

# Prevention through<br/>Design for Safety (DFS)Guidance Notes & Worked Examples透過建築安全設計作出預防 - 指南及實例

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### **Modern Architectural Design**

**DESIGN FOR SAFETY** 











### DESIGN FOR SAFETY

#### **Peculiar External Shape**









### **Concerns on Safe Design (1)**

No safe means of access to facilities and <u>no safe</u> means of support for workers to carry out RMMA works at external walls of buildings









### **Concerns on Safe Design (2)**

### **DESIGN FOR SAFETY**



Impracticable to erect scaffold or provide anchorage as fall protective measures at external walls









### **Concerns on Safe Design (3)**

### DESIGN FOR SAFETY



#### <u>No guardrails</u> or <u>fall protective</u> <u>measures</u> at rooftop / canopy







### **Construction Design and Management (CDM 2006)**



### **DFS Review Programme Methodology in 2013**

#### **Interview / Focus Group Meeting / Site Visit**

#### **DESIGN FOR SAFETY**

#### *Literature Review / Questionnaire Survey*



Litorature	Review on the Review and
Dronaraf	ion of Design for Safety
Guidelin	es for the Construction
Indu	stry of Hong Kong

Reference: WQ/024/13

Occupational Safety and Health Council

October 2013

On	ganisation details	in Imore than one	duty holders can be selected)
81.	What is your organisation's prin	sary roat linese costs	
		Project Super	visor (CDM Coordinator)
	Client	Principal Con	mactor
	Designer	Contract Sup	ervisor
	Maintenance super room		
	if other please specify.		
82.	How many employees do you h	ave in HK?	D 10 to 49
	None None	D 100 9	1.000 +
	50 to249	D 230 (0 999	
83.	How many construction project	s was your organisation in	volved with in the last 12 months?
	(e.g. deusloped, designed, built,	maintained etc.)	
	1109	10 to 19	20 to 49
	S0 1099	100+	Not known
	How many construction project	s in your organisation have	e implemented the CDM
	approach?		
	1 to 9	D 10 to 19	20 to 49
	G 50 to 99	D 100+	Not known
Su	ccesses and problems wit	h CDM	
C1.	Can you point out the 3 key su	ccess areas where CDM be	ought improvement to Health &
	Safety standards in your const	ruction project to ensure a	afer arrangements for
	construction and for maintains	rg it so as to control risks	to workers by using the published
	t		
	2		
	3.		









### Literature Review -Experience of UK, Australia & Singapore

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Country/ City	United Kingdom Health and Safety HSE Executive	Australia	Singapore
Regulation	<ul> <li>-introduced the CDM Regulations in 1994</li> <li>-CDM 1994 was revised and replaced by CDM 2007</li> <li>-CDM 2015 came into force on 6</li> <li>April 2015, replacing CDM 2007</li> </ul>	No specific regulation on Design for Safety	No specific regulation on Design for Safety in 2013
Code of Practice / Guidance	<ul> <li>-issued the Guidance on "Construction (Design and Management) Regulations" in 2015</li> <li>-issued the Approved Code of Practice "Managing health and safety in construction – Construction (Design and Management) Regulations" in 2007</li> </ul>	-issued the "Code of Practice on the Safe Design of Structures" in 2012 -issued the "Safe Design of Buildings and Structures Guide" in 2009	<section-header></section-header>
Execution	regulate Design for Safety by legislation	promote Design for Safety by training and issuing relevant Code of Practice	promote Design for Safety by training and safety award

### Literature Review -Experience of UK, Australia & Singapore

d

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Guidance	Code of Practice "Managing health and safety in construction – Construction (Design and Management) Regulations" in 2007	-issued the "Safe Design of Buildings and Structures Guide" in 2009	
Execution	regulate Design for Safety by legislation	promote Design for Safety by training and issuing relevant Code of Practice	



#### Result: Key Success Areas - Questionnaire Survey



#### Key success areas of the CDM Guidance Notes

#### Key success areas of the CDM Worked Examples



12

Client Designer Maintainance Supervisor & Contractor Supervisor Principal Contractor Project Supervisor

### Result: Key Success Areas - Questionnaire Survey



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#### Result: Key Success Areas - Questionnaire Survey



Client Designer Maintainance Supervisor & Contractor Supervisor Principal Contractor Project Supervisor

#### Result: Key Suggestions - Questionnaire Survey



■ Client ■ Designer ■ Maintainance Supervisor & Contractor Supervisor ■ Principal Contractor

Project Supervisor

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### Result: Key Suggestions - Questionnaire Survey



Result: Key Suggestions - Questionnaire Survey



Client Designer Maintainance Supervisor & Contractor Supervisor

Project Supervisor

### **DFS Review Programme Focus Group Meeting / Site Visit**

Site Visit

#### **DESIGN FOR SAFETY**



#### **Focus Group Meeting**



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GUIDANCE NOTES OF

DESIGN FOR SAFETY

### **Design For Safety (DFS)**

WORKED EXAMPLES O

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DESIGN FOR SAFET

### **DESIGN FOR SAFETY**

Main Objective:

- To promote <u>early involvement</u>, <u>effective cooperation</u> & <u>communication</u> of all stakeholders
- To improve clarity on the <u>demarcation</u> <u>of roles & responsibilities</u> of parties
- To strengthen <u>hazard identification &</u> <u>mitigation</u> at early design stages

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### New Features in DFS – 1 Simplify the roles of duty holders

### DESIGN FOR SAFETY

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### **New Features in DFS - 2 New Tool – Checklist for Duty Holders**

#### **DESIGN FOR SAFETY**

#### Appendix A: Checklist for Duty holders

Checklist of considerations for Client

	Pre	-tender stage			Yes / No	Actions		~					0 1	<b>D</b> EC	
	1	Does the content of the proposed proj	ect c	ome within any of the				Supervis	sor. (	durir	ig each s	stage of	of the	DFS proc	3
		definitions for construction work?						<b>I</b>	- )		0				_
	2	Does the project team identify who wil	be t	the client? (A group of											
		clients can elect one of them to be trea	Ch	ecklist of consideratio	ns for De	signer									
	3	Do you need to appoint any designers	Pre	-tender stage					Yes / No	Actions					
	4	Do competent duty holders, i.e. design	1	Have you checked that	t the client	t is aware o	of his	duties?							
		project?	2	Have you checked the	competer	nce of any	sub-o	designers working for							
	5	Do you give the information to the d		you?											
╞	~	a pe of the works?	3	Have you received the	'Health an	d Safety I	Che	ecklist of considerati	ions for C	ontractor					
	F	as much as possible in		need to complete the c	design?		Pre	-construction stage				Yes	No Action	s	
			4	Have you ensured the	e design pr	rocess ful	1	Are you aware of you	ur duties a	s contracto	r?				
6		Chefit V Hazard Analysis		principle?			2	Are you competent	to underta	ike the dut	ties of contractor in	dealing			
		i impact Summary	5	Have you identified har	zards and	foreseeal		with the health and s	safety issu	ies involve	d in the managemer	nt of the			
1				the construction and fu	iture use c	of the stru		construction stage?							
			6	H you established I	how your d	lesign can	3	Have you taken step:	s to ensure	e that the c	onstruction stage is	properly			
				adverse e	effect on the	he health		planned, managed	and moni	itored, with	Charlingto recours	ae and		Cum am dia am	
Y		X	Г	s and	other occu	upants?		competent site mana	agement a	ppropriat	Pro construction sta	derations for	maintenanc	e supervisor	
			4	ated	I with othe	ers to cor	4	Have you ensured the	hat all the	foreseea	A Are used and a sta	iye			
								are addressed in the	Outline H	ealth and	Are you aware	d in the meeting	as maintena	t / designers for the designers	an
				0	rkplace, ha	ave you ta	F	Have you ensured	that the c	onstructi	2 Are you involve	u in the meeti	iys with thei	it / designers for the desig	gn
								uction work be	gins?		2 Are you familia	with the inter	ation of the d	losian?	
								alth and Sa	fety Plan p	prepared?		with the inter	nuon or the u	esign?	
						Co	ntra	actor			Post-construction pl	hase			
								ge			4 Are you compe	tent to under	take the duti	ies of contractor in dealir	na
							-	vided t	the duty h	olders w	health and	l safety issue	s involved i	in the management of t	he
				1.000								orks?	-		
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					and the second	and the second	No. And	A A A A A	PAR -			re work?			
		and the second se	-	The second s		and the	him	tob-				d to every o	ontractor wh	o will work on maintenan	ce
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#### Checklist for Duty holders

to illustrate the role and responsibilities and submission of documentation for different duty holders - Client, Designer, Contractor, Maintenance stage of the DFS process

Yes / No Actions

Yes / No Actions

### **Application of DFS under different Project Stages**



### **Application of DFS in Design Stage**

#### **DESIGN FOR SAFETY**



### Application of DFS from Tendering to Construction and Operation & Maintenance Stages

#### **DESIGN FOR SAFETY**



																					New Feat	tur	res in DFS - 3		
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Significant Hazards and Designers' Action					Si	gnifi	cant	t Haz (	zard Tick	s Ide <i>if ap</i>	entifie plica	ed D ble)	uring	De	sign						Designers' Actions				T
Design Areas and Construction / Maintenance Activities	Hazardous Substances	Fall From Height	Falling Objects	Site Plant Vehicles	Collapsing Structure	Manual Handling	Lining Operations	Burred / Overnead Services	Intertace With Others	Noise and Mination	Deep Excavations	Asbestos	Fire Means of Escape	Highway Traffic	Restricted Access	Access for Maintenance	Confined Spaces	Vorking Over or Near Water	Temporary Works Required	Others	Key C=Comments/Qualification; I=Information required to assis G=Guidance, summary of P of Prevention that MUST be to a significant risk when des A=Avoidance (Design to avo fied hazards but beware of ii ing others)	st design Principles applied signing bid identi- ntroduc-	Record of Major Issues Raised and R	Resp	onses
																								Any	Action
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Superstructure Frame				_	+	+	+	+	+	+	+			-		-		-				• Pr	rovision of proper physical isolation of dust and		
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### New Features in DFS - 4 New Design Tool – Red, Amber and Green Lists

#### **DESIGN FOR SAFETY**

#### 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.

Red, amber and green lists

the practical aides for designers on what should be <u>eliminated/avoided</u>, and what should be <u>encouraged</u> to be completed during the design stage

<ul> <li>Hand scabbling of concrete (stop ends', etc);</li> </ul>	Amber Lists: Products, processes and procedures to be eliminated or reduce	ed as far as
· Demolition by hand-held breakers of the top sections of concrete pil	possible and only specified/allowed if unavoidable. Including amber items we	
techniques are available);	lead to the provision of information to the Duty holders	Julu diways
<ul> <li>The specification of fragile roof lights and roofing assemblies;</li> </ul>	Internal manhales / inspection shambers in sirgulation areas:	
· Processes giving rise to large quantities of dust (dry cutting, blasting etc	Internal manholes / inspection chambers in circulation areas,     External manholes in beauty used vehicle access zenes;	
On-site spraying of harmful substances;	<ul> <li>External manifolds in neavy used vehicle access zones,</li> <li>The specification of "lin" details (i.e. trip bazards) at the tops of pre-cast concrete</li> </ul>	a staircasas:
. The specification of structural steelwork which is not purposely designed	<ul> <li>The specification of shallow steps (i.e. risers) in external paved areas:</li> </ul>	
safety nets;	The specification of heavy building blocks:	Green Lists: Products, processes and procedures to be positively encouraged.
· Designing roof mounted services requiring access (for maintenance, etc)	Large and heavy glass panels;	Adequate access for construction vehicles to minimise reversing requirements (one-way
for safe access (eq. barriers).	The chasing out of concrete / brick / blockwork walls or floors for the installatio	evetome):
Glazing that cannot be accessed Safely. All glazing should be anticip	The specification of heavy lintels (the use of slim metal or hollow concrete	Provision of adequate access and headroom for maintenance in plant rooms, and adequate
cleaning and replacement so a safe system of access is essential	alternatives);	• Fronsion of adequate access and near common maintenance in plant rooms, and adequate
Entrances floors ramps stairs and escalators etc not specifically design	The specification of solvent-based paints and thinners, or isocyanates, partic	provision for replacing neavy components;
and trins during use and maintenance, including effect of rain water and	in confined areas;	Inougnitui location of mechanical / electrical equipment, light fittings, security devices etc.
Design of environments involving adverse lighting noise vibration term	Specification of curtain wall or panel systems without provision for the tying	to facilitate access and keep away from crowded areas;
<ul> <li>Design of ormanismum mention and areas in granting, more conditions during use</li> </ul>	scaffolds;	The specification of concrete products with pre-cast fixings to avoid drilling;
enerationa	<ul> <li>Substituting dangerous with inherently less dangerous chemicals.</li> </ul>	Specify half board sizes for plasterboard sheets to make handling easier;
Designs of structures that do not allow for fire containment during const	Modify the design to reduce areas where dust and dirt can collect and thus	Early installation of permanent means of access, and pretabricated staircases with hand
<ul> <li>Designs of structures that do not allow sufficient space for the battering (class)</li> </ul>	need for cleaning at height	rails;
During excavation, unable to allow sufficient space for the battering (so     of every stienes to minimize the risk of collenses. Where peecilile	Design plant to extract dust and fumes effectively rather than deposit them	<ul> <li>The provision of edge protection at permanent works where there is a foreseeable risk of</li> </ul>
or excavations, to minimize the risk of collapse. where possible, avoid loc	will need cleaning	falls after handover;
near static loads (such as buildings, walls and immobile plant) or dynami	<ul> <li>Simplify the process control and reduce the sensitivity to deviation, there</li> </ul>	<ul> <li>Practical and safe methods of window cleaning (e.g. from the inside);</li> </ul>
traffic and excavation equipment)	reliability of control systems when handling the hazardous chemicals.	<ul> <li>Off site fabrication and prefabricated elements to minimize on site hazards;</li> </ul>
	Using specific building components and construction methods that can elimin	• Encourage the use of engineering controls to minimize the use of Personal Protective
	for falsework or formwork for temporary works.	Equipment;
	Anchor points should be provided at suitable spacings to limit the worker's	Using high durability and low maintenance materials that do not need to be re-coated or
	the protected area for temporary works.	treated:
	<ul> <li>Information about restrictions, proper use and load bearing capacities</li> </ul>	Designing the structure so that maintenance can be performed at ground level or safely
	components, and on lateral forces to be supported by temporary works equi	from the structure, for example, positioning air-conditioning units and lift plant at ground
	be provided for designing the temporary works.	level and designing inward opening windows etc.
	<ul> <li>Site traffic routes that do not allow for 'one way' systems and/or vehicular traffic</li> </ul>	Using continual support beams for beam-to-column double connections, be it adding a
	from site personnel	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
	and the second s	due to unexpected vibrations, misalignment and unexpected construction loads:
		Reducing the space between roof trusses and battens to reduce the risk of internal falls
		reducing the space between root trusses and batteris to reduce the risk of internal falls
▶ 【 職 兼 女 全 健 曻		auring root construction;
OCCUPATIONAL SAFETY & HEALTH C	OUNCH	<ul> <li>Separate neavy transport access from lighter vehicle access, and separate pedestrians</li> </ul>
- OCCUPATIONAL SAFETT & HEALTH C	VUINCIE	from vehicle access.

### **Examples – Red, Amber and Green Lists**

#### **DESIGN FOR SAFETY**

**Red Lists**: Hazardous procedures, products and processes that should be eliminated from the project where possible.

- Designing roof mounted services requiring access (for maintenance etc.), without provision for safe access (e.g. barriers)
- Glazing that cannot be accessed safely. All glazing should be anticipated as requiring cleaning & maintenance, so a safe system of access is essential

**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.

- Substituting dangerous with inherently less dangerous chemicals
- External manholes in heavy used vehicle access zones

Green Lists: Products, processes and procedures to be positively encouraged.

- Off site fabrication and prefabricated elements to minimize on site hazards
- Designing the structure so that maintenance can be performed at ground level or safely from the structure, e.g. positioning air-conditioning units at ground level and designing inward opening windows etc.

#### **DESIGN FOR SAFETY**

Appendix G: Good design practices

Design for Safe Maintenance

Risks relating to cleaning, servicing Design for Safe Construction

- Designing the structure so that mail the structure, for example, position designing inward opening windows structural frame
- Designing features to avoid dirt trai
- Designing and positioning perman maintenance needs to be undertak Designing safe access, such as s
- maintenance activities.
- Avoid locating high maintenance ite
- · Eliminating or minimising the need Using high durability and low main
- treated Locating maintenance items of roo skylights and roof edges, and provid non-slip surface. Marking hazards :
- Control measures for risks relating to the construction of a structure include: Providing adequate clearance between the structure and overhead electric lines by burving. disconnecting or re-routing cables Design for Temporary Traffic Management operating cranes and other tall equip Designing components that can be pre-
- or erecting at heights and to reduce v falling objects, for example fixing win · Designing parapets to a height that need to construct guardrails during c Using continual support beams for be
- seat, extra bolt hole, or other redund This will provide continual support unexpected vibrations, misalignment · Designing and constructing perman associated with temporary stairs an construction.
  - Reducing the space between roof t during roof construction.
  - Choosing construction materials that
  - Limiting the size of pre-fabricated wat
  - Selecting paints or other finishes that Indicating, where practicable, the pc
  - safety procedures.

- · Consider the installation of perr locations where there are freque Before work begins, holding plan contractor, resident engineer,
- systems of work.

- Modifying the confined space it

#### Design for Manual Handling

- Avoidance of manual handling
- Mechanise or automate process
- Changes in the layout of the tas
- · Reducing the risk of injury from

A 10 10 1

### Good design practices

**New Features in DFS - 5** 

**Examples of Good Design Practices** 

· 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

One-way systems to reduce the likelihood of collision, reduce congestion and improve traffic

. 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

Design for Working at Height

Provide reference to designers e.g. Design for safe construction & maintenance

Ensure that temporary traffic management layouts start in safe locations by avoiding

locations to the site.

appropriate in areas when

· Physical barriers to prote

Entrances and exits – pro

Walkways – provide firm,

Crossings – where walkway

· Provide parking for the wo

Control entry to the work a

Plan storage areas so that

The need for vehicles to n

where drivers and pedest

pipe-work systems, buildir

movement

hazards)

- hazardous positions, e.g. close Design for Traffic Management
- · Consider specifying the use of r

Design for Work in Confined Space

- Consider what measures can be to enter the confined space.
- undertaken from outside the spa
  - where possible

- - especially in storage areas
    - Separate heavy transport vehicle access.
      - In areas that are likely to safe access to the locatio

- 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 in permanent access
  - Design in permanent anchor points for temporary access
  - Provide permanent lifelines for vehicle loading and unloading

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Fail-safe Design for Machinery

#### Design for <u>Hazardous Material</u> to limit people at risk



### **Examples of Good Design Practices**

#### Safe Design for <u>Temporary Works</u>





Design for <u>Temporary</u> <u>Traffic Management</u>

#### Design to minimize <u>Working at Height</u> e.g. remote control for concrete skip and lifting sheet piles & H piles





1. Sports Centre and Library, Tseung Kwan O



2. Joint-user Complex, To Kwa Wan



### **DFS - Worked Examples**

4. Kai Tak Nullah – Reconstruction & Upgrading

3. Indoor Velodromecum-Sports Centre, Tseung Kwan O



5. Kai Tak Approach Channel – Improvement works



6. Sha Tin Water Treatment Works – Design and Construction



7. North District and Tolo Harbour Sewerage Upgrade



### Worked Example No. 1 – Joint-User Complex at Bailey Street, To Kwa Wan Reclamation

#### **DESIGN FOR SAFETY**

<u>Ten - storey complex</u> accommodating two co-users – Department of Health and Home Affairs Department

#### The building consists of

- Hung Hom Community Hall
- Kowloon City District Office
- Dental Clinics
- Maternal and Child Health Centre
- Families Clinic

Client & Project Supervisor & Designer ArchSD & Contract Supervisor

Contractor China State Construction Engineering (HK) Ltd.

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### Brainstorming Sessions to Identify Potential Risk Items of Project (examples)

#### **DESIGN FOR SAFETY**

		Hazaro	l and Impact Summary			
Task	Hazards and Impacts	Risk Assessment Rating	Control Measures	Hazards Resolved Yes/No	Necessity to Notify Contractor Yes/No	Other Relevant Parties to Be Notified
On-site installation of plant material at height (e.g. installation at ceiling level)	Falling from heights	6	Provide guarded stairs, catwalks, working platform, etc. for equipment require regular service/ maintenance	Yes	Yes	E&M Contractor
Manual handling of heavy and bulky equipment	Cause harm / injury to workers, e.g. sprains, strains and back pain.	4	Provide mobile trolley for transporting bulky machine parts	Yes	Yes	E&M Contractor

職業安全健康局 Occupational Safety & Health Council

### **Examples of Safe Design**

### DESIGN FOR SAFETY



#### Use of electric trolley in the multipurpose hall

• to transport the audience chairs easily, <u>minimizing the manual handling work</u>



#### **Maintenance corridor on external facades**

 improve the <u>safety and access</u> for the workers during window cleaning & maintenance of facilities



## S

### Worked Example No. 2 - Town Park, Indoor Velodrome-cum-Sports Centre in Tseung Kwan O

#### **DESIGN FOR SAFETY**

- a town park
- an indoor velodrome-cum-sports centre (provide a cycling track, <u>spectator stand</u> and <u>other ancillary</u> <u>facilities</u> which meet standards for international competition)



UPATIONAL SAFETY & HEALTH COUNCIL





### Brainstorming Sessions to Identify Potential Risk Items of Project (examples)

	Hazard and Impact Summary											
Task	Hazards and Impacts	Risk Assessment Rating	Control Measures	Hazards Resolved (Yes/ No)	Necessity to Notify Contractor (Yes/ No)	Other relevant parties to be notified						
Fall from height while carrying out maintenance works / cleaning	Fall from height while carrying out maintenance works / cleaning / watering of green roofs - especially the bottom of cycling track	6	Access for maintenance of building services inside the Velodrome will be facilitated by maintenance catwalk. Proper material to lengthen the lifespan of cladding and avoid materials / finishing that require aggressive cleaning	Yes	No	Maintenance staff						
Ergonomics - muscular- skeletal injuries from posture/ manual handling	Potential hazards (e.g. health hazard due to inadequate spatial requirements) while carrying out maintenance works	4	Proper lifting appliance / trolleys will be provided for transportation of materials	Yes	No	Maintenance staff						

# DESIGN FOR SAFETY

### **Examples of Safe Design (1)**

#### **Catwalks and Maintenance Platform**

• provided <u>safe access and platforms for maintenance</u> of all ceiling mounted services including fire services facilities, lighting system, ventilation louvers system and acoustic panels



### **Examples of Safe Design (2)**

#### **DESIGN FOR SAFETY**

#### Link Lift system

- Installed the hydraulic elevator driving systems for multi-purpose venues
- Facilitate the transportation of the bulky equipment from G/F to 1/F
- <u>Platform with suitable guardrails</u> to prevent risk of fall during operation



# S

**DESIGN FOR SAFETY** 



Client Drainage Services Department(DSD)

> Project Supervisor & Designer & Contract Supervisor AECOM Asia Co. Ltd.

Contractor China Road & Bridge Corporation - Dix Construction & Transportation Ltd. Joint Venture and Sang Hing Civil Contractors Co., Ltd

Maintenance Supervisor Drainage Services Department (DSD)

OCCUPATIONAL SAFETY & HEALTH COUNCIL

Worked Examples No. 3 -

North District and Tolo Harbour Sewerage, Sewage Treatment and Disposal - Regional Sewerage Works, Sewerage Upgrade

 construct / upgrade a total of <u>14 km of sewers</u> and <u>3 sewage</u> <u>pumping stations</u>, with over 20 work sites scattered among three districts (Sha Tin, Tai Po and North District)





### **Brainstorming Sessions to Identify Potential Risk Items of Project (examples)**

	Hazard and Impact Summary												
Task	Hazards and Impacts	Risk Assessment Rating	Control Measures	Hazards Resolved (Yes/ No)	Necessity to Notify Contractor (Yes/ No)	Other relevant parties to be notified							
Construction and Maintenance for Deep Sewer	<ul> <li>Ground water intrusion during construction</li> <li>Work at height during construction</li> <li>Risk of falling during access of manhole</li> <li>Higher risk in confined space</li> </ul>	4	<ul> <li>Alternative design scheme of a double- storey SPS was proposed and deep sewer was avoided at Kau To Shan</li> <li>Alternative design scheme of steeper sewer with epoxy lining and grade 40 concrete manhole instead of relying on backdrop manholes</li> </ul>	Yes	No	DSD							
Maintenance In large Diameter Trunk Sewer	<ul> <li>Impractical to isolate large flow</li> <li>Long-distance Pumping infeasible</li> </ul>	4 <	- Provision of twin pipes	> Yes	No	DSD							



### Examples of Safe Design (2)

#### **DESIGN FOR SAFETY**

#### **Improvement in Design of Sewers at Steep slope**

• The Project Team explored the way for constructing the <u>sewers</u> with a steeper gradient and hence <u>shallower depth</u> from road level



#### **Conventional Design**

#### Alternative Safe Design



### Examples of Safe Design (3)

#### **DESIGN FOR SAFETY**

#### Design a New Twin Pipe System with Diversion Switch Arrangement

- In case of inspection and maintenance, <u>one of the twin pipes could be</u> <u>shut and the sewage could be temporary conveyed by the other one</u>
- Safety hazard was therefore eliminated by <u>allowing workers to work</u> <u>in dry condition</u>









 魯班 - 中國土木工匠的祖師,
 古代最出色的建築師、木匠和發明家

 Lo Pan - the Patron Saint of Chinese Builders and Constructors, the
 genius builder, carpenter and inventor in ancient China

「準繩分曲直,規矩定方圓」 **"Thread regulates Criteria, Compass regulates Radii**"

時至今日,安全更正正是其中一個決定設計的考慮因素 劃定方圓的規矩!



Today, <u>Safety is one of the important considerations</u> that regulates the Design!

