continual support beams for beam-to-column double connections, be it adding a beam seat, extra bolt hole, or other redundant connection points during the connection process. This will provide continual support for beams during erection – to eliminate falls due to unexpected vibrations, misalignment and unexpected construction loads.
- Designing and constructing permanent stairways to help prevent falls and other hazards associated with temporary stairs and scaffolding, and schedule these at the beginning of construction.
- Reducing the space between roof trusses and battens to reduce the risk of internal falls during roof construction.
- Choosing construction materials that are safe to handle.
- Limiting the size of pre-fabricated wall panels where site access is restricted.
- Selecting paints or other finishes that emit low volatile organic compound emissions.
- Indicating, where practicable, the position and height of all electric lines to assist with site safety procedures.

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

Design for Traffic Management

- Speed limits for adverse site conditions and for areas near work in progress.
- Traffic lights to control flow at busy junctions, in narrow locations and at entry and exit locations to the site.
- One-way systems to reduce the likelihood of collision, reduce congestion and improve traffic movement
- Traffic calming devices such as speed humps, rumble strips, width restrictors etc. can be incorporated into road design to encourage a reduction in speed. (such devices are not appropriate in areas where fork lift trucks routinely operate since they introduce additional hazards)
- Physical barriers to protect vulnerable and hazardous installations such as storage tanks, pipe-work systems, buildings or pedestrian access areas.
- Entrances and exits – provide separate entry and exit gateways for pedestrians
- Walkways – provide firm, level, well-drained pedestrian walkways that take a direct route where possible
- Crossings – where walkways cross roadways, provide a clearly signed and lit crossing point where drivers and pedestrians can see each other clearly.
- Provide parking for the workforce and visitors away from the work area if possible.
- Control entry to the work area.
- Plan storage areas so that delivery vehicles do not have to cross the site.
- The need for vehicles to reverse should be avoided, a one-way system can reduce the risk especially in storage areas.
- Separate heavy transport access from lighter vehicle access, and separate pedestrians from vehicle access.
- In areas that are likely to be vehicle traffic areas, additional consideration is needed for the safe access to the location of offices, meal rooms and toilets.

Design for Temporary Traffic Management

- Ensure that temporary traffic management layouts start in safe locations by avoiding hazardous positions, e.g. close to a bend, slip road, junction or the brow of a hill.
- Consider specifying the use of remotely-operated roadwork signs in high-risk situations.
- Consider the installation of permanent sign support brackets or remotely-operated signs in locations where there are frequent works.
- Before work begins, holding planning meetings with the traffic management contractor, main contractor, resident engineer, police and highway department to determine appropriate systems of work.

Design for Work in Confined Spaces

- Consider what measures can be taken to enable the work to be carried out without the need to enter the confined space.
- Modifying the confined space itself to avoid the need for entry, or to enable the work to be undertaken from outside the space.

Design for Manual Handling

- Avoidance of manual handling
- Mechanise or automate process
- Changes in the layout of the task to reduce the risk of injury
- Reducing the risk of injury from the load – make the load lighter

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

Design for Machinery

- Eliminating the cause of the danger (intrinsic safety – a process by which the designer eliminates dangers at the design stage with consideration for the elimination of dangerous parts, making parts inaccessible, reducing the need to handle work pieces in the danger areas, provision of automatic feed devices, and enclosure of the moving parts of the machine)
- Failure to safety – ensure that machines fail to safety and not to danger
- Safety by position - reducing or eliminating the need for people to approach the dangerous part(s) of the machine, making access to the dangerous parts difficult
- If possible, guards should be designed so as to allow minor maintenance on the machines without removing the safeguards
- If the guard must be removed or deactivated, then lock-off procedures or isolation procedures should be followed.

Design for Hazardous Material

Design to limit potential

- Keep inventories of hazardous materials as small as possible
- Eliminate risks by substituting the dangerous with the inherently less dangerous
- Minimise risk by small inventories of hazardous material that these are insufficient to cause significant harm even if released. Using personal protective clothing as a last resort

Design to limit likelihood

- Simplify the process control and reduce the sensitivity to deviation, thereby improving reliability of control systems
- Combat risks at source by engineering controls and giving collective protective measures priority e.g. enclosing the process

Design to limit people at risk

- On-site: Careful thought should be given to site layout to ensure that personnel who need not be close to the plant have buildings, workshops, etc. away from the plant
- Off-site: The installation site should be chosen with regard to the population nearby and there should be control of future development

Design for Human Factors

- The job is well-designed to match known strengths and limitations of person or team doing it.
- Select individuals matched to the needs of the job
- Management within the organization take responsibility for all aspects of work and work design.
- Human error assessment and reduction technique (HEART) is a technique used in the field of human reliability assessment (HRA), for the purposes of evaluating the probability of a human error occurring throughout the completion of a specific task.
- Such analyses measures can then be taken to reduce the likelihood of errors occurring within a system and therefore lead to an improvement in the overall levels of safety.
- There are three primary reasons for conducting an HRA; error identification, error quantification and error reduction.
- There are a number of techniques used for such purposes, they can be split into one of two classifications; first generation techniques and second generation techniques. First generation techniques work on the basis of the simple dichotomy of ‘fits/doesn’t fit’ in the matching of the error situation in context with related error identification and quantification and second generation techniques are more theory based in their assessment and quantification of errors.

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

Design for Working at Height

- Eliminate the need to work at height at the design stage
  - Modify the design to reduce areas where dust and dirt can collect and thus eliminate the need for cleaning at height
  - Clean from ground level using jet washers
  - Design plant such that checking, sampling and maintenance can be done from ground level
  - Design plant to extract dust and fumes effectively rather than deposit them in areas that will need cleaning
  - Design to minimize manual handling at height
  - Design plant and structures so that the erection work can be done at ground level with the unit being craned into its final location
- Design in permanent measures to permit safe work at height
  - Where maintenance has to be done at height, design permanent access
  - Design in permanent anchor points for temporary access
  - Provide permanent lifelines for vehicle loading and unloading
- Provide temporary access to permit safe working at height
  - Scaffolding
  - Roof ladders
  - Working platforms and crawler boards
  - Secure means of getting on and off a roof
  - Mobile elevating working platforms
- Provide collective control measures always take priority over personal control measures. Collective measures protect more than one person at any one time, such as scaffolds. Personal control measures rely on personal protective equipment and only protect individual users.
  - Working platforms
  - Edge protection- guard-rails, barriers, toe-boards and fences
  - Coverings for openings
  - Gangways and runs
  - Safety netting
- Provide personal protective equipment to personnel working at height
  - Fall arrest system
  - Fall prevention/travel restriction systems
  - Harnesses
  - Lanyards
- Other measures
  - Demarcation of safe areas
  - Plan the construction and/or installation so that the permanent means of access are in place as early as possible
  - Issue permits to work to prevent unauthorized access

Design for Excavation

- Use of trenchless technology which eliminates the hazards associated with excavations
- Identify the exact location of existing underground utilities.
- Allow sufficient space for the battering (sloping) or benching of excavations, to minimize the risk of collapse. Where possible, avoid locating excavations near static loads (such as buildings, walls and immobile plant) or dynamic loads (including traffic and excavation equipment).

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

Design for Ladders, Steps and Stairways

The gradient of stairs should be considered and adequate handrails, ramps and lighting should be provided.

- Ladders, if considered for working at height apart from access, should be less than 2 m in height and their applications should be limited for works of short duration and light-duty in nature, whereby the arrangement to provide a working platform for the work would be reasonably impractical. In connection with this, a risk assessment should be conducted to justify the use of ladders before they are used for work on the site.

Design for Workplace Housekeeping

- Demarcation of Areas:
  - Workplace
  - Materials storage area
  - Plants setup & location
  - Entrance & access
- Design:
  - Tailor-made machinery
  - Temporary storage
  - Waste Control (Solid & Water)
- Sufficient drainage is provided to manage the effects of rainwater and ponding.

Design for Utilities

- An electric hazard is considered to be removed when protective measures are put in place at the source (remove hazard or de-energize), or along the path (place electrical insulation/ barrier between the worker and the electrical hazard). Where PPE is relied upon for worker protection, an electrical hazard is considered to remain and it is still necessary to address safety requirements for other workers in the area.
- Design should consider the location of, access to and egress from, and work space in the switchroom.
- Adequate space for ducts and equipment to ensure that installers can work from safe position.
- The detailing of ducts, channels and openings should specify that they are either cast or built into the structure, to ensure that workers do not have to chase out their locations.

Design for Temporary Works

- Using specify building components and construction methods that can eliminate the need for falsework or formwork.
- Information about the restrictions, proper use and load bearing capacities of structural components, and on lateral forces to be supported by temporary works equipment should be provided.
- Anchor points should be provided at suitable spacing to limit the worker's movement to only the protected area.

4. Perspective from Designers for Temporary Works and Works Execution during Construction or Maintenance – Good Practice of Planning and Design for Safety

Presenter: Mr Michael LEUNG (HKCA)

Fast Track Construction in HK Nowadays

Location – 18 Westlands Road, Taikoo Place, Hong Kong
Period – March 2006 to May 2008 (790 days ~ 2 Years)
Value – HK$2,338 million
70-storey commercial building tower
2-level of basement with 4m deep raft foundation
320 m from ground
Curtain wall enclosed

"Nowadays, Construction in HK is very Fast Track !!!!"
"As a Competent Contractor, Detailed Planning for Safety, Time & Cost is very important !!!!"
See the two-minute video !!!!

Zero Harm

- Zero deaths
- Zero injuries to the public
- Zero seriously disabling injuries to workforce (the 500,000)
- Zero long term harm to health
- Accident Frequency Rate (AFR) target Zero (Incident Rate)
- Accident Frequency Rate (AFR) below 0.1

These are all outcomes.
We can't manage outcomes but we can manage the risks.
To deliver the zero harm outcomes with certainty, we have to eliminate the risk of them occurring.

Inspiration And Commitment.....Without All The Answers

"I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth."

25th May 1961

"That's one small step for man, one giant leap for mankind."

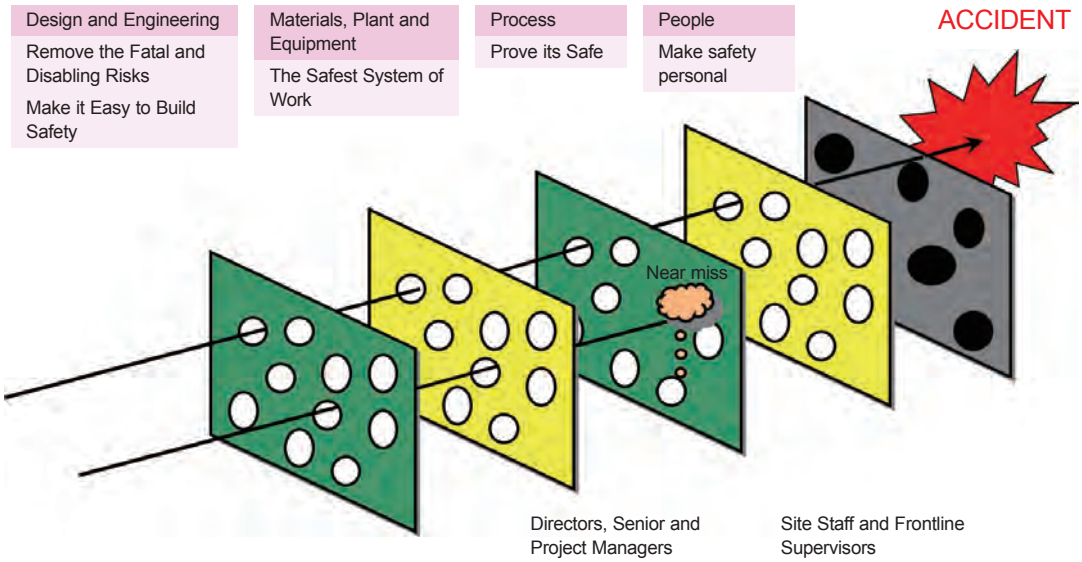
21st July 1969

4. Perspective from Designers for Temporary Works and Works Execution during Construction or Maintenance – Good Practice of Planning and Design for Safety

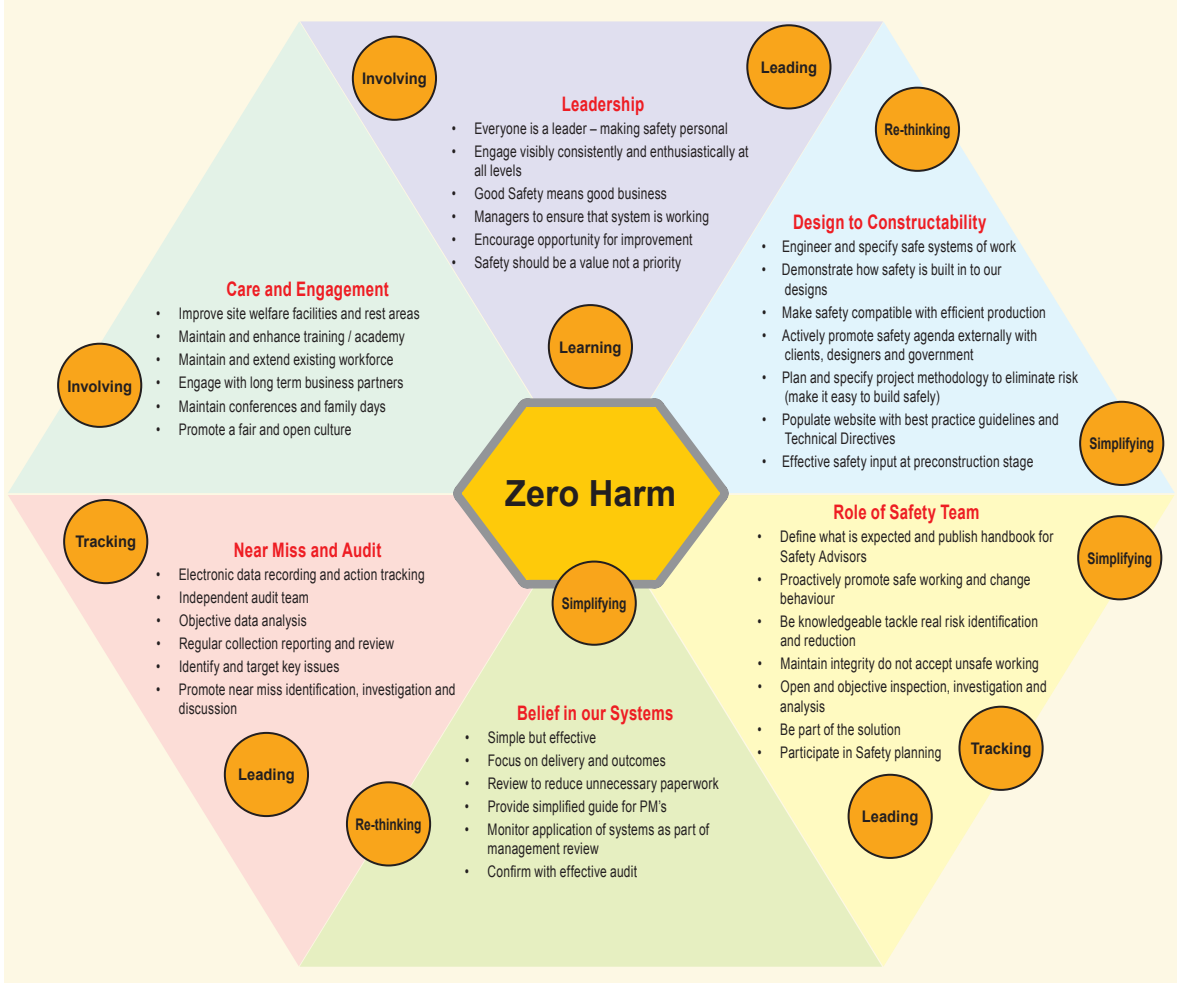
The Safety Management Process (Swiss Cheese Method) – People make mistakes – we need several lines of defences

Our 4 Layers of Protection

Design and Engineering	Materials, Plant and Equipment	Process	People
Remove the Fatal and Disabling Risks Make it Easy to Build Safety	The Safest System of Work	Prove its Safe	Make safety personal



Focus on Zero Harm – Our Standard



4. Perspective from Designers for Temporary Works and Works Execution during Construction or Maintenance – Good Practice of Planning and Design for Safety

Six Point Safety Focus

- **Leadership**
- **Care and Engagement**
- **Near Miss and Audit**
- **Belief in our Systems**
- **Role of the Safety Team**
- **Constructability**

"The journey to ZERO HARM will be through the application of the Six Point Safety Focus which is taking us to the next level of safety"

Leadership

- Everyone is a leader – make safety personal
- Visible, enthusiastic and consistent engagement by all
- Good safety is good business
- Managers must ensure the system is delivering our objectives
- Seek and encourage opportunities for improvement
- Safety should be in our DNA not just a priority

Care and Engagement

- Managers will sponsor and live the Zero Harm culture
- Managers will make every opportunity to be role model "Duty of Care"
- HSE, HR and Managers to keep an open dialogue with frontline staff
- Business units to share best practice via website
- Update corporate practice to breed Zero Harm DNA
- Spread and deliver Zero Harm by proactively engaging with stakeholders
- Everyone to take part and support each other

Near Miss and Audit

- Establish an independent audit team
- Introduce electronic data capture and tracking
- Provide objective data analysis to prioritize improvements
- Regular performance review and update
- Target key issues and implement actions
- Develop a learning culture in support of Near Miss reports

Belief in our Systems

- Keep them simple but make them effective
- Use the system to help deliver the objectives
- Taskforce to simply the paperwork
- Provide a simplified guide for Project Managers
- Managers to regularly review implementation and delivery
- Confirm achievements with effective audit

Role of the Safety Team

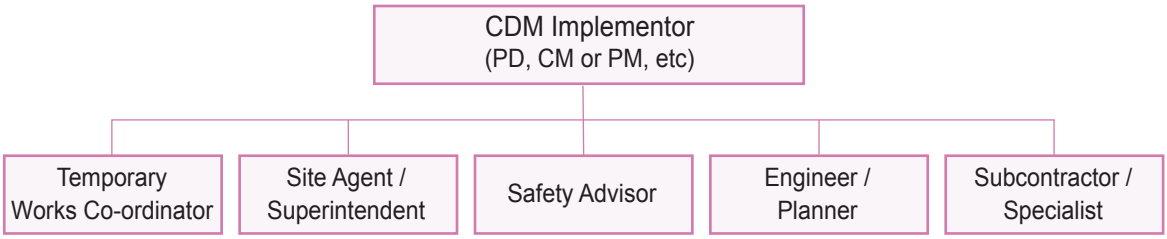
- To actively assist Managers to deliver Zero Harm
- Be proactive, plan ahead engage in risk identification and reduction
- Be part of the solution
- Supported by our Managers to address unsafe working and provide open, objective and consistent inspection reporting and analysis
- Proactively and enthusiastically promote safety planning and behaviour

4. Perspective from Designers for Temporary Works and Works Execution during Construction or Maintenance – Good Practice of Planning and Design for Safety

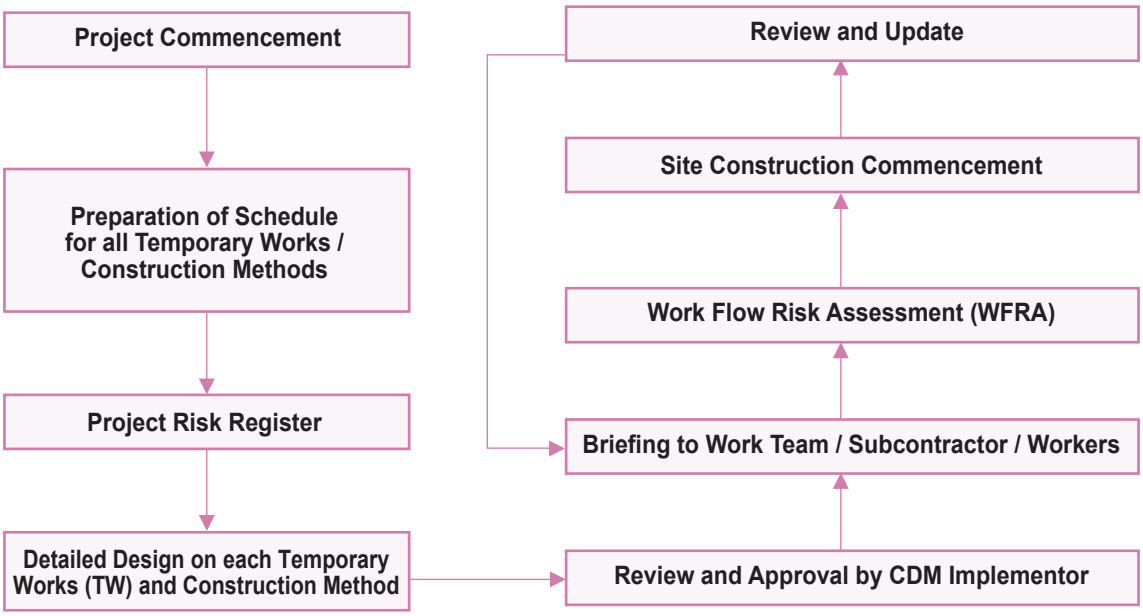
Constructability

- Engineer and specify safe systems of work
- Demonstrate how safety is built into designs and methods
- Make safety integral with efficient production
- Actively promote "Safety by Design" with Clients, Designers and Government
- Use intranet to promote and collect good practice
- Include safety from the earliest key decision stages
- Make it easy to build safely

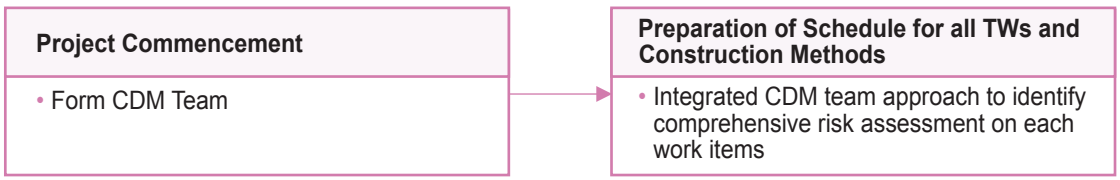
Construction Design Management - CDM



CDM Implementation Flow



CDM Added Value:
- Not only for Temporary Works Design in the Focus of Structural Check Need to
- Consider for the Whole Work Process to meet Zero Harm Target Integrated
- Team Approach to remove Risk and Hazards of all Work Faces



4. Perspective from Designers for Temporary Works and Works Execution during Construction or Maintenance – Good Practice of Planning and Design for Safety

Scoring Scheme for Health, Safety & Environmental Risk Assessment

HSE Impact Rating Scale

(note for cost and delivery ratings)

IMPACT RATING Consequence	HEALTH, SAFETY & ENVIRONMENT(S)
5 Very High	A fatality or fatalities, conviction, prolonged adverse effect on the environment.
4 High	Serious injuries also involving the public. Irreversible, life shortening health effect or disability. Potential prosecution. Medium term adverse environmental impact or complaints concerning pollution. Breach in security.
3 Medium	Serious injury or illness. Short-term adverse environmental impact requiring recovery actions. Isolated nuisance complaint.
2 Low	Minor injury involving first aid or minor illness. Reversible health effect. Isolated environmental impact.
1 Very Low	Negligible impact.

Probability rating scale

PROBABILITY RATING	DESCRIPTION	GUIDANCE
5	Very likely, almost certain	A threat or opportunity with a greater than 90% chance of occurring during the period.
4	Probable	A threat or opportunity with a 50% – 90% chance of occurring.
3	Possible	A threat or opportunity with 10% – 50% chance of occurring.
2	Remote	A threat or opportunity with a 1% – 10% chance of occurring.
1	Improbable	A threat or opportunity that is so unlikely that it can be assumed that it will not occur.

IMPACT / PROBABILITY MATRIX

IMPACT RATING (1 TO 5)

ORANGE	RED	RED	RED	RED
YELLOW	ORANGE	ORANGE	RED	RED
YELLOW	YELLOW	YELLOW	YELLOW	YELLOW
GREEN	GREEN	YELLOW	YELLOW	YELLOW
GREEN	GREEN	GREEN	YELLOW	YELLOW

PROBABILITY RATINGS (1 TO 5)

RISK RATINGS

Red

- **Risk unmitigated. Do not proceed.**

Orange

- **Residual risk to be managed by specially defined controls and monitoring, proceed with caution.**

Yellow

- **Residual risk to be managed by standard and supplementary minor controls.**

Green

- **Risk fully mitigated and standard controls required.**

(Rating edited for CDM process)

4. Perspective from Designers for Temporary Works and Works Execution during Construction or Maintenance – Good Practice of Planning and Design for Safety

Project Risk Register

It is progressively reviewed and updated by the CDM Implementor and risk owners, recording progress of how risk is eliminated and also recording control measures to be put in place for any residual risk.

Example

No	RISK	CONSEQUENCES	REVIEW & DATE	MITIGATION STAGES & CONTROLS (Record any consequential risk in RISK column)	COST OF MITIGATION	RISK			OWNERSHIP (Nominees from relevant disciplines)
						I	P	I*P	
1	**Working at Height** Falling off truss when bolting up steel sections	• Injury or death to work • Loss of company image • Banned from tendering	Concept Design Jan 2009	Review and mitigation required		5	3		Nominee A
			Design March 2009	Pre-assemble sections into frames before erection Install permanent access platforms before erecting, bracing, where scaffold access is not possible	Minimal	5	1		Nominee A
			Construction June 2009	Ensure adequate site supervision and riggers are suitably skilled and wear harnesses		3	1		Nominee A
2	**Falling objects** Dropping splice plates, hand tools, nuts and bolts.	• Injury or death to public and workers • Damage to adjacent properties • Loss of company image • Banned from tendering	Concept design Jan 2009	Minimise weight of truss and number of individual small sections. Design steelwork sections to be preassembled in frames for erection in one lift.		5	2		Nominee B
			Pre-construction review June 2009	Provide safety netting catch small items and reduce impact.		2	2		Nominee C
3	**Structural failure** Support bearings fail and truss falls off roof onto Nathan Road. Uplift restraint required during service conditions.	• Injury or death to public and workers • Damage to adjacent properties • Loss of company image • Banned from tendering	Design Jan 2009	Ensure bearings are correctly specified and of reliable construction with higher than normal safety factors. Designer's advisory note required on design drawings that bearings must be property maintained.	Cost of bearings =20% Stringent inspection & Maintenance required	5	5		Nominee B
			Design March 2009	Eliminate bearings and risk by casting truss supports directly into the building and design truss to accommodate thermal restraint forces. Designer to inspect supports before concreting.	Cost of bearings eliminated. Additional Steel minimal.	-	-		Nominee D
4	**Instability during erection** Frames can topple because they are unstable during erection, until bracing is installed.	• Injury or death to public and workers • Damage to adjacent properties • Loss of company image • Banned from tendering.	Pre-construction June 2009	Mitigation required by August 2009.		5	3		Nominee C
			Construction August 2009	To prevent toppling, erect and brace centre frames first and work outwards to the ends, bracing each frame as it is erected. Site supervision to ensure workers understand and implement the method statement.	Minimal	4	1		Nominee C

I=Impact rating P=Probability rating Ratings: 5=high to 1=low

4. Perspective from Designers for Temporary Works and Works Execution during Construction or Maintenance – Good Practice of Planning and Design for Safety

Detailed Design on each TW and Construction Method

- Comply with Zero Harm Policies
- Easy to build safely
- Highlight safe working method and guideline into all working drawing / shop drawing / method statement
- Remove fatal and disabling risk
- Plan mitigation measures to eliminate risk

→

Review and Approval by CDM Implementor

- PD / CM / PM to scrutinize detailed design
- Ensure safety elements and design incorporated in the TW design and construction method
- If required, further review by design engineer

Briefing to Work Team / Subcontractor / Workers

- Ensure all work team / subcontractor / workers understand the works and related mitigation measures

→

Work Flow Risk Assessment (WFRA)

- Check any site constraints and risk different from the method statement

↓

Site Construction Commencement

- Supervise the works according to approved TW design and method statement

→

Review and Update

↑

Building Information Modeling

Examples of Digital Project Implementation in China – The Beijing Olympic Stadium
Project Architect: Herzog & DeMeuron, Structural Engineer: Arup

Objectives

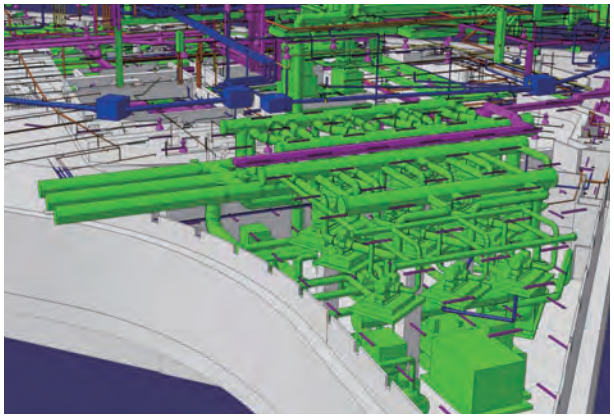
- Facilitate design co-ordination and planning
- Clash Identification prior to construction
  - Minimize abortive works
  - Minimize waste generation
- Handover the as-built 3D model to the Client after project completion

4. Perspective from Designers for Temporary Works and Works Execution during Construction or Maintenance – Good Practice of Planning and Design for Safety

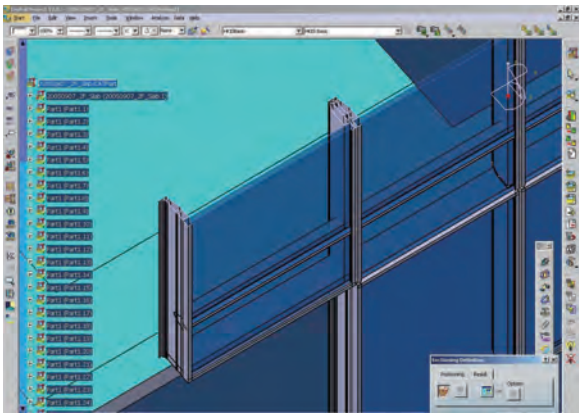
Scope

- Structural frame and slab
- Architectural layout and works
- M&E works (including Lifts and Escalators)
- Façade works – Curtain Wall
- Façade works – Glass Wall & Link Bridges

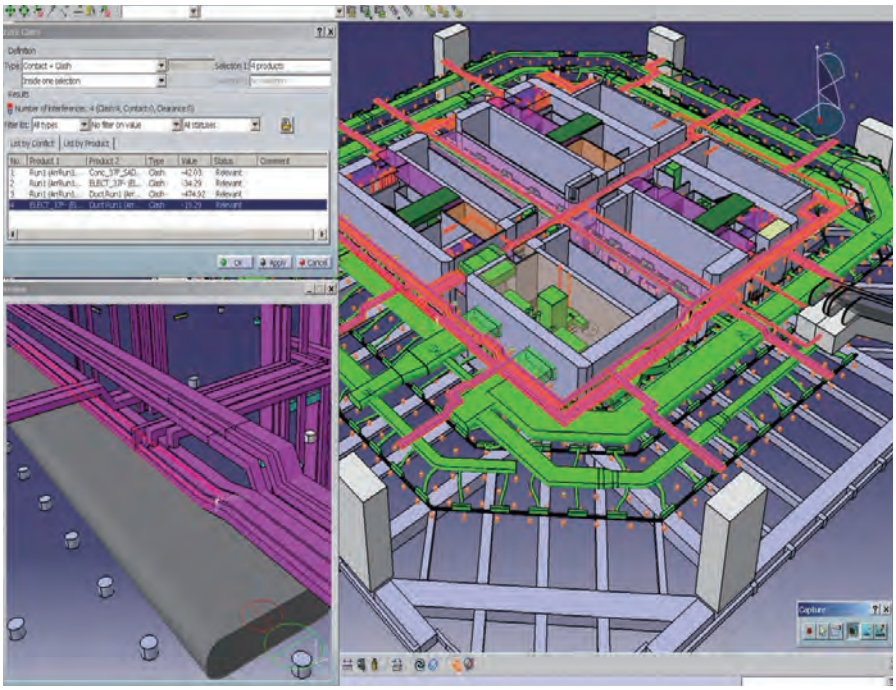
Use of 3D Model for Construction



Realistic Level of Details -
Chiller Plants



Realistic Level of Details -
Curtain Wall Units

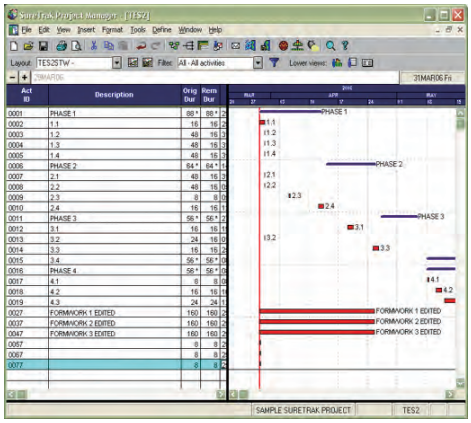


Automatic Clash Identification and Management

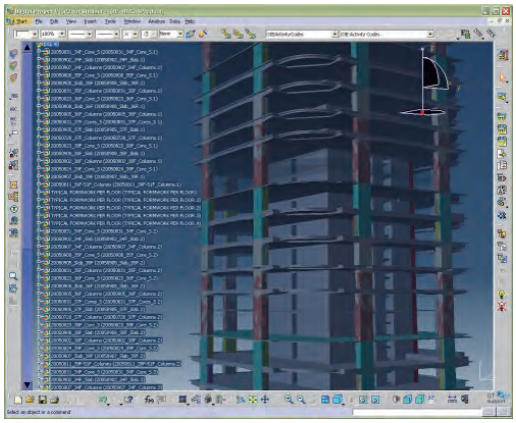
4. Perspective from Designers for Temporary Works and Works Execution during Construction or Maintenance – Good Practice of Planning and Design for Safety

Linking to Project Portfolio Management Software Tool for Progress Monitoring

Data exchanging between Project Portfolio Management Software Tool and Digital Project



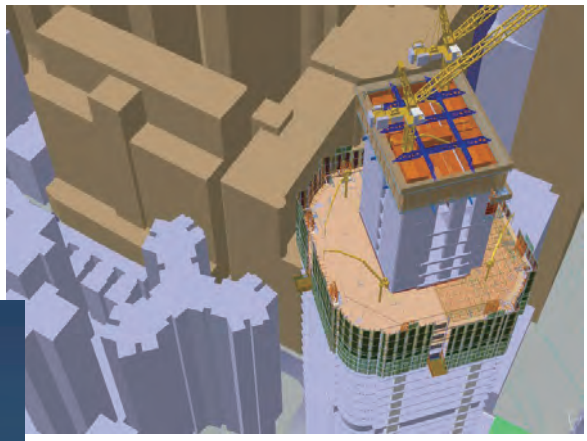
Primavera

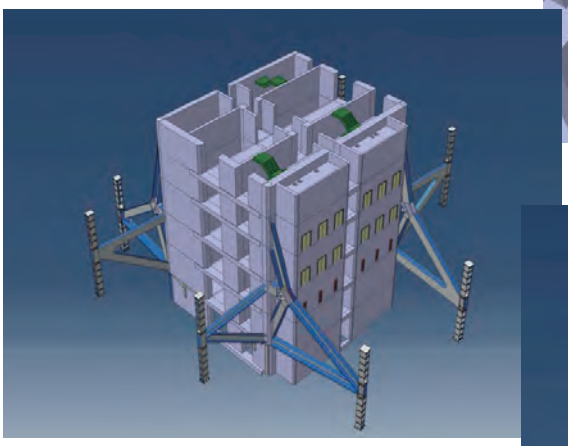


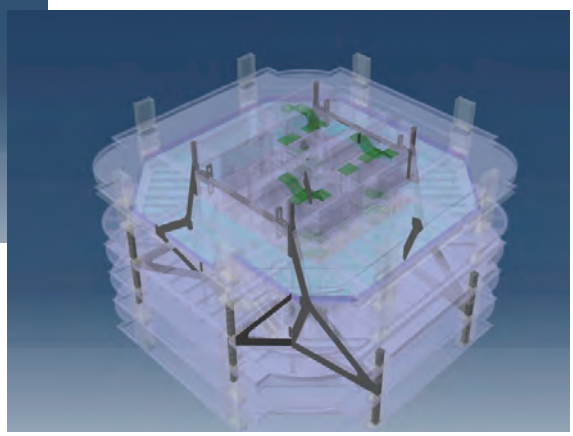
Digital Project

Virtual Prototyping (4D Model)

- Detail study on the critical process
  - 4-day floor cycle
  - Outrigger construction
- To partner with University to carry out the simulation exercise
- Outrigger Construction







Conclusion and Further Development

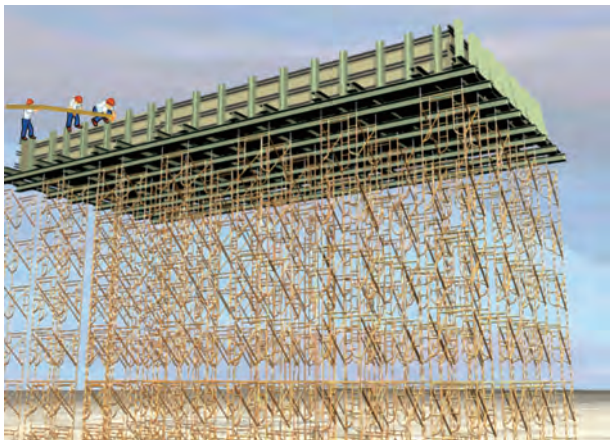
- Zero Harm
- Swiss Cheese
- CDM - Construction Design Management
- BIM - Building Information Modelling

5. Case Studies - Miniature CDM: Temporary Works

Presenter: Mr W Y WONG (LD)

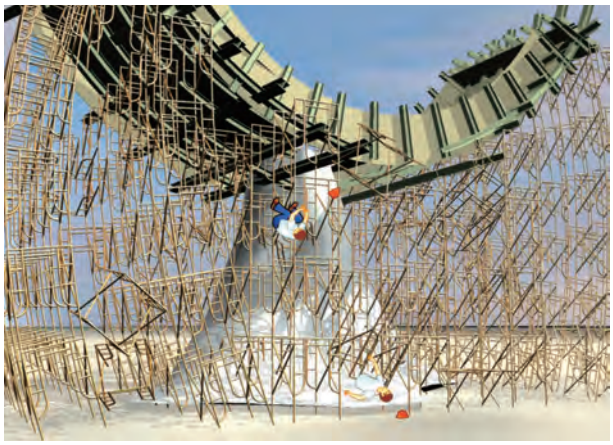
Collapse of Falsework

- Only a structural calculation on a typical plane frame column by unnamed engineer.
- No fabrication drawing.
- No specification on material composition.
- No method statement.
- No supervisor for fabrication.
- No appointment of competent person for fitness for use.
- Missing cross bracing.
- Inadequate lacing.
- Some prop extensions more than 300mm.
- Improper wedging on prop baseplates.
- No competent person or engineer for certification of fitness for use.



Safety of Falsework

- The principal contractor should appoint a Competent Engineer to design.
- Preparation of instructions: drawings, specifications, method statements.
- Engineering justifications: vertical loads, lateral loads.
- Fabrication: lacing, bracing, wedging and extensible portion of props.
- Appointment of construction supervisor to carry out the work.
- Sufficient technical knowledge and management skill.
- Reject materials and workmanship of substandard construction.
- Seek Competent Engineer's approval for deviation.
- Coordination with parties.
- Arrangement for certification of completion.
- Method statement for erection and dismantling.
- Site supervision on job steps of erection and dismantling.
- Provision of access and egress.
- Use of personal protective equipment (PPE).
- Certification of completion.
- Documentation.



Other Examples

- Anchorages of cranes, suspended working platforms (SWPs).
- Wall-supported working platforms inside lift shaft.
- Climbing stage platforms.
- Metal/bamboo scaffolds.
- Metal mould/formwork.

Conclusion

- The case studies demonstrate core ingredients of a miniature CDM.

6. Discussion Forum (A)

During the discussion forum, representatives of Hong Kong Housing Authority and industry stakeholders shared experience on how to enhance planning and design for safety in project life cycle for public housing developments (from planning, design, construction, occupation to maintenance stages). The participants were -

- Ms Ada FUNG, Deputy Director of Housing (Development & Construction) **(Fung)**
- Mrs Irene CHENG, Assistant Director of Housing (Development & Procurement) **(Cheng)**
- Mr Conrad WONG, President of Hong Kong Construction Association **(Wong)**
- Mr Stephen LEE, Vice-President of Hong Kong Construction Association **(Lee)**
- Mr Stephen KUOK, President of Lifts & Escalators Contractors Association **(Kuok)**
- Mr KM NG, Vice-Chairman of Hong Kong Professional Hoisting Engineering Association **(Ng)**
- Mr Jason WONG, Senior Consultant of Occupational Safety & Health Council **(Jason)**

Question (1) **We have just shared the experience of acting as a "designer". As many of us play the role of a "designer", how do you integrate the safety requirements into the project design and the daily operations?**

Fung : First of all, as a public development organization, there should be comprehensive "design" for its system and mechanism, including procurement cycle, technological research, workflows and guidelines. We should pay attention to safety holistically. For the practical aspects, I just leave it to the Assistant Director. Lastly, the slides about "zero incident" and the experience we shared today are saved in this CD. We hope you can help us promote it to other industry participants and related personnel for their reference.

Cheng : Many colleagues have been working under the Housing Authority for many years and their experience has been incorporated into the design guidelines and contract specifications, which may serve as a reference for our new colleagues and professional service providers. All designs are subject to the approval of the Project Design Review Committee and the Building Committee, and we emphasis on safety throughout the process. During the construction period, OSHC also helps us to manage and supervise safety audits. All the above measures aim to ensure the safety in all stages including operation and maintenance.

Wong : As a contractor, we should fully understand the calibre of our colleagues and ensure that the designers have sufficient awareness for safety. It demands a lot of time and effort to train our staff and to equip them with sufficient knowledge, awareness and experience to fulfill safety requirements in designing. Designers sometimes focus on their designs and overlook safety. This is a time consuming process and requires more knowledge and experience for such new design culture, which is not easy to achieve. Therefore, we have to cultivate the right concept in our designers.

Jason : Some foreign organizations transform good safe design practice into occupational safety template and put them into database for sharing by the staff and industry participants. We should do the same in Hong Kong.

Kuok : Contractors should upgrade to and familiarize themselves with newly imported machines and equipment. Sometimes, contractors and workers are not familiar with these machines or the models of such machines may change frequently. So, contractors should find out whether the workers are familiar with the new machines and equipment. This caring culture should be promoted from the top to the bottom.

Ng : In many cases, frontline workers need to be reminded to cooperate with contractors in each and every step of the work processes. If workers do not cooperate effectively, accidents may occur easily. Workers should have team spirit and contractors should supervise them more closely.

Lee : As a contractor, I believe that it is necessary to be proactive, and to understand and identify safety issues before construction to enable early communication with the designers so that we can work together in addressing the problem.

6. Discussion Forum (A)

Question (2) **There are lots of constraints during design such as site constraints and the needs of users, etc. and particularly, there are more challenges for hoisting work. Is there any solution suggested by the Housing Authority, Hong Kong Construction Association, Hong Kong Professional Hoisting Engineering Association and OSHC?**

Fung: In the past, most of our colleagues were familiar with the standard designs and standard buildings that were generally used, so it did not require a demanding deliberation in hoisting. However, designs are much different now. They are more flexible and site specific to cater to the conditions of a site. The contractors and subcontractors need to design the operation of each site after making a careful consideration of the different site characteristics and situations, which require prior and careful examination of the site and operation logistics. Difficulties encountered by frontline colleagues about engineering and machines must be reported and raised in order to seek solution for the problem. We should pay more attention to risk management. We should not stick to our past practices.

Cheng: While designing a project, designers should communicate with the contractors to optimize their design. Given various site constraints such as limited space for temporary storage of metal formwork, early communication with the contractors to optimize the design and safety is recommended.

Wong: The senior management should provide guidelines for the staff and it is worthwhile for a company to put more resources on safety.

Kuok: Workers should put off and stop using a machine immediately if it is found to be unsafe during operation, and call the engineers to check and evaluate whether the machine is safe or not. Serious consequence can be caused if workers continue to use the machine without adopting necessary precaution.

Ng: If the site is found to be unsafe, the engineers should check it up before resuming the work.

Jason: Safe design must be started from its origin, which should be considered according to the features of the projects including site characteristics, the sizes, shapes and the weight of materials and the weight of modules etc.

Question (3) **Recently, there have been several accidents concerning lifts. What precaution should be taken for working in lift shafts?**

Kuok: The construction, maintenance or repair work of lifts have to be carried out in the lift shaft and most of them are conducted by construction companies. The most important thing is to design a sound fall arresting system.

Question (4) **For fulfilling the obligation of a "construction designer", as subcontracting is a usual practice, how can a contractor enhance the communication with and support to a subcontractor?**

Lee: It is the responsibility of the main contractor to communicate with subcontractors. Construction safety should be considered by professionals. The original design should be reviewed to see whether there is any impropriety and improvement needed. Certain facilities that serve no specific purpose should be removed for construction safety.

Question (5) **In which way the Housing Authority can do better? Do you have any suggestion?**

Jason: The Housing Authority outperforms other industry participants in respect of safety and its design team always takes safety into consideration. In view of the development of globalisation, the Housing Authority should consider strengthening the existing mechanism. Deputy Director has just mentioned that the Housing Authority will provide a comprehensive training programme for its management and frontline staff. I suggest that the Housing Authority should establish an archive of safety design and provide reward to encourage the staff to actively engage in safety design. As the experience just shared by the contractors, the Housing Authority may consider seeking technical opinion from contractors in the Design & Build Project. The Housing Authority will get improvement heading to this direction.

6. Discussion Forum (A)

Conclusion

Question (6) How do you communicate the belief, messages and culture of your institution to your work team or staff for implementation?

Fung: I want to respond to the suggestion of Mr. Jason Wong first. We always look for improvement. We are now planning to provide a deeper, more comprehensive and detailed safety training for our colleagues as well as the professional service providers such as architectural firm and engineering firm, who should share the same belief with us and work in concert and consider the safety matters of the project design in all aspects during its life cycle. By the way, reward and punishment system is the most effective measure. One should admit mistakes, if any, and turn over a new leaf. A fault confessed is half redressed. Maybe the one who has made the mistakes is the pacesetter of reform. One should rectify every mistake one has made and we should reward those who perform well. Please always remember, "Safety first and safe design is everyone's responsibility."

[Supplemental Information about the Planning and Working Safety of the Operation of Tower Crane from the Hong Kong Professional Hoisting Engineering Association]

Construction is a risky activity and many accidents occur during hoisting, installation, dismantling and use of machines. A slight negligence and carelessness can result in accidents. Losses in time, money and property will come along with any accident. If unfortunately there is a casualty in the accidents, the seriousness of the loss cannot be evaluated.

Therefore, frontline workers should concentrate in each and every operation and carefully carry out the working procedure. If there is any doubt, they should report the same to the supervisors. Don't be a wiseacre. The management should provide a safe working environment and facilities, educate and direct the staff with the safety information as well as continuously remind them and update their knowledge.

Currently, the CIC has organized different safety courses. Besides the training courses, staff is required to cooperate in the site as most of the work is teamwork. Furthermore, building trust and communication is important as accidents may occur due to a slight carelessness, which is more or less the reason for some of the past accidents.

1. Currently, there are lots of safety guidelines for construction site with picture illustrations. The HKCIC and Labour Department also issued many safety guidelines which are clear and easy to understand. Frontline workers should adhere to these guidelines and operate carefully with due consideration for their own safety as well as others.
2. Before hoisting, contractors should check the surrounding environment to see whether it is suitable for the operation, discuss the related procedures with site personnel, know the size and weight of each object and select proper and appropriate hoisting equipment in order to ensure the safety of hoisting.
3. The stability of the object must be always confirmed to ensure safe lifting. There are different procedures for different materials or machines. The A12 "Construction Materials Rigger", a course currently organized by CIC, clearly outlines various lifting procedures for each material.
4. Any hoisting device such as crane and tower crane is only for vertical hoisting. Horizontal hoisting (left or right), dragging or pulling are not allowed. Such improper operation was attributable to accidents.
5. All hoisting equipment should be maintained in a sound condition. If damage is found, it should not be used even if the certificate has not yet expired.
6. It is important to communicate with the operator during the process of hoisting. Clear instruction should be given after confirming the stability of an object. Besides, the operator should concentrate and follow the instruction carefully to ensure the safety in each procedure.
7. Personal safety devices should be well prepared. In some case, those devices saved lives.
8. All in all, effective cooperation is needed in the whole construction, from the main contractor to subcontractor and all frontline workers. Correct procedure can avoid serious accidents and minimize the casualty so as to achieve a win-win situation.

7. Useful Tools Utilizing Information Technology – Use of Building Information Modelling (BIM) for Construction Planning

Presenter: Professor Heng LI (PolyU)

Content

- Introduction to BIM
- Integration of BIM and Safety during:
  - – Design stage
    - Construction Process
    - Project design
  - – Construction stage
    - Construction Process
    - Interaction between machineries and workers
    - Evaluation from the viewpoint of workers
  - – Safety Training
- Conclusion

BIM

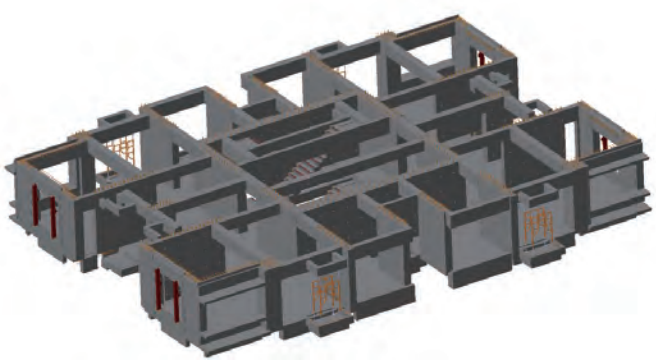
- BIM consists of different elements
  - – Architecture elements
    - Facade, Finishes, Partition wall, e.t.c.
  - – Structure elements
    - Structure wall, Beam, Column, e.t.c.
  - – Building Service elements
    - HVAC system, Drainage system, Sprinkler System, e.t.c.
  - – Geotechnical elements
    - Pile, Pile cap, e.t.c.

BIM integration with other usages

- With proper information, the BIM integrates with different tools and perform various kinds of analysis. Typical examples are:
  - – Sun-lighting analysis
  - – Shadowing analysis
  - – Ventilation and wind flow analysis
  - – Acoustic analysis
  - – Structural analysis

Integration of BIM and Safety during:

Design stage



Which one is better for designer to consider safety?

7. Useful Tools Utilizing Information Technology – Use of Building Information Modelling (BIM) for Construction Planning

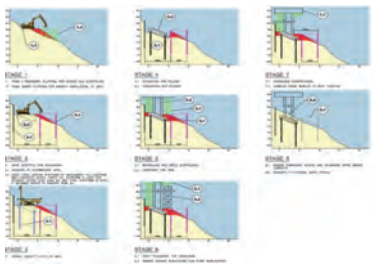
	Activities		Working days	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6
	Tower 1 (In Floor)																																						
1	Rebar fixing (Core)	WK	5	Lift	Stair			Others																															
2	Fixing column + wall rebars / E&M conceal items / Inspection	WK	12		C			D				A																									B	
3	Wall formwork removal (Core)	CYS (1)	3	Lift	Stair	Other																																
4	Wall formwork removal (Others)	CYS (2)	9	Others																																Assessors		
5	Lifting of Lift Shaft working platform	CYS (1)	1																																			
6	Installation of Precast Elements	CYS (3)	8		D	A	B	C	Core									Bal																					
7	Erection formwork (Core)	CYS (1)	5					Lift		Stair	Others																												
8	Erection formwork (Column, wall)	CYS (4)	12	B				C				D				A																							
9	Erection falsework and slab formwork + E&M openings	CYS (4)	14									Core	B					C				D			A													
10	Fixing slab rebars / conduits / Inspection	WK	10																						Core			B		C		D			A			
11	External scaffolding erection	WL	7																																			
12	Final formwork footing	CYS (4)	3																																			
13	Concreting column, wall, slab & beam (Flat B-C-D-A)	GCL	8#																																B + C + A + D			
	Usage of Tower Crane TC2:	For			Fac	Fac		Fac	Fac																			WL	WL			EM				GCL			
		For														Concrete	Fac												EM	Fac	Fac								
	Tower 2																																					
1	Rebar fixing (Core)	WK	4																									Lift	Stair			Others						
2	Fixing column + wall rebars / E&M Conceal items / Inspection	WK	12																			A							D			C				B		
3	Wall formwork removal (Core)	CYS (1)	3																									Lift	Stair	Others								
4	Wall formwork removal (Others)	CYS (2)	9																			Assessors						Others										
5	Lifting of Lift Shaft working platform	CYS (1)	1																																			
6	Installation of Precast Elements	CYS (3)	6	Bal																									B	A	D	C	Core						
7	Erection formwork (Core)	CYS (1)	5																													Lift		Stair	Others				
8	Erection formwork (Column, wall)	CYS (4)	12																										A			D			C		B		
9	Erection falsework and slab formwork + E&M openings	CYS (4)	14																															Core		A			D			C		B	
10	Fixing slab rebars / conduits / Inspection	WK	10	A			D		C			B																												Core	
11	External scaffolding erection	WL	7																																						
12	Final formwork footing	CYS (4)	3																																						
13	Concreting column, wall, slab & beam (Flat B-C-D-A)	GCL	11*													D		A		Core			B		C															
	Usage of Tower Crane TC3:	For			WL				EM							GCL												Fac	Fac		Fac	Fac							WL	
		For				EM	Fac	Fac																																	
	Facade (Fac) Delivery				Tower 2 Bay window + Façade + Staircase + balcony (14 Nos)																								Tower 1 Bay window + Façade + Staircase + balcony (14 Nos)													

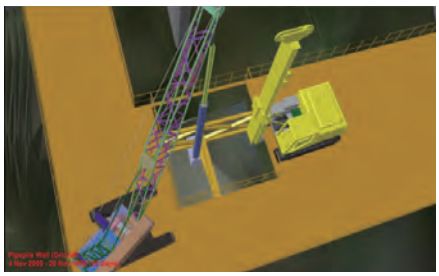
How to design a safe construction plan with bar chart?

- The use of BIM can enhance anticipating the following:
  - Relationship between working time and space
  - Construction sequence planning
  - Anticipate the interaction between workers and machineries
  - Design for safety

Example – Project Design

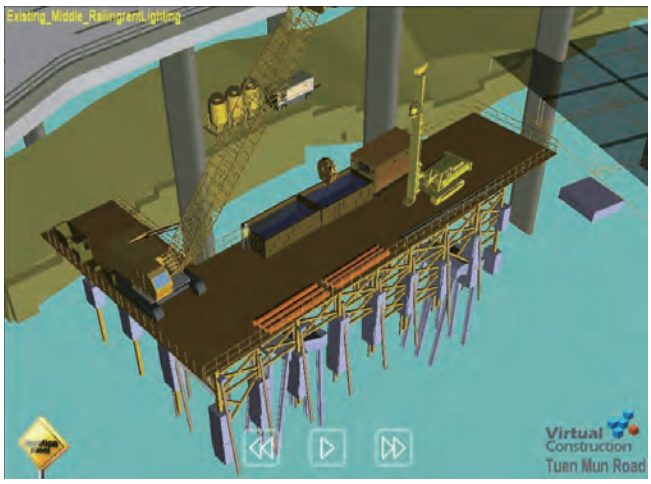
Construction sequence, resource and temporary work design





7. Useful Tools Utilizing Information Technology – Use of Building Information Modelling (BIM) for Construction Planning

Construction sequence, resource and temporary work design
Interaction between workers and machineries

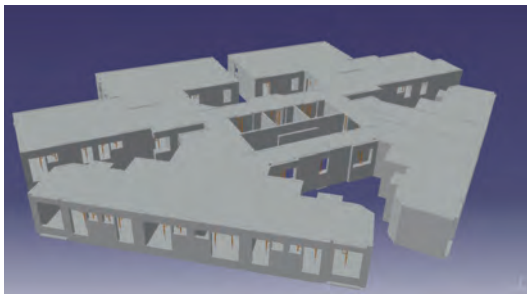


Construction Stage

- The use of BIM can enhance anticipating the following:
  - Relationship between working time and space
  - Validation of existing construction planning
  - Anticipate the interaction between workers and machineries
  - Evaluation of safety from workers viewpoint
  - Concern from the public

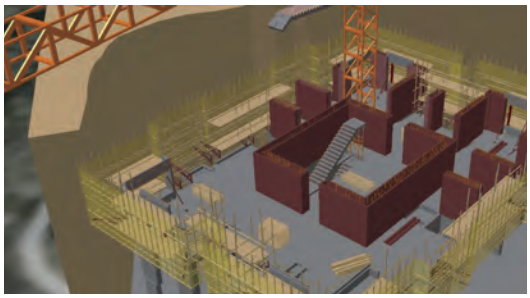
Example – Visualization of Floor Cycle

Relationship between Time and Working Space



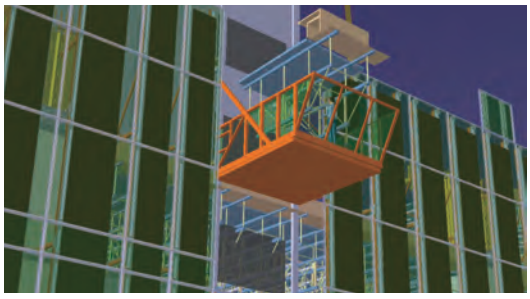
Example – Validation of Floor Cycle

Relationship between Time and Working Space



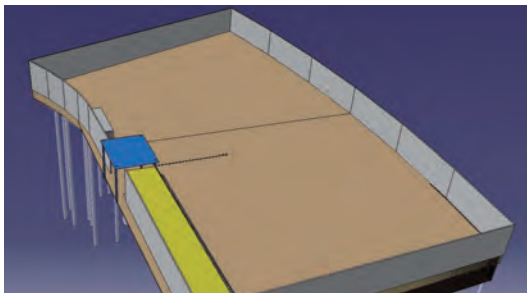
Example – Visualization of Non-typical process

Anticipated interaction between workers and machineries



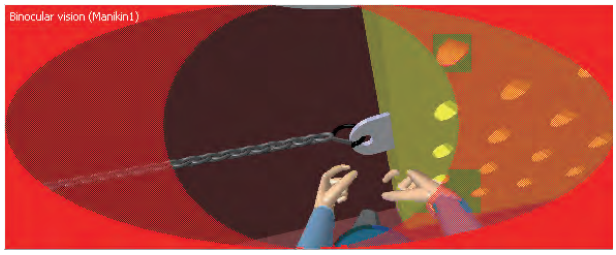
Example – Validation of Design

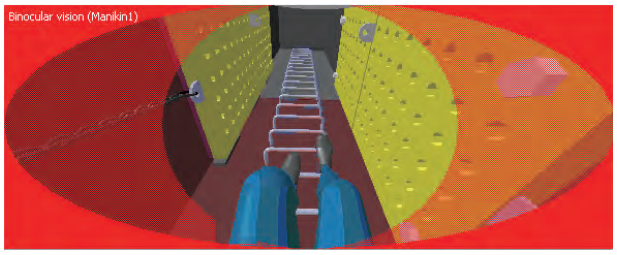
Relationship between Slope, Access road and Working Space



7. Useful Tools Utilizing Information Technology – Use of Building Information Modelling (BIM) for Construction Planning

.Evaluation from the viewpoint of the workers





Example – Validation of TTA

Relationship between Program and Public concern

Conclusion

- With proper use, BIM provides a platform for the safety management to:
  - Examine the project design
  - Examine construction program
  - Examine working space
  - Examine the relationship between design, program and space
  - Conduct safety training instead of real life mock-up
- With proper use, BIM could eventually:
  - Reduce construction time
  - Reduce construction cost
  - Reduce construction risk
  - Reduce construction accidents

8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

Presenter: Architectural Section

Collaboration between Development & Construction Division (DCD) and Estate Management Division (EMD) *on Design Review and Feedback*

- Meeting of Project Design Review Committee (PDRC)
- Meeting of Detailed Design Review Panel (DDRP)
- Meeting of Liaison Group on Construction Quality (LGCQ)
- Technical Feedback

Safety Considerations for Cleansing & Maintenance Workers

(a) Cat-ladders

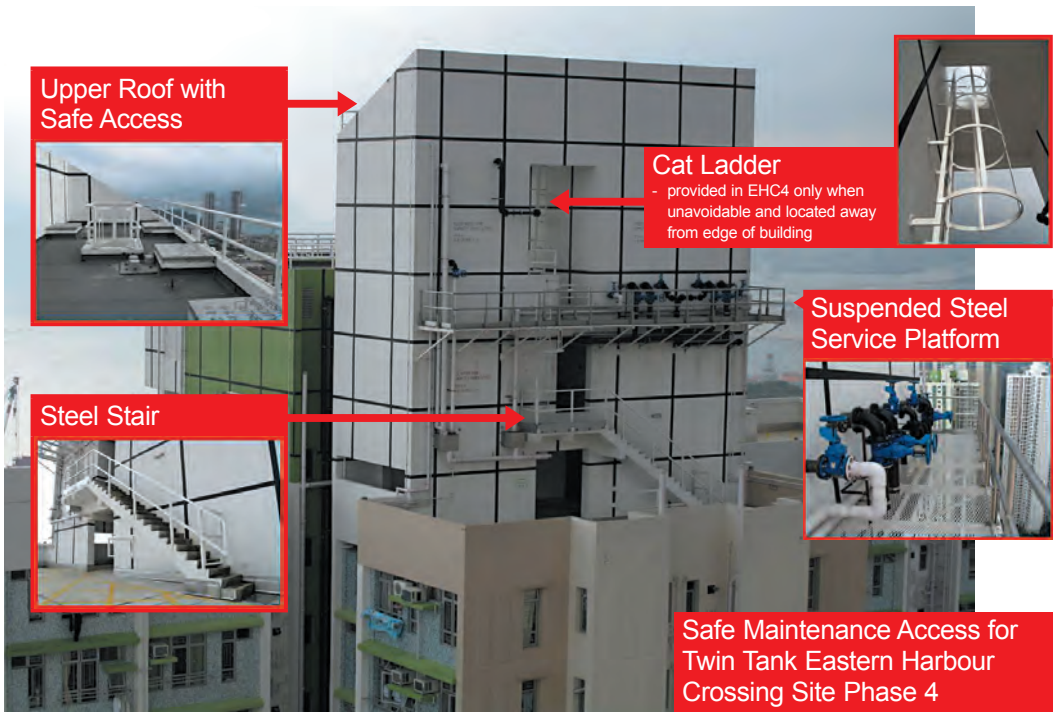
- Avoid placing cat-ladder near building edges to prevent accidental fall of equipment to below

- Access to cat ladder should be free from obstacles, such as water pipes, drain pipes

- Avoid high cat-ladder and replace by staircase as far as possible
- Intermediate resting platform should be provided for cat ladder with excessive height
- Working platform shall be provided for operation of the valves at high level
- First step of cat ladder should not be too high from finished floor level
- Cat ladder shall be provided with safety loops to protect workers from falling down

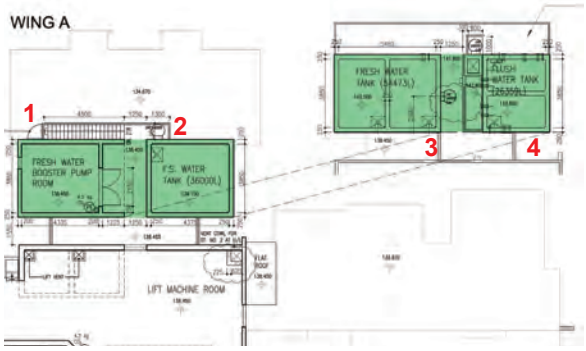
Model Client Brief for Public Housing Developments (2015 Edition)
Schedule of Provisions and Fittings

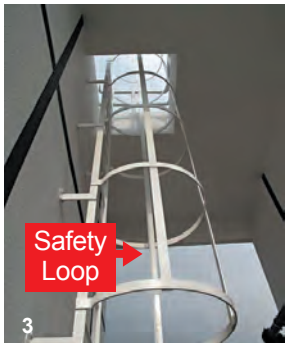
2.8.2 (a) (i) Provide safe access to main and upper roof level for operation and maintenance of the services such as permanent platform and staircase. For limited space, provide suspended steel platform and cat ladder with adequate security measures from trespass.



8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

Avoid Risk of Fall from Height



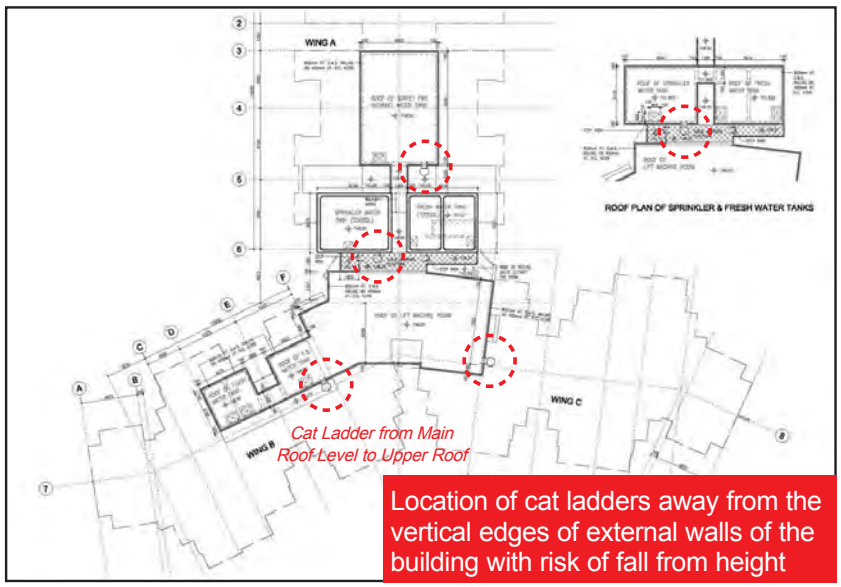


Cat ladder from maintenance platform to upper roof

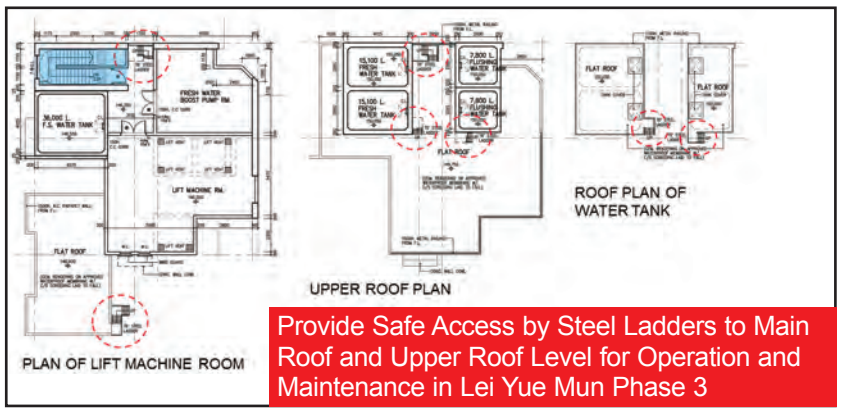
External stair from main roof to maintenance platform

Maintenance platform with safe and easy access to valves and pipes

Upper roof with safe access to top of water tanks

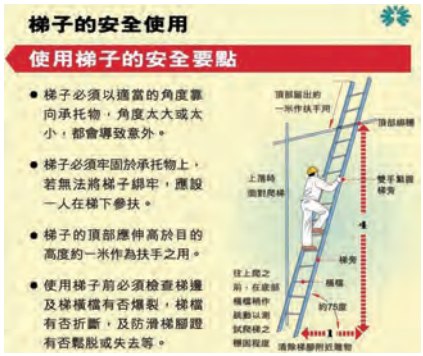


Enhancement – Steel Ladder Provision

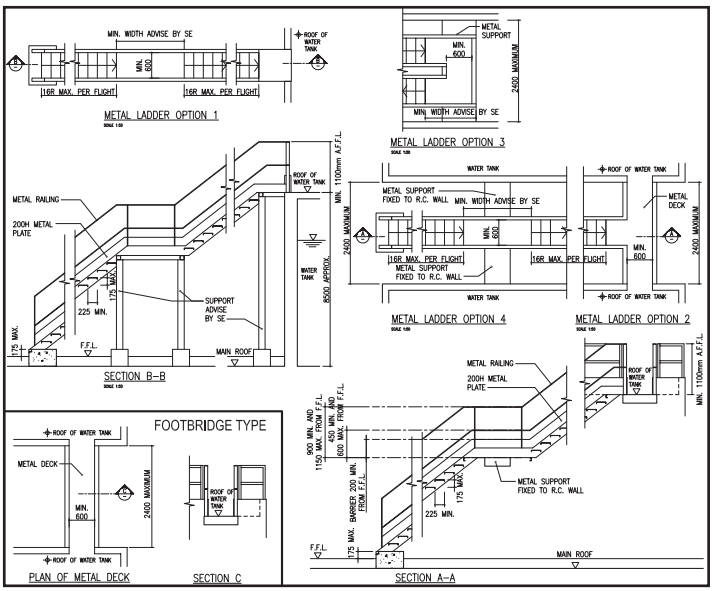


8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

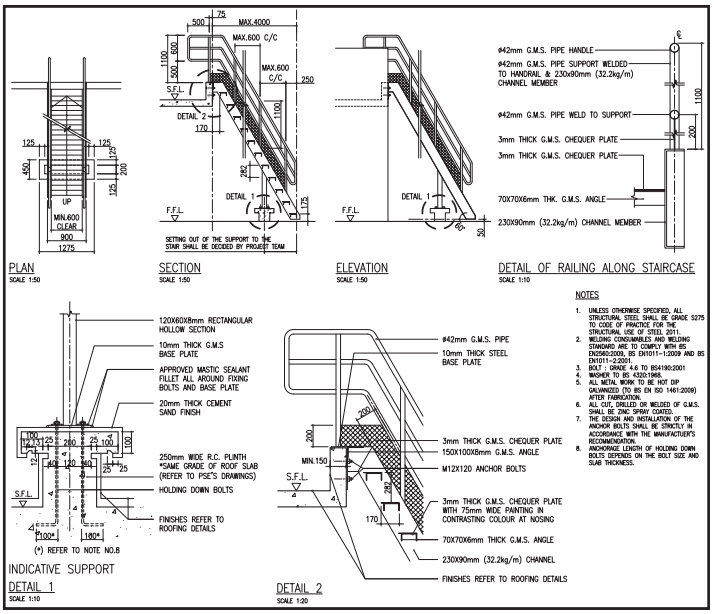
Avoid Risk of Fall from Height



- Provide **fixed** staircases for maintenance access to flat roof
- **Cat ladder is NOT recommended** for safety concern



Metal staircase for roof access (appox. 35˚)



Metal staircase for roof access (appox. 60˚)

8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

(b) Horizontal Lifeline Fall Arrest System

Model Client Brief for Public Housing Developments (2015 Edition) Schedule of Provisions and Fittings

4.2.4(c) Provide fall protection (guardrails) or fall arrest provisions – to floor edges (near floor opening – light well, skylight, canopy, upper roof top such as water tank, generator room & lift machine room, top of pedestrian walk-ways, etc).

Safe Maintenance Access to First Floor Canopy
Eastern Harbour Crossing Site Phase 4

Maintenance Access from G/F to 1/F

- External Cat Ladder
- Fall Arrest System

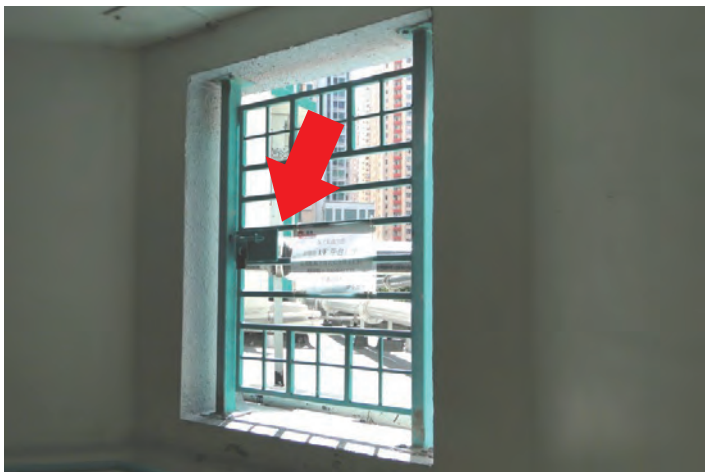
- A standard provision to enhance safety of workers working at height

8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

- Not to be placed close to edge for low canopies or covered walkways as the fall arrest distance will be inadequate

- Provide safe access immediate next to each zone of the Horizontal Lifeline

Operation of horizontal lifeline fall arrest system



Level access

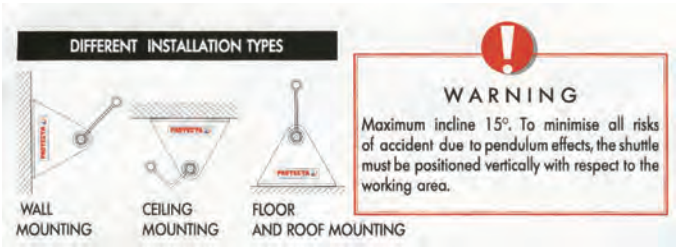
Railing preferable

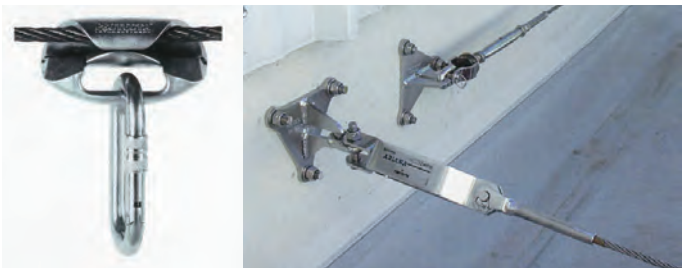
- Provide safe and direct access to Horizontal Lifeline on 1/F canopy from common area such as lift lobby, corridor and staircase, instead of by cat ladders inside pipe duct from G/F

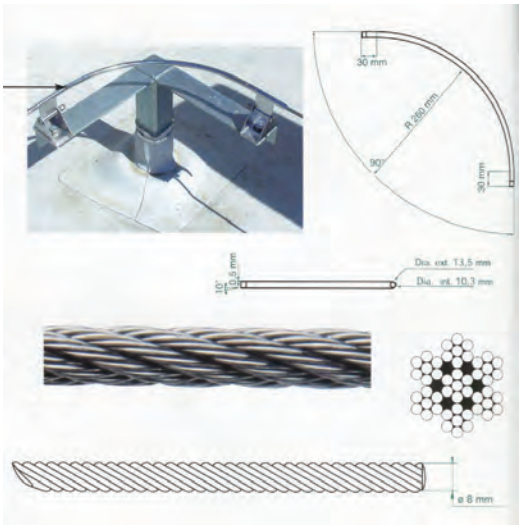
8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

Selection Criteria

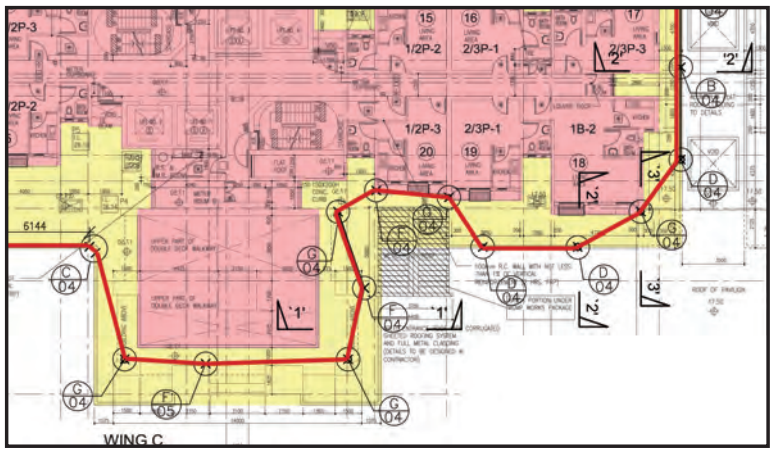
- Evidence of compliance with relevant EN standards
- Evidence of manufacturer operating ISO quality system
- Major components to comply with the required material grades
- Certificate of manufacturer's authorised competent person for installation / testing
- Samples of components

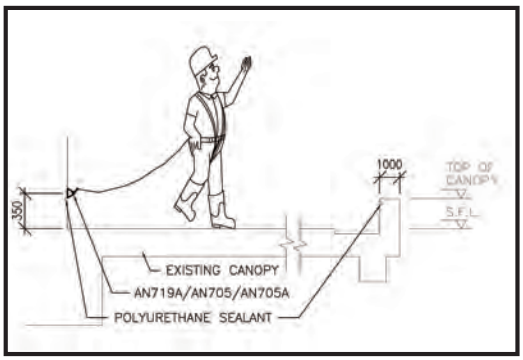


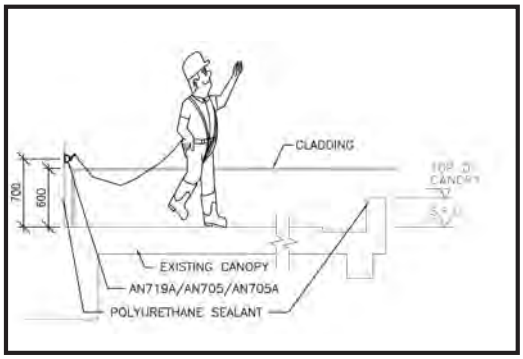


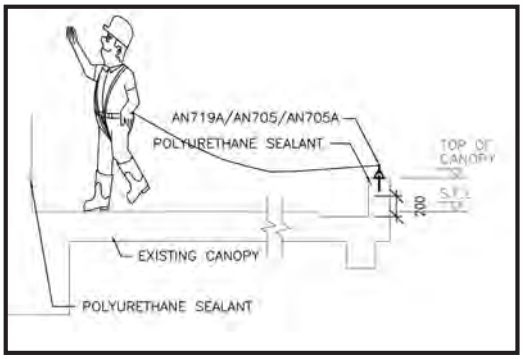


Fall Arrest System at 1/F Canopy





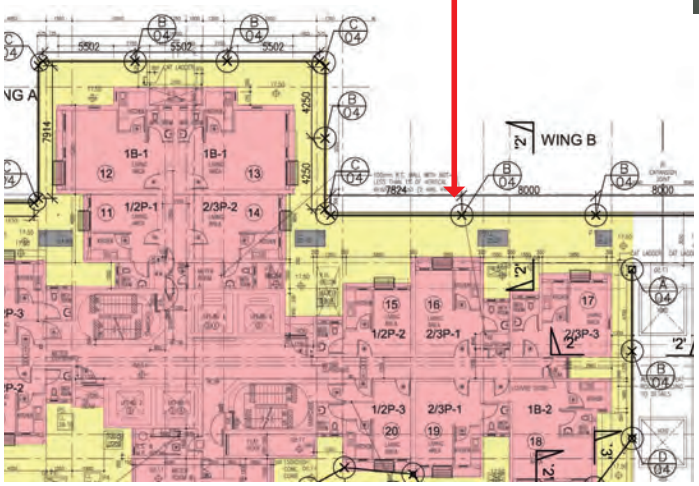




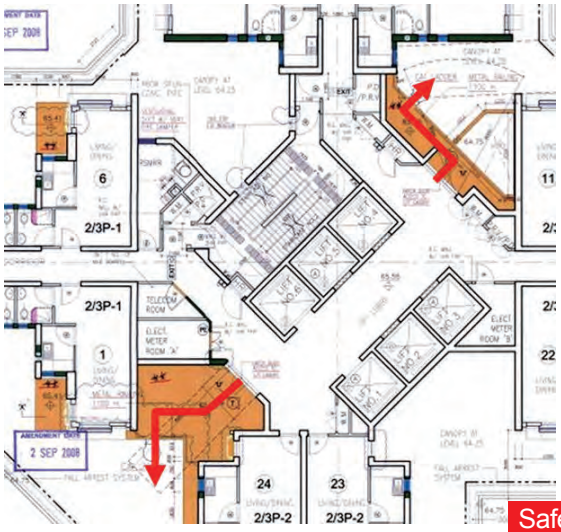
8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

Working Platform for Inspection Chamber at 1/F Canopy

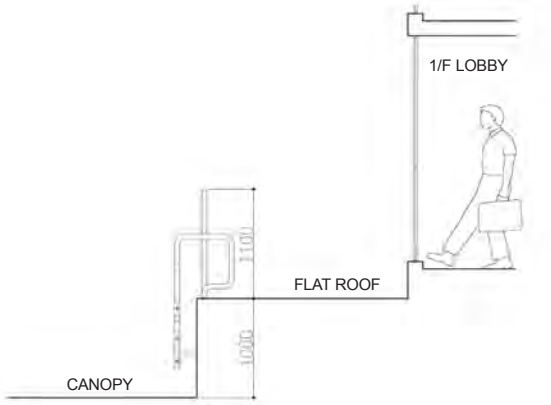
- Cat Ladder
- Railing
- Working Platform



Safe Access



From 1st Floor Lobby to Flat Roof and then to Canopy



Safe Access to Fall Arrest System at Canopy – From Flat Roof to Canopy

(c) Safe Maintenance Access for External Work at Green Roof, Covered Walkway and Footbridge

- Proper and safe access, maintenance path should be provided on green roof, covered walkway and footbridge for cleansing and maintenance

8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

(d) External Works Design and Provision

Green Roof

External Works Design Guide DCG-E-EW-126 – (3, 4, 5 & 6) on green roof

Small / Single - Storey Structures

(ii) Provision of proper, easy and safe access for maintenance.

Safe Access to Green Roof

- Metal Scaffolding to Roof
- Fall Arrest System
- Automatic Irrigation System
- Choice of plant material with low maintenance species, e.g. drought tolerant type






Safe Maintenance Access to Vertical Greening

1 Hoisting Beam
2 Steel Scaffolding with Working Platform
3 Concrete Plinth for Setting of the Scaffolding
4 Automatic Irrigation System

8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

Covered Walkway

External Works Design Guide DCG-E-EW-101-7.3 on Access for cleaning & maintenance

Provision for proper, safe and easy access for regular cleaning & maintenance shall be considered.

External Works Design Guide DCG-E-EW-101-2.1 on Weather protection / Protection from falling objects

The covered walkway design shall fulfill the following requirements:

- *Weather protection*
- *Protection from falling objects*
- *Roofing materials (polycarbonate/acrylic sheets and rooflights) susceptible to damage by falling objects shall be located minimum 7.5m away from the main face of buildings …*
- *The covered walkway shall connect to the main entrance of standard domestic blocks, providing a continuous link to and from all strategic points.…*

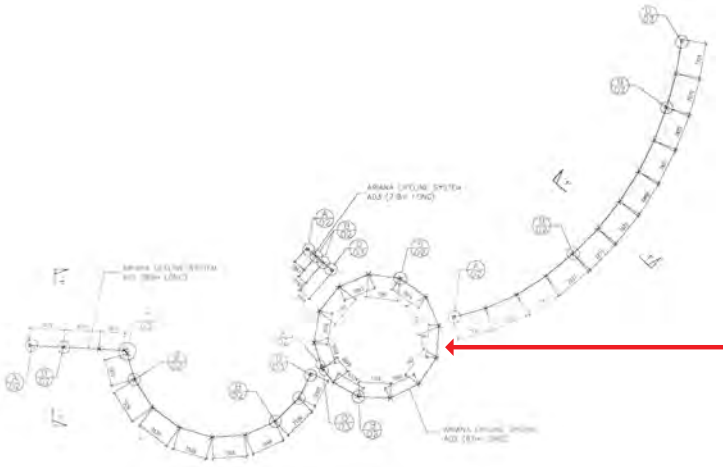
Safe Maintenance Access to Roof Top of Covered Walkway

- Railing and toe-board (fall arrest system for particular locations of covered walkway where provision of railing is proved to be impossible or impracticable after risk assessment)
- Maintenance Path

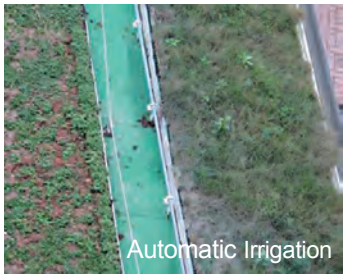
Additional Features for Green Roof

- Automatic Irrigation System
- Choice of plant material with low maintenance species, e.g. drought tolerant type

Provide railing to prevent accidental fall



Fall Arrest System



Automatic Irrigation

Maintenance Path

8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

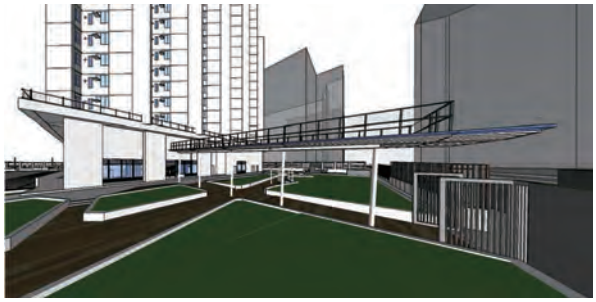
Footbridge Design Guide DCG-E-EW-117-2.8 on Access for cleaning & maintenance

Safe Maintenance Access to Top of Footbridge

- Railing and toe-board (fall arrest system for particular locations of footbridge where provision of railing and toe-board is proved to be impossible or impracticable after risk assessment.)
- Maintenance path

Footbridge with fall arrest system

Fall Arrest System at planter on both sides of the footbridge



Railing on roof of footbridge

(e) Safety Provision on Roof Top

- Railings shall be provided on top of the roof water tanks to prevent persons from falling when carrying out the maintenance work

8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

Provisions for fixing gondolas

- Provision of parapet walls of adequate structural capacity on all roofs and proper planning of fixing points for tie-back wires

Safety platform for paths with services / pipes

- Demountable platform should be provided across and over utilities / pipes in narrow paths at roofs / canopies to ensure safe passage of workers
- Workers may be tripped down or slip down from the water pipes when they step on it in particular when they are carrying heavy equipment and the water pipes are not designed for sustaining persons from stepping on

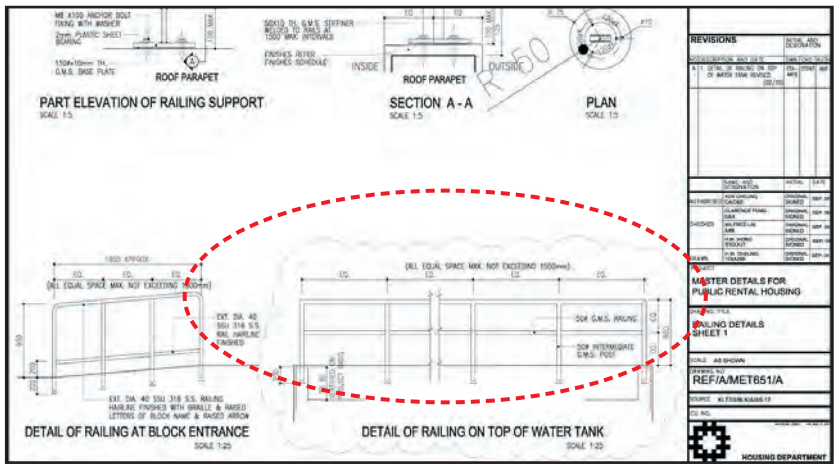
Roof Top Design and Provision

Model Client Brief for Public Housing Developments (2015 Edition)
Schedule of Provisions and Fittings

2.8.2 (a) (ii) The location and routing of the services shall have railing (with non-paint finishes), safety barrier or fall arrest system at appropriate location to avoid risk of fall from height including roof top to water tanks and lift machine rooms.

2.8.2 (b) (ii) Allow adequate space for the services to run over the roof area avoiding the need for deck over the refuge areas.

Railings to Water Tank



Railing to Roof Top Water Tank
Design provision

8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

Provisions for Future Installation of Gondolas

Model Client Brief for Public Housing Developments (2015 Edition)
Schedule of Provisions and Fittings

2.8.2 (c) (i) Allow proper access to the parapet(s) for future installation of gondola.

2.8.2 (c) (ii) Provide essential provisions for future installation of gondola for maintenance such as adequate structural strength for fixing the clamp, facilities for tie back and safety rope, electricity supply for powering the gondola.

2.8.3 Provide one waterproofing 32A 3-phases socket outlet per wing at main roof level for future installation of gondola.

Provision of safe facility for Gondola on Parapet

Provide parapets of adequate strength

(f) Safety for Building Services Provisions

- Rooms designed for electrical service and water service shall be separated apart as far as practical either in horizontal or vertical direction such that any flooding at the water pipe duct or water meter room due to burst of water pipes shall not result in electricity power disruption to the building

Electricity Meter Room is separated away from Water Meter Room

- Pipe ducts shall not be provided by the side of the cable ducts, so that any flooding in the pipe duct due to burst of water pipe on any level shall not cause power disruption to floors below or the whole building as water may flow downward along the cable riser and ingress to the submain switches or the main switchboard
- Water tank on top of the lift machine room / switch room shall be avoided

8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

Lift Machine Room and Water Tank are placed side by side

- All underground cable duct leading to building blocks shall be sealed up to prevent leakage of town gas or LPG gas outside from ingressing to the building which may subsequently result in explosion incidents similar to a serious explosion incident in a private building years ago

Before *After* *Before* *After*

Model Client Brief for Public Housing Developments (2015 Edition)
Schedule of Provisions and Fittings

2.2.2 (a) Architectural Provisions and Fittings

vi. Avoid locating the electrical services rooms adjacent to any pipeduct of wet services such as FS pipes and water pipes.

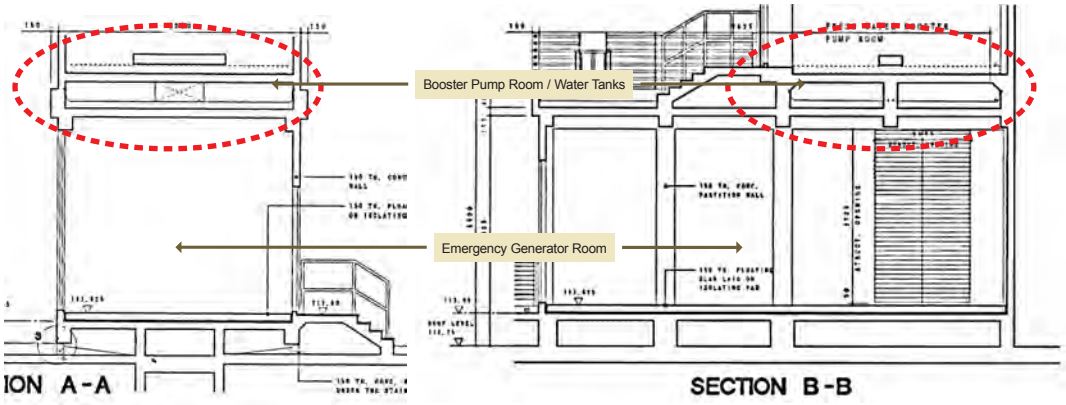
vii. In case of design constraint in relocating the electrical services rooms away from the pipeducts of wet services, apply waterproofing to the partition wall(s) between electrical services room and pipeduct of wet services.

DCG-D 303 – 1.3.1(e)

Avoid as far as possible, "wet" environment such as water tanks and booster pump room above lift machine room, PV equipment room and emergency generator room. If this cannot be avoided, double ceiling slab or water proofing with proper drainage should be provided above.

8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

Double Slabs Design



Double Slabs Design

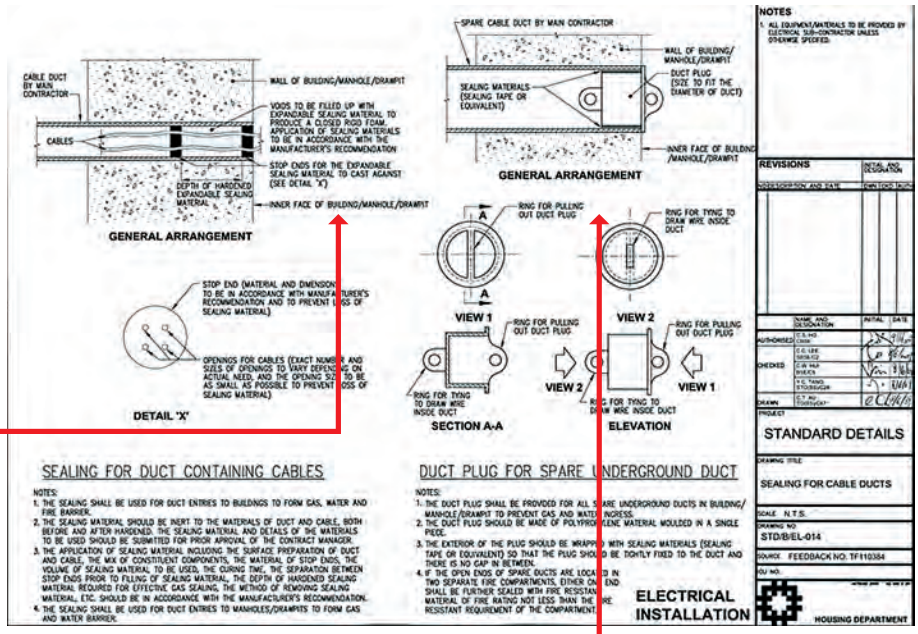
Master Details for Building Services (underground) – Gas Barrier

Prevent leakage of town gas outside from ingressing to the building to avoid explosion incident (e.g. Wai King Building in Ngau Tau Kok on April 2006)

Preventive Measures

- Void space of cable duct shall be sealed by expandable materials to form gas barrier.
- The measure applies at where the duct passes through external wall of building / manhole / drawpit.
- Sealant used shall be inert materials.

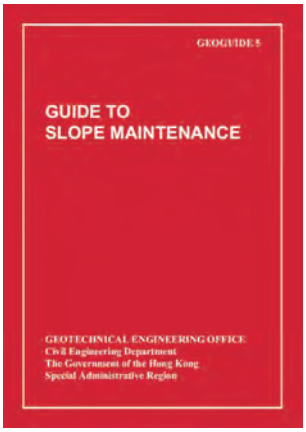
- Spare duct to building / manhole / drawpit shall be sealed up by polypropylene duct plug wrapped with sealing material.



8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

(g) Slope

- Safe access and railings for cleansing and maintenance should be provided



(h) Handover Stage

- During handover, item of Safety concerns will be raised and highlighted to ensure safe maintenance and management.

Safety Considerations for End Users

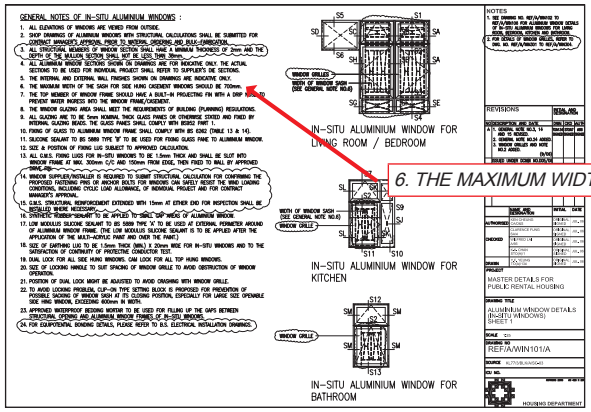
(a) Inside flats – Bathing Facilities

- Sunken shower and contrary colour at edge.

8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

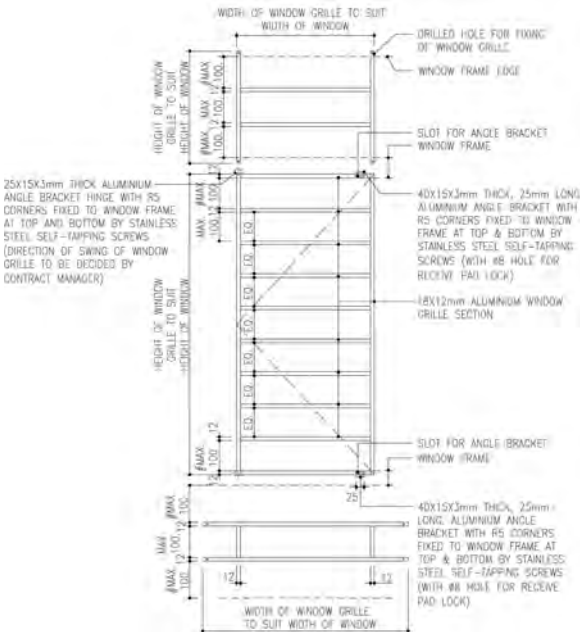
(a) Inside flats – Windows

- Burglar grilles with open jaw at the bottom is hazardous and should be avoided



Provision of New Window Grille Design without "Jaw" for Modular Flat Design

Window Grille Design



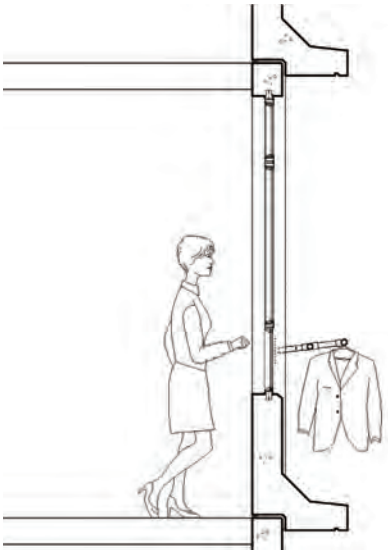
8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

(a) Inside flats – Laundry Rack

- From the traditional provision of laundry pole holders to the provision of laundry racks at suitable height and locations to meet tenants' expectations



Laundry Rack Design



(a) Inside Flat Design and Provision

Large Size Window

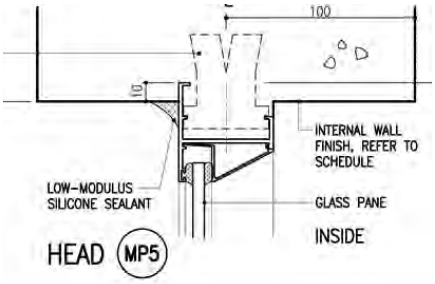
TECHNICAL GUIDE TO PUBLIC HOUSING DEVELOPMENTS DCG-D-1302 (MF-101) for MODULAR FLAT DESIGN REFERENCE (2015 Version)

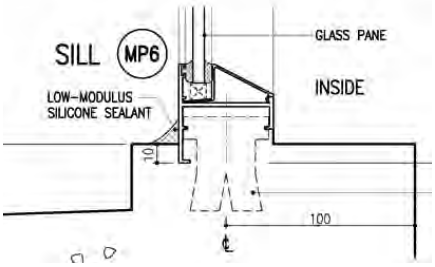
Para. 10 General (c) Minimize the number and types of window design among the flat types. ***Avoid corner window and large glazing panel in domestic flats.***

(a) Inside Flat – A/C installation

- Provide A/C hood in living areas and bedrooms;
- Enlarge A/C window and A/C hood to allow choice of units (window type or split type);
- Locate condensation pipe close to openable window.

8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

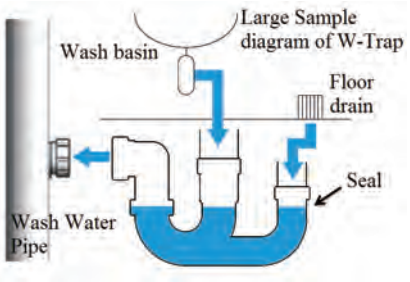




Glazing from inside

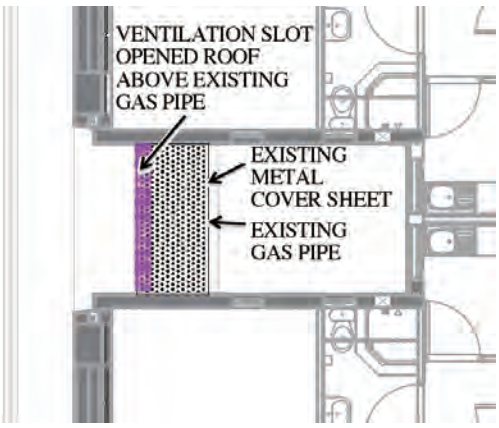
- Glazing bead and glass panel easily dismantled from inside.

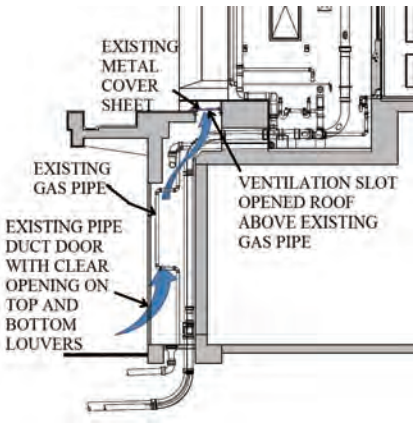
(a) Inside flats – W-trap



W-trap: Waste water from wash basin / shower directed to replenish the W-trap common with the floor drain. Avoids drying up of seal and **prevents the spread of foul air and disease** between floors, and ensures healthy living.

(a) Inside flat – Ventilation provided for concealed gas pipes





Gas Safety Ordinance Cap 51C GAS SAFETY (INSTALLATION AND USE) REGULATIONS Reg.17(5), mentions that "No person shall install an installation pipe in an unventilated shaft, duct or void."

8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

(b) Common areas in buildings – Homogeneous wall tile finishes at corridors

- Remove previous problem of tile adhesion failure by replacing with painting finishes

(b) Common areas in buildings – G/F entrance gateset design

- From previous use of heavy gate with standard floor spring to current use of lighter design with safety chain and off-set floor spring

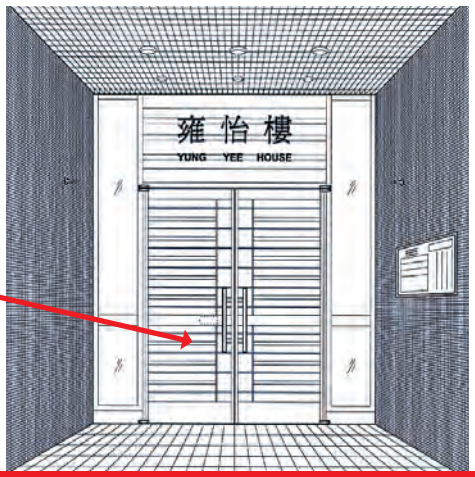
Heavy Gate

Lighter Gate

Safety Chain

Current Doorway Design

Issued by CDMBI No. D07/03



Signage

Stainless steel etched plate behind the door

Current Safety Measures to Fallen Gateset

Current Safety Measures to Fallen Gateset

- Offset pivot hinge floor spring used.
- Inspection panels added.
- Stainless steel screws / bolts, locknuts, thread locking adhesive, spring washer and safety pin specified.
- Reduced in height.
- Door lock status indicating light and signage added.

8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

Off-set (Single Action) Floor System

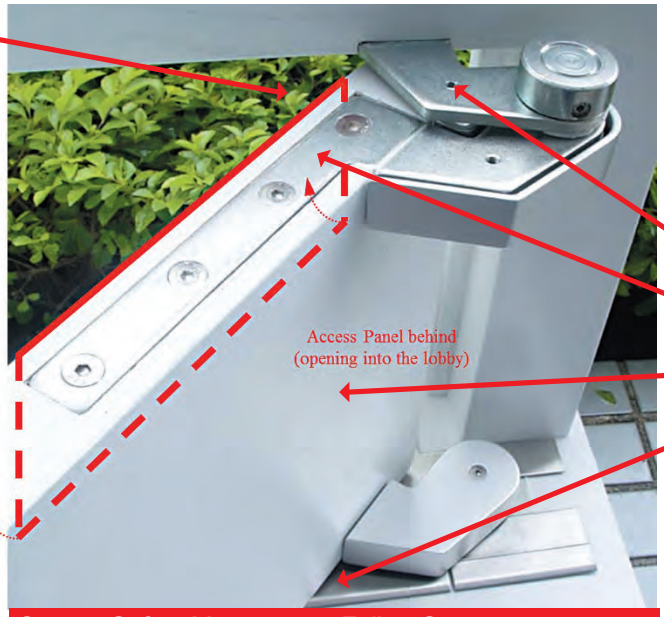
Issued by CDMBI No. D07/03

Access Panel

Provide access panel for fixing the accessories, inspection and maintenance

Allen's screw, Nut & Spring Washer

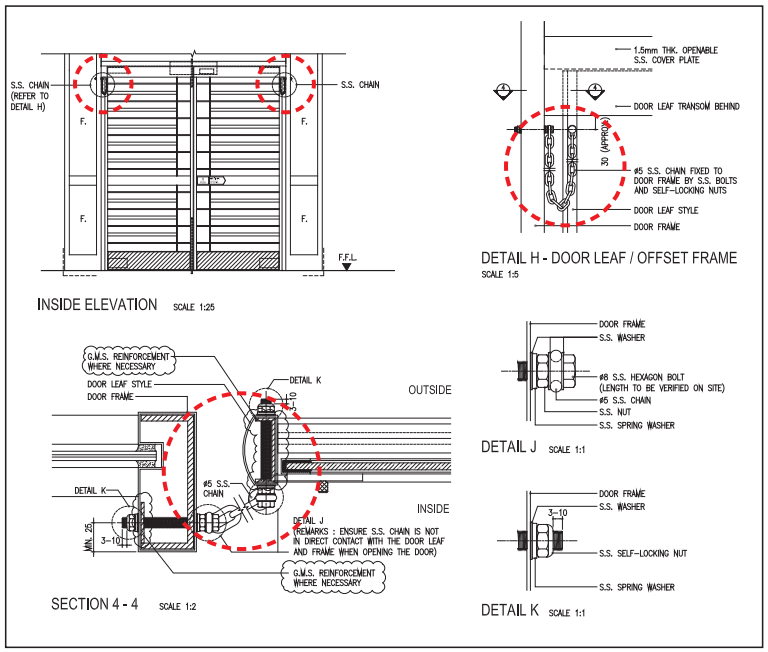
Fix all straps with stainless steel Allen's screw, nut and spring washer

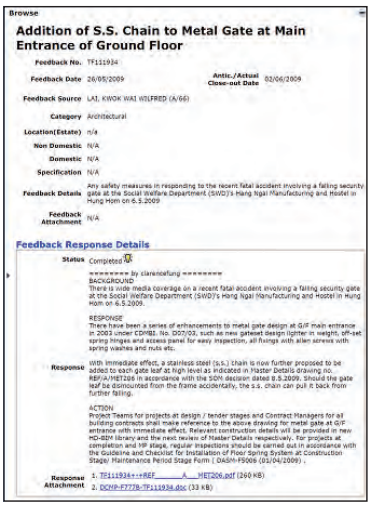


Current Safety Measures to Fallen Gateset

Corner Cap

Provide additional protection to pivot pin

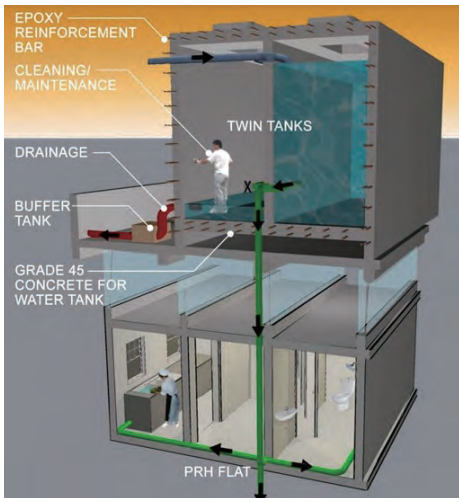




Additional Safety Measures to Fallen Gateset – stainless steel chain fastening the leaves to the frame

8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

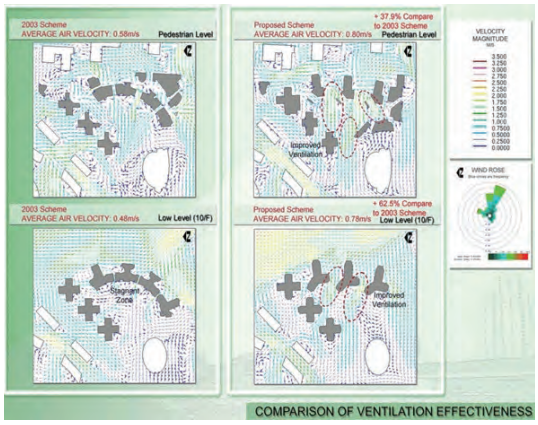
(b) Common area in building – Twin roof tank



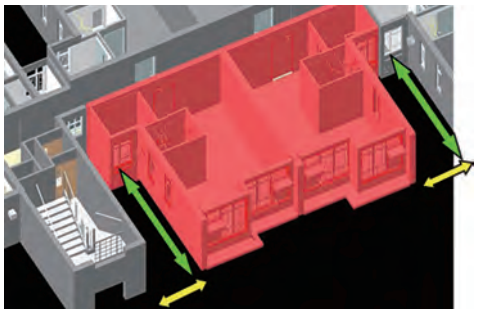
Twin roof tanks: Provide uninterrupted **clean water** even during cleansing of water tanks

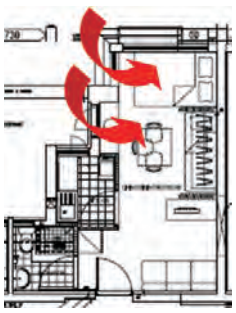
Well designed testing and commissioning procedures for water supply system to prevent Legionnaire's disease.

(b) Common area in building – Micro-climate studies



Micro-climate studies: Best use of **natural lighting and ventilation, effective dispersion of pollutants** from refuse rooms on domestic floors and refuse collection point of the estate.





Large and additional windows: Better **natural lighting and ventilation.**

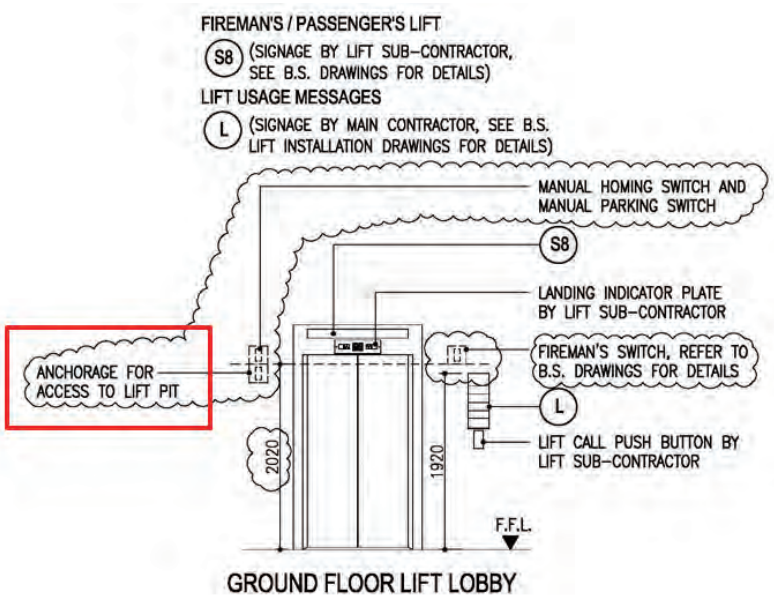
Re-entrants: Maintain a ratio of not less than 1:3 to **avoid stagnant effect and improve ventilation** at kitchens and bathrooms.

8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

(b) Common areas in buildings – Anchorage for access to lift pit

(Reference : Guidelines on Safety of Lift Shaft Works Vol.2 issued by CIC)

- To provided **permanent anchorage** adjacent to lift landing door at the **lowest landing floor of every lift**, for use by worker to anchor fall arrestor and safety harness when required to access lift pit.
- To provide **Inspection Certificate** for the permanent anchorage upon completion.



(c) Pedestrian and vehicular circulation

- Segregation of pedestrian and vehicular circulation
- Avoid placing pedestrian crossing near turning point of vehicular traffic
- Refuge island is recommended
- Suitable road humps provided at strategic points
- Cycle track separated from estate road / EVA as far as possible to ensure safety
- Bicycle parking space on periphery as far as practical
- Use footbridges where appropriate

8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

Vehicular Traffic

External Works Design Guide DCG-E-EW-112-8.1 & 8.3 on Access, Vehicular Movement and Design of Roads and EVAs within Housing Department Estate

8.1

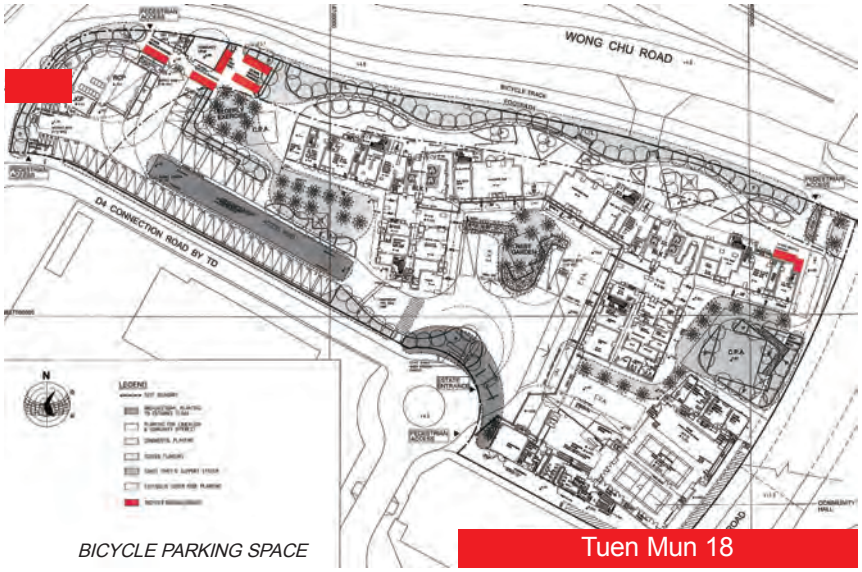
The provision of road humps, …, is fully described in the Code TPDM Vol.2 Chapter 5, ….including…Use and location of road humps etc.

8.3

…exact location of these humps, Contract Managers are to liaise and agree with…EMD prior to commencement of the road work. Standard 3.7m deep concrete road humps should be planned in the direction of traffic flow.

Common Facilities Design Guide DCG-E-CF-103-3.3(c) on Guidelines on Refuse Collection

…access route for the RCV is to be clearly defined by suitable choice of materials…which clearly differentiate the vehicular access from the pedestrian areas of the development.



Bicycle Parking in Housing Estates

External Works Design Guide

DCG-E-EW-119-3.1 & 3.2 on Bicycle Parking

3.1

Bicycle parking shall be provided relatively conspicuous in areas within the development to discourage vandalism or theft.

3.2

Better to integrate bicycle parking into the development's design such as reserving areas at the gable end wall of buildings or along the perimeter of estates.

Cycle Track

Clear delineation from vehicular / pedestrian traffic.

(d) External Areas – Playground facilities

- Location should be far from estate road or EVA to ensure safety of children
- Avoid types with potential danger like rotating equipment
- Posting conspicuous warning sign / notice

8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

(d) External Areas – Non-slip floor finishes & Tactile guide path

- Use of finishing materials of adequate anti-slip character in particular for areas with ramping surfaces
- Attention should be given to the proper location of facilities for visually impaired persons like tactile guide path

(d) External Areas – Weather protection / Protection from falling objects

- Covered walkways and / or canopies should be provided continuously without disconnection within the whole estate to protect pedestrians from bad weather / falling objects. Significant improvement is noted in recent developments compared with those built at older times

Provide pergolas for protection from the weather as well as from falling objects.

Covered walkways for protection from the weather as well as from falling objects.

8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

(d) External Areas – Uneven ground or inconspicuous steps

- Provide nosing tiles with contrast colour for steps
- Avoid uneven ground or inconspicuous steps
- Grasscrete is not recommended at location with heavy pedestrian flow

(d) External Areas – Playground facilities

External Works Design Guide DCG-E-EW-106 on General Principles

2.2 For supervision, children's play areas shall be separated from traffic and have some form of containing boundary to define the areas.

2.4 Uncovered community's play areas and other outdoor activities like chess tables or pebble footpaths, etc. shall be located minimum 6m and 5m away from domestic blocks and from gable end wall (without window openings above) respectively.

External Works Design Guide DCG-E-EW-106 on Selection & Layout / planning of Play / Fitness Equipment

3.6 Apart from available space and budget, the economic justification of selecting a particular play equipment should be determined on factors such as play function, age group of users, play value rating, design hazard / injury risks, etc. and that the fitness equipment for the elderly is simple, user friendly and installed with graphical instructions.

4.2 Play Equipment agents… must provide an endorsement on their plan by Approved Playground Safety Inspector, that the required safety margins for each item of equipment and relevant safety standard (ASTM / BSEN) have been met.

External Works Design Guide DCG-E-EW-106 on Warning Sign

6.1 Suitable warning signs shall be provided to all play areas. There should be at least one sign for each location of play area. The signs shall be located at prominent locations e.g. at the entrance to the playground or adjacent to play equipment. The wordings of the signs shall state the suitable age range of persons using the equipment and the age range of children using the equipment where adult supervision is necessary.

(d) External Work Design and Provision Provisions For The Visually Impaired

External Works Design Guide DCG-E-EW-127

2.1

Visually impaired have their special needs and appropriate facilities shall be provided to assist them to travel safely and independently.

2.2

…Provisions such as audio signals, Braille and tactile information, tactile guide paths and tactile warning strips would help them.

8. Safety Considerations for Cleansing & Maintenance Workers and End Users: Safety Design Provisions under Model Client Brief and Technical Guides

2.5.4

Level changes along the tactile guide path shall be avoided as far as possible….ramps, stairs and dropped kerbs fulfilling the design requirements in paragraph 3.2 to 3.4 can be provided.

3.3.1

Stairs shall comply fully the obligatory design requirements of the "Design Manual: Barrier Free Access" including the following to assist the visually impaired residents … iv. Non-slip nosing in contrasting colour.

Multi-sensory map for the sighted as well as the visually impaired. Audio signals, braille and other tactile information to assist the visually impaired to travel safely and independently.

Tactile Guide Path and non-slip paving

Non-slip nosing in contrasting colour

(d) External Work Design and Provision Special features / Paving to Pedestrian Area

External Works Design Guide DCG-E-EW-105-7.3 on Water Features

….BARRIER TO THE POOL MUST BE PROVIDED

….Warning danger signs to be provided.

Similar safety design guides could be developed to avoid possibility of encouraging climbing by children for special features eg irregular rock features.

External Works Design Guide DCG-E-EW-113-2.1 & 2.3 on Paving to Pedestrian Area

2.1

The paving materials shall be… Non-absorbent, durable, non-slippery and easy to clean. Avoid porous floor tiling.

2.3

Paving blocks laid on sand shall not be used for sloping ground at gradient steeper than 1:10.

9. Safety through Early System Planning and Structural Design Approach for Demolition, Foundation and Building Contracts

Presenter: Structural Engineering Section

Preface

- This section is to highlight some of those areas that have potential safety risks in structural construction, including demolition, foundation and building works.
- Emphasis will be placed on early planning, design and specification provisions.

Demolition

Demolition Plan

- Demolition plan is prepared early by the Structural Engineer incorporating all critical safety provisions.
- These plans are to be incorporated into tender documents.
- When the contract is awarded, the Contractor is required to submit their proposed demolition plan which should be in line with the SE's demolition plan.

Demolition Planning Features

Double deck hoarding / covered walkway to protect pedestrians; locations and extent of hoarding should be clearly defined

Scaffold, nylon mesh and periphery catch platforms / fans to prevent demolished debris from falling out of the block

The route for movement of mechanical breaker must be defined in Demolition Plan. Adequate propping should be provided underneath

Stacking of demolished debris not to exceed allowable height. Debris is to be cleared from time to time

Barrier erected at the opening of refuse chute. Scaffold and nylon mesh at the building perimeter must be higher than the floor level by 1 meter

Clamping instead of tack welding to bracing should be specified in Demolition Plan; tack welding is difficult to assess for adequacy

9. Safety through Early System Planning and Structural Design Approach for Demolition, Foundation and Building Contracts

Asbestos Handling

- Asbestos removal should be well planned.
- These include:
  – Early identification of possible asbestos containing materials by asbestos consultant before tender.
  – Requirements for asbestos removal specialist contractor stipulated in Specification.

Identification of Asbestos Containing Materials

Early identification of asbestos containing materials by asbestos consultant

Asbestos Removal Works

Asbestos removal works for fuse box

Asbestos removal works for grille panel

Chalk board covered by polythene sheet

Vacuum cleaner with HEPA filter

9. Safety through Early System Planning and Structural Design Approach for Demolition, Foundation and Building Contracts

Sealed drum



Respiratory protective equipment and protective clothing used for asbestos abatement work


Spray of water



Asbestos particles removing

Compartment for Asbestos Removal Works


Passage for Asbestos Removal Works



Transferring sealed drum to the ground

9. Safety through Early System Planning and Structural Design Approach for Demolition, Foundation and Building Contracts




Designated asbestos sorting area



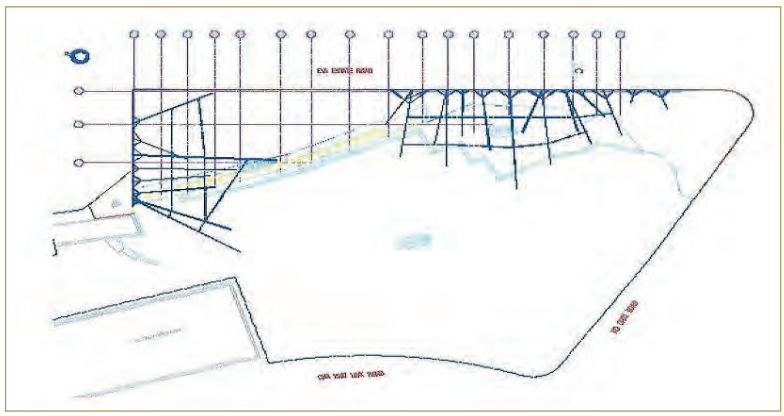
Transportation of sealed container to designated chemical dumping site

Foundation

Excavation and Lateral Support (ELS) Works

- For large scale excavation and lateral support (ELS) works, it is important that Structural Engineer should design a pretender scheme.
- The scheme would be used as a base for comparing with Contractor's proposed scheme at tender return.
- This allows the SE to better assess the structural adequacy of Contractor's proposed scheme, as well as the correct order of the ELS cost.

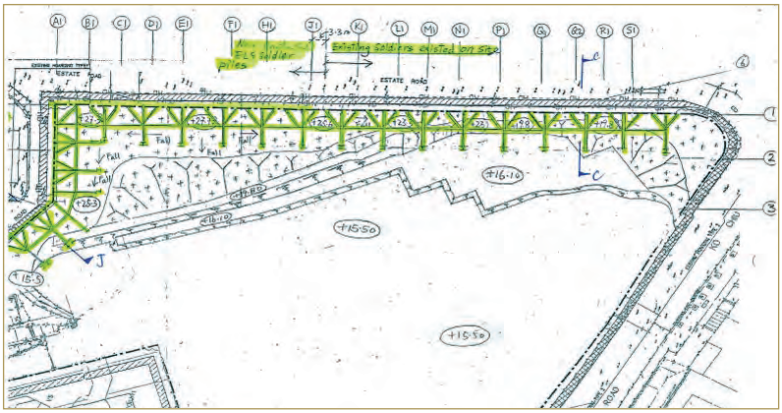
Engineer's ELS Scheme at Pretender Stage



Plan

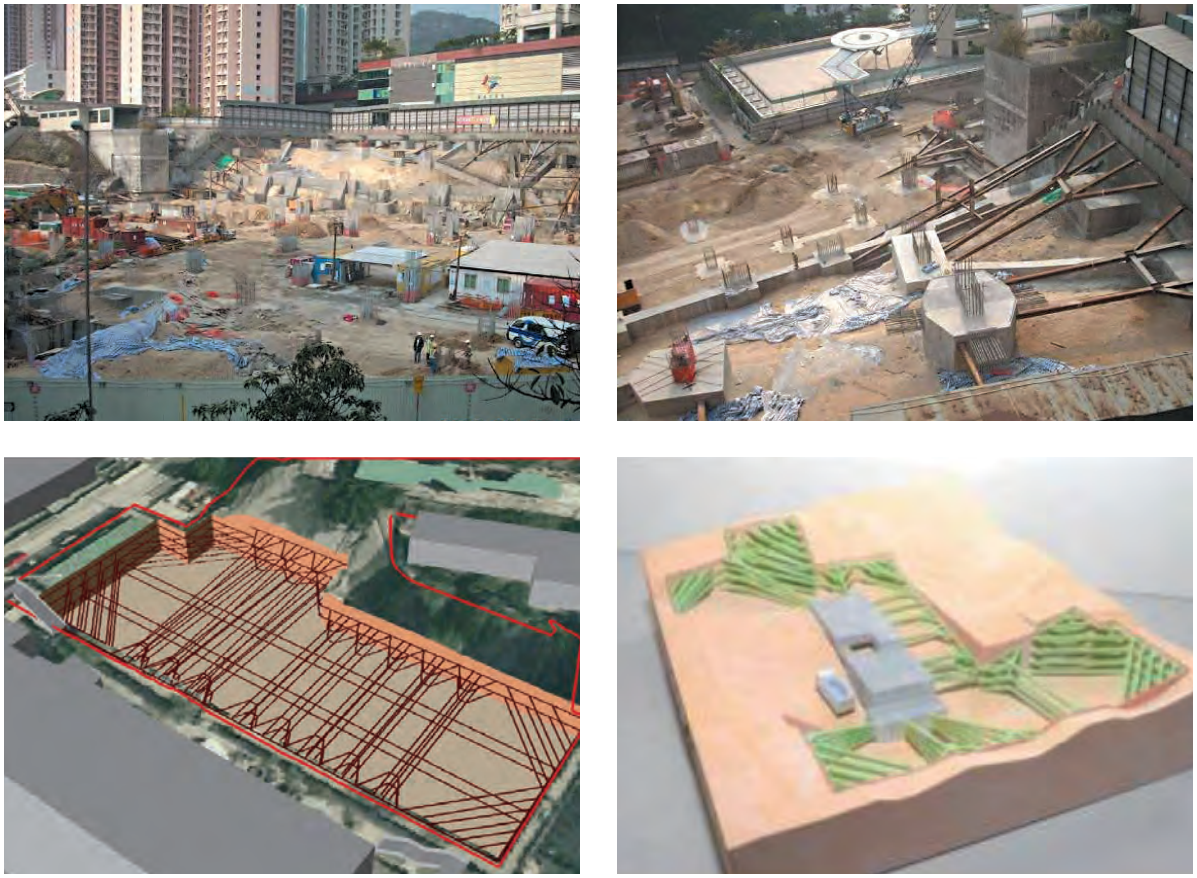
9. Safety through Early System Planning and Structural Design Approach for Demolition, Foundation and Building Contracts

Contractor's ELS Scheme



Plan

ELS Works



BIM and 3-D printing models can be used to simulate and refine the ELS works before actual construction

9. Safety through Early System Planning and Structural Design Approach for Demolition, Foundation and Building Contracts

Materials and Plant Handling

- Safety in material and plant handling is often critical in foundation contracts.
- Early planning by contractor and checked by SE in materials storage, manoeuvering of plants, transporting of heavy and large volume of materials are essential.

Materials Storage

Proper storage of H-pile material

Proper storage of steel casing

Store rack for RCD drill rod

Proper storage of steel liner

LDBP Steel Cage Fixing

Good Example

Proper steel cage fixing using working platform and supporting frame

Bad Example

Unsafe working environment and possible collapse of steel cage without using working platform and supporting frame

9. Safety through Early System Planning and Structural Design Approach for Demolition, Foundation and Building Contracts

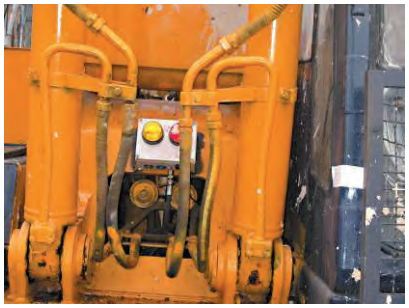
Equipment Disposition and Transportation

CCTV in operator cabin

Warning bar & rear camera


Lifting casing (horizontal)


Overload alarm


Overload alarm of excavator


Lifting steel cage by 2 cranes (horizontal)


Lifting steel cage (vertical)


Lifting steel casing (vertical)

Loading Test

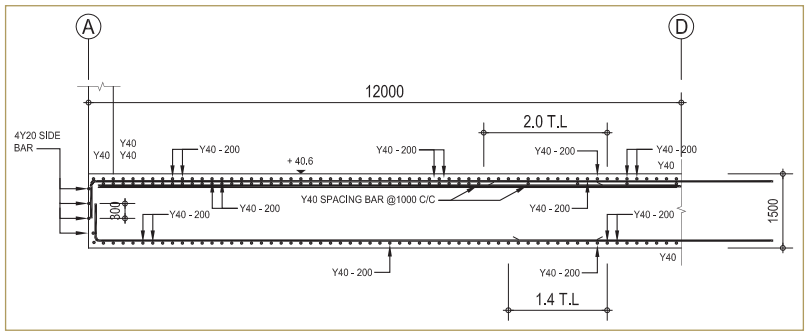

Final set up of mass steel kentledge


Typical concrete block kentledge

9. Safety through Early System Planning and Structural Design Approach for Demolition, Foundation and Building Contracts

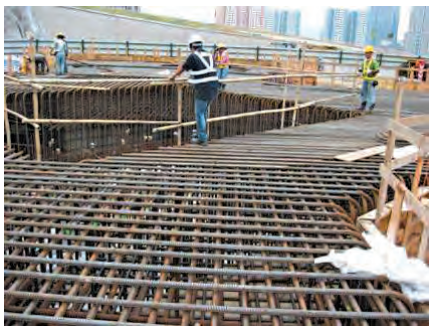
Building

Large Steel Cage Erection in Pile Cap and Transfer Structures
Large Steel Cage Erection in Raft Footing for Domestic Blocks



Typical RC Detailing – Minimization of shear links by new design approach

Large Steel Cage Erection in Raft Footing for Domestic Blocks (Shear Links not Required)



Large Steel Cage Erection in Raft Footing for Domestic Blocks (Shear Links Required)

Less congested shear links

Congested shear links

Congestion of shear links can be mitigated by enlargement of member size

The upward projections of congested shear links pose safety concerns during fixing of the upper layers of the reinforcement bars

9. Safety through Early System Planning and Structural Design Approach for Demolition, Foundation and Building Contracts

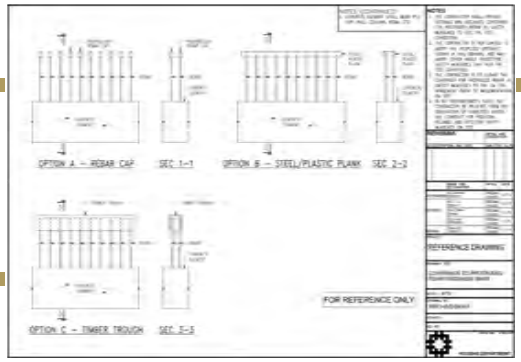
Passage through Falsework

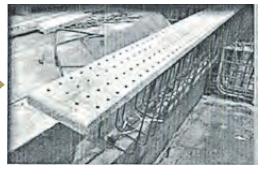
Adequate lighting and fencing off hazardous area

Protective Coverings to Protruded Steel Bars

Injury caused by falling on unprotected protruded steel bars
Protection of workers from injury using one of the protective options

Rebar Cap





Steel Plank

Wooden Trough

Steel Fixing and Concreting at Heights

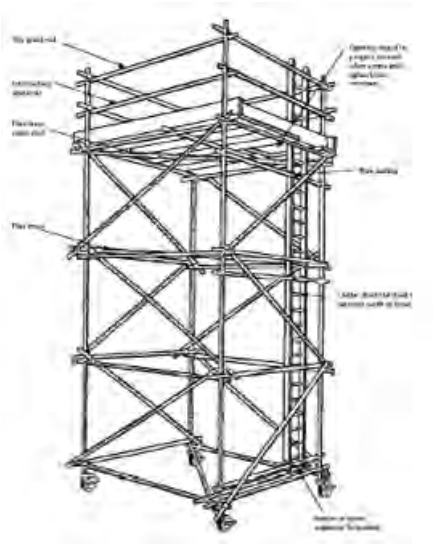
Bad example

Bad example

Bad example

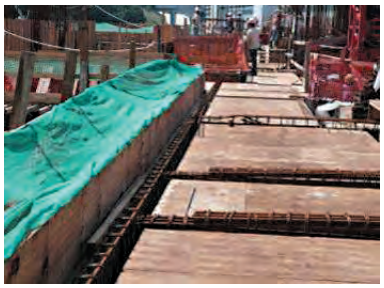
9. Safety through Early System Planning and Structural Design Approach for Demolition, Foundation and Building Contracts

Working platforms suggested in COP



Mobile working platforms for steel fixing or concrete pouring suggested in COP

Working platform with adequate railings and toe boards was provided during working at heights



Good housekeeping in working area

Working platform provided for steel fixing works at heights (≥ 2m)

Hop-up platform provided for steel fixing works at heights (< 2m)

Hop-up platform provided for concrete pouring at heights (< 2m)

Mobile working platform (≥ 2m)

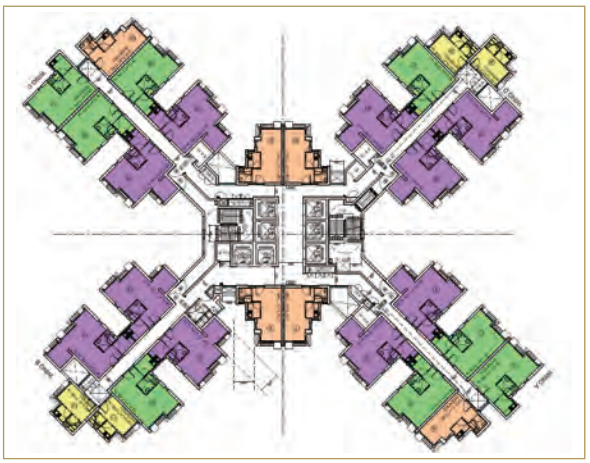
9. Safety through Early System Planning and Structural Design Approach for Demolition, Foundation and Building Contracts

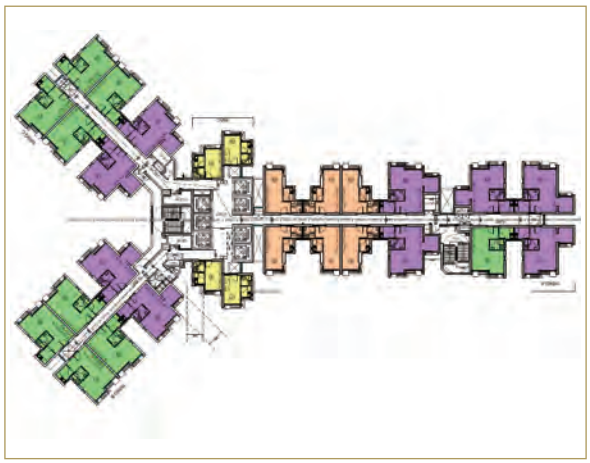
By Use of Fabric Reinforcement at Walls

Traditional rebar fixing

Fixing of fabric reinforcement

Mechanized and Precast Construction for Elevated Structures Benefit of Rotary Symmetry





Ideally design block with rotary symmetry to avoid moving formwork to ground level

Large Panel Formwork

If rotary symmetry cannot be fully achieved, designated site crews should be assigned to look after every movement of formwork to ground level

9. Safety through Early System Planning and Structural Design Approach for Demolition, Foundation and Building Contracts

Precast Facade

Allow enclosed working floor for other construction

Precast Staircase

Precast staircase is supported on concrete landing cast earlier so that temporary props are not required. Temporary props may be easily disturbed due to frequent passage of workers

Semi-precast Slab

Avoid slab formwork construction and minimize nos. of proppings

Precast Beam

Avoid insitu construction of tie beams at elevated positions

9. Safety through Early System Planning and Structural Design Approach for Demolition, Foundation and Building Contracts

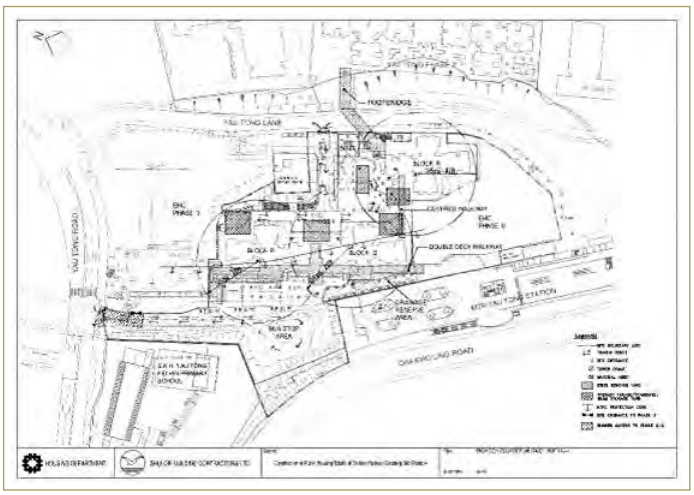
Crane Handling

Tower Crane, Material Hoist, CCTV and Double Chain Sling

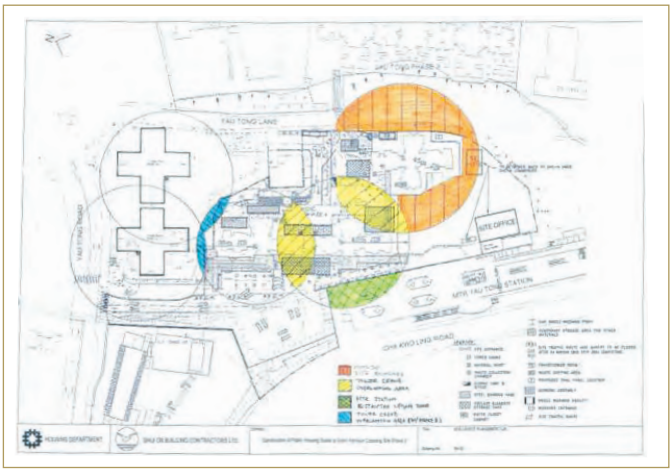
Tower crane CCTV, monitor and control panel

Material hoist CCTV and recording

New design double chain sling for lifting of hopper



Lifting zones are identified during site planning stage maximum required lifting weight for the precast elements has been considered in the selection of crane system & jib length as well as in the location of tower cranes



Overlapping areas and sensitive areas were identified during site planning stage and anti-collision system were installed to all cranes

Walkie-talkie is provided for signaler

9. Safety through Early System Planning and Structural Design Approach for Demolition, Foundation and Building Contracts

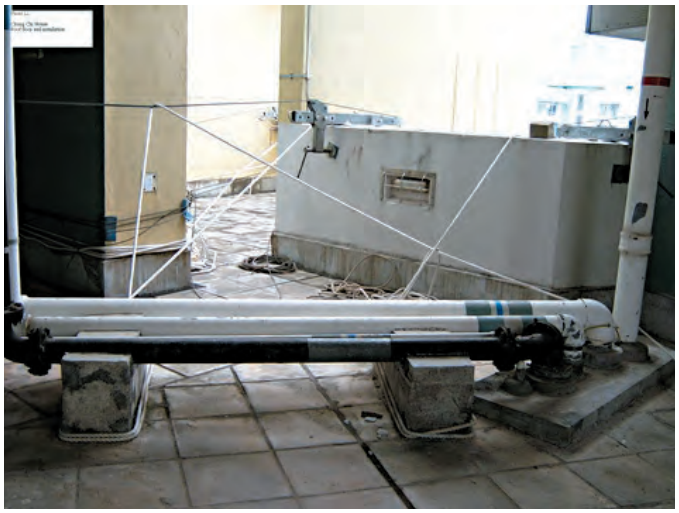
Construction Plant in Safe and Serviceable Conditions

Require regular inspection and maintenance of major construction plant on site to ensure that they are in safe and serviceable conditions

Major construction plant	Overhaul ages (years)			Ages beyond which the plant is not allowed to be on Site (years)
	1st Overhaul	2nd Overhaul	3rd Overhaul	
1. Tower cranes (rented)	10	17	22	25
2. Tower cranes (self-owned)	14	23	30	35
3. Derrick cranes (used for installing and dismantling tower cranes)	10	17	22	25
4. Gondolas	7	12	15	17
5. Material hoists	10	17	22	25
6. Mobile cranes (excluding crawler cranes)	12	20	26	30
7. Truck-mounted cranes	12	20	26	30
8. Crawler cranes (rented)	15	25	30	35
9. Crawler cranes (self-owned)	20	30	35	40
10. Pile drivers (rented)	15	25	30	35
11. Pile drivers (self-owned)	20	30	35	40
12. Hydraulic hammers (rented)	15	25	30	35
13. Hydraulic hammers (self-owned)	20	30	35	40
14. Oscillators (rented)	15	25	30	35
15. Oscillators (self-owned)	20	30	35	40
16. Rotators (rented)	15	25	30	35
17. Rotators (self-owned)	20	30	35	40

9. Safety through Early System Planning and Structural Design Approach for Demolition, Foundation and Building Contracts

Gondolas



Previous arrangement – Two supports
for one gondola holding down / fixing to roof floor

Conclusion

- Safety responsibility does not rest with the workers and site supervisors alone. It would be more effective if the safety DNA be early built in the design and management levels.
- At design levels, if structural components including both permanent and temporary designs are well considered and adequately allowed, it would remove significant safety risks for workers carrying out the construction.
- At management levels, if construction methodology and plant and equipment control and housekeeping are well planned and properly managed, the high safety risks to workers operating these systems could be much reduced.

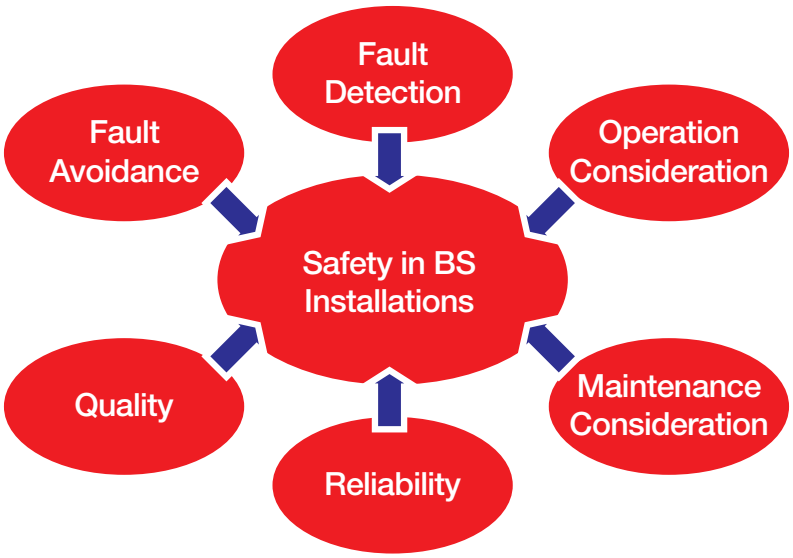
10. Planning and Design for Safety at Operation, Use, Management and Maintenance of Building Services Installations

Presenter: Building Services Section

Preface

- Safe and effective BS systems are the essential element to any successful building project from conception to day-to-day operation.
- This section is to highlight some of the measures to prevent the possible risk areas from planning, design, specification provisions to the operation and maintenance.

Safety In Building Services Installations



- By preventive design
  - Fault avoidance
  - Fault detection
  - Safe operation and maintenance
  - Reliability and quality (Specification)
- By installation control
  - Encourage and enforce good site practice
  - Perform good site management through contract control
  - Ensure safety

1. Preventive Design

Fault Avoidance – Materials and Equipment


Prefabricated branch cable riser


Modular design switchboards


Prefabricated generator set

- Wider user of prefabricated materials & equipment
- Prefabrication in controlled factory environment is safer than site fabrication

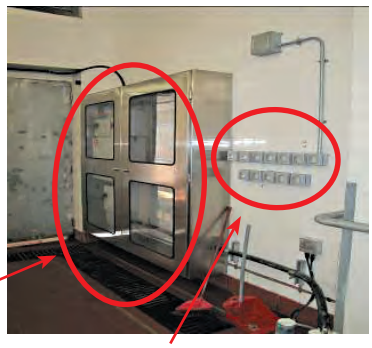
10. Planning and Design for Safety at Operation, Use, Management and Maintenance of Building Services Installations

Weatherproof type break glass unit at outdoor locations

- Frequent occurrence of false fire alarm will deteriorate tenants' alertness to real fire alarm
- Measures to avoid false alarm:-
  – Use of standalone smoke detectors and alarms
  – Use weatherproof type equipment at locations susceptible to weather conditions

Fault Avoidance – Maintenance Consideration

Double doors / enclosure for control panels inside pump rooms



Weatherproof switch panels used in wet environments

- Double doors / Enclosure for control panels to prevent water ingress in case of bursting of water pipes
- Reduce risk to operators / maintenance personnel

Previous Design

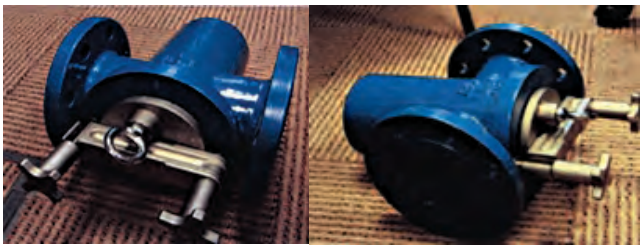
Big mild steel pressure vessels with conventional control

New Design

Small stainless steel pressure vessels with VSD control

- Use of Variable Speed Drive (VSD) and stainless steel pressure vessels for fresh water booster pump system enable size reduction
- Minimize risk in handling equipment during maintenance / repair

10. Planning and Design for Safety at Operation, Use, Management and Maintenance of Building Services Installations



Provision of bucket type strainer in flushing water incoming pipe

Automated self-cleansing strainer to be provided at the discharge pipe of the flush water pumps

- Prevent dirt or grits clogged in the flushing water pipes and thus prevent bursting
- Minimize risks from flooding and manual repair works

- LV switchboards are constructed in two isolated supply sections
- Maintain partial supply during maintenance such that workers not necessary to compact work and improve awareness on safety

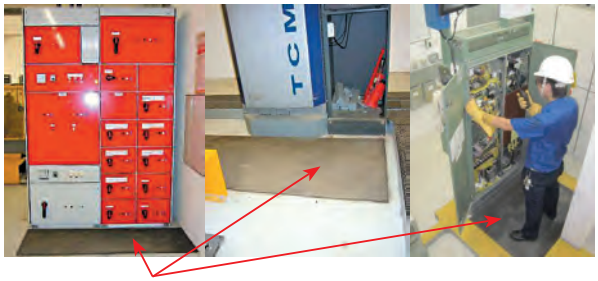
Electrical meter room

Main switch room

Pump room

Lift machine room

- Adequate space for installation, operation and maintenance



Insulation rubber mat

- Provision of insulation rubber mat to prevent electric shock during maintenance work

10. Planning and Design for Safety at Operation, Use, Management and Maintenance of Building Services Installations

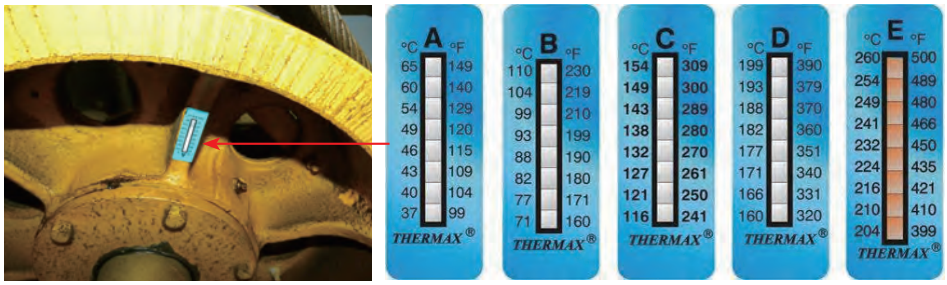
Provide working platform for repair / maintenance of building services installed at high level

Provide permanent working platform with railings, toe-boards and access ladder for repair / maintenance of chillers on the roof

Provide safe and easy access for repair / maintenance of cooling towers on the roof

- Provision of working platform for repair / maintenance

Fault Detection – Early Identification of Fault



- Temperature strips are provided at lift pulley assemblies to alert the maintenance personnel of any abnormality

Slack rope switch

- Slack rope switch for lift suspension rope is installed to stop the lift when either
  i) rope breaks or ii) rope slackens

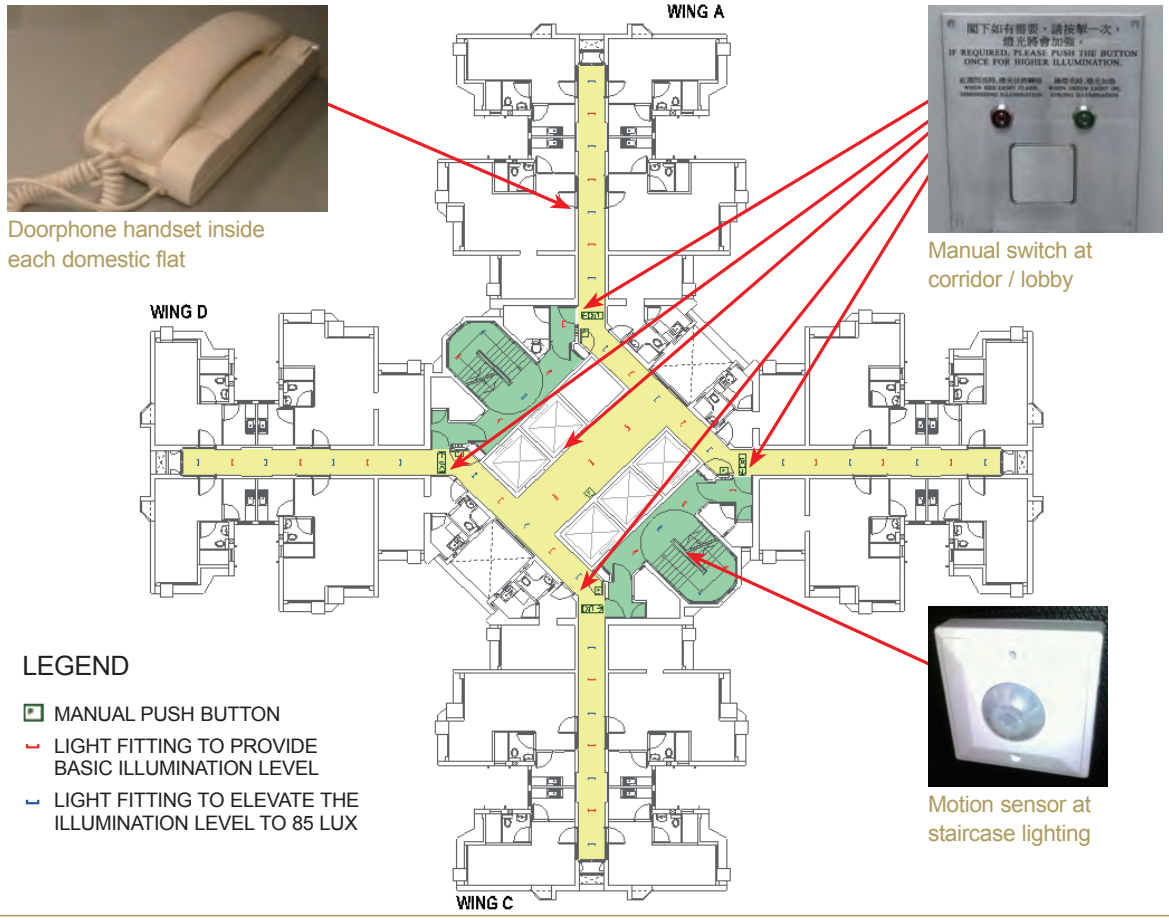
10. Planning and Design for Safety at Operation, Use, Management and Maintenance of Building Services Installations

Operation Consideration – Meet all Users' Needs

Lighting Level Requirements for Internal Public Areas of Domestic Blocks		
Location	Normal Illumination Level	Elevated Illumination Level*
Lift lobby	50 lux	85 lux
Corridor	30 lux	85 lux
Staircase	30 lux	85 lux

* The elevated illumination level will be automatically resumed to normal illumination level after an adjustable time delay.

- New Lighting Control System to elevate illumination levels for Visually Impaired Person

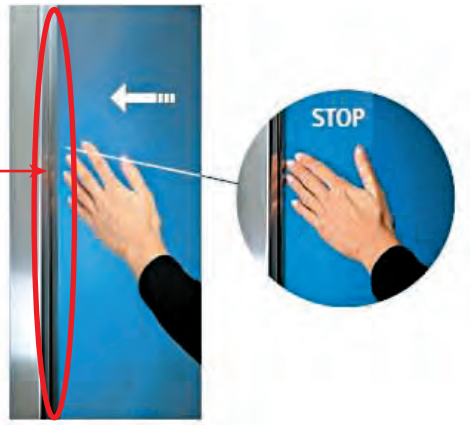


- New Lighting Control System at Typical Domestic Floor

10. Planning and Design for Safety at Operation, Use, Management and Maintenance of Building Services Installations

Operation Consideration – Prevent Mishap

Sensor



- Anti-trap device to stop the lift door operation for preventing the trapping of passenger hand into the lift door gap

Electrical Interlock

- Electrical Interlock to prevent operation of Refuse Storage Device if refuse bin is not in position

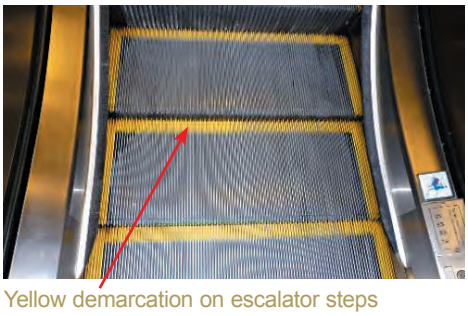
Operation Consideration – Enhance Awareness

Warning stripes at the bottom of lift car

Warning stripes at the bottom of landing opening

- Warning stripes at both lift car and landing to alert passengers and workers of any uneven level difference

10. Planning and Design for Safety at Operation, Use, Management and Maintenance of Building Services Installations



Yellow demarcation on escalator steps

- Yellow demarcation on the three borders of each escalator step to alert passengers of the gap

2. Installation Control

Site Management

- Fix cables at high level to avoid damage that leads to electric shock:
  – Min 5.8 m across vehicular road
  – Min 5.2 m at other locations

- Full height lift landing barriers at all landing openings to prevent falling of people and objects

- Safety net with net eye ≯ 20mm x 20mm inside lift shaft at interval of not more than 20m to protect workers from falling objects

10. Planning and Design for Safety at Operation, Use, Management and Maintenance of Building Services Installations

Use 110-volt power supply


Circuit protective device (RCCB) provided for sockets for portable equipment


Effective earthing for all circuits / exposed conductive parts

Display notice for First Aid to Electric Shock in plant rooms

Display the warning label 'Electric Hazard' at switch room

Properly isolate the source of electricity with lockout and tagout procedure

- Various measures to avoid electric shock to workers

- Provisions of site supervisors
  - Supervising engineer
  - Full time site supervisor
  - Site foreman per block
- Provisions of skilled workers to carry out the work

Skilled workers trades	Minimum percentage
Electrical	40%
FSWP	30%
Lift	50% (during last 35% of installation period)
Air-conditioning / Ventilation	10%

- Pay for Safety
  - Site Safety Committee
  - Safety Audit
  - Safety Plan - Include trade specific training
  - Hazard Identification and Pre-work Safety Check
  - Safety Supervisor
- Work Control
  - Do not allow hot work and electric arc welding process inside lift shaft and hot or electric arc cutting of guide rail sections on site generally. Obtain contract manager's approval if it is practically unavoidable.
  - Provide measure / protection to contain the risk for on-site welded components inside lift shaft

10. Planning and Design for Safety at Operation, Use, Management and Maintenance of Building Services Installations

Lift Shaft Works

Replacement of suspension ropes

Lifting operation

Lift modernization and lift dismantling inside the lift shaft

Hot work

- Contractors are required to implement a permit-to-work system for hazardous trade processes.

工作許可證 (升降機槽內工作)
Permit to Work (Work inside lift shaft)

Permit No. 許可證號碼：_____

Project 地盤名稱 ：_____
Location 工作地點 ： (Lift shaft no. 升降機槽) _____ (Floor 樓層) _____
Description of work 工作性質 ：

Company 公司：_____ Date 日期：_____
Permit valid from 許可工作由：_____ hrs. to 至：_____ hrs.

Foreseeable hazards associated with the work 可預見危害：

☐ Falling Objects 物料從高處下墮
☐ Fall of person 人體從高處下墮
☐ Insufficient Lighting 燈光不足

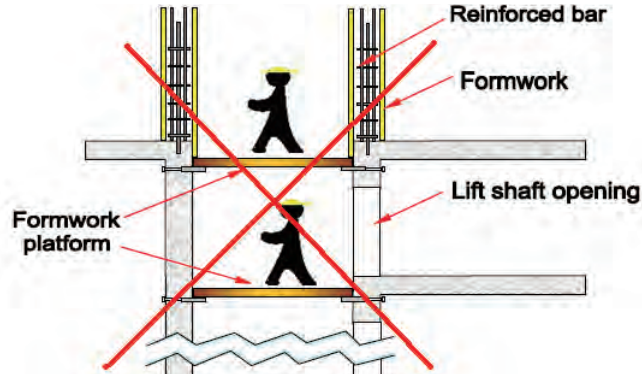
Permit-To-Work System

- Ensure close supervision on the adoption of safety precautions.

10. Planning and Design for Safety at Operation, Use, Management and Maintenance of Building Services Installations

Metal scaffolding for new building construction

- Metal scaffolding is adopted for lift shaft works for better strength, fire resistance and reliability.



Simultaneous working at different levels is generally not allowed

- It is strongly not advisable to allow simultaneous working at different levels.

3. Lift Maintenance / Improvement Works

All dangerous mechanical moving parts which would cause injury upon bodily contact should be effectively guarded with metallic see-through guards to prevent injury to lift workers

Provide fall arrest system with permanent anchorage for the lift worker's safe access / egress to / from lift pit

Provide permanent ladder for lift worker's safe access / egress to / from the lift pit

Provide emergency stop switch near the lift landing door of the lowest landing floor to stop the lift

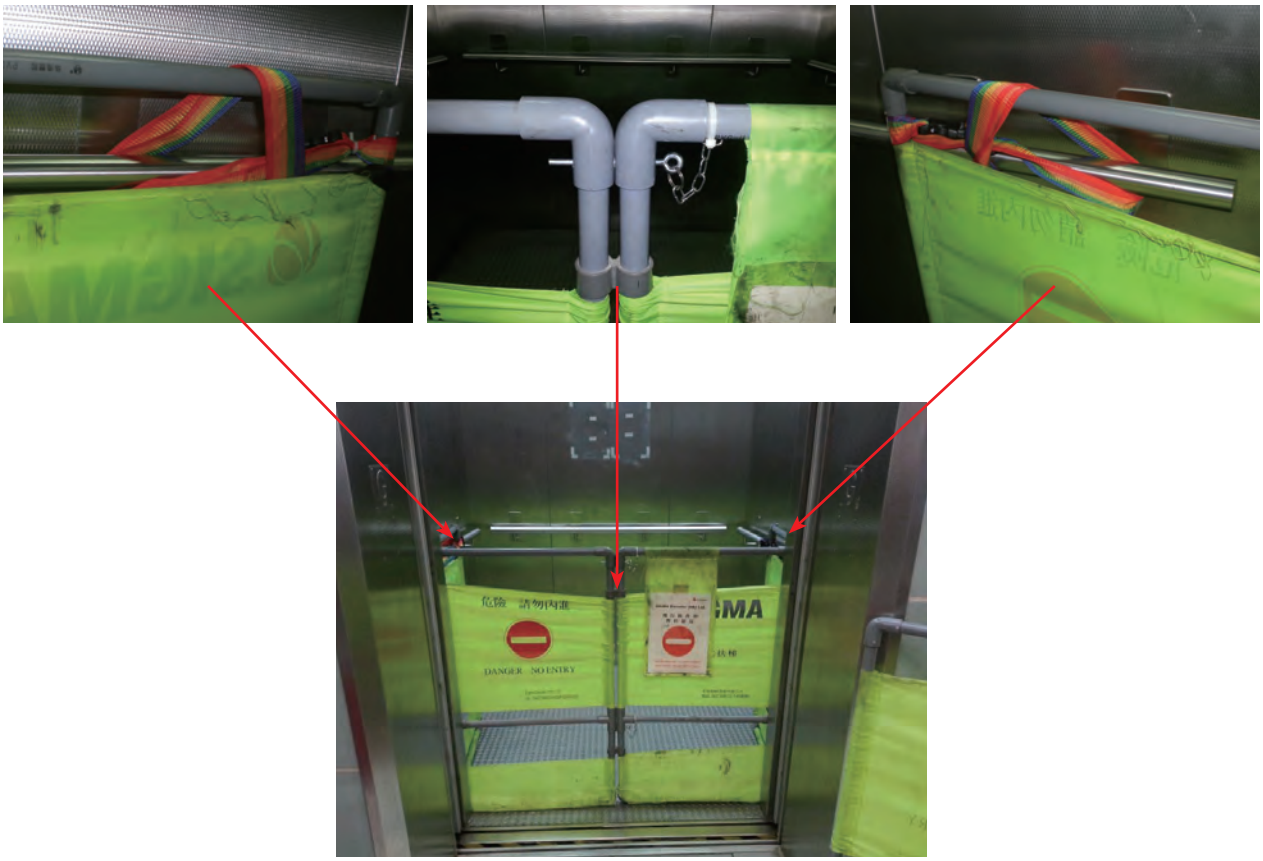
- Adopt safety measures to protect lift maintenance workers

10. Planning and Design for Safety at Operation, Use, Management and Maintenance of Building Services Installations

For lift modernization works - before dismantling the landing doors, provide full-height fire resistant boarding with an access door

Post warning notice to indicate the lift is out of service at prominent position

- Adopt measures to protect existing tenants



- Modification on existing barrier for lift car to prevent unauthorized entry into the lift car during lift maintenance

10. Planning and Design for Safety at Operation, Use, Management and Maintenance of Building Services Installations

4. Way Forward

Use of Builders' Lift within Lift Shaft

Builders' lift cathead

Builders' lift car

Builders' lift car top

- Provide a convenient means of vertical transportation for site personnel, reduce travelling time, the risks associated with human fatigue and manual handling operations on construction site.

5. Conclusion

- Achieving site safety requires joint effort of designers, contractors, workers and users.
- Good preventive design to avoid fault occurrence and prompt detection of fault is useful to minimize risk and danger.
- Due consideration of operational risks will help to avoid accidents.
- Good installation control will help to ensure safety and work quality.

11. Safety Considerations in Civil Engineering Design and Management

Presenter: Civil Engineering Section

Safety Considerations in Civil Engineering Design and Management

• Excavation for Roads and Drainage Works

– Land (Miscellaneous Provisions) Ordinance
– Road Safety Checklist

• Utilities Detection before Excavation

• Good Practices in Civil Engineering Design

– Manholes
– Catchpits
– Pedestrian Crossings
– Road Gullies

Excavation for Roads and Drainage Works

Land (Miscellaneous Provisions) Ordinance

Section 10T – Provision of safety precautions and support

The permittee and nominated permittee of an excavation permit shall

- adopt all necessary safety precautions to protect the public or any person making or maintaining an excavation to which the permit relates from any danger or injury;
- provide adequate support for the structural stability of building, roads, slopes, structures, pipes, lighting posts, utility services or similar installations adjacent to the excavation so as to prevent the public or any person from being endangered by a fall or displacement of earth, rock or other material.

It is an offence if the above requirements are contravened. A court may, in making a decision on the defence, take into consideration that a person charged with an offence has

- hired a competent person to supervise the excavation (competent person can be registered architect, registered professional engineer of relevant discipline, registered professional surveyor or registered safety officer);
- a documented system for supervising the excavation and ensuring the contractor complies with the above requirements;
- taken other reasonable steps.

Road Safety Checklist

- Provision of safety precautions and support
  – Install adequate support to trench excavation in a timely manner for trench with a depth greater than 1.2m to prevent collapse of the trench (as stipulated in Construction Sites (Safety) Regulations);
  – Provide and properly maintain adequate safe access to and egress from any trench deeper than 300mm;
  – Provide adequate drainage measures (e.g., pumps with sufficient capacity, upstands along sides of excavation) to minimize water runoff from the surface falling into the trench excavation.
- Provision of adequate proper lighting, signing and guarding to road opening works
  – Provide traffic signs, traffic cones / cylinders, temporary barriers, road hazard warning lanterns, traffic control equipment etc. as per Code of Practice for Lighting, Signing and Guarding of Roadworks published by HyD;
  – Traffic signs, cones / cylinders, barriers, lantern are to be in good condition and quality.
- Temporary road markings for temporary traffic arrangement
  – To be reflectorised and provided in accordance with the Road Traffic (Traffic Control) Regulations;
  – Existing road markings (if only required to be covered temporarily) to be covered temporarily with proprietary black tape.
- Name and contact telephone number of the responsible technician are to be displayed at the back of portable traffic light signal.
- Monitor any apparent ground movement or damage of roads, buildings, slopes and any other structures, or services under or above ground adjacent to or within the site.

11. Safety Considerations in Civil Engineering Design and Management

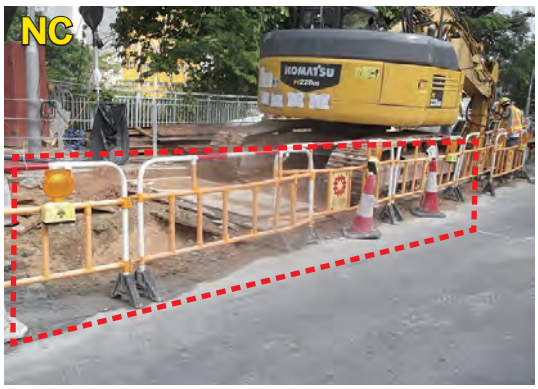
Section 10(T)(1)(a) – Shoring

Inadequate support

Section 10(T)(1)(a) – Safe Access

Inadequate safe access

Item 13 – Placing of Traffic Cone



Traffic cone max. spacing 3m

11. Safety Considerations in Civil Engineering Design and Management

Item 13 – Advance Warning Signs (Road Narrows On The Right / Left)

Wrong sign

At least 300mm above carriage way

Item 13 – Continuous Pedestrian Barriers

No continuous pedestrian barriers

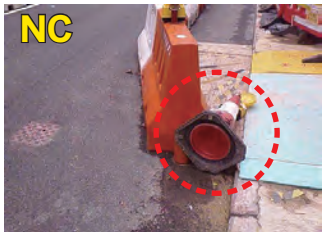
With continuous pedestrian barriers but without adequate traffic cone

No continuous pedestrian barriers

Item 14 – Condition / Quality of Traffic Cones

No white portion

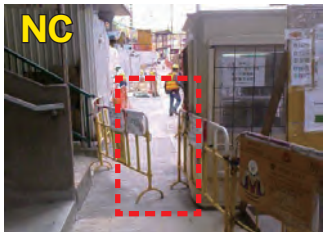
Should be free-standing (Bag filled with sand as ballast is not acceptable)



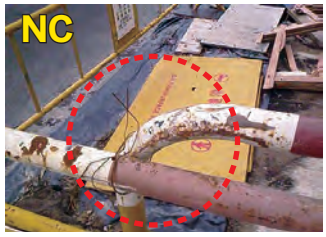
Toppled

11. Safety Considerations in Civil Engineering Design and Management

Item 14 – Condition / Quality of Barriers



Barriers should be hooked / fastened to form continuous barriers



Barriers should be painted so that they stand out conspicuously in contrast

Utilities Detection before Excavation

To reduce risk of damaging existing underground utility services, especially high voltage cables and gas mains which might lead to fatal site accidents.

- Electrical Supply Lines (Protection) Regulation and Gas Safety (Gas Supply) Regulations stipulate that all reasonable steps shall be taken to ascertain the locations and positions of electrical cables and gas pipes respectively before commencing of any works in the vicinity of these underground services.
- Obtain utilities records from utility undertakers before commencing excavation.
- Verify locations of utilities on site. Follow Code of Practices published by EMSD for practical guidance on locating underground cables and gas pipes.
- Common non-destructive utilities detection methods include use of “Pipe and Cable Locator” and “Ground Penetrating Radar”.
  - Pipe and Cable Locator locates buried pipes / cables by detecting magnetic field around the lines, e.g., electric cables, metallic pipes;
  - For non-metallic pipes, Ground Penetrating Radar can be employed to map the buried features using radio waves;

Pipe and Cable Locator

Ground Penetrating Radar

  - Survey interval – not exceeding 2m in discrete areas and 10m along alignments of services;
  - Survey depth – up to 4m below ground or predicted depth of known deepest utilities, whichever is greater.
- Accuracy of location and level
  - for depth up to 1.5m below ground, 90% of a representative sample of points on locatable services shall be within ±165mm;
  - for depth more than 1.5m below ground, the error shall not be more than 10% of depth below ground.
- Survey by non-destructive method should be carried out under supervision of competent engineer or senior technician experienced in relevant surveying procedure.
- If necessary, dig trial pits to further confirm utilities locations.

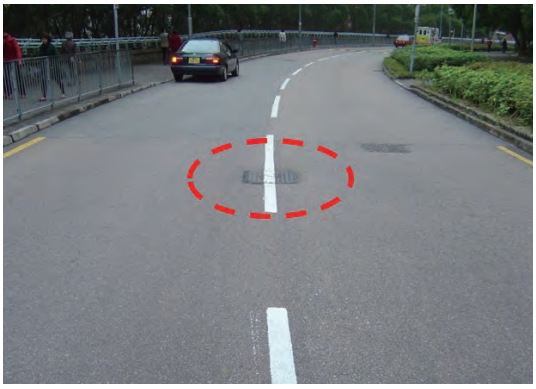
11. Safety Considerations in Civil Engineering Design and Management

Good Practices in Civil Engineering Design

Good Practices – Manholes

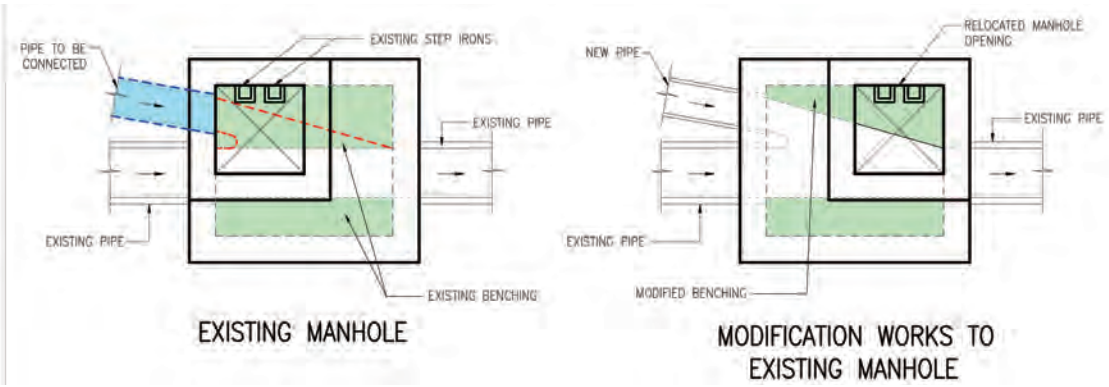
- **Avoid locating manholes at centre of road and run-in / out as far as possible**
  – To avoid hazardous working conditions to workers / road users and interruption to EVA during repair / maintenance works

Manhole at centre of run-in / out

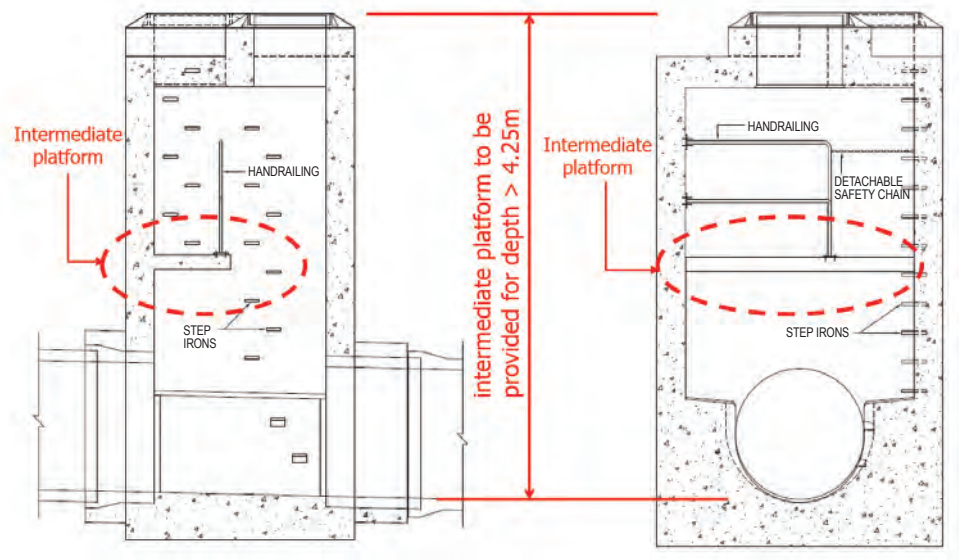


Manhole at centre of carriageway

- **Avoid locating manhole access opening above drainage channels**
  – To ensure safe landing on benching of manhole for repair / maintenance

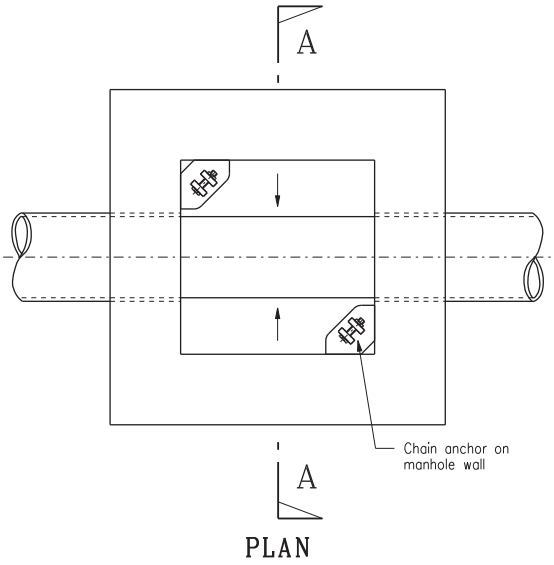


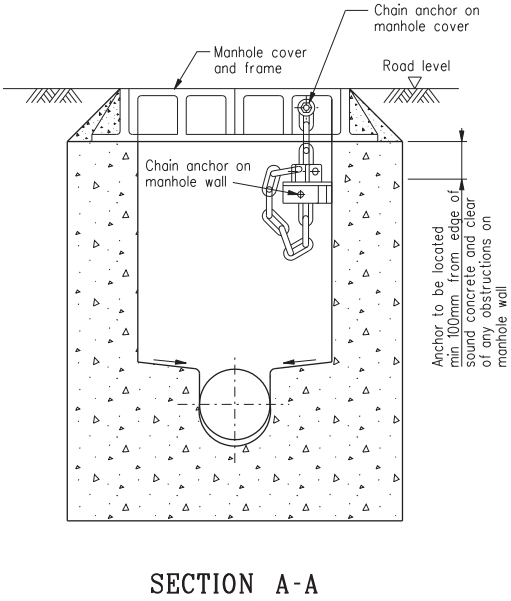
- **Provide intermediate platform for deep manhole**
  – To provide safe working intermediate platform for repair / maintenance



11. Safety Considerations in Civil Engineering Design and Management

- **Provide restraint to covers of manholes with inadequate ventilation**
  – To prevent gas explosion hazard in the manhole





Good Practices – Catchpits

- **For catchpits easily accessible to general public, install with grating or cover**
  – To safeguard pedestrians from falling into the pits

Catchpit with gratings

Catchpit covered up with concrete strips

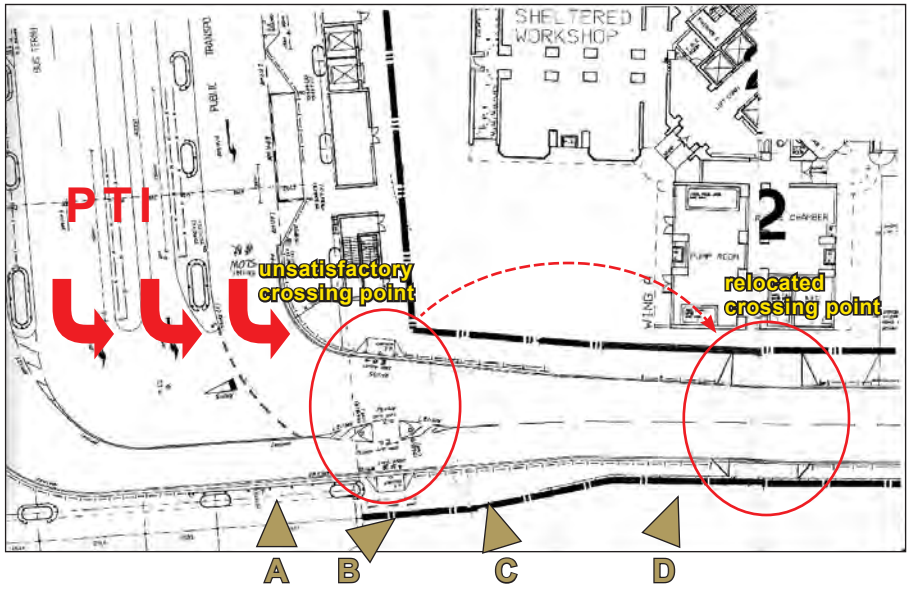
Good Practices – Pedestrian Crossings

- **Construct with gradient not exceeding 1 in 12**
  – To avoid slippery surface (especially with tactile) and meet barrier free standard

Crossings constructed with too steep gradient may cause slippery surface (especially with tactile)

11. Safety Considerations in Civil Engineering Design and Management

- **Ensure sight line unobstructed**
  – To avoid hazardous traffic conditions to pedestrians



View A

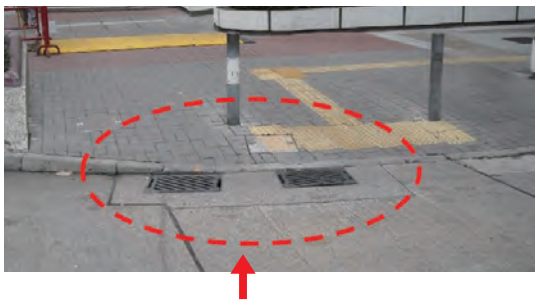

View B


View C


View D

Good Practices – Road Gullies

- **Avoid locating gullies on pedestrian pathways (e.g. crossings, stairways)**
  – To avoid pedestrians from being tripped by the gully gratings


Gullies in front of crossing


Gullies in front of stairway

Conclusion

- Take safety considerations from operational and maintenance points of view.
- Implement safety audit on design.
- Maintain well documented system on site safety supervision.

12. Geotechnical Engineering Works (Safety Aspects in Slopes and Ground Investigation Works)

Presenter: Geotechnical Engineering Section

Contents

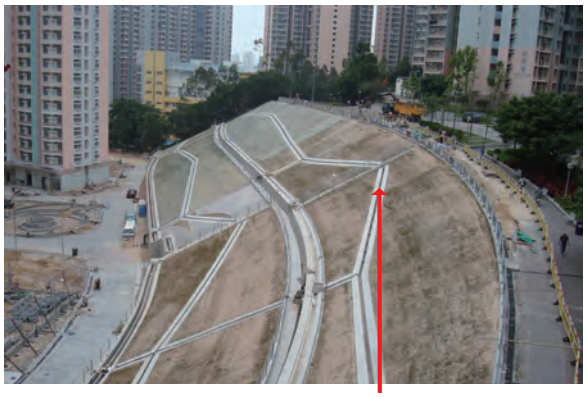
Safety Aspects in Slopes

- Safety Considerations in Design
- Safety Measures during Construction
- Safe Access for Slope Inspection and Maintenance
- Slope Management and Maintenance

Clear intervening space

Safety Considerations in Design

- Adequate Safety Factor corresponding to Consequence-to-life and Economic Consequence Categories
- Adequate Clear Intervening Space from Buildings
- Slope Surface Protection with due consideration of "Greening" for the Slope
- Slope Surface Drainage Provision
- Details to enhance safety
- Natural Terrain Hazard Mitigation Measures
  (e.g. debris resisting barrier, boulder fence, trapezoidal channel with raffle blocks, etc.)



Slope surface drainage system

Hydroseeding slope surface protection

Chain-link fence

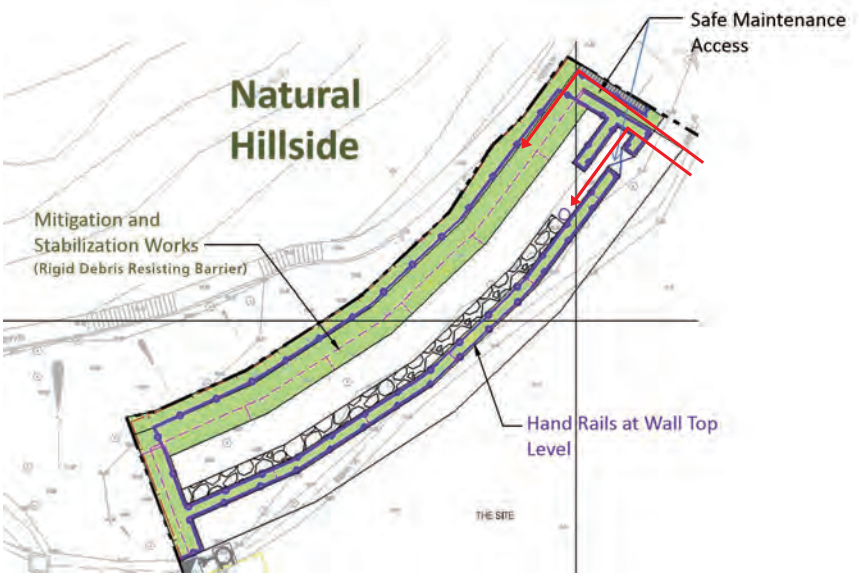
U-channel with cover

U-channel cover

Hand-rail along berm

12. Geotechnical Engineering Works (Safety Aspects in Slopes and Ground Investigation Works)

Debris Resisting Barrier with Maintenance Access to Protect Public Housing from Natural Terrain Hazards (Project: Sha Tin Area 4D)



12. Geotechnical Engineering Works (Safety Aspects in Slopes and Ground Investigation Works)

Safety Measures during Construction

Temporary works for excavation works

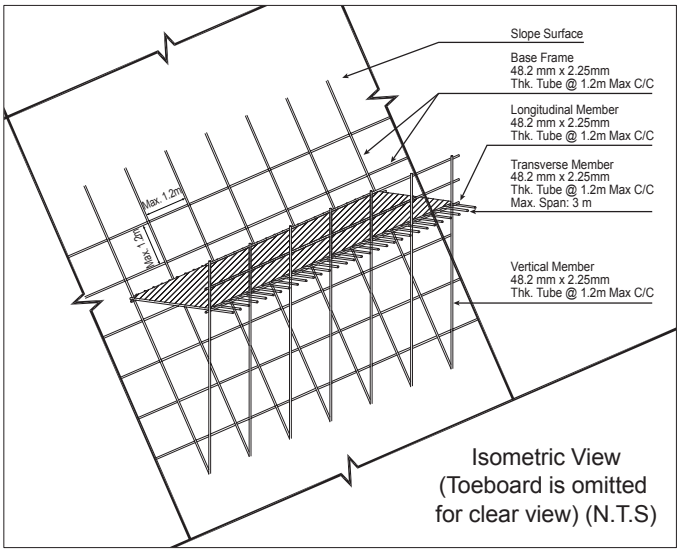
Temporary Pre-stressed Ground Anchors for Excavation and Lateral Support Works (Project: Anderson Road Site B)

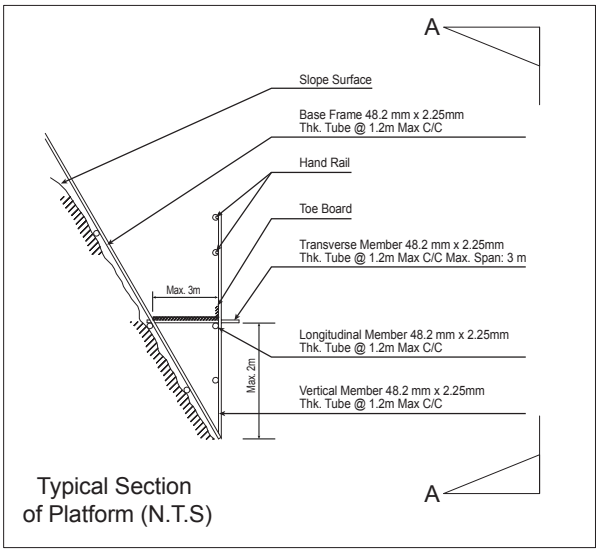
General view of Excavation and Lateral Support Work Using Temporary Ground Anchors

Temporary platform for soil nails works

12. Geotechnical Engineering Works (Safety Aspects in Slopes and Ground Investigation Works)

Soil Nailing for Slope Improvement Works





Details of working platform for soil nails works
(Project: Ex-Au Tau Departmental Quarter)

- Quality Site Supervision for Slope Works
- Verification of Design Assumptions during Construction
- Safe Temporary Works for Excavation Works and Soil Nailing Works
- Precautionary Measures during Heavy Rainfall Period
- Emergency Attendance
- Effective means of improving stability of existing slopes
- Avoid major cutting
- Minimize soil movement
- Preserve existing vegetation

Safe Access for Slope Inspection and Maintenance

- Code of Practice on Access and Safety Precautions
- Provision of Intermediate Berms on Slope
- Provision of Staircase for Access to Berms
- Provision of Railing along Berms

12. Geotechnical Engineering Works (Safety Aspects in Slopes and Ground Investigation Works)

Slope Management and Maintenance

- Slope Registration and Updating the Catalogue of Slopes
- Production of Slope Maintenance Manual, including
  a. Providing Basic Information and As-built Records of the Slope
  b. Recommending Minimum Frequencies for Routine Maintenance Inspection and Engineer Inspection
  c. Providing a List of Items requiring Routine Maintenance
  d. Providing Information on Water Carrying Utilities that may affect the Stability of the Slope

Redevelopment of Sau Mau Ping Estate Phases 13 & 16

Safety Aspects in Ground Investigation Works

- Occupational Safety and Health
- Safety Measures in Ground Investigation (GI) Fieldworks
- Safety Training for Site Staff

Occupational Safety and Health

- Provision of Mobile Site Office and Toilet at GI Work Site

Mobile site office

Toilet

12. Geotechnical Engineering Works (Safety Aspects in Slopes and Ground Investigation Works)

- Provision of Adequate Potable Water
- Provision of Safety Helmets, Safety Shoes and Wet Weather Gears for Site Staff
- Other Precautionary Measures (e.g. Against Heat Stroke, High Air Pollution)

Personal protective equipment

Safety Measures in GI Fieldworks

- Checking Underground Utility Records from Utility Undertaking
- Use of Electronic Device to locate Underground Utilities
- Excavation of Inspection Pit before Drilling
- Use of Protection Guard to Protect Workmen from Rotary Part of Drill Rig

Electronic device to locate underground utilities

Inspection pit

Protection guard & rotary part

Protection guard & rotary part

12. Geotechnical Engineering Works (Safety Aspects in Slopes and Ground Investigation Works)

Site safety in ground investigation works (Lesson learnt from a fatal accident)

A worker was struck to his death by a backstay of a drilling rig which was being dismantled for a non-Housing Authority site.

Lesson learnt:

- Competent person to conduct job specific risk assessment;
- Setting up a danger zone;
- Providing the workers with safety information, instruction and training; and
- Competent person to supervise dismantling work.

Training to workers

Supervised by competent person

Safety Training for Site Staff

- Provision of 1-Day Construction Safety Certificate Course for “Green Card”
- Provision of 1-Day Workers of Confined Space Operation Certificate Course
- Provision of 4½-Day Safety Training for Resident Site Staff

Conclusion

- Safety is the culture to be inherited from early site planning till maintenance, i.e. at all times
- Safety should be considered seriously in the design of all types of works. All works should have a safe design and can be constructed in a safe manner
- Safety and health of site personnel are contributing factors to success of a project

Drilling on a slope

13. Discussion Forum (B)

During the discussion forum, representatives of Hong Kong Housing Authority and industry stakeholders shared experience on how to enhance planning and design for safety in project life cycle for public housing developments (from planning, design, construction, occupation to maintenance stages). The participants were –

- Mr S C LEUNG, Chief Manager / Management (Tuen Mun & Yuen Long) **(Leung)**
- Mrs Rosa HO, Chief Architect / 3 **(Ho)**
- Mr Martin TSOI, Chief Structural Engineer / 1 **(Tsoi)**
- Mr W H WONG, Senior Building Services Engineer **(Wong)**
- Mr C S TANG, Chief Technical Officer (Building Works) / A3 **(Tang)**
- Mr Y S YEUNG, Chief Technical Officer (Building Services) / C1 **(Yeung)**

Question (1) As a designer, how can you incorporate safety consideration into your design? I want to hear the answers from Mr. Leung, Mrs. Ho, Mr. Tsoi and Mr. Wong.

Leung : I am mainly engaged in property management and maintenance. It is right to say that we are four in one: the designer, property manager, contractor and user (i.e. the workers) of safety facilitates. The four parties share the same belief, safety first. As mentioned by one of the presenters, action speaks louder than words. If there is a good design but the contractors do not supervise their workers to use the safety facilities correctly, or the workers do not know how to use such facilities, or they do not receive proper training and the facilities are not properly maintained, whatever you do is in vain. That's all I want to say.

Ho : I agree with Mr. Leung. In fact, as an architect, all of us opt for practical concepts. During the process of design, we emphasize on process management. Our designs are reviewed by different committees in different aspects. I really appreciate the colleagues responsible for the management and maintenance. Although each meeting concerning design matters takes a lot of time, they pay serious attention to safety and may scrutinize the designs in detail. The colleagues responsible for auditing review our design in various stages to optimize safety issues. I agree that attitude is very important. As a designer, we should listen to the opinion of users in respect of the practicality and maintenance, collect more feedback and make improvements.

Tsoi : As for the design of structures, we would share the ideas of our design with the contractors, and cooperate and communicate with the contractors before and during the construction. Before the construction commences, the engineers would meet the contractors at the sites and introduce our design to them with a view to enhancing work quality and safety. In addition, the contractors would tell us how their temporary works will be constructed so that we can coordinate with them. Where necessary, we may make minor change to our design to make the work smooth. For example, if we anticipate that a lot of site formation work or large-scale temporary work needs to be carried out before the foundations work, we would discuss with the contractors in advance to see whether the engineers' design can be implemented under sound management of safety and quality control in the construction without too much cost. After the commencement of construction, we need to pay attention to the details, including the working drawings, such as the reinforcement fixing work. If the design is too complicated, workers may be exposed to danger. An example is that bars at wall tops or column heads have to be lapped at a level above workers' head. In such case, there are safety issues in respect of weight, hoisting and concentration of manpower. In such areas, we would seek suggestion from workers or the Bar-Bending Contractors Association for improvements in our design. We will also convey opinions we obtained from the industry to the Buildings Department for their consideration. I believe that cooperation of each industry participant is really important for the safety design and construction of structures.

Wong : Put your mind to it and consider every detail as if you are the users. Prevention is better than cure. As for the building services, answers just made by my colleagues have already covered such factors.

13. Discussion Forum (B)

Question (2) Do you have any suggestion for site safety?

Tang : Usually, different contractors have different policies and more resources will be put into safety management and safety facilities if the company is more safety-conscious. For example, robust steel railings will be set up surrounding the metal formwork modules, and toe-board will also be added to ensure the safety of workers. Some companies have not contracted with the Housing Department for a long time, and their compliance with the safety standards of the Housing Department may be inadequate. We will step up our supervision on these companies and arrange them to visit other sites which are adopting comprehensive safety measures, thus they can learn from the others. All of these are very effective ways.

Yeung : Site personnel have to face great pressure when supervising industrial safety of contractors. Especially when construction commences in a site, the contractors' attitude and point of view towards industrial safety may be different from ours. To achieve the target of 'zero incident', our colleagues will provide advice to the contractors as early as possible on various safety issues such as the arrangement of hoisting, delineating passage for the workers and vehicles, and storing materials. This will enable the contractors to make proper arrangement at the early stage and avoid the need to deal with undesirable situations later on. Since April of this year, we have been arranging safety training to site staff to enhance their knowledge on safety management and understanding of related works. Our colleagues also hold regular meetings among them and communicate with the contractors to share experience in implementation and solutions for problems, which do help alleviate the pressure they encounter.

Question (3) Nominated subcontractors play certain role in a project. How can you make them cooperate with contractors effectively?

Wong : First of all, contractors and subcontractors should have harmonious relationship and more communication. We would specify safety standards in the contracts for the compliance by subcontractors. We also provide incentive such as implementing the Pay for Safety Scheme. Under the Scheme, if the subcontractors complied with the safety requirements, we will reward them with an additional payment of about 1.5% to 5% of contract amount, depending on the scale of the project. If the subcontractors failed to comply with requirements, we will impose punishment which, if it involves serious safety default, may affect their successful bidding of our projects in the future.

Question (4) How does the estate management team cooperate with the design team to improve safety design?

Leung : They should share the same value that safety always comes first. Value affects our behaviour. As mentioned earlier, our values, rewards and punishments as well as the system should be further improved.

Ho : We need to have empathy and think from their points of view. When an architect is designing a building, he / she should take future maintenance and repair into consideration in addition to the beauty of the appearance of the building design.

Tsoi : Cooperation is required, and listens to users' demand.

Wong : We should share the same goals and cooperate with each other to look for success.

Question (5) In your opinion, what factors should be taken into account during the process of design in addition to safety considerations? If safety is in conflict with other considerations, how do you deal with it?

Leung : Conflicts do exist once we place safety as our top priority. But with our determined efforts, everything could be sorted out in the end.

13. Discussion Forum (B)

Question (6) As an architect, how do you make the construction design to comply with safety standards?

Ho : There are many guidelines set by the department to facilitate our design. Although many colleagues may feel that their design are constrained, I want to emphasize that sacrificing safety construction for design is not an option. In addition, the bidders are required to provide a comprehensive technical report when they submit their tender. We will also review construction safety when we examine the tender. If it is reckoned that such technical report has neglected construction safety, the tender will be rejected.

Question (7) How should architect or engineer balance design and safety?

Ho : Design and safety should complement each other.

Tsoi : Safety takes priority over design. For example, designers can optimize their designs by using large formworks to reduce the need of working at height.

Closing Remarks

Presenter: Ms Ada FUNG (HD)

Enriched with solemn topical issues and enjoyable plays, today's workshop is a valuable course on liberal arts education. You must have found it useful and rewarding. I would like to thank our guests, speakers, friends and colleagues for attending the workshop. Also, I would like to extend my gratitude to all the participants who have rendered support to this event. The "Cradle-to-Cradle" Workshop is indeed a great success.

Your participation in and support to the workshop has demonstrated your commitment and safety performance is a function of commitment. I hope that all of you will make effort to closely monitor the safety issues in project life cycle and enhance site safety performance on all fronts to achieve the target of "zero incident". Furthermore, I hope that you will undertake to go back to your workplaces together with the commitment, right attitude and the contents of this workshop in the PowerPoint Package of "Zero Incident" for sharing with your colleagues.

With the same aspirations, we must work hand in hand to put into reality our commitment, whether we are frontline staff, management personnel or senior staff. We firmly believe that "right attitudes produce right actions". According to our presenters in this workshop, we should always listen, bearing an empathetic attitude and "Safety First" in mind, working in unison and adopting 3 EARLYs, namely, "early planning", "early design" and "early management". I hope that we will continue to work hand in hand to foster safe working habits and culture in the industry and translate our words into actions. The workshop today only marks a milestone. Before we conclude today's programme, would you please stand up, raise your right hands, and repeat this pledge aloud after me: "We pledge our commitment to observe and drive planning and design for safety".

Ms Ada Fung, Deputy Director of Housing (Development and Construction), pledged with industry practitioners to observe and drive "planning & design for safety".

Thank you very much.

3 EARLYs
Early planning
Early design
Early management

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Abbreviation	
BIM	Building Information Modelling
CCTV	Closed circuit television
CDM	Construction Design Management
CIC	Construction Industry Council
CICTA	Construction Industry Council Training Authority
CM	Contract Manager
COP	Code of Practice
CRC	Contractors Review Committee
DCD	Development and Construction Division
DDRP	Detailed Design Review Panel
EFQM	European Foundation for Quality Management
ELS	Excavation and lateral support
EMD	Estate Management Division
EMSD	Electrical & Mechanical Services Department
ETWB	Environment, Transport & Works Bureau (the present Development Bureau)
EU	European Union
EVA	Emergency vehicular access
GI	Ground investigation
HA	Housing Authority
HASAS	Housing Authority Safety Auditing System
HD	Housing Department
HKCA	Hong Kong Construction Association
HKCIC	Hong Kong Construction Industry Council
HKCSA	Hong Kong Construction Sub-contractors Association
HKFEMC	Hong Kong Federation of Electrical & Mechanical Contractors
HKHA	Hong Kong Housing Authority
HKPHEA	Hong Kong Professional Hoisting Engineering Association
HSE	Health, Safety & Environment
HVAC	Heating, ventilation and air conditioning
HyD	Highways Department
ISO	International Organization for Standardization
LD	Labour Department
LECA	Lifts & Escalators Contractors Association
LGCQ	Liaison Group on Construction Quality
LPG	Liquefied petroleum gas
OHSAS	Occupational Health Safety Assessment Series
OSH	Occupational Safety and Health
OSHC	Occupational Safety and Health Council
PASS	Performance Assessment Scoring System
PD	Project Director
PDRC	Project Design Review Committee
PM	Project Manager

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PolyU	The Hong Kong Polytechnic University
PPE	Personal protective equipment
PTAS	Preferential Tender Award System
PtD	Prevention through Design
RCV	Refuse collection vehicle
RVD	Reversing Video Device
SE	Structural engineer
TTA	Temporary traffic arrangement
UK	United Kingdom
USA	United States of America
WFRA	Work flow risk assessment

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We pledge
our commitment to
observe and drive
“Planning & Design for Safety”

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ISBN 978-988-19626-5-2